RICE FARMERS' KNOWLEDGE, ATTITUDES, AND WILLINGNESS TO PAY FOR WEATHER INDEX BASED CROP INSURANCE IN QUEZON PROVINCE, PHILIPPINES

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I. Introduction

The Philippines is among the countries in which the impacts of global human activities are immediately felt by the most vulnerable, particularly in the countryside. In recent years, Filipino farmers have had to deal with increasing frequency and severity of droughts and typhoons. Between extreme events of drought and flooding, shifts in the rainfall pattern have led to sub-optimal crop yields. These present tragic consequences for households' food security, livelihoods, and over-all welfare. Without appropriate adaptation efforts at the national, regional, and local levels, climate change will continue to adversely affect rural communities, particularly small farming households.

Even with agricultural insurance as a means of risk management for farmers and other stakeholders, the challenge and costs of managing covariate risk can significantly constrain its utilization as a climate change adaptation tool. The introduction of the weather index based insurance (WIBI) in the past years provides a favorable alternative. WIBI is an insurance instrument that places a guarantee on weather risks such as drought or flood, which are typically highly correlated with agricultural production losses (Collier, Skees, & Barnett, 2009). It pegs payouts to weather data thresholds (usually rainfall) so farmers are spared of the long wait entailed by loss assessment under the conventional insurance scheme. It is deemed to reduce moral hazard and adverse selection, in turn lowering monitoring costs in crop insurance provision. WIBI allows for reinsurance or the sharing of risk with other actors because it is based on an independently verifiable index. With these features, WIBI is reckoned to help catalyze sustainable safety nets and promote agricultural growth in climate risk-prone rural areas (Hazell & Hess, 2010).

WIBI has been initiated in many countries, including the Philippines. In 2014, the Weather Index Based Crop Insurance (WIBCI) was piloted as a component of the Philippine Climate Change Adaptation Project (PhilCCAP), a World Bank-funded project initiated by the Department of Agriculture. In the same year, a $1 million weather index based crop insurance project titled "Scaling-up Risk Transfer Mechanisms for Climate Vulnerable Agriculture-based Communities in Mindanao" or "WIBI Mindanao" was launched by the United Nations Development Programme (UNDP), the Department of Agriculture and Philippine Crop Insurance Corporation (PCIC). Pending the release of final evaluation reports, progress of the two WIBI pilots have been reported in terms of number of farmers covered and amounts of payouts released. WIBI Mindanao reported providing insurance to 2,413 farmers in Bukidnon and Davao, with 178 of them availing a total payout of approximately US$ 29,700.00 from PCIC (WIBI Mindanao Project, 2017).

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Accounts of the experiences across the global South point to low demand for the insurance product. Skees (2010) expounds on this in terms of low proportion of takers, extent of coverage purchased, and proportion of poor farmers buying. This is consistent with Binswanger-Mkhize's (2012) observation that for any type of crop insurance, demand is even very low among farmers who can afford it due to their own ability to self-insure against production risks, and those who need the coverage are too poor and credit constrained to pay the premium. Furthermore, it is observed that uptake has generally been low and in most cases, unsustainable (Carter, de Janvry, Sadoulet, & Sarris, 2014).

This study explores how farmer knowledge and attitudes may influence the potential demand for WIBI in Philippine rural communities, which, to the investigator's knowledge, is an inquiry that has yet to be done in the country. Findings stand to complement results of the preceding pilots in informing policy, which is currently being studied in the Philippine Senate. Moreover, the research can contribute insights into farmers' knowledge and attitudes that can guide service delivery of public and private providers, as well as engagement of local communities in expanding farmers' climate change adaptation options through crop insurance.

As baseline research for anticipated provision of WIBI to farmers adapting to the adverse impacts of climate change, this study investigates farmers' knowledge and attitudes in relation to their willingness to avail of the insurance product. Specifically, it aims to:

i. survey farmers' knowledge and attitudes about climate change, conventional crop insurance and WIBI;
ii. assess the current adaptation practices of farmers as means of self-insurance against climate-related risks, and;
iii. examine the influence of farmers' knowledge and attitudes on farmers' willingness to pay for WIBI.

Financing climate change mitigation and adaptation efforts has become key to building individual and community capacities for climate-resilient development. The provision of funds from developed to developing countries ensures that resources are available for capacity-building, R&D, and economic development. For developing countries like the Philippines, climate change adaptation presents itself as a more urgent concern than mitigation, as the impacts of global human activities are immediately felt by the most vulnerable majority in the countryside. Interestingly, only about 28 percent of the overall multi-lateral climate funds in the East Asia and Pacific region was reported in 2018 to support adaptation (Climate and Environment Programme, 2018). Within the adaptation finance architecture, finance flows from insurance and risk pooling mechanisms have been increasing. Given such development, this study offers some insights about the perceptions and attitudes of the target clients of the innovation, WIBI, which can help guide decision making on how insurance financing as a means of climate change adaptation could best be allocated.

II. Review of Literature

Natural disasters cause widespread human, material or environmental losses that exceed the capacity of the affected society to cope using only its own resources and hence play a major role in the economic development and survival of humanity throughout history (Sivakumar, 2006). Sivakumar reports that casualties have risen to 50 percent for each decade since the 1950s, while the global yearly economic expenditures associated to natural disasters have been estimated to amount at about $50-100 billion. His study also showed that agricultural production is highly dependent on weather, climate and water availability, and is unfavorably affected by weather and climate related disasters. The impact of natural disasters would hence be brutal for those who are in involved in agriculture. Moreover, the agriculture sector is the main source of income in most developing countries, with about 70 percent of the land worldwide is used for agriculture, rangeland and forestry.

The Philippines is known as one of the most hazard-prone countries in the world (SEPO, 2013). The country has been tagged as a natural disaster hot-spot, with nearly 50.3 percent of its total area and 81.3 percent of its population being vulnerable to natural disasters (World Bank, 2008). According to the 2012 World Risk Report issued by the United Nations University Institute of Environment and Human Security (UNUEHS), the Philippines is the third most disaster risk-prone country worldwide with a Risk Index of 27.98 percent. Natural disasters can not only lead to considerable loss of lives, homes, livelihood and services, but also result in injuries, health problems, property damage, as well as social and economic disruption. The report indicates that from 2000 to 2012, natural disasters in the Philippines injured 138,116 persons and left 12,899 people dead. Furthermore, these disasters have also affected more than 71 million people and rendered almost 375,000 individuals without homes. Socio-economic damages are similarly estimated at US$3.37 billion, with average yearly damages of US$251.58 million (SEPO, 2013).

Benson (1997) shows that poverty, disaster vulnerability and environmental degradation are intrinsically linked, and natural hazards have played a vital role in strengthening poverty. Israel and Briones (2012) report that though typhoons, floods and droughts have an irrelevant impact on agricultural production at the national level, typhoons have a substantial negative impact on paddy rice production at the provincial level. Further, they argue that typhoons, as exemplified by Ondoy and Pepeng in 2009, have a significant negative impact on the food security of the households in the affected areas. In addition, they found out that households have erratic consumption and non-consumption strategies to cope with the impacts of typhoons.

Climate Change and Crop Insurance

Natural disasters drastically impact agriculture. In many developing countries especially the rural communities, farming is the main source of income. Agricultural insurance has the potential to battle the effects of weather and climate related restrictions as well as lessen the farmers' uncertainties. A study done in Ghana led by Karlan (2009), discovered that crop insurance altered the farmers' investment behavior as those who participated in the crop insurance were 25 percent more likely to take their harvest to markets instead of selling to dealers who came to pick up the crop. The change in investment activities, however, does not make the farmers more productive. On the other hand, Summer and Zulauf (2012) report that crop insurance in the United States affects production in three ways: (1) subsidies raise the net revenue per acre and thereby raise incentives to plant eligible crops and plant more of crops with higher subsidy rates; (2) availability of crop insurance, which is made possible by the government program, encourages planting insured crops on fields that would not otherwise be considered for that crop because of the potential for significant losses; and (3) by reducing chances of losses from low yields and prices, crop insurance creates incentives for growers to undertake fewer alternative risk mitigating practices, therefore focusing more on increases in average productivity. In the province of Laguna, Philippines a study conducted by Rola (2013) found that the amounts of net income losses of the rice farmers were significantly reduced as a result of their participation in the rice crop insurance program. A higher average net income loss was suffered by the farms near the lake compared to those who are farther away. The study also showed that a larger amount of average net income loss was suffered among large farms since these farms had a higher cost of production than the small farms.

Traditional crop insurance depends on direct measurement of the loss or damage incurred by the farmer. However, field loss assessment is normally costly or not feasible; particularly where there are a numerous small-scale farmers or where crop insurance markets are undeveloped (IFAD, 2011). The World Bank (2011) categorizes traditional crop insurance into two main products: a) damage-based indemnity insurance (or named peril crop insurance) and b) yield-based crop insurance (or Multiple Peril Crop Insurance, MPCI). Damage-based indemnity insurance is crop insurance in which the insurance claim is computed by measuring the percentage damage in the field right after the damage occurs. The damage measured in the field, minus a verifiable expressed as a percentage, is applied to the pre-agreed sum insured. The sum insured may be based on production costs or on the estimated income. Where damage cannot be measured accurately immediately after the loss, the assessment may be deferred until later in the crop season. On the other hand, Yield-based crop insurance is coverage in which an insured yield, such as cavans per hectare, is established as a percentage of the farmer's historical average yield. Yield-based crop insurance typically protects against multiple perils, meaning that it covers many different causes of yield loss (often because it is generally difficult to determine the exact cause of loss).

The World Bank (2011) further categorizes Index-Based Crop Insurance into two products: a) Area yield index insurance and b) Weather Index Insurance (WII) also known as WIBI. In the first category, the indemnity is based on the recognized average yield of an area such as a county or district, not the definite yield of the insured party. The insured yield is determined as a percentage of the average yield for the area. An indemnity is paid if the recognized yield for the area is less than the insured yield notwithstanding of the actual yield on a policyholder's farm. This type of index insurance entails historical area yield data. Meanwhile, in WIBI, the indemnity is based on recognitions of a specific weather parameter measured over a pre-specified period of time at a specific weather station. The insurance can be designed to protect against index recognitions that are either so high or so low that they are projected to cause crop losses. The indemnity is computed based on a pre-agreed sum insured per unit of the index. The important feature of WIBI is that the insurance contract acts as an objective parameter, such as the measurement of rainfall or temperature, at a distinct weather station during an arranged period of time. The parameters of the contract are set so as to correlate, as accurately as possible, with the loss of a specific crop type suffered by the policyholder. All policyholders within a clear area would receive indemnity based on the same contracts and measurements at the same station, removing the need for in-field assessment (IFAD, 2011). This implies that the processes in WIBI would be quick and transparent. WIBI connects indemnity payments to the behavior of significant weather indicators that are in turn linked to crop yields and other outcomes of interest. Indemnities are therefore based on objective, evident, and verifiable weather variables (such as rainfall or temperature) as an alternative of direct economic losses suffered by farmers. Under this method, every farmer with the same insurance contract in the same region will be given identical indemnity payment regardless of his or her actual economic loss. The basic payment arrangement of a weather-indexed product cores around two main values: the threshold and the limit. The threshold represents the value of the index upon which indemnity payments kick in, while the limit represents the point upon which payments reach a maximum level. Indemnity payments typically increase as the index approaches to the limit, with the rate of increase a function of the threshold, the limit, and the actual value of the weather index (USAID, 2006).

According to USAID (2006), the costs related with traditional crop insurance delivery are made up of the following components: a) the expected economic loss covered by the insurance policy, or equivalently, long-term average of indemnities that would be paid out under the insurance policy; b) cost of information to control adverse selection as insurance might attract riskier farmers into the market, and policy-holders with higher risk should pay an extra premium; c) cost of information to control moral hazard of farmers exerting less effort; d) loss adjustment as insurance companies must estimate actual economic losses that are produced by the covered risks; e) delivery cost, including those related to marketing, selling and delivery of the insurance product, in addition to management costs; and f) capital cost as the insurance provider must have quick and easy access to financial resources in order to be able to pay out indemnities that exceed premiums paid by policy holders. USAID (2006) pointed out that WIBI can decrease or eliminate many of these above-mentioned costs, such as loss adjustment or damage estimation processes which are not compulsory when implementing WIBI products since the actual financial losses do not play any part at the indemnity payment procedure. Likewise, WIBI also immensely decreases informational requirements. Problems on moral hazard diminishes since indemnity payments are established only by objective weather variables which policyholders cannot influence. Adverse selection problems are also disposed of because insurers no longer must define who is a risky farmer, because all farmers will receive the same payment nonetheless of their individual risk. Moreover, WIBI grounds the threshold of insurability which is the economic size of an insurance transaction that can be reasonably serviced by an insurer. The simplified nature of the product offers additional opportunities to reach a wider range of households and for innovative design to target the poor. However, the most likely target group will be emergent and commercial farmers, as it is deemed unlikely that the majority of poor smallholders would directly purchase insurance on a sustained basis (IFAD, 2011).

WIBI Development and Implementation Challenges

WIBI as we know today started out in the form of weather derivatives which first emerged in the United States in 1997 behind the deregulation of American energy and power industries and represent a present day type of financial product launched to evade weather risks. Initially, energy companies were the main enterprises hedging weather risk by trading weather derivatives. Today, diverse enterprises such as resorts, hotels, restaurants, universities, governments, airlines, and especially farming activities are using weather derivatives to manage risk (Brockett et al., 2005). Zeng (2000) defined weather derivative as an agreement between two parties that specifies how payment will be exchanged between the parties depending on certain weather-related conditions during the contract period. In order to configure a weather derivative contract, the buyer must determine the type and level of protection desired and establish the contract parameters such as contract type, contract period, an official weather station from which the meteorological record is obtained, definition of weather index underlying the contract, strike, tick, and the premium. This is generally based on the buyer's knowledge of the relationship between the variations of the weather index and the income or expense of the business. Syroka (2007) reports that the first weather derivative transaction in the U.S. took place in 1997 and was incorporated into the research agenda of the World Bank in 1999. The design of generic applications especially to the rural sector economies in developing countries was the academic focus during these times. On the other hand, the first involvement of diverse donors in financing project development costs started in 2002 and focuses on pilot weather-index insurance projects design and implementation (Syroka, 2007).

There are a number of developing countries where index insurance has been implemented. This has been both at the individual farmer level and at the regional, national, or institutional level. Tables 1 and 2 summarize the individual level and institutional level adoptions of developing countries (Hellmuth et al., 2009; Vargas-Hill and Torero, 2009; Burke, de Janvry and Quintero, 2010). These developments revealed relevant implementation concerns for WIBI.

Albeit WIBI products are superior to traditional products from a cost viewpoint, earlier assessments highlight how the challenge posed to implementation by "basis risk", which is the difference between the indemnity payments and the actual losses suffered by policyholders. Basis risk takes place in index-based products because payments are based upon a weather indicator that is imperfectly correlated with crop yields, rather than on crop yields themselves. While basis risk does not directly elevate insurer costs, it was noted that high basis risk is likely to lower farmer demand for the insurance product, constricting hopes for market growth (USAID, 2006). Another challenge faced in the implementation of WIBI as reported by the World Bank (2011) is data availability. Even with simpler data requirements, precise and complete data sets are requirements for WIBI. This involves the historical record of the selected weather factors for underwriting and pricing purposes as well as for the documentation of the factors for payout computations during the period of insurance, in addition to historical yield data to calculate risk, design, and price the product, if the weather index is to serve as an accurate proxy for loss. The World Bank report also mentions the integrity of weather stations as problematic in the implementation of WIBI. Weather stations operated for index insurance must be adequately protected to avoid tampering. They should also have automatic, as opposed to manual, documentation of data. Moreover, it was noted that there must be farmer/insurer/regulator capacity building and education. WIBI is a new concept for farmers, hence any showcase of the product involves intense education programs to help them to comprehend the notion of the payout scheme as well as the fact that it covers only one risk variable. For the side of the insurers, this is a new kind of product which requires considerable technical assistance in designing contracts as well as indexes and extensive capacity building to allow them to commence product development on a continuous basis. Likewise, research, local adaptation and scalability issues give challenges to WIBI. The method of devising an index

Table 1. Selected individual-level index insurance schemes.

Country	Year of Adoption	Policy-holder	Project name	Instrument	Scale/No. of Beneficiaries
Brazil	2001	Participants in government seed Program	AgroBrasil	Area-based yield Index	15,000
Ethiopia	2007	Teff and bean Farmers	HARITA	Rainfall index	300
India	2003	Smallholders growing various crops	BASIX, ICICI Lombard, others	Rainfall, temperature index	150,000
India	2007	Potato farmers under Pepsico contract	Pepsico	Temperature and humidity index	4,000
India	2004	Smallholders	AIC	Rainfall, temperature index	1,000,000
Kenya	2009	Smallholders	Rockefeller	Rainfall index	500
Kenya	2009	Maize and wheat smallholders	Kilimo Salama	Rainfall index	200
Malawi	2004	Maize and groundnut	World Bank, Opportunity Intl, others	Rainfall index	1700
Malawi	2008	Maize, tobacco farmers	MicroEnsure, others	Rainfall index	2500
Millennium Villages (Kenya, Ethiopia, Mali)	2007	Smallholders	Millennium Villages	Rainfall and satellite-based greenness index	1000
Mongolia	2006	Herders	IBLIP	District-average livestock losses	5000
Nicaragua	2008	Smallholders	World Bank	Rainfall index	200
Rwanda	2009	Smallholders	MicroEnsure	Rainfall index	500
Tanzania	2009	Smallholders	MicroEnsure	Rainfall index	400
Thailand	2007	Smallholders	BAAC	Rainfall index	400

Sources: Hellmuth et al., 2009; Vargas-Hill and Torero, 2009; Burke, de Janvry and Quintero, 2010

Table 2. Selected institutional-level insurance schemes

Country	Year	Policy-holder	Project name	Instrument	Scale/No. of Beneficiaries
Caribbean	2007	Governments of 16 Caribbean countries	Caribbean Catastrophe Risk Insurance Facility	Insurance indexed to hurricanes and earthquakes	16 Countries
Colombia	2005	Government of Colombia	World Bank Contingency Credit Line	Earthquake contingent Debt	Country level
Ethiopia	2005	World Food Program	AXA Re	Drought-indexed Insurance	Coverage for 62,000 households
Malawi	2009	Government of Malawi	World Bank	Weather derivative on rainfall index	Country level
Mexico	2003	Government of Mexico	Agroasemex (state reinsurance company)	Drought-indexed insurance	800,000 Beneficiaries
Mongolia	2009	Government of Mongolia	World Bank Contingency Credit Line under IBLIP program	Contingent debt, indexed to country-wide livestock losses	5000 Herders

Sources: Hellmuth et al., 2009; Vargas-Hill and Torero, 2009; Burke, de Janvry and Quintero, 2010

includes the analysis of historical weather data and analysis of it in relation to the particulars of the crop to be insured. World Bank (2011) argues that an area yield index product may be more applicable to tropical climates or where pest and disease are leading causes of loss, indexation with WIBI may be problematic.

IFAD (2011) points out similar implementation challenges such as basis risk, technical capacity training, limited perils, and the lack of data availability, as reported by the World Bank. The report echoes the implementation challenges presented by World Bank such as replication which triggers, limits and increments of a specific product need to be adjusted to reflect the weather parameters of each weather station. IFAD also stressed that different product designs are required for different crop types (or at least generic crop types). The report also mentioned WIBI can provide support when it is part of an integrated approach, being one element in an overall risk management or market development strategy. In addition to relocating the risk away from the farmer, WIBI can deliver better access to high-value markets, modern technologies and inputs, agricultural information, and credit and other financial services (IFAD, 2011).

Climate has become a vital issue on the development agenda and there is a great degree of interest in the possible role of WIBI in agricultural adaptation to climate change (Hellmuth et al. 2009). Adaptation to these changes is built on actions to increase resilience and reduce risk such as appropriate crops, varieties and cropping patterns, irrigation, soil and farm management techniques, as well availment of protection against the "aftermath" through crop insurance. WIBI is an innovation deemed to help mitigate the impacts of climate change on farmer livelihoods. The concerns cited in the preceding literature highlight the relevance of further investigating the elements that could significantly influence success in its implementation, translated here as adoption. This study proceeds with investigation of farmer motivations in availing of WIBI, with a focus on the context in the Philippines.

III. Conceptual Framework

In areas where WIBI was first introduced, the earliest research concerns revolve around adoption by target clients. From a marketing perspective, the question is simplified into finding out what factors need to be considered to improve the acceptability and adoption of WIBI for its envisioned impacts to be realized in the community. Previous studies have considered socio-economic factors that influence decisions to avail of WIBI. Hill, Hoddinott, & Kumar (2011) observe that educated, wealthier individuals are more likely to purchase insurance, pointing largely to the capacity to afford as driver of demand. Other works have examined the influence of gender on the demand for WIBI, showing female farmers to be averse to the insurance product (Guo, 2016; Akter, 2016), unless offered through groups (Hill, Hoddinott, & Kumar, 2011).

Researchers on WIBI have explored how the design of the WIBI contract affects demand. Hill, Hoddinott, & Kumar (2011) report negative influence of premium value and basis risk. Basis risk, which is defined as "the difference between the loss experienced by the farmer and the payout triggered." (IFAD, 2011, p22) indicates that if the losses are not highly correlated with an indexed peril, farmers run the risk of experiencing yield loss without a payout. In a less disadvantageous scenario, farmers receive a payout despite not experiencing actual loss. Uncertainty associated with basis risk somehow counterbalances transaction costs of loss adjustment in the conventional crop insurance scheme where payouts directly correspond to the event of actual yield loss. So far, research dealing with basis risk in WIBI, such as the ones conducted by the Centro Internacional de Agricultura Tropical (CIAT) for dry beans in Nicaragua, have focused on developing and fine-tuning estimations of drought probability and severity (Nieto, et al., 2010; Nieto, et al., 2012). To these efforts, Kost et al. (2012) incorporate perceptions and preferences of potential customers into the process of developing acceptable insurance products. Jensen, Mude and Barrett (2009) find that basis risk and spatiotemporal adverse selection play a major role in determining demand for index based livestock insurance in Kenya.

Farmers' knowledge and practices have also been examined in relation to decisions to purchase WIBI. In Nepal, existing adaptation strategies were found to "crowd out" households' tendency to purchase the insurance product as awareness of climate change positively influences the willingness to pay for it (Guo, 2016). Evidence from Morocco and Ethiopia show the positive relationship between perceived or actual risk faced by farmers in the community and the demand for rainfall index crop insurance (McCarthy, 2003; Castellani, Viganò, & Tamre, 2014). Evidence from another study in Ethiopia indicates negative influence of risk aversion to insurance (Hill, Hoddinott, & Kumar, 2011).

The selected studies above offer insights into what factors may affect individual farmer decisions to avail WIBI. These literatures reveal two clusters of studies focusing on: 1) the target clients, and 2) the product design. This research represents the first cluster and is the first to investigate it in the context of Filipino farmers. Potential demand for WIBI is investigated in this study in terms of target clients' willing to pay (WTP) for the insurance product. WTP is also known as the reservation price and is equivalent to the maximum payment that a consumer is willing to give in exchange for a given quantity of product or service. An earlier model of the demand for WIBI looks at the insurance product as a hedging contract and assumes that the target clients or consumers of WIBI are utility maximizers who are well-informed, price taking, and risk averse with decreasing absolute risk aversion (Clark, 2010). One of the major premises of the model is that farmers who have the knowledge and capacity to understand the insurance product's importance are the ones who can make optimizing decisions on whether to avail WIBI. Because WIBI has yet to be rolled out in the Philippines, the "well-informed consumer" assumption will have to be verified and informed by the target clients' level of knowledge about the insurance product vis-à-vis existing alternatives, be it formal crop insurance, other economic means of protection or adaptive farm practices. Attitude, which is defined a "way of thinking that affects behavior", is also an important consideration in the estimation of demand for WIBI. Farmer attitude toward risk is a key factor in individual decision-making and behavior. In literature, attitude is also referred to as risk aversion, which has been measured econometrically following the seminal work of Arrow and Pratt (Arrow 1971; Pratt 1964).

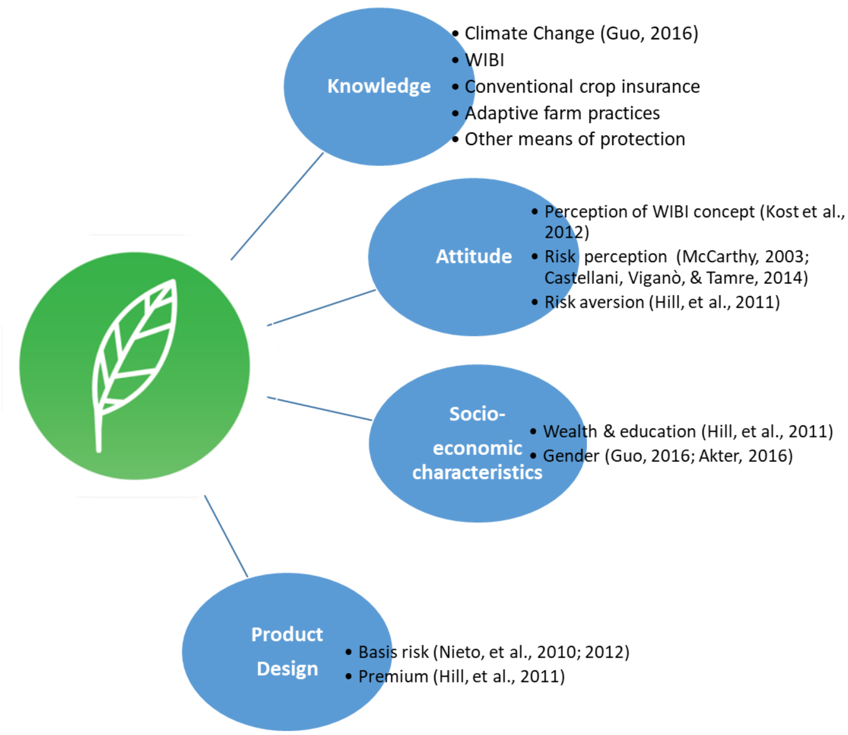


Figure 1. Conceptual Framework

IV. Research Methodology

The study was conducted in the municipalities of Catanauan and Lopez in Quezon Province, Philippines. Quezon is in the southern part of Luzon island and is one of the provinces in the country considered vulnerable to climate change. The municipal sites are considered moderately vulnerable to climate hazards in the recently completed AMIA2[2] Project led by CIAT. Both municipalities are accessible to financing and insurance facilities, while also possessing two of the five automatic weather stations (AWSs) operated by the national government agency, Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) in the province. These sites are hence ideal for anticipated roll-out of WIBI.

The main data gathering activity for this study is a survey of rice farmers within the five-kilometer radius of the PAGASA AWSs in Catanauan and Lopez. Respondents were randomly drawn from the list provided by the respective municipal agriculture offices. Proximity to an AWS was incorporated into the selection criteria to limit the profiling of target respondents to those whose farms are within the distance considered to enable greatest accuracy for local weather information measurement. Farm locations of respondents were geo-tagged to validate the proximity criteria. With Catanauan having a relatively smaller population of rice farmers compared to Lopez, the full

[2] AMIA2 refers to the Second Phase of the Philippine government's Department of Agriculture funded program entitled, Adaptation and Mitigation in Agriculture. CIAT lead one of the projects in AMIA2, which involved assessment of communities' vulnerability to climate change.

list of farmers within the five-kilometer radius of the local AWS was pursued during the survey. On the other hand, Lopez farmers within the five-kilometer radius of the AWS, estimated to be totaling 1600, were randomly sampled to complete the target of 400 respondents for the two sites.

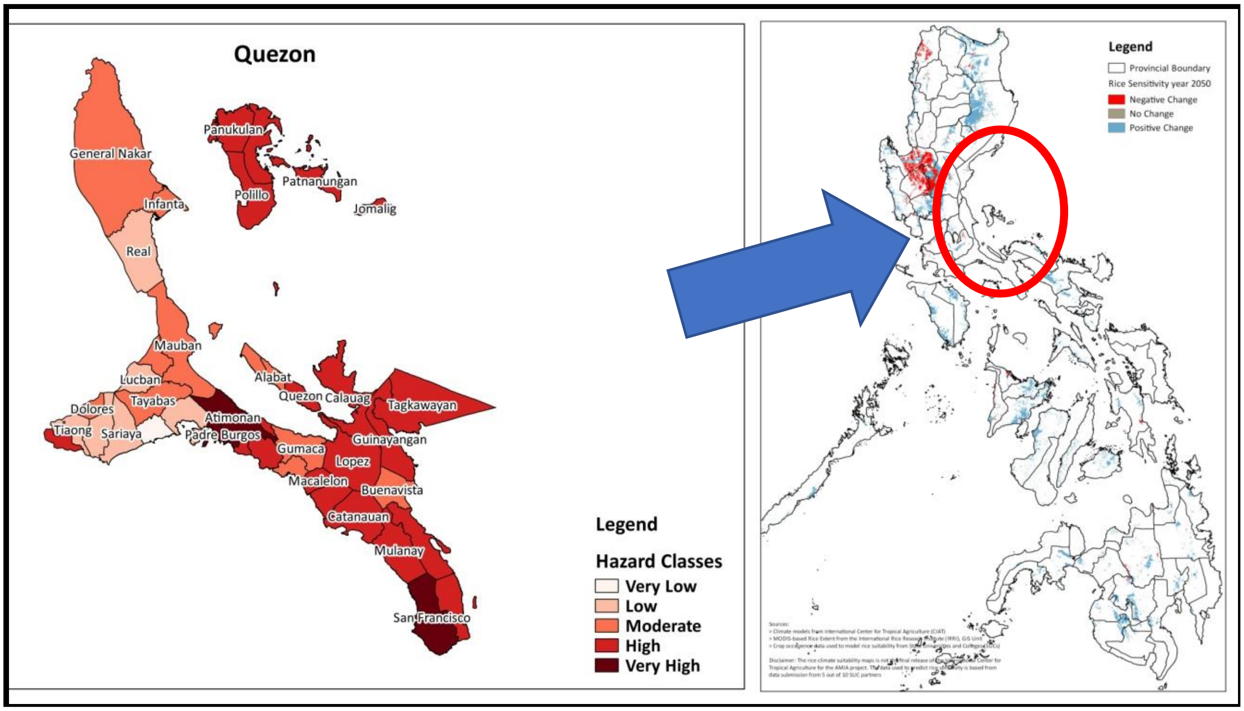


Figure 2. Map of Quezon Province

Attached to this document (Annex A) is copy of the final instrument used in the survey. It comprised of questions pertaining to farmers' profiles along with those of their farms and farming practices. Knowledge and perceptions about climate change, conventional crop insurance and WIBI were determined from the interviews.

Figure 3. Workshop with the survey team was conducted in July 6, 2017 to orient enumerators to the research study, the instrument and to discuss logistics

Figure 4. Pre-test of survey instrument conducted in July 6, 2017

Figure 5. Field survey conducted in Catanauan from July11 to 18, 2017.

The survey includes questions intended to capture farmers' willingness to pay for the insurance. Contingent valuation method (CVM), a survey technique based on economic theory and mostly used in environmental economics to place a value on a good or service that have yet to have an established market, was implemented. The same method has been applied in other studies on WIBI (McCarthy, 2003; Guo, 2016). In the use of contingent valuation method, respondents were asked to indicate interest in purchasing the described insurance at every given value level. At the same time, respondents were asked about the maximum amount (in PhP) that they can each set aside per season to pay for crop insurance premium payments. Information about farmers' knowledge and attitudes toward climate change, conventional crop insurance and WIBI were organized and descriptively analyzed. At the same time, current adaptation practices were tagged from the farmers' responses using qualitative assessment for use as means of self-insurance.

Finally, focus group discussions were conducted in the final leg of the fieldwork. The FGDs served as opportunity to report back findings of the study with local stakeholders and the communities. It also allowed for validation and drawing of supplemental insights into the prospects of launching WIBI in the local communities. Key informant interviews with service providers, as well as secondary data sources, also complement observations from the survey.

Figure 6. AFFP fellow and research supervisor reporting back and discussing with local government officials (September 3, 2018).

Figure 7. AFFP fellow and research supervisor in FGD with male and female rice farmers (September 4, 2018).

Analytical Design

In this study, two-step Heckman estimation was done to decompose the farmer's decision making process into two stages: 1) willingness to buy WIBI and 2) the premium that the farmer would like to pay. Such a model has been applied in several consumer studies (Nicolau & Mas, 2005; Sellers-Rubio & Nicolau-Gonzalbez, 2016)

First, $V1_{ir}$, a set of r variables which represent the characteristics of the farmer i is considered. These variables determine the decision to pay for WIBI–measured by a latent variable d_i -, and γ_r are the coefficients which reflect the effect of these variables on this decision. Second, $V2_{is}$ a set of s variables that represent the characteristics of farmer i and explain the amount of premium P_i that the farmer would pay. βs are the coefficients which reflect the effect of these variables on the premium amount. Thus, the Heckman (1979) model can be expressed as follows:

$$d_i^* = \sum_{r=1}^{R} \gamma_r V1_{ir} + u_i \qquad (1)$$

$$P_i = \sum_{s=1}^{S} \beta_s V2_{is} + \varepsilon_i \text{ observed only if } d_i^* > 0 \qquad (2)$$

In this study, the Heckman (1979) two-stage estimation methodology is used to obtain consistent estimations for the parameters. This method considers the following expression of conditional expectation
of y:

$$E(P_i/d* > 0) = \beta V2 + \sigma_{\varepsilon u}\sigma_e \lambda(-\gamma V1) \qquad (3)$$

where λ is the inverse ratio of Mills, defined as λ(γV1)¼ ϕ(γV1)/(1Φ(γV1)); β and γ are the vectors of parameters which measure the effect of the variables. V1 and V2; and ϕ and Φ are the functions of density and distribution of a Normal, respectively. This expression shows that both decisions - to pay for WIBI coverage and the actual premium price farmers are willing to pay- are related; in other words, the expectation of Pt equals βV1 only when the errors ui and εi are non-correlated (sεu¼0); otherwise, the expectation of Pt is affected by the variables of Eq. (1). The significance of parameter sεu ratifies the superiority of this model over others. From Eq. (3) we can obtain that:

$$P_i/d* > 0 = E(P_i/d* > 0) + v_i = \beta V2 + \sigma_{\varepsilon u}\sigma_\varepsilon \lambda(-\gamma V1) + v_i \qquad (4)$$

where vi is the distributed error term N(0, sε(1sεu(λ (λγV1))). As vi is heteroskedastic, we have to use a heteroskedasticity robust covariance-variance matrix to obtain consistent estimators of the standard errors. From Eq. (4), Heckman proposes the following two-stage procedure: i) estimate by maximum likelihood the coefficients γ of the Probit model represented by Eq. (1), and calculate the Mills' inverse ratio for each observation of the sample $\hat{\lambda}$; and ii) estimate β and βλ¼sεusε, with an OLS regression of Pt over V2 and the estimation of $\hat{\lambda}$. Therefore, in this two-stage choice context the Heckit model is employed to simultaneously model the decisions to buy WIBI and the value of premium to be paid.

V. Results and Discussion

A total of 400 rice farmers were interviewed for the study, representing nine villages in Catanauan and 33 villages in Lopez, all within the five-kilometer radius to the local AWS. Given the relatively large population of rice farmers in Lopez, respondents from the municipality were three times as many as those from Catanauan. Average age of respondent is 54 years, with about half belonging to the 40-59 years age group. The proportion of aging farmers is however substantially large at 33 percent. Most of the respondents (82 percent) were male and about 49 percent have at least some highschool level education. The respondents are distributed as follows:

Table 1. Distribution of respondents, by municipality and socio-demographic characteristics (n=400).

Socio-demographic Characteristics	Catanauan		Lopez		Both	
	No.	%	No.	%	No.	%
Total No. of respondents	85	21	315	79	400	100
Respondents by age group						
Below 40	14	4	51	13	65	16
40-59 years	44	11	159	40	203	51
60 and older	27	7	105	26	132	33
Sex						
Male	74	19	254	64	328	82
Female	11	3	61	15	72	18
Education Level						
None	1	0	3	1	4	1
Elementary undergraduate	19	5	12	3	31	8
Elementary graduate	25	6	103	26	128	32
Highschool undergraduate	12	3	53	13	65	16
Highschool graduate	19	5	112	28	131	33
Vocational/College Undergraduate	8	2	32	8	40	10
College Graduate	1	0	0	0	1	0

Household incomes in the study sites average PhP133,235 (See Table 2). A major source of this income come are non-farm sources (57 percent) such as employment in the public and commercial sectors. Farm incomes make up about 39 percent of household incomes. In Catanauan, income from rice production make up about 42 percent of the farm income while in Lopez, the share of rice income is only 34 percent. Other farm income sources include coconut and vegetable farming, as well as livestock production.

Table 2. Average household incomes, by municipality (n=400).

Income Type	Catanauan	Lopez	Both
Farm Income			
Amount (PhP)	58,098	50,438	52,085
% of Income	44	38	39
Off-Farm Income			
Amount (PhP)	3,547	5,172	4,823
% of Income	3	4	4
Non-Farm Income			
Amount (PhP)	69,551	78,183	76,327
% of Income	53	58	57
Total Income			
Amount (PhP)	131,196	133,793	133,235
% of Income	100	100	100

Drought is the most prevalent stress event for crops in both municipalities (See Table 3) . Catanauan and Lopez farmers share dry, hilly terrain, where pockets of rice paddies are located in between sloping areas. Farmers lament the lack of access to open sources of irrigation. With largely rainfed rice ecosystems, fewer rains pose greater threats to the farmers in these communities. Low lying areas are however also vulnerable to flooding as water from adjacent villages drain into some of the villages during the monsoon season.

Figure 8. Typical terrain and wet season field condition in the study sites

Table 3. Most common crop stress event in the area (n=400).

Stress Event	Catanauan		Lopez		Both	
	No.	%	No.	%	No.	%
Drought	59	13	173	55	224	56
Flood	26	6	55	18	77	19
Flood with Typhoon	15	3	70	22	83	21
Pest Infestation	0	0	16	5	16	4

Farmers' knowledge on climate change

Going into the fieldwork, there was concern about how much farmers actually know about climate change. Preliminary informant interviews suggested that farmers know little about the meaning of climate change despite the term's frequent use in public forums. The survey revealed that only 35 percent of the farmers have a high degree of confidence about their knowledge on climate change (See Table 4).

Although only 30 percent of the farmers are sure about the difference between climate and weather, many of them indicated their awareness of the changing weather patterns. About 74 of the farmers strongly recognize that the weather changes from year to year. Majority were certain that the climate has neither been the same nor colder than in the distant past.

With regard to the causes of climate change, about 49 percent strongly attribute it to the rising levels of carbon dioxide in the atmosphere, 45 percent recognize the effect of crop residue burning, and 34 percent identify it with human activities.

As to the effects of climate change on farming, majority of the respondents acknowledge that some areas will experience more floods due to more intense rains, while some will experience more droughts due to longer dry periods between rain events. Moreover, 59 percent associate climate change with resulting changes in pest and diseases occurrences in the field. About 77 percent of the respondents strongly affirm that changes in rains and temperature due to CC result to changes in yields of rainfed crops.

Knowledge scores derived from farmers' responses to these questions indicate that, on average, rice farmers have substantial understanding of climate change's manifestations, causes and impacts on farming. The mean knowledge score is 74 percent, with about 88 percent of the farmers getting a score of 60 percent or better. The distribution of scores is illustrated in Figure 9.

Farmers' adaptation practices

Table 5 summarizes the most common adaptation practices reported by the respondents. In there, adjustments in the planting schedule register as the most popular adaptation strategy (56 percent). Transplanting is the commonly practiced crop establishment method in the area. In this method, farmers sow the seeds in a seedbed and later manually transplant the seedlings into puddled and leveled fields once the seedlings are 15 to 40 days old. Adjustment in the planting/transplanting schedule is done to ensure that the plant is mature enough to overcome stresses from weeds, other pests, diseases and abiotic factors. With the changing patterns in rainfall, farmers in these rainfed areas commonly wait until the rains come before proceeding to transplant the seedlings. The delays in transplanting schedules are apparent to any observer as planting materials waiting to be transplanted tend to be taller than those in other places in the province where irrigation is not a problem. In some cases, the plants die out before transplanting. Some farmers adjust to this likelihood by increasing the amount of seeds purchased so replacement can be made possible in cases of loss.

Many of the respondents (42 percent) also adjust their harvest schedules in order to adapt to changes in the climatic conditions. Farmers shared that when a typhoon is anticipated, they either delay or hasten the date of harvest, depending on the maturity stage of the plant and the anticipated strength of the typhoon. The concern is not the same during drought as farmers find that the crop does not need as much irrigation at the late stages of maturity. Other adaptation practices point to intentions of minimizing costs and hence exposure to profit loss such as adjustments in the use of inputs to production, including the area of land cultivated. Some farmers even resort to postponing rice production for the season.

Other adaptation practices identified from the interviews include use of rice varieties deemed appropriate for the anticipated stress event---short-duration varieties should there be threat of typhoon-related flooding, or drought resilient varieties for times of extended dry season. Supplemental irrigation is also sought by farmers such as pumping water from an open source. However, in times of extended drought, even open sources run out of water. Some farmers choose to intercrop rice with either legumes for improved soil quality or cash crops for supplemental food and income.

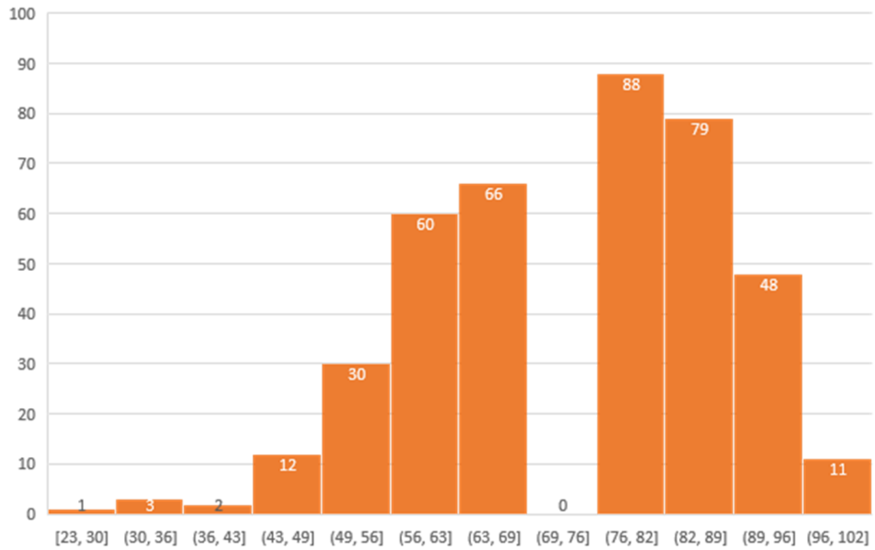


Figure 9. Distribution of rice farmers' knowledge scores

Table 4. Rice farmer's knowledge on climate change (n=400).

Knowledge Statement	Definitely False	Probably False	Not Sure	Probably True	Definitely True
I am very well informed about climate change (CC) and its impacts on farming,	13%	7%	17%	**29%**	**35%**
Weather often changes from year to year.	1%	2%	1%	**23%**	**74%**
Weather and climate are the same thing.	**30%**	**21%**	9%	23%	17%
Rising levels of carbon dioxide in the atmosphere have caused global temperature to increase.	5%	5%	8%	**34%**	**49%**
The Earth's climate has been pretty much the same for millions of years.	**55%**	**22%**	4%	9%	10%
The Earth's climate is colder now that it has been before.	**56%**	**22%**	4%	10%	9%
The Earth's climate has changed naturally in the past; humans are not the cause of global warming.	**34%**	**22%**	8%	19%	17%
Scientists' computer models are too unreliable to predict the climate of the future.	**30%**	**27%**	8%	23%	14%
As an effect of CC, some areas will experience more floods due to more intense rains, while some will experience more droughts due to longer dry periods between rain events.	2%	2%	4%	**25%**	**68%**
The patterns of pest and diseases occurrence change with the climate.	2%	5%	5%	**30%**	**59%**
Changes in yields of rainfed crops will be driven by changes in rains and temperature due to CC.	1%	1%	0%	**21%**	**77%**
Burning of crop residues in the field is also contributing toward CC	10%	7%	11%	**28%**	**45%**

Table 5. Primary adaptation strategies of rice farmers (n=400).

Primary Adaptation Strategy	Farmers Reporting No.	%
Adjust planting schedule	222	56
Adjust harvest schedule	166	42
Adjust fertilizer use	133	33
Adjust pesticide use	118	30
Change variety planted	98	25
Adjust seeds use	94	24
Adjust labor use	81	20
Adjust use of supplemental irrigation	75	19
Adjust the size of area cultivated	41	10
Plant other crops with rice/intercrop	25	6
Postpone planting for the season	15	4
Other strategies	9	2

Adaptation practices entail additional costs to the farmer. Majority of the rice farmers who adapt their farming practices to changes in the climate (47 percent) draw from their own revolving capital in paying for the costs of their adaptation (See Figure 10). While about 14 percent of the farmers avail loans for this purpose, a greater combined proportion (23 percent) of the farmers get their adaptation financing from other crop income and means of employment. These costs could be justified in terms of the values of loss in production and income mitigated by the practice.

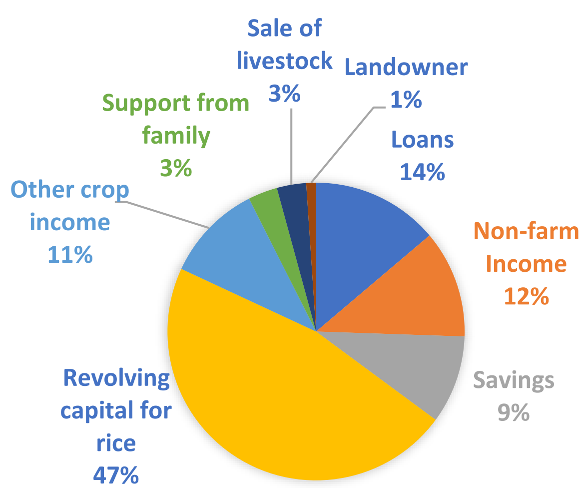


Figure 10. Rice farmers' sources of funds for adaptation strategies (n=94).

Table 6. Perceived effectiveness of adaptation strategies in loss mitigation (n=400).

Primary Adaptation Strategy	% Production Loss Mitigated	% Income Loss Mitigated
Adjust planting schedule	52.33	44.33
Adjust harvest schedule	43.59	37.82
Adjust fertilizer use	21.12	23.89
Adjust pesticide use	34.82	35.89
Change variety planted	34.48	35.48
Adjust seeds use	35.88	36.72
Adjust labor use	29.60	31.77
Adjust use of supplemental irrigation	50.38	46.18
Adjust the size of area cultivated	54.79	53.26
Plant other crops with rice/intercrop	50.59	36.27
Postpone planting for the season	88.46	19.23
Other strategies	52.78	52.78

Table 6 summarizes the advantages of adaptation practices reported by the farmers in terms of the value of mitigated losses in production and income. Among the practices reported, the highest average value of production loss mitigated was found for postponement of planting for the season. The strategy refers in particular to periods when a drought is anticipated and farmers would rather not try exposing themselves to losses because they are mostly dependent on rain as source of irrigation for the farm. Farmers are able to do this if they have other sources of income by which they can afford food and other necessities. Next to postponement of planting is the related practice of adjusting or reducing the size of area cultivated which in farmers' opinion mitigates on average 55 percent of the production losses. Another perceived top mitigating practices against production loss is the adjustment of planting schedule, which farmers estimate to mitigate an average of 52 percent of the production losses. As farmers see the effectiveness of this strategy, cropping calendars can be expected to shift over time, along with shifts of rainfall patterns ascribed to climate change. Other top adaptation strategies in terms of production loss mitigation include intercropping and use of supplemental irrigation, which were both seen to help recoup half of the production that could be lost to changes in the climate.

In terms of mitigating rice income losses, farmers see the adjustment of area cultivated as most effective in terms of reducing the greatest proportion of loss. It can once again be conjectured that the strategy pertains to the anticipated drought seasons and farmers solely dependent on rains for irrigation. A related adaptation practice is adjusting pesticide use (36 percent), which was also confirmed from the FGDs as targeted at reducing costs in rice farming. Farmers see these practices as helpful in reducing exposure rather than actually reversing the adverse impact of climate change on their incomes from rice farming. Farmers also see the use of supplemental irrigation as mitigating income losses in higher proportions compared to other practices. This highlights the importance of irrigation in rice productivity, in that while the practice incurs more expense, it is able to help improve the situation of the crop enough to help recover about 46 percent of what could be income losses from rice production. Adjustment of the planting schedule also helps mitigates higher proportion of the production losses (44 percent) followed by adjustment in harvest schedule (38 percent). Both these practices once again point to the rainfall dependence of the rice ecosystem in the study sites. Other top farming income mitigation mechanisms include adjusting seeds us to allow for replacements during early crop growth stage (37 percent) and changing the variety being used to more tolerant ones (35 percent).

Farmers and Crop Insurance

Despite the many years of the PCIC's operations in the province, crop insurance is still not very popular among the farmers. About 39 percent of the respondents have heard of crop insurance. Among those who did, only 17 percent have actually availed coverage. While it can be learned from Karlan et al. (2012) that experience with insurance (in terms of undergoing payouts) is essential for demand because it provides basis for learning and trust, many of the respondents who availed of crop insurance expressed dissatisfaction. In fact, only two (out of 26) were satisfied with the experience. These findings pose a challenge to the promotion of crop insurance as an adaptation mechanism for rice farmers.

After the mechanics of the crop insurance was explained to the respondents, about 80 percent expressed willingness to get coverage. The average premium rice farmers were willing to pay is estimated at PhP1602 (USD32.04) per hectare, which is much lower than the 9-12 percent range of premium offered by PCIC to self-financed farmers. Such information is useful for consideration in the formulation of subsidy schemes. As of now, the Philippine government provides multi-peril crop insurance to qualified indigent farmers at 100 percent subsidy. Discussion with local government officials revealed that farmers found the current process of conventional insurance availment tedious work and slow and thus would choose to rather depend on their other means of livelihood to start over from their losses. Another informant shared that some farmers have had problems in having their claims processed and so became disillusioned with the service.

Given that WIBI is still in the piloting stage in the Philippines, it is practically unheard of among the respondents. The features of WIBI were presented to the farmers using Annex B as a guide. Thereafter, the farmers were asked about their willingness to be covered by WIBI. About three-fourths of them responded positively. Among the desirable features of WIBI that farmers identified mainly point to convenience and reliability of AWS data (See Table 7). Some farmers focused on the probable positive outcome of basis risk in which a pay-out may be higher than actual losses suffered (as opposed to the lose-lose situation in which pay-out is either not warranted or not commensurate to value of losses) Farmers also perceive that WIBI can cover more areas compared to conventional crop insurance.

Table 7. Desirable features of WIBI (n=400).

WIBI Features	Responses	
	No.	%
Less waiting time for payout	175	44
Less paperwork	174	44
AWS recorded data is more reliable	168	42
Flip side of basis risk	14	4
Can cover more areas	7	2
Pay out for different stages of rice	1	0

A few farmers shared some concerns about the concept of WIBI presented to them (See Table 8). Most of the comments were about uncertainty on how the AWS works and how accurate and reliable it is in generating weather information that will be used for determining pay-outs. This only goes to show that farmers have yet to be further oriented on the climate information technologies like AWS in order for them to appreciate innovations like WIBI. Another concern shared by farmers is about the limited coverage of risks involved, which is also related to the basis risk. The WIBI concept presented to the respondents is one pegged to the amount of rainfall. Some of the farmers noted that WIBI does not cover crop loss due to factors other than rainfall, such as pests and diseases. During discussions with farmer leaders, one of the participants described how the general landscape of the municipality is such that low lying villages serve as catch-basins of floods originating from other villages where the rains may occur. WIBI that is based on localized rainfall data can hence not account for landscape-related flood risk in the rice fields. With rainfall data as basis for payout, some farmers noted that they may fail to receive payment when losses occur due to other causes. The farmers expressed interest in learning more about the WIBI scheme. There were concerns about the affordability of coverage, as well as technologies that would be required for coverage like use of certified seeds. Others would still like to know about the results of pilots done in the country. These concerns can inform implementation design for eventual roll-out of WIBI.

Table 8. Rice farmers' concerns about WIBI.

Concerns about WIBI	Responses	
	No.	%
Accuracy and reliability of the AWS equipment in recording weather info	50	13
Limited coverage of risks	28	7
Lack of knowledge about details of implementation scheme for WIBI	21	5
Basis risk affecting pay-outs	18	5
Premium payment might be too expensive	4	1
Need to see implementation results in pilot areas	2	1
Required use of certified seeds entail higher costs	2	1

After the general mechanics of the WIBI was explained to the respondents, about 75 percent expressed willingness to get coverage. Farmers who have indicated reservations about WIBI echoed much of the same concerns as reasons for their reluctance (See Figure 11).

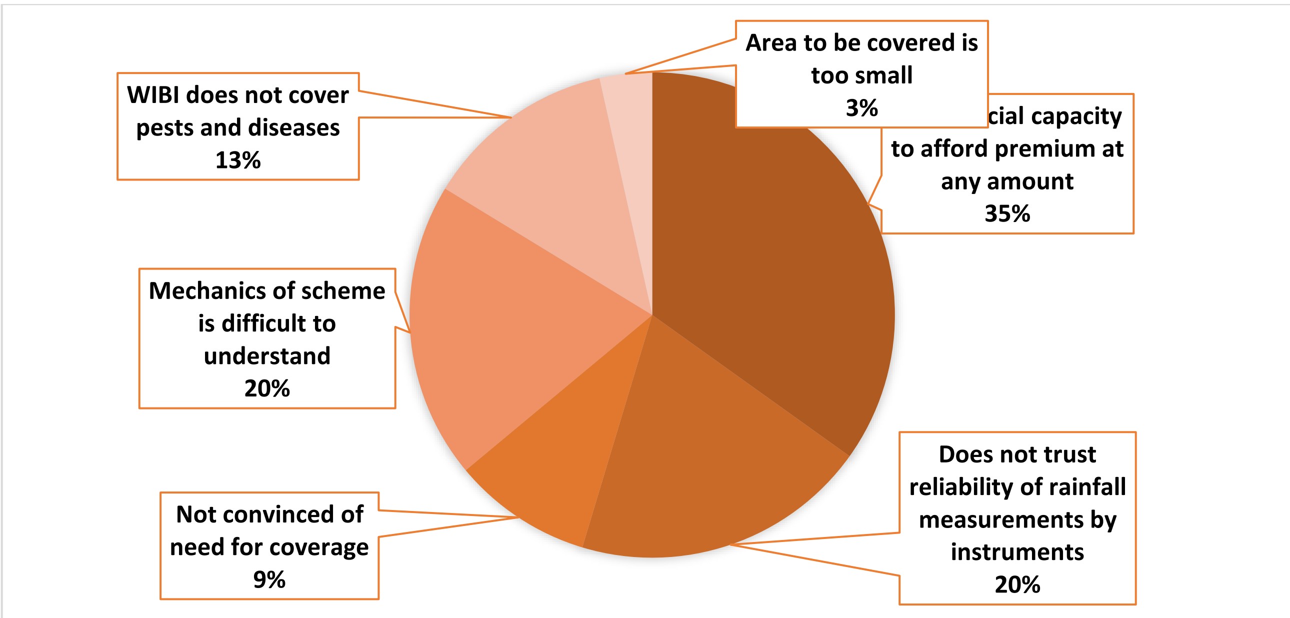
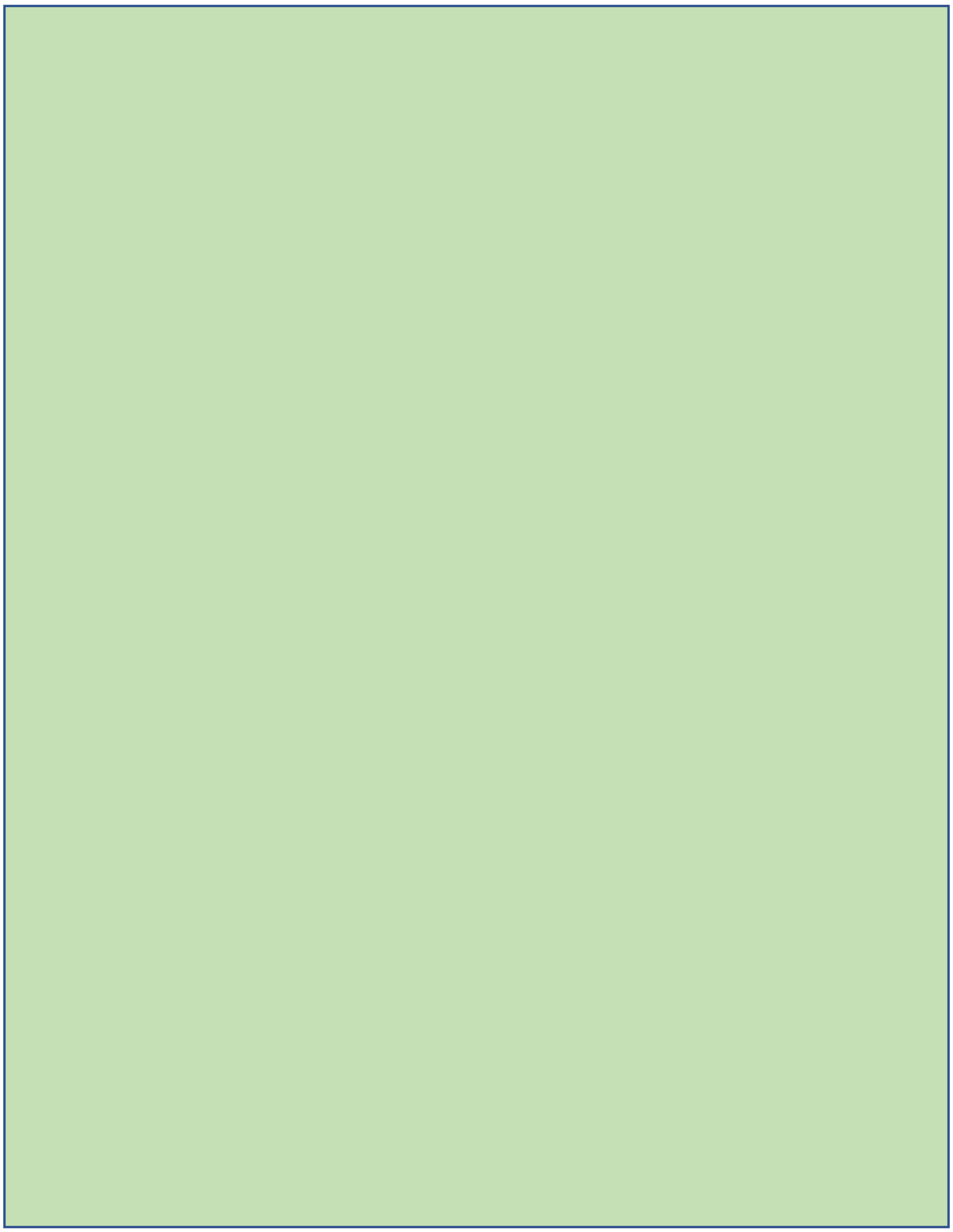


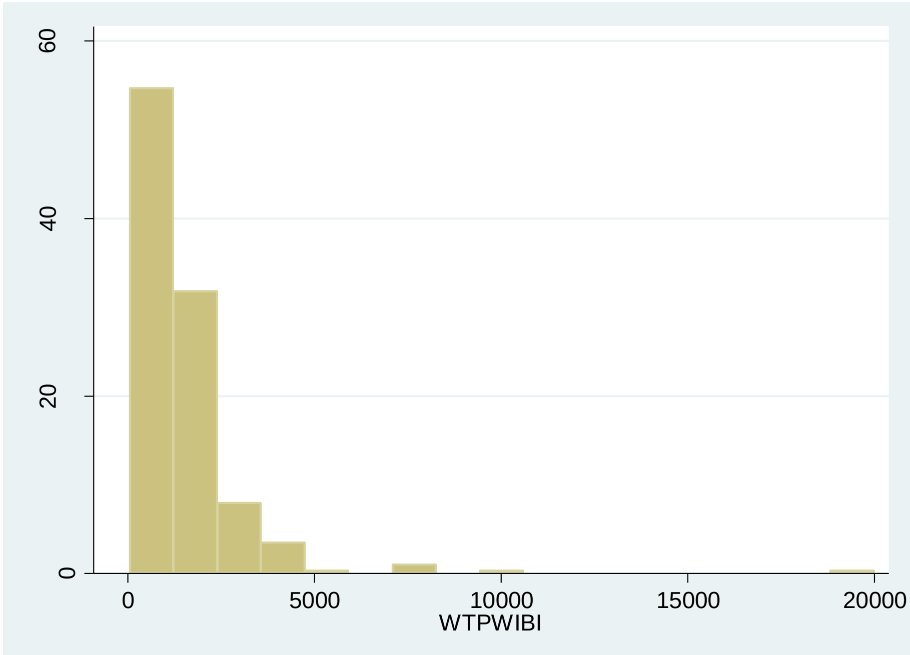
Figure 11. Farmers' reason for reluctance toward WIBI

Estimation results of the Heckman sample section model (Table 9) indicate that on average, younger farmers tend to be more willing to get covered by WIBI than their senior. This is indicative of the openness to innovative schemes of risk protection. Women farmers were also found to have less likelihood of preferring WIBI coverage. Such finding resonates with the observation of Akter et al. (2016), where such behavior was further explained by a preference for an alternative mode of delivery, that is, through groups. A follow-up FGD with women farmers reveal a few related observations. Women farmers were more concerned about addressing the other risks to rice farming that are not directly related to rainfall like area flooding. When probed, farmers shared basis risk concerns. Moreover, the women shared how little they know of crop insurance, with information trickling through the farmer associations. Since women admit they play an important role in making financial decisions in the farm, this result calls for further consideration of how information about crop insurance can better reach both men and women farmers.

Another significant determinant of the willingness to be covered by WIBI is non-farm income. Estimation results show that an increase in non-farm income increases the tendency of farmers to be amenable to WIBI coverage, perhaps due to perceived greater ability to afford premium payments. Non-farm incomes have served to smoothen household incomes of the farm households, particularly in times of poor gains from farming.

The average premium for WIBI that rice farmers were willing to pay is estimated at PhP1563 (USD31.24) per hectare, which is also lower than the 9-12 percent range of premium offered by PCIC for multi-peril crop insurance to self-financed farmers. Such information is useful for consideration in the formulation of subsidy schemes. Figure 12 shows the distribution of rice farmers' willingness to pay for conventional crop insurance and WIBI.





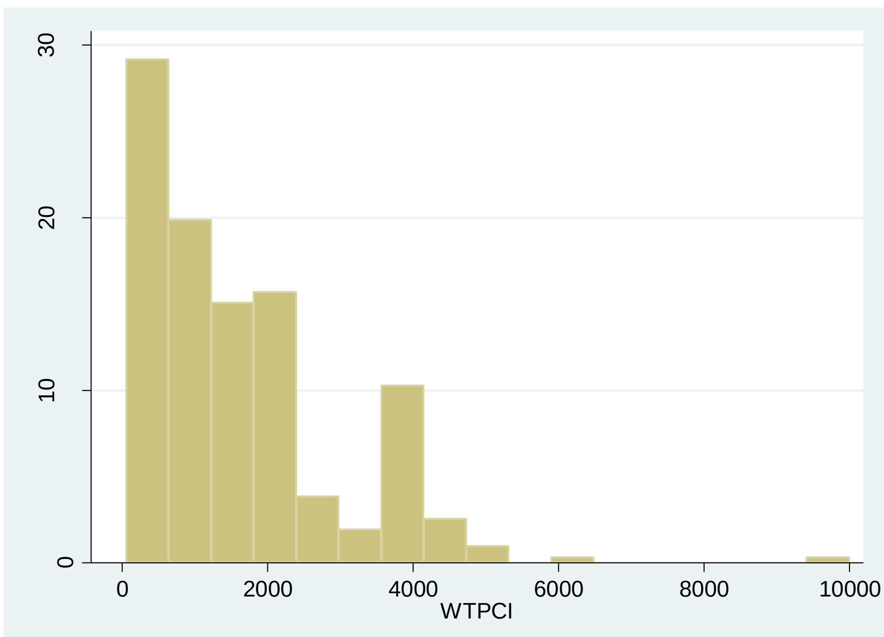


Figure 12. Distribution of rice farmers' willingness to pay (PhP/ha) in Catanauan and Lopez, Quezon.

When it comes to estimates of the willingness to pay for coverage, results show the marginal yet significant influence of wealth in terms of the value of household assets. An intriguing result is The rice farmers' willingness to pay for WIBI significantly declining with area planted to rice, which is further illustrated in Table 10. Follow-up discussions with farmer leaders were done to explain this result. Farmers explain that much of decision in determining the maximum premium for WIBI coverage is based on their appreciation of the actual costs that they will face from the transaction. Since most of the farmers produce rice primarily for home consumption, they have little interest in monitoring cost efficiencies and are more concerned about the total production costs they would be facing. Payment for WIBI coverage is seen more as an expense rather than an income loss-mitigating mechanism. At the end of the day, most farmers just want to keep the total production expense down.

Table 9. Rice farmers' willingness to pay for WIBI (Heckman sample selection model).

	Coefficient	**Linearized Std. Error**	**t**	**P>|t|**
WTPWIBI				
No. of adaptation strategies	64.712	43.066	1.50	0.13
Rice area (sqm)	-0.053	0.020	-2.63	0.01
Household assets (PhP)	0.000	0.000	-1.74	0.08
Rice income (PhP)	0.003	0.003	0.91	0.36
Non-farm income (PhP)	0.002	0.002	1.30	0.19
Constant	1885.270	298.303	6.32	0.00
WIBI				
Education Level	0.075	0.064	1.16	0.25
Being a female farmer	-0.352	0.177	-1.99	0.05
Age	-0.018	0.006	-2.95	0.00
Knowledge Score on CC	-0.004	0.005	-0.71	0.48
HH Asset Value (PhP)	-1.26E-07	1.46E-07	-0.86	0.39
Rice income	-1.42E-06	3.01E-06	-0.47	0.64
Non-farm income	2.20E-06	8.33E-07	2.64	0.01
Constant	1.55E+00	1.55E+00	2.65	0.01
Athrho	-0.0869083	3.76E-02	-2.31	0.02
Lnsigma	7.736981	2.69E-01	28.75	0.00

Table 10. WTP for WIBI by rice area.

Rice Area	Catanauan No. of Farmers	Catanauan Mean WTP	Lopez No. of Farmers	Lopez Mean WTP	All No. of Farmers	All Mean WTP
<1 ha	22	3,625	127	1,725	149	1,995
1-3 ha	32	1,513	109	1,193	141	1,264
> 3ha	3	500	5	1,587	8	1,179
All	57	2,264	241	1,481	298	1,627

VI. Summary and Conclusion

This study validates that on average, rice farmers have substantial understanding of climate change's manifestations, causes and impacts on farming. The farmers also exhibit substantial knowledge of the causes of climate change, particularly as it relates to human activities. Farmers are also able to link climate change related adverse events to crop stresses that eventually lead to drops in productivity. Ironically however, estimation of rice farmers' willingness to pay for WIBI did not indicate significant influence of such knowledge.

Estimation results indicate that on average, younger farmers tend to be more willing to get covered by WIBI than their senior. This is indicative of the openness to innovative schemes of risk protection. Women farmers were found to have less likelihood of preferring WIBI coverage, a finding that resonates with the observation of Akter et al. (2016). A follow-up FGD with women farmers revealed their greater concerns about addressing the other risks to rice farming that are not directly related to rainfall, as well as little they have about crop insurance. Since women admit playing an important role in making financial decisions in the farm, this result calls for further consideration of how information about WIBI can equitably reach both men and women farmers. Another significant determinant of the willingness to be covered by WIBI is non-farm income. Estimation results show that an increase in non-farm income increases the tendency of farmers to be amenable to WIBI coverage, perhaps due to perceived greater ability to afford premium.

When it comes to estimates of the willingness to pay for coverage, results show the marginal yet significant influence of wealth. An intriguing result is that rice farmers' willingness to pay for WIBI significantly declines with area planted to rice. Follow-up discussions revealed that much of decision in determining the maximum premium for WIBI coverage is based on their appreciation of the actual costs that they will face from the transaction. Since most of the farmers produce rice primarily for home consumption, they have little interest in monitoring cost efficiencies and are more concerned about the total production costs they would be facing. Payment for WIBI coverage is seen more as an expense rather than an income loss-mitigating mechanism in farming. At the end of the day, most farmers just want to keep the total production expense down.

Despite general amenability to WIBI coverage, it can be noted that farmers' willingness to pay falls below the range of premiums currently offered by PCIC to non-indigent farmers. In fact, whether it is conventional insurance or WIBI, the willingness to pay remains below on-going PCIC rates. On one hand, while many farmers are deemed eligible for fully subsidized multi-peril crop insurance at the moment, the tediousness of the process and accounts of bad experiences during the filing of claims have already discouraged farmers from availing of insurance coverage. On the other hand, we must account for the fact that farmers still have some concerns about the concept of WIBI which could influence their willingness to pay for coverage. Much of the concern, which was further validated in the FGDs pertain to basis risk and the unfavorable landscape in which many of the farms are located. In three FGDs conducted, it was highlighted that flooding in low-lying areas expose farms to flood risk that may not be directly linked to local rainfall levels.

With drought as the most common climate-related crop stress in both municipalities, a WIBI product may best be designed specifically for drought events. Most of the farms are also rainfed, rendering farmers more vulnerable to rainfall shortages. They would hence benefit most from such a WIBI insurance product. On the other hand, a WIBI insurance for typhoon or flooding will need further analysis as the problem, as verified in this study, is at a landscape level and would hence require an insurance product design that is more appropriate to the local conditions.
From farmers' perspective, postponement of planting for the season has the highest production loss mitigation result among other strategies implemented to adapt to climate change. This is quite problematic since postponement of farming does not actually reverse the adverse impact of climate change on production. This adaptation strategy would instead make more sense in terms of mitigating costs (and income losses) in rice farming. Practices that reduce farmers' exposure to income loss would include reductions in use of material inputs, size of land cultivated, and at the extreme a postponement of farming for the entire season. Given the large average share of non-farm income in the household incomes of respondents, many farmers are able to do this as they can afford food and other necessities even without farming activity for a season. Farmers also see the use of supplemental irrigation and adjustment of the planting schedule as effective means of mitigating income losses due to adverse impacts of climate change on rice farming. Many farmers adjust the crop calendar to adjust planting schedule to the arrival of rains, or the harvest schedule to the anticipated strength of a typhoon. These practices along with other adaptation strategies like intercropping, changing to stress-tolerant varieties, and use of supplemental irrigation, have additional cost implications which adapting farmers fund mostly from a revolving capital. Formal credit takes a backseat to this and other means of sourcing funds for adaptation like borrowing from friends and relatives, using of other income sources, and savings.

Going back to question of why farmer knowledge did not significantly influence their willingness to pay for WIBI, this paper posits that the issue does not rest on farmer knowledge per se but on several other important considerations. For one, past experience with government provided crop insurance indicate disappointment not only in the delivery of the service for the few that availed of it among the respondents, but also in the general impression of it having low accessibility in the communities. Local officials noted that insurance agents have yet to develop systematic coordination mechanism with their office regarding their interactions with farmers. Secondly, product design (which at the time of the study have limitations at specificity) will need to be fitted to concerns of target farmers, particularly when the basis for risk may not be directly associated with a weather derivative like rainfall. Socio-demographic considerations must also be noted, along with ensuring sufficient and equitable access to insurance and other climate adaptation concerns.

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