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CLIMATE CHANGE ADAPTATION STRATEGIES AMONG SMALL-SCALE FARMERS IN ARAKAN

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Abstract :
The effects of climate change are growing more pronounced and increasingly threaten the well-being of society, regardless of geographic location. However, the burdens of climate change are not equally distributed. Although there are various arguments on the methods of climate change assessment, this study is necessary to determine the farmer's challenges related to climate change in agriculture and their adaptation strategies in response to climate change-related problems. The study employed a quantitative descriptive research design with 32 samples of small-scale farmers. Results revealed that farmers perceived drought, pest infestation, and the prevalence of plant diseases, as well as heavy rainfall and typhoons, as climate change-related risks to agriculture. They further perceived that the government's seed distribution program is a very applicable adaptive strategy to mitigate the effects of climate change in their context.
IndexTerms : socio-economic profile, small-scale farmers, climate change risks, adaptation strategies

I. INTRODUCTION

The effects of climate change are getting worse and are becoming more of a threat to the well-being of all people, no matter where they live. However, the burdens of climate change are not equally distributed. Communities that are especially vulnerable or underrepresented often suffer the most, and climate change impacts can exacerbate existing social inequalities. (USAID, 2019). The prevalent concern over the detrimental effects of climate change, particularly in the agriculture sector, is quite alarming. These climate variability impacts on the agriculture sector have been mostly harmful. For instance, intermittent impacts such as droughts and floods threaten the livelihood of rural people who are dependent on agriculture (Saptutyningsih, Diswandi, & Jaung, 2019). Short-lived disasters such as typhoons damage farmer's homes, equipment, and irrigation infrastructure, and such long-lasting impacts continue to pose a threat to food security. An increase in the frequency of climate extremes such as droughts and flooding may lower crop yields and livestock productivity (Mallari & Ezra, 2016). Thailand also experienced drought impacts in its agriculture sector: in 2001, drought affected 51 provinces in the country and damaged 1.7 million rai of agricultural land; and in 2005, 71 provinces were affected and 13.7 million rai of agricultural land was damaged (Ketsomboon and von der Dellen, 2013). In Indonesia, climate change impacts such as droughts, flooding, and pest attacks contributed to crop failure and damaged settlements and farms, leading to losses for farmers and fishermen in the Wajo District (Rolos et al., 2012). Agricultural losses have also been experienced in the Philippines due to climate change impacts. PhilRice-BAS, as cited by Lansigan et al. (2000), mentioned that typhoons, floods, and droughts caused 82.4% of rice loss from 1970–1990.

Smallholder farmers are one of the most vulnerable groups to climate change, yet efforts to support farmer adaptation are hindered by a lack of information on how they are experiencing and responding to the change. More information is needed on how different types of smallholder farmers vary in their perceptions and responses to climate change and how to tailor adaptation programs to different smallholder farmer contexts. (Harvey et al., 2018)

Accordingly, climate change in Region XII, specifically in the Arakan Valley Complex, is likely to imply both challenges and opportunities. Regardless of climate impacts, adaptation policies and measures are essential to limit vulnerability and take advantage of opportunities presented by climate change. Increased crop yield potential (Olesen et al. 2002), for example, may be realized only with adaptation responses such as changed timing of the planting of specific cultivars, erosion protection, increased fertilization, shifts in varieties, and protection of crops from plant pests (Olesen et al. 2011).

Although there are various arguments on the methods of climate change assessment, this study is necessary to determine the farmer's challenges related to climate change in agriculture and their adaptation strategies in response to climate change-related problems.

NEED OF THE STUDY.

The goal of this research was to determine the problems or risks which the farmers were exposed and the factors which significantly influence the adaptive strategies applicable for them. Specifically, it sought to answer the following questions?

1. What is the profile of the small-scale farmers in Arakan?
2. What are the climate change-related risks which farmers are exposed to?

3. What is the level of applicability of the adaptive strategies of the farmers exposed to climate change -related risks?
4. What are the factors which significantly influence the level of applicability of adaptive strategies of the farmers exposed to climate change -related risks?

RESEARCH METHODOLOGY

3.1Population and Sample

The goal of this research was to determine the problems or risks which the farmers were exposed and the factors which significantly influence the adaptive strategies applicable for them. Thus, quantitative research design suits this purpose.

. A sample of 32 of small-scale farmers was selected through quota sampling. The researchers considered the number of sample due to the survey procedure of which face to face interview was done.

A criterion was approached to select the respondents. This further enhanced researcher's objectivity. The researchers selected small-scale farmers considering farm size, income and number of equipment owned.

The involvement of the respondents was be totally voluntary, and no incentives was provided, or else they will be contributing for the wrong reasons thus influencing the validity of the study. The main advantage for them is that they would be able to present their voices to incite possible future social and economic changes.

3.2 Data and Sources of Data

In order to get data from the respondents, the researcher personally visited the barangay and personally did the interview since the instrument was expressed in English. The respondents were thoroughly briefed about the purpose of the study, the possible risks of their participation and the assurance of treating their response with utmost confidentiality.

A researcher-made instrument was used to collect data. Part I of the questionnaire was used to determine the farmer's profile in terms of age, gender, educational attainment, farm size, crops, and tenure of land ownership

Part II was the risks or problems related to Climate Change in Agriculture.

Part III was the applicable adaptive strategies to cope up with the risks related to Climate Change in Agriculture.

In rating the responses, the scoring procedure items below were used:

7 – extremely applicable
6 – very much applicable
5 – moderately applicable
4 – neither applicable nor inapplicable
3 – moderately inapplicable
2 – very much inapplicable
1 – extremely inapplicable

After scoring the items, the scores of the individual items were added to get the level of applicability of adaptive strategies.

Data collected were thoroughly tabulated, analyzed and interpreted in the light of the objectives of the study. The most suitable statistical tools like frequency count, percentage, weighted mean and Multiple Regression were used in the study.

The researchers were aware that the utmost integrity and ethical standards are to be followed especially with the goal, nature and the setting of the study. Therefore, the researchers had given utmost attention and careful consideration to ensure ethical compliance throughout the entire interview process, data analysis, confidentiality, privacy, protection of data, and presenting of the study. The researchers obtained a consent letter which will clarify the academic purpose, the benefit of participation, the voluntary nature of farmers' participation throughout the study, and assure anonymity (Creswell 2013). Selected farmers were contacted personally and received a formal invitation to participate after obtaining permission from the barangay captain of the chosen community.

3.3 Theoretical framework

Resilience, the ability to bounce back and withstand disruption, is increasingly at the center of debates over development and responses to climate change. The Resilience Alliance defines the resilience of a social-ecological system(SES) as: " the ability to absorb disturbances, to be changed and then to re-organise and still have the same and identity (retain the same basic structure and ways of functioning" (Resilience Alliance, 2014). This definition resonates strongly with the challenges of an increasingly interconnected world where climate and other change processes threaten development progress and tension exist between change and continuity. Like all high level concepts however, translating resilience into practice requires framework that relate basic scientific understanding of SES dynamics to much more specific factors.

Climate Resilience Framework (CRF) focuses on the roles of systems, agents, institutions and exposure in climate resilience and adaptation, and supports planning and strategic policy development using iterative shared learning technique.(Moench, 2014)

For the framework to be useful, considerable skill is required in adapting its use to different contexts. Substantial translation and interpretation is required for use with practitioners and policy actors.

However, Cultural Theory of Risk as applied to climate change adaptation requires an understanding of people's cultural worldview and participatory, community-based approaches to analysis to understand the nuances of the relationship between culture, climate change and adaptation strategies. The diversity of worldviews within and among communities, organizations and institutions points to the need for adaptation solutions that reflect multiple constituencies, worldviews, and approaches on adaptation strategies – that is, some necessary and reasonable regulatory measures based relevant science that allowed for individuals' or groups' autonomous adaptation actions. In other words, where the organization of institutions can be such that it allows for the inclusion of all the voices in devising solutions, societies can move from conflict to cooperation. (McNeeley, 2014)

This study therefore opted to test the Culture Theory of Risks in the context of small-scale farmers for considering that the farmers themselves are given the opportunity to take part in determining the most applicable adaptation strategies on their own context.

3.4Statistical tools and econometric models

Descriptive Statics has been used to find the maximum, minimum, standard deviation, mean and normally distribution of the data of all the variables of the study. Multiple Linear Regression was used to determine the factors influencing the adaptive strategies of the farmers in Arakan.

IV. RESULTS AND DISCUSSION

Profile

Shown in the following table is the profile of the respondents. It could be gleaned that majority (68%) of the respondents are more than 50 years, 31 % of them are college graduate and 25% are non-graduate of elementary level. 65% of them are not 4P's beneficiary. 50% of the respondents have income within the range of 6,000-10,000. Almost 72% of them have multiple crops in their area. In addition, 87.5% owned their own farm land and almost 85% have farm land below 5 hectares.

Results further show that farmers in Arakan are matured enough to engage in agriculture. Although most of the farmers earned college degree, there are still farmers who have not earned elementary education. Likewise, most of the respondents have not availed the 4P's program of the government though their income are less than 10,000 monthly. It could be further inferred that farmers also initiate to plant more than one crop since they rely mainly to rain-fed agriculture, thus, planting several crops could also help them earn income. Furthermore, it is good to know that most of the farmers in Arakan owned the land they are tilling although they only have less than 5 hectares.

Table 1: Profile of the Respondents

Profile		Frequency	Percentage
Age			
30-39		3	9.4
40-49		5	15.6
50-59		12	37.5
60-69		10	31.3
70 above		2	6.3
Education			
Non-grad ELEM		8	25.0
Elem Graduate		3	9.4
Non-grad HS		1	3.1
HS Graduate		6	18.8
College undergraduate		4	12.5
College Graduate		10	31.3
	Total	32	100.0
4P's Beneficiary			
No		21	65.6
yes		11	34.4
	Total	32	100.0
Income			
below5000		7	21.9
6,000-10,000		16	50.0
11,000-15,000		3	9.4
16,000-20,000		2	6.3
above 20,000		4	12.5
	Total	32	100.0
Crops			
monocrop		9	28.1
multicrop		23	71.9
	Total	32	100.0
Tenure of Land Ownership			
tenant		4	12.5
owner		28	87.5
	Total	32	100.0
Farm Size			
Below 5 hectares		27	84.37
6-10 hectares		4	12.50
Above 10 hectares		1	3.12
	Total	32	100

Climate change related risks in Agriculture

Based on the result revealed in the following table, farmers in Arakan considered drought, pest infestation, prevalence of plant disease, heavy rainfall and typhoon as the top 5 major problems related to climate change in agriculture.

Result could be attributed to the fact that Arakan is mountainous area therefore, flood and landslide seldom happened. In addition, its topography is hilly which made it more exposed to drought. Considering that they rely mainly on rain-fed agriculture, they consider drought as their main problem. In addition, they also consider pest infestation and prevalence of disease as problems since they experienced that insect-pests thrived after long dry-season then followed by rainfall, after which, different diseases prevailed.

Table 2. Climate Change related Risks in Agriculture encountered by farmers.

Risks	No	Yes	Rank
Drought	3.13	96.88	1
Flood	75.00	25.00	7
Landslide	71.88	28.13	6
Heavy Rainfall	46.88	53.13	4
Typhoon	53.13	46.88	5
Pest Infestation	3.13	96.88	2
Prevalence of Plant disease	12.50	87.50	3

Adaptation Strategies

Shown in the following table are the applicable adaptation strategies of small-scale farmers in Arakan. It could be assumed that the most applicable adaptation strategy as perceived by farmers is the seed distribution program of the government. This implied that farmers themselves provide information that they need assistance from the government in availing drought-tolerant seeds. This could be attributed to the fact that Arakan farmers rely mainly on rain-fed agriculture, thus, their yield is affected by the quality of their seeds.

Table 3. Applicable Adaption Strategies of Farmers Exposed to Climate Change related Risks

Adaptation Strategies	Mean	Description
1. Use of drought tolerant crops and crop varieties	4.90	Moderately applicable
2. Engagement in skilled non-farm activities	4.56	Moderately applicable
3. forest management	4.88	Moderately applicable
4. community based watershed management	4.47	Neither applicable nor inapplicable
5. seed-distribution program of the government	5.58	Very much applicable
6. conduct of agriculture extension service	4.59	Moderately applicable
7. Agricultural insurance	5.28	Moderately applicable
8. Access Early warning systems	4.53	Moderately applicable
9. Increase market access	4.59	Moderately applicable
10. Farmer's union	4.97	Moderately applicable
11. Farmers cooperative	4.94	Moderately applicable
Weighted Mean	**4.75**	Moderately applicable

Legend:
6.17-7.00 Extremely Applicable
5.31-6.16 Very Much Applicable
4.45-5.30 moderately applicable
3.59-4.44 neither applicable nor inapplicable
2.73-3.58 moderately inapplicable
1.87- 2.72 Very Much inapplicable
1.0-1.86 extremely inapplicable

Factors influencing adaptive strategies of farmers

It could be gleaned on the following table that the overall regression model is significant $F_{(6,25)}=3.621$, P=.010>.05. This means that tenure, educational attainment, farm size, crops, being 4P's beneficiary and income when taken as a set are significant predictors of applicable Adaptive Strategies. Result further revealed on the table that the predictive power of the independent variables taken as a group is 46.50% based on the R^2 which is .461. Thus, the hypothesis which stated that tenure, educational attainment, farm size, crops, being 4P's beneficiary and income do not significantly affect Applicable Adaptive Strategies is rejected.

However, if when each independent variable is looked into individually, only educational attainment and income are found to have significant influence on adaptive strategies of farmers. This means that other variables such as farm size, being 4P's beneficiary, kind of crops and tenure of land ownership do not significantly influence adaptive strategies.

Looking into the result, it could be further inferred that in every unit increase of income, there is a corresponding increase in the level of applicable of adaptive strategies in mitigating climate change challenges in agriculture.

Results conformed with the findings of

Table 4. Factors Influencing the Applicable Adaptive Strategies of Farmers

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.965	.688		5.764	.000
	Farm size	.077	.054	.240	1.428	.166
	income	.000	.000	.628	2.976	.006
	4Ps	.494	.435	.217	1.135	.267
	HEA	-1.023	.404	-.439	-2.531	.018
	crops	.592	.391	.247	1.514	.142
	tenure	-1.038	.598	-.318	-1.735	.095

a. Dependent Variable: AdaptiveStrategies

R^2 .461
$F_{(6,25)}$=3.621,

P=.010>.05

II. ACKNOWLEDGMENT

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