

FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF CLIMATE CHANGE ON AGRICULTURE

ABSTRACT

The main objectives of the study were to determine farmers' perception towards harmful effects of climate change on agriculture and to identify the factors that influence farmers' perception towards harmful effects of climate change. The study was conducted in four villages under Kazipur upazila of Sirajgonj district. Data were collected by using interview schedule from randomly selected 113 respondents. The findings revealed that an overwhelming majority (89.4%) of the respondents had lower to moderately agreed perception towards harmful effects of climate change on agriculture. Among nine selected characteristics, organizational participation, extension media contact and knowledge on climate change had significant positive contribution to the farmers' perception towards harmful effects of climate change on agriculture. It is recommended that to minimize the harmful effects of climate change on agriculture initiative should be taken to improve farmers' perception through more involving with organizational participation, extension media contact and increasing knowledge.

Key words: Farmers perception, climate change effects, Bangladesh agriculture

1. INTRODUCTION

Bangladesh is the fifth most populous country in Asia and the seventh in the world. Its population growth rate is 1.36% and current population is 150,790,000 (BBS, 2017). So, this population requires more food as a result of dependence on agricultural sector. Agriculture is the single largest producing sector of the economy and its contribution about 14.79% to the total Gross Domestic Product (GDP) of the country. This sector accommodates around 45.1% labour force (BBS, 2017). GDP growth rate of Bangladesh mainly depends on the performance of the agricultural sector. Although due to natural calamities loss of food and cash crop is almost regular phenomenon. Bangladesh incurs annual loss of 1.81% of GDP due to extreme weather events. Total losses were 2.56 billion dollar a year from 1990 to 2017 (Anonymous, 2017).

32 Agriculture is always related with weather events and climate conditions. Despite
33 technological advances such as improved crop varieties and irrigation systems, weather and
34 climate are important factors, which play a significant role to agricultural productivity. The
35 impacts of climate change on food production are global concerns and for that matter
36 Bangladesh, where lives and livelihoods depend mainly on agriculture, is exposed to a great
37 danger. This is because, the country is one of the most vulnerable countries to climate change
38 and climate change have negative effects in agriuculture sector.

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40 Climate is generally average conditions of a certain region, including temperature, rainfall
41 and wind. On earth climate is most affected by latitude, the tilt of the earth axis, the
42 movement of the earth wind belts, and the difference in temperature of land and sea, and
43 topography. Climate change may refer to a change in average weather conditions, or in the
44 time variation of weather around longer-term average conditions. The climate of Bangladesh
45 can be characterized by high temperatures, heavy rainfall, high humidity, and fairly marked
46 three seasonal variations like hot summer, shrinking winter and medium to heavy rains during
47 the rainy season. In general, maximum summer temperatures range between 38 and 41°C
48 (100.4 and 105.8°F). April is the hottest month in most parts of the country. January is the
49 coolest month, when the average temperature for most of the country is 16– 20°C (61–68°F)
50 during the day and around 10°C (50°F) at night. According to IPCC (2007) due to climate
51 change effect sea level in the coastal region of Bangladesh has been predicted to rise up to 80
52 cm by 2100.

53 Climate change accelerated the intensity and frequency of occurrences of salinity, storms,
54 drought, irregular rainfall, high temperature, flash floods, etc. that resulted from global
55 warming. Due to climate change, farmers` agriculture affected adversely. The marginal
56 people and poor are affected mainly by salinity and flood in Bangladesh. More intense and
57 more frequent extreme weather events such as flood and droughts, high temperature
58 increasing abnormalities in rainy season patterns and rising sea levels are already having
59 instant effect through reducing food production. To minimize the harmful effects of climate
60 change on agriculture, it is necessary to use more and more adaptation strategies by the
61 farmers which is related with their perception towards climate change effects in agiculture.
62 In this context, the present study entitled farmers perception towards harmful effects of
63 climate change on agriculture has been conducted with a view to the follwing objectives.

64

- 65 1.1 To describe some selected characteristics of the farmers;
- 66 1.2 To determine farmers' perception towards harmful effects of climate change on
- 67 agriculture and
- 68 1.3 To identify the factors that influence farmers' perception towards harmful effects of
- 69 climate change on agriculture.

70 **2. METHODOLOGY**

71 **2.1 Study area**

72 The study was conducted at Kazipur upazila under Sirajgong district of Bangladesh where

73 people were affected by climate change especially flood. As a locale to the proposed study,

74 two unions namely, Maizbari and Natuarpara under kazipur upazila of Sirajgonj district were

75 selected purposively. Four villages from both union were selected randomly as the locale of

76 the study.

78 **2.2 Population and Sampling**

79 The Researcher himself with the help of Upazila Agriculture Officer, Local leaders and

80 concerned Sub-Assistant Agriculture Officer (SAAO) was collected an updated list of

81 population of the study. The total numbers of farm families head in the selected villages were

82 1293. According to Yamane's (1967) formula, sample size was 109 at 9% precision level,

83 50% degree of variability and the value of the standard normal variable (Z)=1.96 at 95%

84 confidence level. The given formula is stated as:

$$85 \quad n = \frac{Z^2 P(1-P)N}{Z^2 P(1-P) + Ne^2}$$

86 Where, n = sample size

87 N = population size

88 e = the level of precision

89 Z = the value of the standard normal variable given the chosen

90 confidence level (e.g. Z = 1.96 with a confidence level 95%)

91 P = the proportion or degree of variability

92 The sample was then selected from the four villages by considering proportionate random

93 sampling procedure. A reserve list of 12 farm families head (about 10% of the sample) was

94 kept purposively if any respondent was unavailable at the time of data collection. The

95 distribution of population and sample was shown in Table 1.

Table 1. Distribution of population and sample of farmers of the selected villages

Name of the unions	Name of the villages	Population	Sample size	Reserve list
Maizbari	Paikortoli	308	25	3
	Salavora	342	29	3
Natuarpara	Natuarpara	316	27	3
	Ghoragacha	327	28	3
	Total	1293	109	12

97

98 **2.3 Selection and measurement of variables**

99 In a descriptive social research, selection and measurement of the variable is a momentous
 100 task. An organized research usually contains at least two identical elements viz. independent
 101 variable and dependent variable. Considering study nature, location of study, time and other
 102 logistic support, we selected farmers' nine characteristics/independent variables for analysis
 103 of the study. These are Age, Educational background, Farm size, Annual family income,
 104 Organizational participation, Agricultural extension contact, Training exposure, Knowledge
 105 on climate change and Cosmopoliteness. On the other hand, the dependent variable of the
 106 study was Farmers' perception towards harmful effects of climate change on agriculture. The
 107 measurement techniques of both independent and dependent variables are discussed as
 108 follows.

109 **Measurement of Independent Variables**

110 Age of the farmers was measured in terms of actual years from his birth to the time of
 111 interview. Level of education was measured as the ability of an individual respondent to
 112 read and write or the formal education received up to a certain standard. It was expressed in
 113 terms of year of schooling. Farm size of the respondents was measured as the size of his farm
 114 on which he continued his farm practices during the period of the study. Annual family
 115 income indicates total earning of a farmer and the members of his family both from
 116 agriculture and other socially acceptable regular means such as business, service etc. It was
 117 expressed in thousand taka during the previous year. Training received was measured by total
 118 number of days of agricultural training received by the respondents' farmer in his/her life.
 119 Organizational participation of a respondent was measured by computing an organizational
 120 participation score according to his/her nature and duration of participation in five (5)
 121 selected different organizations up to the time of interview. The extension media contact of a
 122 respondent was measured on the basis of the response of the farmers against the extent of his

using of selected seven media. Knowledge of the farmers towards climate change was measured on 10 basic open ended questions. Cosmopolitaness of a respondent was measured in terms of his nature of visits to the six (6) different places external to his own social system.

Measurement of dependent variable

Farmers' perception towards harmful effects of climate change on agriculture was the dependent variable of the study. Perception is the activity through which an individual becomes aware about harmful effects of climate change on agriculture and was measured by using 14 statements about various aspects of harmful effects of climate change on agriculture. The farmers were requested to give their responses on these 14 statements. A modified 5-point Likert type scale was used to measure the extent of perception of the farmers. Necessary score such as 4 for 'strongly agree', 3 for 'agree', 2 for 'neutral', 1 for 'disagree' and 0 for 'strongly disagree' was assigned to each of the statement to measure the perception level of the farmers. To find out overall perception level of a farmer, total scores of the 14 statements were added together. Thus, the perception score of a respondent could range from 0 to 56, where 0 indicated highest levels disagree with the harmful effects of climate change on agriculture and 56 indicated highest level of agree with the harmful effects of climate change on agriculture.

2.4 Collection and processing of data

Data were collected by the researcher himself through face to face interview. A well-structured interview schedule (questionnaire) was developed based on the objectives of the study. The schedule contained both open form and closed form questions. The interview schedule was pre-tested with 20 farmers by the researcher. Necessary additions, corrections and modifications were made in the schedule on the basis of the pre-test results. Then final data were collected from the selected 113 farmers with using questionnaire. Questions were asked systematically and explanation was made whenever necessary. The respondents were interviewed at their leisure time so that they can give accurate information in a cool mind. To build rapport and motivation in the interview situations, the researcher endeavoured to provide conditions that maximum trust maintained each respondent's interest and minimized status difference. The final data were collected during 1 January to 30 January, 2018.

After completion of data collection, data were coded, compiled, tabulated and categorized according to the objectives of the study. The entire individual respondent's data were transferred into a master sheet for facilitating the required analysis. Local units were

converted into standard units. In case of qualitative data, appropriate scoring technique was followed to convert the data into quantitative form.

2.5 Analysis of data

Descriptive statistical measures, including number, percentage distribution, range, average, and standard deviation were used. To find out the contribution of identified characteristics on the farmers' perception towards harmful effects of climate change on agriculture, multiple regression model was used.

The model used for this analysis can be explained as follows:

$$Y_i = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + e$$

where Y_i is the farmers' perception towards harmful effects of climate change on agriculture; x_1 is their age; x_2 is educational background; x_3 is organizational participation; x_4 is farm size; x_5 is annual household income; x_6 is knowledge on climate change; x_7 is training experience, x_8 is agricultural extension contact; and x_9 is cosmopoliteness. $b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8$ and b_9 are regression coefficients of the corresponding independent variables, and “e” is random error, which is normally and independently distributed with zero (0) mean and constant variance.

3. RESULTS AND DISCUSSION

3.1 Selected Characteristics of the Farmers

The salient features of the selected characteristics of the farmers like possible and observed range, number and percent distribution, mean, standard deviation and categorisation are presented in Table 2.

Table 2. Distribution of the respondents according to their characteristics (N=109)

Variables (Measuring Unit)	Range		Categories	Respondents		Mean	SD
	Possible	Observed		Number	Percent		
Age (Years)	-	20-70	Young (up to 30)	18	15.9	49.27	12.08
			Middle Aged (31-50)	58	49.6		
			Old (> 50)	37	34.5		
Education	-	0-16	Illiterate (0- 0.5)	28	24.8	3.79	3.61

(Year of schooling)			Primary (1-5) Secondary (6-10) Above Secondary (>10)	30 47 8	26.5 41.6 7.1		
Farm size (Hectare)	-	0.09-2.16	Marginal (0.02-0.20) Small (0.21-1.0) Medium (>1.0)	26 79 8	23.0 69.9 7.1	0.42	0.33
Annual family income ('000') Taka	-	46-531	Low (up to 177) Medium (>177-354) High (>354)	73 26 14	64.6 23.0 12.4	177.7 1	130.1 2
Training received (No of days)	-	0-15	No (0) Low (1-7) Medium (>7)	41 42 30	36.3 37.2 26.5	4.25	4.20
Organizational participation (Score)	0-15	0-12	No (0) Low (1-4) Medium (5-8) High (>8)	41 46 24 2	36.3 40.7 21.2 1.8	2.91	2.84
Extension media Contact (Score)	0-28	10-24	Low (upto 13) Medium (14-19) High (>19)	27 54 32	23.9 47.8 28.3	16.72	3.59
Knowledge on climate change (Score)	0-20	12-18	Low (up to 13) Medium (14-15) High (>15)	24 52 37	21.2 46.1 32.7	14.12	1.53
Cosmopolitaness (Score)	0-21	9-19	Low (up to 11) Medium (12-15) High (>15)	29 63 21	25.7 55.7 18.6	13.15	2.30

179

180 The majority (84.1%) of the farmers were middle aged to old aged. About two-third (68.1%)

181 of them were primary to secondary level of education. Majority of the respondents had

marginal to small farm size (92.9%), low to medium annual family income (87.6%) and no to low training received (73.5%). Most of the farmers had no to low organizational participation (77.0%), medium to high extension media contact (76.1%). medium to high knowledge on climate change (76.0%) and low to medium cosmopolitaness (79.0%).

3.2 Farmers' perception towards harmful effects of climate change on agriculture

Farmers' perception towards harmful effects of climate change on agriculture of the respondents ranged from 28 to 45 against the possible range 0-56. The average perception was 37.05 with a standard deviation of 3.19. Based on the perception scores, the respondents were classified into three categories (mean $\pm$ sd) as lower agreed, moderately agreed and highly agreed which has been shown in Table 3.

Table 3 Distribution of the farmers according to their perception

Categories	Respondents'		Mean	SD
	Number	Percent		
Lower agreed (up to 35)	21	18.8	37.05	3.19
Moderately agreed (35-40)	80	70.8		
Highly agreed(Above40)	12	10.6		
Total	113	100		

Findings revealed that the majority (70.8%) of the respondents had moderately agreed perception while (18.6%) and (10.6%) having lower and highly agreed perception categories respectively with the harmful effects of climate change on agriculture. From above, it can be said that, the respondents who have moderately to highly agreed perception towards harmful effects of climate change on agriculture were more conscious about harmful effects of climate change on agriculture. However, still 18.8% farmers possess lower agreed perception towards harmful effects of climate change on agriculture which need to change or improved their perception through taking various steps.

3.3 The Contribution of the selected characteristics of the respondents to their perception towards harmful effects of climate change on agriculture

The contribution of the selected characteristics of the respondents to their perception towards harmful effects of climate change on agriculture has been shown in Table 4. The table shows that only three characterises viz., organizational participation, extension media contact and

knowledge on climate change were positive and significant contribution with their perception towards harmful effects of climate change on agriculture. The remaining characteristics such as age, education, farm size, annual family income, training received and cosmopolitaness have no significant contribution with their perception towards harmful effects of climate change on agriculture.

Multiple regression analysis was computed to find out contributing independent variables of farmers perception towards harmful effects of climate change on agriculture. All the 9 variables, when considered together, the predictability co-efficient (R^2) were 67.60. This means that all the 9 variables put together would bring 67.60% variation of perception to their harmful effects of climate change on agriculture. Among these 9 variables, organizational participation, extension media contact and knowledge on climate change on agriculture showed positive and significant influence on farmers' perception towards harmful effects of climate change on agriculture. The results indicated that a unit increase in organizational participation, extension media contact and knowledge on climate change would results in 0.566, 0.168 and 0.164 units increase in the extent of farmer's perception towards harmful effects of climate change on agriculture respectively. The F value was found significant. Hence, it may be concluded that the selection of analysis was appropriate.

Table 4. Multiple regression coefficients of the contributing variables related to the farmers' perception towards harmful effects of climate change on agriculture

Dependent variable	Independent variable	β	ρ	R^2	Adj. R^2	F
Farmer' perception towards harmful effects of climate change on agriculture	Age	-0.042	0.313	0.676	0.653	31.02
	Education	0.003	0.964			
	Farm size	-0.003	0.961			
	Annual family income	-0.025	0.718			
	Training received	0.086	0.291			
	Organizational participation	0.566	0.000**			
	Extension media contact	0.168	0.025*			
	Knowledge on climate	0.164	0.021*			

	change					
	cosmopolitaness	-0.025	0.719			

227 ** Significant at $p < 0.01$;

228 *Significant at $p < 0.05$

229 Data presented in Table 4 revealed that organizational participation of the farmers was
 230 positive and significantly contributed (significant at 1% level, $p < 0.01$) with their perception
 231 towards harmful effects of climate change on agriculture. This finding indicated that farmers'
 232 have more organisational participation increased the farmers' perception towards harmful
 233 effects of climate change on agriculture. The finding is similar with the studies of Uddin
 234 (2004), Fardous (2002) and Alam (2001).

235

236 It was revealed from the analysis that knowledge on climate change on agriculture of the
 237 farmers was positive and significantly contributed (significant at 5% level, $p < 0.05$ towards
 238 harmful effects of climate change on agriculture. This finding means that increase of
 239 knowledge on climate change of the farmers will also increase their perception towards
 240 harmful effects of climate change on agriculture. Knowledge helps farmers to make
 241 favourable possess- as which ultimately help them to take adaptation strategies. The finding
 242 is similar with the study of Kabir and Rainis (20012), Adeola (2012) and Uddin (2004).

243 From the analysis it is also indicated that extension media contact of the farmers was positive
 244 and significantly contributed (significant at 5% level, $p < 0.05$) with their perception towards
 245 harmful effects of climate change on agriculture. It means that the more the extension media
 246 contact of the farmers the more is their perception level towards harmful effects of climate
 247 change on agriculture. Alternatively it can be said that with the increase of extension media
 248 contact of the farmers will increase their perception towards harmful effects of climate
 249 change on agriculture. The finding is similar with the studies of Sharmin (2005), Sayeed
 250 (2003) and Kabir (2002).

251 4. CONCLUSIONS AND RECOMMENDATIONS

252 From the above findings and discussion it may be concluded that overwhelming majority of
 253 the farmers were moderately agreed perception to lower agreed perception towards harmful
 254 effects of climate change on agriculture. Only few framers had highly agreed perception
 255 towards harmful effects of climate change on agriculture. Therefore, still there have scope to

improve farmers' perception scenario through taking various steps. Organizational participation, extension media contact and knowledge on climate change of the farmers were important in making more favourable perception towards harmful effects of climate change on agriculture. The result concluded that establishment of more organization and farmers' involvement with those will increase farmers' favorable perception towards harmful effects of climate change on agriculture. Extension media contact also helped farmers to make more favorable perception towards harmful effects of climate change on agriculture. Therefore, the extension agent should increase their contact with the farmers. Knowledge helps the farmers to make favourable perception. So, more training, meeting and demonstration program should arrange in order to make favourable perception of the farmers towards negative effects of climate change. All these initiative probable will help the farmers to make favourable perception which ultimately help them to take more adaptation strategies to minimize harmful effects of climate change in agricultural production.

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