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Knowledge, Attitude, and Practices on Climate Change Among Rice Farmers in Central Luzon, Philippines

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ABSTRACT

The Philippines has been listed as the topmost affected country by climate change. One of the sectors affected by this climatic change is the agricultural sector. This study aimed to document the knowledge, attitude, and practices (KAPs) on climate change among rice farmers as a baseline study in disseminating the practices on disaster risk reduction management to rice farmers in Central Luzon to reduce risks and improve the rice yield and income of rice farmers. A total of 969 respondents were randomly sampled from the seven provinces of Central Luzon. A survey questionnaire and an unstructured questionnaire were used as instruments in gathering the needed data. Descriptive and thematic analysis were used in analyzing the data. Results revealed that rice farmers are knowledgeable and have favorable attitudes toward the impact of climate change on farming. They sometimes practice climate-smart agricultural practices. Generally, the farmers are affected by weather and climatic conditions as well as the hazards that cause a reduction in rice yield. Climate change has affected farmers in their social well-being, economic aspect, and rice production. In terms of climate change disaster adaptation measures, the farmers sometimes adopt measures in terms of flood and drought and seldom adopt measures in typhoons, erosion, and volcanic eruptions. The study recommends the conduct of capability training on disaster risk reduction in rice production (such as early planting and planting of high-yielding varieties) based on the specific needs of each province.

INTRODUCTION

The Global Climate Risk Index 2020 listed the Philippines as the topmost affected country by climate change, using 2018 data. Since the Philippines is an archipelago lying in the western Pacific Ocean, it is surrounded by naturally warm waters that will likely get even warmer as the average sea surface temperatures continue to rise. Jabines & Inventor (2007) likewise considered the country as one of the climate hotspots due to its geographical location and low level of economic development, further aggravated by its people's poor access to resources.

Climate change and, in particular, increasing surface temperature, rising sea levels, and increased precipitation will cause significant changes in the lives of people in the forthcoming years (Celik 2020, Ebi & Hess 2020, Griggs & Reguero 2021). Drastic changes in temperature and rainfall levels are predicted. Droughts will be more intense and frequent, as well as typhoons and, consequently, flooding and landslides. The country has experienced the world's strongest storm to make landfall in Philippine history, typhoon Yolanda or Haiyan. The devastation from that typhoon propelled the country to the top of the list of the most vulnerable countries to climate change based on the annual Global Climate Risk Index of Germanwatch (Ranada 2015). Central Luzon and Bicol Regions are two of the most disaster-prone areas in the country due to their geophysical location. The natural hazards in Central Luzon, mainly storms and floods, put the lives of vulnerable households at risk. Four of the 7 provinces of Central Luzon – Pampanga, Tarlac, Nueva Ecija, and Bulacan are among the top 10 provinces which are highly susceptible to flooding (Mines & Geosciences Bureau 2015).

Agriculture played a very important role in providing about 30% of employment and 10% of the country's gross domestic product (GDP) in 2013. Natural calamities and the changing climate have affected crop and livestock production in the country, causing economic loss and food insecurity (Hidrobo et al. 2014). Flora (2018) reported that "agriculture is the most affected sector in the country in terms of the effects of climate change, according to Chief Legal Counsel of the Climate Change Commission Efren Basco. The country faced the biggest challenge in the agriculture sector when typhoon Haiyan (locally known as Super Typhoon *Yolanda*) devastated the country in 2013, destroying around P17,321,150,996.38, which is considered the biggest in the country's history.

Central Luzon, the rice granary of the Philippines, is not spared from the damage brought about by typhoons. Central Luzon accounts for 14-15% of the total rice production in the country (Flora 2018). According to Suarez (2013), Central Luzon rice production areas were damaged by several typhoons. In 2015, the total damaged rice production area due to several typhoons, including the most destructive Lando, was 51,398.6 hectares, and the province of Pampanga was the worst hit with 26,514 hectares. In 2015, Typhoon Lando damaged at least P5 billion worth of crops in Central Luzon. In 2016, the total recorded damage was 7,081.54 hectares. Pampanga had the highest damage in terms of production areas. In 2018, a total of 174,468 hectares were damaged by 6 typhoons, Ompong was the most damaging, and Nueva Ecija was the most affected, with more than 93,000 hectares of rice affected. However, the region recorded a damage of at least P5B worth of crops in 2015 due to typhoon Lando, and this was compounded by the damage in rice crops due to flooding brought by typhoon Nona before the end of 2015 and by typhoon Nina in 2016, wherein Nueva Ecija is the hardest hit. In the province of Zambales, the onslaught of typhoon Lando in Sta. Cruz alone caused P500 M losses in food, rice, mango, and fish production. Aside from typhoons, drought also affected rice production. In 2016, 10 441.48 hectares were damaged, with a total loss of more than Php589M in rice production.

Since the state of the farmers is mostly affected by changing climate, particularly the rising temperature and fluctuations in precipitation (changing intensity and duration of rainfall) resulting in hazards, the promotion of disaster risk reduction management to the rice farmers in Central Luzon is deemed necessary.

The findings of this study will be used as benchmark information for the identification of priority areas for action and as a guide for the development of a regional adaptation program. This could also pave the way to the development of a strong institutional mechanism with enabling policies to ensure that the rice farming communities and their practices are resilient and sustainable so as to cope with the impacts of the changing climate.

OBJECTIVES OF THE STUDY

Generally, this research aimed to ascertain the rice farmers' knowledge, attitude, and practices (KAPs) on climate change as a basis for promoting disaster risk reduction management to rice farmers in Central Luzon to reduce risks and improve the rice yield and income of rice farmers. The study specifically identified the impact of natural disasters on the socio-cultural and economic conditions of the rice farming community and the farmers' coping mechanisms and adaptive practices.

MATERIALS AND METHODS

Study Design

The descriptive method of research was employed in the study. Descriptive research is characterized by the objective description and systematic analysis of phenomena without manipulating variables. It aims to provide a comprehensive and accurate portrayal of the characteristics, behaviors, or conditions under investigation.

Study Population Size and Location

Table 1 presents the distribution of the respondents by province.

As gleaned from the table, most of the respondents came from Tarlac (26.21%), followed by Zambales (19.20%) and Aurora (15.58%). Other respondents came from Pampanga, Bulacan, Nueva Ecija, and Bataan. A total of 969 rice farmers took part in the study.

The data was collected in the seven provinces of Central Luzon through random sampling. Random sampling involves selecting participants from the population in such a way that each individual has an equal chance of being chosen. Central Luzon is the highest rice-producing region in the Philippines. Fig. 1 shows the location of the study where data were collected.

Data Collection Method

The triangulation method was used in which the information was generated through Focus Group Discussion (FGD)/ Key Informant Interview (KII), Face-to-face interview, and the use of secondary data. The unstructured questionnaire

Table 1: Frequency distribution of the respondents.

Provinces	F	%
Aurora	151	15.58
Bataan	94	9.70
Bulacan	68	7.02
Nueva Ecija	86	8.88
Pampanga	130	13.42
Tarlac	254	26.21
Zambales	186	19.20
Total	969	100.0

Fig. 1. Map of the study area.

was used for FGD and KII, while an Interview Schedule (structured questionnaire) was formulated for interviewing the randomly selected respondents. Participatory Rural Appraisal (PRA) was utilized in this undertaking.

Data Analysis and Presentation

The data collected was organized, tallied, and tabulated in an Excel spreadsheet. Statistical tools like Percentage, Arithmetic Weighted Mean, and Pearson-r were used. The Likert Scale was used in the interpretation of the generated data.

RESULTS AND DISCUSSION

Knowledge, Attitude, and Practices of Rice Farmers on Climate Change and Farming

Table 2 shows the knowledge of rice farmers on climate change and farming.

As given in the table, the rice farmers are moderately knowledgeable about climate change, as shown by the overall mean of 3.28 (SD=0.57). They moderately understand what climate change is (M=3.40, SD=0.83) and are moderately

Table 2: Knowledge of rice farmers on climate change and farming.

Knowledge	M	SD	QI
1. I understand what climate change is	3.40	0.83	M
2. The climate change is changing and becoming more unpredictable	3.36	0.79	M
3. Climate change can negatively affect rice production	3.39	0.80	M
4. Frequent and stronger typhoons can be a result of climate change	3.36	0.85	M
5. The temperature is increasing, and it may increase more in the coming years	3.29	0.89	M
6. I am aware that the sea level is rising	3.04	0.98	M
7. Peoples activities like the operation of power plants and tree logging can contribute to a change in climate	3.27	0.93	M
8. Drought can also be a result of climate change	3.36	0.82	M
9. Aerosols, refrigerants, and other chemicals can contribute to a change in climate	3.16	0.91	M
10. Flooding is also a possible result of climate change	3.29	0.84	M
11. I understand what crop insurance is.	3.31	0.96	M
Overall Mean	3.28	0.57	M

Legends: H-Highly Knowledgeable (3.50-4.00); M-Moderately Knowledgeable (2.50-3.49); Slightly Knowledgeable (1.50-2.49); N-Not Knowledgeable (1.00-1.49); M-Mean; SD-Standard Deviation; QI-Qualitative Interpretation knowledgeable that climate change can negatively affect rice production (M=3.39, SD=0.80). They moderately know that drought can also be a result of climate change (M=3.36, SD=0.82) and that frequent and stronger typhoons can be a result of climate change (M=3.36, SD=0.85). According to Mandal & Singh (2020), 75- 80% of farmers in Nepal feel that temperature increases, rainfall duration and frequency decrease due to global warming. About 33.33% of farmers experience an increase in flooding hazard due to an increase in rainfall intensity during the rainy season in Siraha and its vicinity. The majority of respondents perceived an increase in weed and pest (65%) and new weed (30%) and new pest (26.7%) infestation due to climate change. About 18% of respondents had a clear knowledge of climate change.

The lowest means were obtained in the following indicators: I am aware that the sea level is rising (M=3.04, SD=0.98), Aerosols, refrigerants, and other chemicals can contribute to a change in climate (M=3.16, SD=0,91), and peoples activities like the operation of power plants and tree logging can contribute to a change in climate (M=3.27, SD=0.93).

The results imply that the rice farmers have a moderate level of knowledge about climate change and its effects on rice farming. Information dissemination driven through training may further improve their level of knowledge about the phenomenon. Similar findings were found by Islam et al. (2019) that an overwhelming majority (78.8%) of the respondents had medium to high knowledge of climate change effects on agriculture. On the other hand, the findings of Grace et al. (2015) show that the farmers are generally aware of direct and observable causes of climate change and the main impacts of climate change on agriculture but are not clear about the interconnections between the natural environment and farm management activities that result in climate change. Table 3 presents the attitude of rice farmers on climate change and farming.

As presented in the table, the rice farmers agree about the different attitude indicators, as shown by the overall mean of 3.12 (SD=0.56). This suggests that rice farmers have a favorable attitude toward climate change. Most farmers in Central Luzon were willing to invest in crop insurance as their way to address climate change effects, having a mean of 3.44 (SD=0.87). However, in the study of Holloway & Ilberry (1996), the farmers indicated a combination of positive and negative impacts from global warming, but most think that changes will enable them to adapt to climate change, and most would also consider the possibility of introducing new crops such as navy beans. The willingness of the farmers to use new technologies in addressing climate change to minimize losses got a favorable attitude for the farmers, with a mean of 3.42 (SD=0.85). In Pakistan, the adoption of such varieties has not been widely adopted due to high prices and a lack of availability. The absence of government subsidies holds back productivity gains, a shortage of credit facilities, a lack of awareness, poor infrastructure, rising costs of fertilizers, and a shortage of irrigation water (Stone & Nicholas 1995). Table 4 shows the practices of rice farmers on climate change and farming.

Table 4 shows the practices of farmers to address climate change. The farmers indicated that the most important practice for them to address climate change is being updated on the weather forecast of Pag-asa with a Mean of 3.59 (SD =0.79). This will determine whether they can plant rice already, especially for the upland areas. The occurrence of typhoons is also being monitored, whether to harvest early or later the mature play. The use of hybrid seeds that are

Table 3: Attitude of rice farmers on climate change and farming.

Attitude	M	SD	QI
1. I am willing to use hybrid rice/climate-smart rice in order to increase my harvest	3.35	0.93	A
2. I am willing to use the new technologies being offered by the concerned agencies to minimize crop losses	3.42	0.85	A
3. I believe that climate change will inevitably affect my crop yield	3.24	0.94	A
4. I am willing to invest and apply for crop insurance in order to minimize crop losses brought about by climatic hazards	3.44	0.87	A
5. I believe that organic farming can help reduce the impacts of climate change on rice farming	3.14	0.97	A
6. I am convinced that I can avoid the impacts of changing climate on my farming activities by adjusting to the existing climatic conditions	3.21	0.93	A
7. I do not believe in climate change*	2.84	1.21	A
8. Rice farmers should not worry about climate change. It is a natural event.*	2.33	1.20	D
Overall Mean	3.12	0.56	A

Legends: SA-Strongly Agree (3.50-4.00); A-Agree (2.50-3.49); D-Disagree (1.50-2.49); SD-Strongly Disagree (1.00-1.49); M-Mean; SD-Standard Deviation; QI-Qualitative Interpretation

Table 4: Practices of rice farmers on climate change.

Practice	M	SD	QI
I shifted my planting and harvesting schedule based on the existing climatic conditions.	3.24	0.93	S
I am using hybrid seeds that are adapted to drought or flooding conditions	2.93	1.25	S
I am using the new technologies being promoted by the Department of Agriculture and other agencies to minimize my crop losses due to climatic hazards.	3.34	0.92	S
I am practicing organic rice farming.	2.83	1.10	S
I keep myself updated on the weather forecast of PAGASA.	3.59	0.79	AL
I increase my agricultural inputs to increase my harvest.	3.29	0.98	S
I am practicing crop and animal diversification	2.92	1.14	S
Overall Mean	3.16	0.65	S

Legends: AL-Always (3.50-4.00); S-Sometimes (2.50-3.49); R-Rarely (1.50-2.49); N-Never (1.00-1.49); M-Mean; SD-Standard Deviation; QI-Qualitative Interpretation

adapted to drought and flooding conditions was sometimes practiced by farmers with a Mean of 2.93 (SD=1.25). Mandal & Singh (2019) indicate that a majority (76.67%) of the respondents in their study in Nepal used the improved rice variety Sonamansuli, followed by Lalka basmati 20%. The study found an increase in disease, pest, and weed infestation in the present context as compared to the past ten years. Farmers of the study area just started adopting different drought-resistant flood-resistant rice varieties to cope with the climate change adversities. About 17% of respondents have used green manuring in their field, and 15% have used the DSR cultivation method. The study explored that only 63.33% of respondents acknowledged crop insurance, but none of them brought in actual practices of crop insurance for any crop or livestock, as shown. Rought and flood. In response to the rising trend of extreme weather events, farmers may take various physical and non-physical measures. Physical measures include investments in and maintenance of irrigation facilities such as canals, tube wells, cisterns, ponds, and pump equipment; non-physical measures include farm management, crop insurance, and other measures that do not require large investments (Wang et al. 2014). This study specifically focuses on non-physical measures such as farm management, which are usually the most convenient type that farmers can implement during crop growing season. Based on field surveys, the most common farm management measures used by farmers related to drought and flood are reseeding, fixing, and cleaning seedlings.

Falco et al. (2014) found that (i) demand for insurance products is likely to increase in response to climatic conditions, and (ii) the use of insurance reduces the extent of risk exposure. We also find that farms growing more crops are less likely to adopt the insurance scheme. This confirms what is found in the theoretical literature. Crop diversification can be a substitute for financial insurance in hedging against the impact of risk exposure on welfare.

Relationship Among the KAPs of Rice Farmers on Climate Change

Table 5 shows the correlation among the knowledge, attitude, and practices of rice farmers on climate change.

Table 5: Correlation among the knowledge, attitude, and practices of rice farmers on climate change.

		Knowledge	Attitude	Practices
Knowledge	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	948		
Attitude	Pearson Correlation	**0.568****	1	
	Sig. (2-tailed)	0.000		
	N	946	961	
Practices	Pearson Correlation	**0.504****	**0.658****	1
	Sig. (2-tailed)	0.000	0.000	
	N	937	951	954

**.Correlation is significant at the 0.01 level (2-tailed).

As shown in the table, the knowledge and attitude of the rice farmers on climate change had a significant positive moderate correlation (r=0.568, p<0.01). Their knowledge and practices also obtained a significant positive moderate correlation (r=0.504, p<0.01), and their attitude and practices likewise had a significant positive moderate correlation (r=0.658, p<0.01). The findings conform to several researches that found significant correlations in the farmers' KAPs towards climate change (Akhtar et al. 2020, Ojo & Baiyegunhi 2021).

CONCLUSION AND RECOMMENDATIONS

The farmers are knowledgeable and have favorable attitudes toward the impact of climate change on farming. They sometimes practice climate-smart agricultural practices. Generally, the farmers are affected by weather and climatic conditions as well as the hazards that cause a reduction in rice yield. Climate change has affected farmers in their social well-being, economic aspect, and rice production.

The government may conduct capability training on disaster risk reduction in rice production (such as early planting and planting of high-yielding varieties) based on the specific needs of each province. It may spearhead training to promote integrated farming systems and crop diversification to build the resilience of agricultural communities to disaster impacts. Seminars on how to reduce the adverse impacts of chemical fertilizers and pesticides in agriculture from the national to the local level in rice production may be conducted. IEC materials based on the baseline data gathered from this study to promote DRRM practices among rice farmers may be developed.

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