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RIGHT ADAPTATION MEASURES TO PROTECT CLIMATIC DAMAGES ON AGRICULTURE IN THE SOUTH–WESTERN COASTAL SATKIRA DISTRICT OF BANGLADESH

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ABSTRACT

The study was conducted during the years of 2019-2021 in Satkhira (Assasuni and Shyamnagar upazilas) district of Bangladesh. In the studied upazilas two unions/two agricultural blocks were selected to carry out the study. The research was conducted in the study area and data was collected from 200 respondents via an interview schedule. The dependent variable in this study was "adaptation measures against climate change". The adaptation scoring is detailed in the section of Materials and Methods. The researcher selected eight characteristics of the respondent as the independent variables in this study. Collected data from the respondents were analyzed in accordance with the objectives of the study. The coded data were put into the computer for statistical analyses. The study revealed that a large portion of respondents are with lower adaptation, where there are vast spaces for adaptation regarding overcoming the challenges for coastal agriculture. It was also noted that the majority respondents (78% respondents) showed their medium level of satisfaction, which argued for more/modern/appropriate agricultural technologies for coastal Satkhira district of Bangladesh. The respondents pass their life with uncertain, so they felt that public and private participation (PAP) as well as collaboration between GO & NGOs are mandatory for adopting the agriculture technologies (opined by 98% respondents). Correlation coefficients noted that all eight selected variables were found to be significantly related to the dependent variable. Amongst those, agricultural damages by natural disaster negatively correlated with agricultural adaptation measures against climate change. These provide the core adaptation criteria for the study area.

Key words: Adaptation measures, climatic damage, agriculture, coastal Satkhira district.

Introduction

The coastal areas of Bangladesh are home to about 40 million people, who are dominated by natural resource-based livelihoods. Almost every year in the last few decades, the region has witnessed multiple disaster events that have caused enormous loss and damage to human life, livelihoods and well-being, and created uncertainty about food insecurity (BBS, 2016; Nasim *et al*., 2019). On average, 25%, 3% and 2% of the population in Bangladesh will be being evacuated due to floods, droughts and cyclones (Akter, 2009). The Bangladesh government predicts that SLR could evacuate 20 million people over the next 40 years (Barua *et al*., 2017). By 2050, one out of seven people in Bangladesh is projected to be migrated from their hometown due to climate change (Khan, 2019). Bangladesh however is one of the most climate-sensitive countries in the world and the negative effects of climate change cause the main obstacle to sustainable development in Bangladesh. So adaptation is perquisite to be confirmed the secured life and safety for properties in climate change vulnerable countries like Bangladesh (Vij *et al*., 2018). Indeed, adaptation is practical steps to protect countries and communities from the likely disruption and damage that will result from effects of climate change. Improving adaptability is essential, and to some extent migration is considered as a method of adaptation to ensure a healthy life (Pachauri and Meyer, 2014). Also, adaptation practices should be integrated with the participation of different levels of stakeholders to ensure sustainable adaptation to climate change (Schmidt *et al*., 2014). The main focus of the study was to be adopted the proper technologies to minimize the agricultural losses in Coastal Satkhira district of Bangladesh. This

pioneer study will open the door for taking strict decision for selecting the right adaptation measures to build secured life and save to environment.

Materials and Methods

The study was conducted during the years of 2019-2021 in Satkhira (Assasuni and Shyamnagar upazilas) district of Bangladesh. This area is most vulnerable due to water logging is miserable during the rainy season. Cyclones are frequently affected badly. Crops failed tremendously. In the studied upazilas two unions/two agricultural blocks were selected to carry out the study. To conduct the research, each research method has its own data collection tools. The research was conducted in the study area and data was collected by two trained enumerators together with the researcher himself from 200 respondents via an interview schedule. The researcher first made a report with the respondents and explained the objectives of the study as much as possible using the local language. The questions were clarified when a respondent had problems understanding. The dependent variable in this study was "adaptation measures against climate change". This variable was measured on the basis of different aspect of adaptation. The adaptation score was computed on the basis of the respondent's adaptation on 20 aspects. A four-point rating scale ranging from "high" to "not ever" be developed to measure the extent of adaptation of the farmers. However, use of four point scales identical to ones was found in many studies 0 employed to ascertain the "adaptation measures against climate change". The range of farmers' agricultural adaptation score could be varied from 0 to 93, where, 0 indicated no adaptation and 93 indicated full adaptation. An independent variable is that factor that is manipulated by the researcher in his attempt to determine the relationship with an observed phenomenon. A dependent variable varies as the experimenter introduces, removes or varies the independent variables. According to the relevant research area, the researcher selected eight characteristics of the respondent as the independent variables.

Extent of adaptation and adaptation measures against climate change	Score assigned
High	3
Medium	2
Low	1
Not at all	0

After completion of field survey, data from the entire used interview schedule were compiled and tabulated. Tabulations and cross tabulations were done on the basis of categories developed by the investigator himself. Collected data from the respondents were analyzed in accordance with the objectives of the study. The coded data were put into the computer for statistical analyses. The SPSS computer program was used for analyzing the data. Statistical measurements such as number, percentage, range, average, standard deviation and ranking were used to describe the variables where ever applicable. To explore the relationship between selected characteristics of the respondents and their adaptation to climate change, Pearson's Correlation Co-efficient (r) was calculated. A probability level of five percent (0.05) was used to reject a null hypothesis.

Results and Discussion

Farmers' feedback for agricultural adaptation in studied coastal zone of Bangladesh

Agriculture is highly vulnerable and the need for adaptation is paramount. Adaptation to climate change is one approach that seems likely to mitigate the effects of long-term changes in climate variables. Many countries have already adapted to current climate events at the national, state, provincial, district and local levels in the short, medium and long term timeframes. Adaptation is a key factor shaping the future severity of climate change impacts on food production. Impacts of climate change are likely to reduce agricultural production and employment opportunities for the population, resulting in serious threats of hunger, food insecurity, poverty and malnutrition everywhere. Adaptation to climate change includes all adjustments in

behavior or economic structures that reduce a society's vulnerability to changes in the climate system (Smith *et al.*, 1996). Adaptation can be spontaneous or deliberate and can be done in response to changing circumstances or in anticipation (Watson *et al.*, 1996). It is the process by which people reduce the adverse effects of climate on their health and well-being and take advantage of the opportunities offered by the climate environment (Burton, 1992). Hence the researcher was tried his best to extract some suggestive adaptation approaches from the respondents in respect of their experienced, lesson learnt and feasible at locality. The respondents were concentrated regarding/ to the agricultural adaptation techniques linked with their sustainability (Table 1). They passed their life with uncertain, so they felt that public and private participation (PAP) as well as collaboration between GO & NGOs are mandatory for adopting the agriculture technologies (opined by 98% respondents). The observations noted that "collaboration between GO & NGO (96%)", "arranged training regarding climate change impacts and adaption (94%)", "increased the embankment height (88%)" and "expansion of embankment slope (85%)" are remarked as the 2nd, 3rd, 4th and 5th top most agricultural adaptation techniques (Table 1). They also expressed that "Provision for pure drinking water" is the last adaptation technique (26%).

Table 1. Farmers' feedback for agricultural adaptation in sense of climate changes at coastal Satkhira district

Sl.	Problems	Respondent's feedback (%)	Rank Order
1	Arranged training regarding climate change impacts and adaption	94	3rd
2	PAP participation	98	1st
3	Collaboration between GO & NGO	96	2nd
4	Implementation of practical lesson learnt	65	14th
5	Skill development of the community	79	8th
6	Arrangement for rehabilitation	77	9th
7	Quick recovery after disaster	76	10th
8	Adoption of climatic adoptive technology	72	11th
9	Incentive on agriculture	71	12th
10	Extensive monitoring by the govt. organization	70	13th
11	Sustainable embankment	84	6th
12	River bank protection by CC blocks	82	7th
13	Increased the embankment height	88	4th
14	Expansion of embankment slope	85	5th
15	Adoption of salt tolerant varieties	59	18th
16	Early planting	64	15th
17	Cultivation of short duration crops	62	16th
18	Adjustment of planting time	61	17th
19	Intensive agriculture in vacant and bare space	46	20th
20	Floating agriculture	45	21st
21	Mangrove plantation in fore shore areas	42	22nd
22	Forestation on embankment slope	57	19th
23	Planned shrimp culture	40	23rd
24	Improved fish culture	37	24th
25	Training on fish culture	36	26th
26	Homestead cultivation	32	27th
27	Organic farming	30	28th
28	IPM practices	29	29th
29	Green belt in foreshore areas	37	25th
30	Regular maintenance of sluice gate	28	30th
31	Provision for pure drinking water	26	31st

The community in Satkhira region is under extreme consequences from natural disaster, so they demand for preparedness and quick recovery after cyclone hit (as opined by 76% respondents). River bank erosion is the highly correlated with their normal life. So they desire permanent protection works to save their geo-position (82%). They want to save their crops from cyclone so they seek early/short duration variety (including adjusting the planting time). As they have to face severe hassle in agriculture/crop production, so they are bound shifted towards shrimp culture (40%), but they require the effective training on improved fish culture (36%). Due to lack of proper repairing/maintaining the sluice gate they are suffering from salinity, that needs to considered from the end of Bangladesh Water Development Board (BWDB). Finally they felt that green belt/mangrove plantation/plantation on embankment slope will save and allow them to stay in their homeland even in adverse cyclonic surge. The positive role of education and literacy on the use of climate adaptation strategies across the globe has been confirmed by other research (Abid *et al*. 2020; Mulwa *et al*. 2017), suggesting that adaptation strategies could benefit by fundamental efforts to increase literacy and numeracy.

A score for overall agricultural adaptation of climate change by the respondents was computed for determining the extent of adaptation by the respondents. The overall scores for agricultural adaptation on climate change by the respondents ranged from 5-93, and the average being 46.78 and standard deviation 14.76, respectively. The highest proportion of the respondents (48.5%) also belonged to medium adaptation category followed by low (46.5%) and high (5%) adaptation categories (Table 2). It is found that a large portion of respondents are with lower adaptation, where there are vast spaces for adaptation regarding overcoming the challenges for coastal agriculture.

Table 2. Levels for agricultural adaptation measures against climate change

Adoption level	Respondent's feedback (n= 200)		Mean	SD
	No.	%		
Lower adoption (upto 31)	93	46.5	46.78	14.76
Medium adaptation (32-62)	97	48.5		
High adaptation (63-93)	10	5		

The study explored the satisfaction of the respondents towards agricultural adaptation for studied coastal Satkhira district. The findings are outlined in Table 3. It was noted that the majority respondents (78% respondents) showed their medium level of satisfaction, which argued for more/modern/appropriate agricultural technologies for coastal Satkhira district of Bangladesh (Table 3).

Table 3. Satisfaction on agricultural adaptation in the studied areas

Actual level of satisfaction		Categories	Respondent's feedback (n= 200)		Mean	SD
Possible	Observed		No.	%		
0-10	1-10	Low (1-3)	24	12	6.87	12.56
		Medium (4-7)	156	78		
		High (8-10)	20	10		

Adaptation is a key factor that will shape the future severity of climate change impacts on food production. Increase in diseases and pests in crops have caused decline of crop productions and threatened to food security in Bangladesh. Impact of climate change may be reduction in agricultural production and employment opportunities of population resulting it would be serious threat for hunger, food insecurity, poverty and malnutrition in any region (Kumar and Sharma, 2013). Some good adaptation practices are identified in agriculture sectors against flood, drought and salinity. Saline tolerate rice varieties like Binadhan-8, Binadhan-10, BRRIdhan-47, BRRIdhan-55 are cultivated by more than one million farmers in Bangladesh. These varieties have the salt tolerate capacity to survive up to 10-12ds/m (Alam *et al*., 2013).

Correlation studies for agricultural adoption: In this regard, the null hypothesis was: "There is no significant association between selected characteristics of the respondents and their extent of agricultural adaptation measures against climate change". Correlation coefficients were calculated to assess the relationships between the selected characteristics of the respondents with their extent of agricultural adaptation against climate change, which are presented in Table 4. All eight selected variables were found to be significantly related to respondents 'extent of agricultural adaptation measures against climate change (the dependent variable). Amongst those, agricultural damages by natural disaster negatively correlated with agricultural adaptation measures against climate change. These provide the core adaptation criteria for the study area. The study by Das (2016) also found similar findings in the case of agricultural adaptation to climate change in coastal areas of Bangladesh. Correlation analysis indicated that age, education, annual family income, communication, media contact and knowledge of the impact of climate change had a positive and significant relationship with the adaptation of agriculture to the impact of climate change (Hossain *et al*., 2016).

Table 4. Correlation Coefficient among different variables

Dependent Variable	Independent Variable	(r^2 Value)
Agricultural adaptation measures against climate change	Age	0.219**
	Educational status	0.329**
	Family types	0.233**
	Family size	0.278**
	Farming experiences	0.399**
	Land ownership	0.257**
	Return of the respondents	0.119*
	Agricultural damages by natural disaster	-0.161**

**Correlation is significant at the 0.01 level.

* Correlation is significant at the 0.05 level.

Conclusion

The researcher highlighted the specific conclusion in respect of set objective of this present Study as follows:

1) The farmers seek the financial support and coastal feasible technologies
2) There is huge requirement for arrangements of fresh water
3) They have great demand for climatic adapted technology

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