FARMERS' KNOWLEDGE ON ADVERSE EFFECTS OF CLIMATE CHANGE IN RELATION TO AGRICULTURE

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FARMERS' KNOWLEDGE ON ADVERSE EFFECTS OF CLIMATE CHANGE IN RELATION TO AGRICULTURE

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CERTIFICATE

This is to certify that the thesis entitled **"FARMERS' KNOWLEDGE ON ADVERSE EFFECTS OF CLIMATE CHANGE IN RELATION TO AGRICULTURE"** submitted to the department of Agricultural Extension and Information System, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfillment of the requirements for the degree of Master of Science (M.S.) in Agricultural Extension, embodies the result of a piece of bona fide research work carried out by Situ Biswas**, Registration No. 13-05295** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, as has been availed of during the course of this investigation has been duly acknowledged by the Author.

Dated: .....

Dhaka, Bangladesh

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DEDICATED
TO
MY BELOVED
PARENTS

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The Author

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ABBREVIATIONS USED

GDP	Gross Domestic Product
BBS	Bangladesh Bureau of Statistics
ICT	Information Communication Technology
IPCC	Intergovernmental Panel on Climate Change
FYM	Farm Yard Manure
BRRI	Bangladesh Rice Research Institute
HYV	High Yielding Varieties
FFS	Farmers Field School
IPM	Integrated Pest Management
SAAO	Sub-Assistant Agriculture Officer

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SITU BISWAS

ABSTRACT

The objectives of this study were to determine the selected characteristics of the farmers, to determine the extent of farmers' knowledge on adverse effects of climate change in agriculture; and to find out the contribution of the selected characteristics of the farmers' to their knowledge on adverse effects of climate change in agriculture. The study was conducted with randomly selected 93 farmers in Gaila and Bakal unions under Agailjhara upazila of Barishal district. A pre-tested interview schedule was used to collect data from the respondents during 15 0ctober to 30 October,2019. Farmers' knowledge on adverse effects of climate change in agriculture was the main focus of the study. Eleven selected characteristics of the respondents contributed the independent variables of the study. Stepwise multiple regression was used to examine the contribution of the selected characteristics of the farmers to their knowledge on adverse effects of climate change in agriculture. The highest proportion (58.0 percent) of the respondents had medium knowledge on adverse effects of climate change in agriculture, while 23.7 percent had low knowledge on adverse effects of climate change in agriculture and the rest 18.3 percent had high knowledge on adverse effects of climate change in agriculture. Five characteristics of the respondent's viz. access to ICTs ,education, farming experience of the farmers, use of climate smart agricultural technologies, agricultural extension media contact had significant positive contribution to their knowledge on adverse effects of climate change in agriculture. Age, family size, farm size, annual family income, organizational participation, and access to information on climate change of the farmers had non-significant positive contribution to their knowledge on adverse effects of climate change in agriculture.

CHAPTER I
INTRODUCTION

1.1 General Background

Agriculture has been the core of economic activities from the ancient time in this part of the subcontinent. It also plays a vital role in the political and cultural history of Bangladesh, where 85% of the population, accounting for 45.1% of the labour force, is directly or indirectly engaged in agriculture. Although the share of agriculture in Gross Domestic Product (GDP) has fallen from around 57% in the 1970s to 13.35% in recent years, it is still the largest economic sector (BBS, 2020).

Climate is generally average conditions of a certain region that includes temperature, rainfall and wind. On earth climate is mostly affected by latitude, the tilt of the earth` axis, the movement of the earth` wind belts, the difference in temperature of land and sea, and topography. Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions. Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, often referred to as "global warming". Glantz (2010) defined climate change as any change in global temperatures and precipitation over a period of time due to natural variability or as a result of human activity.

Climate change is a major challenge to agricultural development and general livelihood conditions in Bangladesh. Living in a developing, densely populated flat land area, the poor people of Bangladesh are at severe risk due to climate change. Despite of the expanding service sector, agriculture which is heavily affected by climatic shocks, is the employment source of 46 percent of the total labor force (Labor Force Survey, 2010) and approximately 13.35 percent of the

country's GDP (Gross domestic product) (BBS, 2020).It is forecasted that a rise of 1 meter sea level will inundate a 29,846 square kilometers area and will displace around 15 million people and to lose 15-17 percent of its land in the coming decades (Akter, 2009 and IPCC, 2001). These geographic and demographic characteristics make the country one of the most vulnerable due to climate change and other shocks.

Rural areas are highly vulnerable to climate change, since people there depend heavily on natural resources such as local water supplies and agricultural land. In fact, about 70% of the population in developing countries live in rural areas where agriculture is their main source of incomes (IPCC, 2007). Agriculture has been increasingly affected by climate variability and changes. The combination of a high level of poverty and a depleted ecological system increase the country's vulnerability to the impacts of climate change. That is why the current study has been taken to determine the farmers' knowledge on adverse effects of climate change relation to agriculture.

Farming in Bangladesh was largely indigenous in nature until 1960s. Integral input-output relations existed between crop husbandries on the one hand and the livestock husbandry coupled with other forms of vegetation on the other. The essence of the farm practices was overwhelming dependence on natural or indigenously grown inputs. Mainly local varieties of crops were grown, restoration of the soil fertility was achieved through use of compost and Farm Yard Manure (FYM) and pests were controlled through indigenous devices based on local wisdom and experience.

Climate change and agriculture are interrelated processes, both of them occur on a global scale. Agriculture influences climate change and climate change affects agricultural production. Global warming is projected to have significant impacts on conditions affecting agriculture including temperature, precipitation and glacial run-off. These conditions determine the carrying capacity of the

biosphere to produce enough food for the human population and domestic animals. Reduction in crop yields in most tropical and sub-tropical regions will be due to decreased water availability and new or changed insect pest incidence. The agriculture sector is a driving force in the gas emissions. This occurs through clearing land for crop-production. Bangladesh climate change is considered one of the most serious threats to sustainable development with adverse impacts expected on the environment, human health, food security, economic activity, natural resources and physical infrastructure. Bangladesh also faces some adverse impacts on various aspects especially on agricultural sector. In some landfall areas of the country about 743321 acre crop damage fully and 1730316 acre crop damaged partly in a severe cyclone storm of Hurricane intensity in 2007 (BBS, 2015)

1.2 Statement of the Problem

Bangladesh is one of the most climate vulnerable countries in the world. Located between the Himalayas and the Bay of Bengal, the country is very prone to natural disasters. Climate change accelerated the intensity and frequency of occurrences of salinity, storms, drought, irregular rainfall, high temperature, flash floods, etc. that resulted from global warming. Due to climate change, farmers` agriculture affected adversely. The marginal people and poor are affected mainly by salinity and flood in Bangladesh. More intense and more frequent extreme weather events such as flood and droughts, high temperature increasing abnormalities in rainy season patterns and rising sea levels are already having instant effect on climate condition through reducing food production, confusing farmers perception towards production, in both urban and rural areas of Bangladesh. In view of the need for having an understanding of the farmer's knowledge on adverse effects of climate change in agriculture, the researcher undertook this price of research entitles "Farmers' knowledge on adverse effects of climate change in relation to agriculture". The purpose of the study was to determine -Farmers' knowledge on adverse effects of climate change in agriculture and others associated aspects. This study

attempted to find out the answers of the following research questions:

- To what extent the farmers had knowledge about adverse effects of climate change in agriculture?
- What were the personal characteristics of the farmers?
- What were the contribution of the characteristics of the farmers to their knowledge on adverse effects of climate change in agriculture?

1.3 Specific Objectives of the Study

In view of the problems stated above the following specific objectives were formulated for giving proper direction to the study:

(i) To determine the following selected characteristics of the farmers:

a. Age
b. Education
c. Family size
d. Farm size
e. Farming experience
f. Annual family income
g. Access to ICTs
h. Organizational participation
i. Extension media contact
j. Perception on climate change and
k. Use of climate smart agricultural technologies

(ii) To determine the extent of farmers' knowledge on adverse effects of climate change in agriculture

(iii) To explore the contribution of the selected characteristics of the farmers' to their knowledge on adverse effects of climate change in agriculture

1.4 Justification of the Study

Bangladesh is an innocent victim of climate change. Rural people living in the marginalized lands pursuing nature dependents agriculture are facing barriers and constraints earning well- being in the changing climate. The main focus of the study is to ascertain the farmers' knowledge on adverse effects of climate change in agriculture. Climate change is forcing people to take diversified occupation to maintain their life. Lives lead on food, clothes, housing condition, education and medicare of the rural farmers of Bangladesh. Farmers of Bangladesh are continuously fighting with effects of climate change on agriculture. Extreme weather events not only limits agriculture persuasion during the event but also has the potential to erode household assets, like destruction of house, trees and even it may kill people or injure them. The household assets including human health and motivation, houses, trees, other physical assets, farmer's perception tools and equipment are destroyed in the extreme weather events and thus reducing capitals to pursue farmer's perceptions and accordingly reducing resilience to extreme conditions (OXFAM, 2009). The findings of this research will be acceptable in the selected area. The farmers' knowledge on adverse effects of climate change in agriculture will be visible through this research. Thus, the findings of the study will have great importance to the agriculture of Bangladesh.

1.5 Assumptions of the Study

An assumption is the supposition that an apparent fact or principle is true in the light of the available evidence (Goode and Hatt, 1952). The researcher had taken the following assumptions into consideration during carrying out the study:

1. The respondents had enough capability to provide proper response of the question furnished in the interview schedule.
2. The respondents were provided views and opinions included in the sample representative of the whole population of the study area.
3. The items, questions and scale of measurement of the variables were

reasonably authentic to present the actual condition of the respondents.

4. The findings of the study would give clear concept of the adverse effect of climate change in agriculture.
5. The data furnished by the respondents were free from bias.
6. The researcher was capable to adjust with the social and cultural environment of the study area. So, the respondents could provide their information correctly.
7. The data were normally distributed.

1.6 Limitations of the Study

It is necessary to impose certain limitations to make the research manageable and meaningful. Thus, during the entire research the most challenging limitations were:

1. The research was confined to the four villages of Agailjhara Upazila under Barishal district.
2. Data were collected from a small group of respondents taken as the sample of the study because of time and resource constrains.
3. The researcher had to face many difficulties during data collection. All the data were recall data. So, the researcher had to rely on the data as given by the respondents.
4. Only eleven characteristics of the farmers were selected as independent variables.
5. For information about the study, the researcher had to depend on the data furnished by the selected respondent's instant memory during the interview time.
6. Time allocation and budget was also a limitation to the study.

1.7 Definition of Terms

Age: Age of a farmer was defined as the period of time in years from his birth to the time of interview.

Education: Academic qualification referred to the development of desirable change in knowledge, skills and attitude in an individual through reading, writing and other related activities. It was measured in terms of years of schooling completed by and individual at the time of interview.

Experience in farming: It referred to the total number of years that a respondent participated in farming and practiced the practices as calculated till the time of data collection.

Extension contact: The term referred to an individual's access to or contact with the communication media and sources being used for dispersion of new technologies among farmers.

Family annual income: Family annual income was defined as the total earning of a respondent and members of his/her family both from agriculture and other sources (business, service etc.) during a year. It was expressed in Taka.

Farm size: Farm size referred to the area on which a farmer carried out his farming operations. The area was being estimated in terms to lull benefit to the farmer's family.

Knowledge on climate change: It was the extent of basic understanding of the farmers in different aspects of climate change.

Adverse effect of climate change: Adverse effects of climate change refers to all those harmful effects due to climate change on global ecosystem which include increased heat, drought, declining water supplies, reduced agricultural yields, flooding and erosion in coastal areas, pandemic, economic instability, and a range of other unfavorable effects.

CHAPTER II
REVIEW OF LITERATURE

The researcher made an intensive search for available literature on the present study. The review was conveniently presented on the major objectives of the study. This chapter is divided into four major sections. The first section deals with concept of knowledge. The second section deals with the reviews on farmer's knowledge on agricultural technologies. The third section deals with relationship between farmers' characteristics and their knowledge and the last section deals with the conceptual framework of the study. Therefore, available literatures' on studied related to farmers' knowledge was only presented in this chapter.

2.1 Concept of knowledge

According to Wikipedia "Knowledge is a familiarity, awareness or understanding of someone or something, such as facts, information, descriptions, or skills, which is acquired through experience or education by perceiving, discovering, or learning. It can refer to a theoretical or practical understanding of a subject. It can be implicit (as with practical skill or expertise) or explicit (as with the theoretical understanding of a subject); it can be more or less formal or systematic."

As indicated by Oxford lexicon "certainties, data, and aptitudes obtained through involvement or training; the hypothetical or pragmatic comprehension of a subject."

Bhuiyan (2012) indicated that "Knowledge may be defined as the scientific fact of an idea which is experimentally or empirically verified."

Boudreau (1995) indicated "Human faculty resulting from interpreted information; understanding that germinates from combination of data,

information, experience, and individual interpretation. Variously defined as, “things that are held to be true in a given context and that drive us to action if there were no impediments.”

2.2 Reviews on farmers’ knowledge on agricultural technologies

Rahman (2017) found that, majority (62.4 %) of the farmers possessed ‘high knowledge’ while 5.5 and 32.1 percent of the farmers possessed ‘low’ to ‘medium knowledge’ respectively in tobacco cultivation.

Mandal (2016) found that, majority (64.3 %) of the farmers possessed ‘medium knowledge’ while 20.7 and 15.0 percent of the farmers possessed ‘low’ to ‘high knowledge’ respectively in watermelon cultivation.

Rahman (2015) studied on knowledge of Salt Tolerant Variety (BRRI dhan 47) of rice and found that majority (81 %) of the farmers had Medium level of knowledge and 5 % of the farmer had low level of knowledge and 14 % percent of the farmers possessed relatively high level of knowledge.

Mondal (2014) studied on knowledge of Strawberry Cultivation and found that majority (54 %) of the farmers had Medium level of knowledge and 27.4 % of the farmer had low level of knowledge and 18.6 % of the farmers possessed relatively high level of knowledge.

Monalesa (2014) studied on knowledge of Summer Tomato cultivation and found that majority (52.4 %) of the farmers had high level of knowledge and 42.6 % of the farmer had medium level of knowledge and 5 % of the farmers possessed relatively high level of knowledge.

Azad (2014) found that, 56 percent of the respondents belong to medium knowledge category followed by 35.7 percent in high and only 8.3 percent in low knowledge category on postharvest practices of vegetables.

Abdullah (2013) found that, the majority (44.6 percent) of the pond farmers' possessed medium knowledge, where as 25.7 percent possessed high knowledge and only 16.8 percent had low knowledge and 12.9 percent of the farmers possessed very high knowledge.

Hassan (2004) reported that the highest proportion of the respondents had medium knowledge on the participation of partnership extension approach (70.4 percent) followed by 16.3 percent had low knowledge and 13.3 percent had high knowledge.

Sana (2003) studied farmers' knowledge of shrimp culture and showed that majority (61 percent) of them had medium level of knowledge, while 30 percent had low and the rest of 9 percent possessed high knowledge.

Saha (2001) made an attempt on farmers' knowledge in improved practices of pineapple cultivation and found that the majority (62 percent) of the farmers possessed good knowledge, 33 percent poor knowledge and only 5 percent possessed excellent knowledge.

Hussen (2001) found in his study on farmers' knowledge and adoption of modern sugarcane cultivation practices found that highest proportion (84 percent) of the farmers possessed medium knowledge, 13 percent high knowledge and a negligible proportion (3 percent) possessed low knowledge.

Rahman (2001) found in his study that the highest proportion (62.22 percent) of the respondents had medium knowledge compared to 25.56 percent having low knowledge and only 12.22 percent had high knowledge on HYV boro rice cultivation practices.

Hussen (2001) conducted a study on farmers' knowledge of modern sugarcane cultivation practices. His study at Zill Bangla sugar Mill area of Dewangonj upazilla under Jamalpur district revealed that majority (84%) of the sugarcane growers had medium knowledge compared to 13% having high knowledge and only 3% having low knowledge on modern sugarcane cultivation practices.

Saha (2001) conducted a study on farmers' knowledge on improved practices on pineapple cultivation. His study a Ausnara union under Madhupur upazilla of Tangail district revealed that 62% of the farmers possessed good knowledge, 33% poor knowledge and only 5% possessed excellent knowledge on improved practices on pineapple cultivation.

Mannan (2001) conducted a study on Proshika farmers' knowledge about food and nutrition. His study at Alokdia union under Madhupur upazilla of Tangail district revealed that majority (75%) of the Proshika farmers had medium knowledge of food and nutrition, while *9%* had low knowledge and the rest 16% possessed high knowledge.

Hossain (2000) studied on farmers' knowledge and perception of Binadhan-6. His study at 4 selected upazillas of Sherpur distinct revealed that majority of the farmers (62%) had medium knowledge while, 25% had low knowledge and the rest 14% possessed high knowledge on Binadhan-6.

Nurzaman (2000) conducted a study on knowledge, attitude and practices of FFS and non-FFS farmers in respect of IPM. His study at sadar upazilla under Mymensingh district revealed that the FFS farmers had a significant higher knowledge on IPM than the non-FFS farmers.

Rahman (1995) conducted a study on farmers' knowledge on improved practices of potato cultivation. His study at Kajipur thana under Sirajgonj district revealed that 54% of the potato growers possessed good

knowledge,34% poor knowledge and the rest 12% possessed excellent knowledge on improved practices of potato cultivation.

Islam (1993) conducted a study on knowledge and attitude of the Sub Assistant Agriculture Officer on the selected modern agricultural technologies. The study was conducted at 7 Thana's of greater Rangpur district revealed that 52% of the Sub Assistant Agriculture Officer had high knowledge on modern agricultural technologies, while 48% had low knowledge.

2.3 Relationship between Farmers' Characteristics and their Knowledge

2.3.1 Age and knowledge

Rahman (2015) , Mondal (2014) , Monalesa (2014) , Saha (2003), Sana (2003), Sarker (2002), Saha (2001), Rahman (2001), Hossain (2000) found no relationship between age and knowledge in their studies.

Islam et al. (2019) concluded that age of the farmers had no significant relationship with their knowledge on climate change effects in agriculture.

Rahman (2006) found in his study that age of the farmers had a significant and negative relationship with their knowledge on prawn culture. Similar results were observed by Sarker (2002), Kashem (1987), Hansara and Chopra (1986) in their respective studies.

Roy (2005) found in his study that age of the farmers had no significant relationship with their knowledge on boro rice cultivation. Similar results were observed by Khan (2005), Islam (2005) and Rahman (2004) in their respective studies.

Akhter (2003) found in his study that the age of the farmers had no significant relationship with their knowledge on agricultural activities.

Islam (1993) in his study concluded that age of the Sub Assistant Agriculture Officer had no significant relationship with their knowledge on modern agricultural technologies.

Bhaskaram and Mahajan (1968) reported that young farmers had gained more information on agricultural technology.

2.3.2 Education and knowledge

Rahman (2017), Rahman (2015), Mondal (2014), Saha (2003), Sana (2003), Sarker (2002), Saha (2001) found that education of the farmers was positively and significantly related with their knowledge in their research work.

Islam et al. (2019) concluded that education of the farmers had no significant relationship with their knowledge on climate change effects in agriculture.

Nasrin et al. (2019) concluded that education of the farmers had positive significant relationship with their knowledge on pesticide application in vegetable cultivation.

Azad (2014) in his study concluded that level of education of the farmers had significant relationship with their knowledge on postharvest practices of vegetables.

Abdullah (2013) in his study concluded that level of education of the farmers had no significant relationship with their knowledge on pond fish culture.

Rahman (2006) observed in his study that education level of the farmers had significant and positive relationship with their knowledge on prawn culture.

Roy (2005) in his study found that education level of the farmers had significant and positive relationship with their knowledge on boro rice

cultivation.

Islam (2005) in his study explored that education level of the farmers had significant positive relationship with their knowledge on IPM in crop production.

Rahman (2004) in a study found that level of education of the farmers had significant and positive relationship with their knowledge on boro rice cultivation.

Hossain (2000) found that education of the respondents had significant positive relationship with their knowledge on Binadhan-6.

Kashem (1987) in his study revealed that there was no significant relationship between education of the farmers and their agricultural knowledge.

2.3.3 Family size and knowledge

Rahman (2004) found in his study that family size of the farmers had no significant relationship with their knowledge on boro rice cultivation practices.

Hossain (2003) found that family size of the farmers was not significantly related to farmers' knowledge on modern Boro rice cultivation practices.

Farhad (2003) found that family size of rural women farmer had no significant relationship with their knowledge in using IPM in vegetable cultivation.

Sana (2003) revealed that family size of the farmers was not related to their knowledge of shrimp culture.

Sutradhar (2002) found that family size of the respondents had a significant positive relationship with their awareness on environmental degradation.

Hanif (2000) found that in his study there was a positive insignificant relationship between family size of the respondents and their awareness on environmental pollution.

Hossain (2000) found that family size of the farmers had significant positive relationship with their knowledge on Binadhan-6.

Parveen (1995) revealed that family size of the farm women had a positive significant relationship with their knowledge on the use of fertilizer, pesticides and irrigation water.

Kashem (1987) in his study, however, did not find any significant relationship between family size and agricultural knowledge of the farmers.

Shidhu (1980) found that family size was not associated with the level of knowledge toward dairying.

2.3.4 Farm size and knowledge

Rahman (2017), Rahman (2015), Mondal (2014), Monalesa (2014) observed that farm size of the farmers had no relationship with their knowledge.

Islam et al. (2019) concluded that farm size of the farmers had no significant relationship with their Knowledge on climate change effects in agriculture.

Nasrin et al. (2019) concluded that farm size of the farmers had no significant relationship with their knowledge on pesticide application in vegetable cultivation.

Azad (2014) in his study concluded that farm size of the farmers had no significant relationship with their knowledge on postharvest practices of vegetables.

Sana (2003) found in his research that there was no relationship of farm size with their knowledge in shrimp culture.

Sarker (2002) also found that there was a positive relationship between farm size of the farmers and their knowledge of BRRI Dhan 29.

Hossain (2000) found that farm size of the farmers had no relationship with their knowledge of Binadhan-6.

Hossain (1991) in his study found that farm size of the farmers was significantly related to farmer's knowledge of crop cultivation.

Ahmed (1974) concluded that there was a significant relationship between farm size of the farmers' and their agricultural knowledge. The relationship was positive which indicated that agricultural knowledge increased with the increase of farm size.

2.3.5 Farming experience and knowledge

No finding was noticed on this aspect to the researcher at the time of reviewing literature.

2.3.6 Annual income and knowledge

Mandal (2016) in his study concluded that annual family income of the farmers had significant relationship with their knowledge on watermelon cultivation.

Rahman (2015), Mondal (2014), Monalesa (2014) observed that Annual family income of the farmers had positive relationship with their knowledge.

Azad (2014) in his study concluded that annual family income of the farmers had no significant relationship with their knowledge on postharvest practices of vegetables.

Hossain (2003) reported that annual family income of the farmers had significant relationship with modern Boro rice cultivation.

Nurzzaman (2000) found that incomes of the rural women farmers had no relationships with their knowledge of the FFS and non-FFS farmers.

Hossain (2000) found that family income of the farmers had no relationship with their knowledge of Binadhan-6.

2.3.7 Access to ICTs and knowledge

No finding was noticed on this aspect to the researcher at the time of reviewing literature

2.3.8 Organizational participation and knowledge

Ahmad (1974) concluded that there is a relationship between organizational participation of farmers and their agricultural knowledge.

Alam (1997) found that organizational participation of the rice farmers had no significant relationship with their use of improved farm practices in rice cultivation.

Ali (1984) found that organizational participation of contact and non-contact farmers had significant positive contribution to their agricultural knowledge.

Hamid (1995) found a positive significant relationship between organizational participation of the farmers and their awareness on environmental pollution.

Hossain (1991) reported that organizational participation had a significant and positive relation with the adoption of improved farm practices in wheat cultivation.

2.3.9 Extension contact and knowledge

Rahman (2017), Rahman (2015), Mondal (2014), Monalesa (2014) , Saha (2003), Saha (2001), Rahman (2001), found in their study that media exposure of farmers had highly positive significant relationships with their knowledge.

Abdullah (2013) in his study concluded that extension contact of the farmers had no significant relationship with their knowledge on pond fish culture.

Sana (2003) found in his research that he was no relationship of farm size with their knowledge in shrimp culture.

Sarker (2002) also found that there was a positive relationship between farm size of the farmers and their knowledge of BRRI Dhan 29.

Hossain (2000) concluded that media exposure of the farmers had a significant relationship with their knowledge.

Rahman (1995) study on farmers' knowledge on improved practices of potato cultivation by the farmers of Kajipur upazilla of Sirajgonj district. The study indicated a significant relationship between extension contact of farmers and their knowledge on improved practices of potato cultivation.

Hossain (1991) in his study found that extension media contact of the farmers was significantly related to farmer's knowledge of crop cultivation.

Rayaparaddy and Jayaramaish's (1989) working on Village Extension Officer's (VE06) knowledge on rice production technology revealed that training had significant positive relationship with the knowledge level of VEOs.

Kaur (1988) found that extension contact and mass media exposure had significant influence upon opinion and level of knowledge of selected

programme of rural women.

Ali (1984) found that contact and non-contact farmers differed significantly in respect of their media exposure. He observed that media exposure of the contact and non-contact farmers had significant contribution towards their agricultural knowledge.

The findings of the study of Manjunatha (1980) revealed that the trained farmers had higher knowledge level and adopting behaviour compared to untrained farmers.

Venugopal (1977) found that there was a significant association between the overall knowledge of agricultural extension officers in respect of rice cultivation and type of training received by them.

Ahmed (1974) found that here was a significant positive relationship between extension contact of the farmers and their agricultural knowledge.

2.3.10 Perception on climate change and knowledge

Kabir et al. (2018) conducted a study on farmers' perception towards harmful effects of climate change on agriculture and found 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.

Various nature and climate change shocks affect coastal farmer’s perceptions differently and govern vulnerability and adaptive capacity. Some of the disasters are fast in coastal areas in terms of its sudden affects to coastal life and farmer’s perceptions like tropical cyclone and storm surges, where others are slow in events like salinity or inundation increase, but these have long-term impacts on social and economic functions (Nicholls et al., 2007).

The adverse impacts of weather events and climate increasingly threaten and erode basic needs, capabilities, and rights, particularly among poor and disenfranchised people, in turn reshaping their perceptions (UNDP, 2007; Leary et al., 2008; Adger, 2010; Quinn et al., 2011).

Weather events and climate affect the lives and perceptions of millions of poor people (Field et al., 2012). Even minor changes in precipitation amount or temporal distribution, short periods of extreme temperatures, or localized strong winds can harm farmer's perceptions (Douglas et al., 2008; Ostfeld, 2009; Midgley and Thuiller, 2011; Bele et al., 2013).

Climatic and other stressors affect farmer's perceptions at different scales: spatial (e.g., village, nation) or temporal (e.g., annual, multi-annual). Both direct and indirect impacts are often amplified or weakened at different levels. Global or regional processes generate a variety of stressors, typically mediated by cross level institutions, that result in locally experienced shocks (Reid and Vogel, 2006; Thomas et al., 2007; Paavola, 2008; Pouliotte et al., 2009)

Poor people generally depend more on ecosystem services and products for their farmer's perceptions than wealthy people. The means by which a poor family gains an income and meets its basic needs are often met by multiple farmers' perception activities. They are therefore severely affected when the environment is degraded or their access to it restricted (NAPA, 2005b).

2.3.11 Use of climate smart agricultural technologies and knowledge

No finding was noticed on this aspect to the researcher at the time of reviewing literature.

2.4 The Conceptual Framework of the Study

In scientific research, selection and measurement of variables constitute an important task. The hypothesis of a research while constructed properly contains at least two important elements i.e. a dependent variable and an independent variable. A dependent variable in that factor which appears, disappears or varies on the researcher introduces, removes or varies the independents variables. An independent variable in that factors which is manipulated by the researcher in this attempt to ascertain its relationship to an observed phenomenon. A simple conceptual framework for the study is shown in figure 2.1.

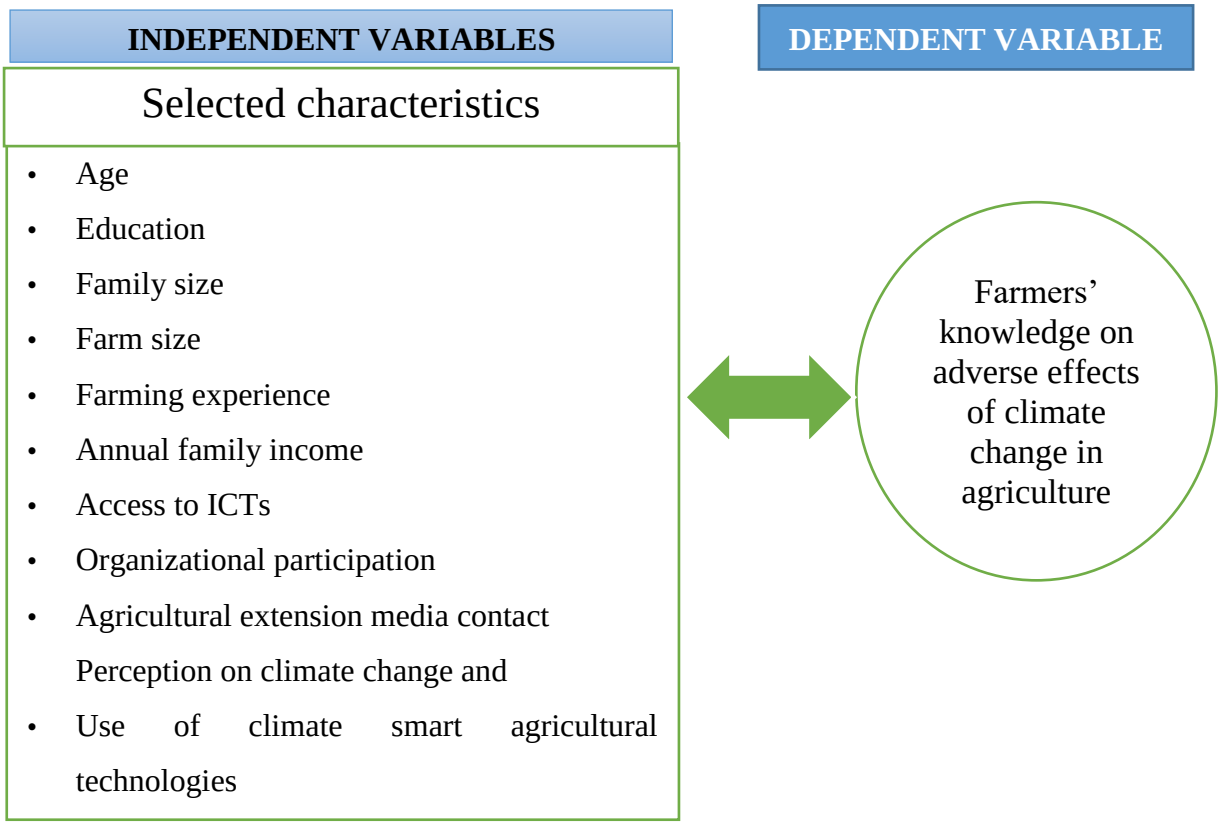

Figure 2.1 The Conceptual Framework of the Study

CHAPTER III
METHODOLOGY

Use of proper methodologies is very important in a scientific investigation. It requires a very careful consideration on the part of the researcher to collect valid and reliable data and to analyze the same properly to arrive a meaningful conclusion. The methods and procedures followed in conducting present study are discussed in this chapter.

3.1 Location of the Study

The study was conducted at Agailjhara upazila under Barishal district of Bangladesh where people were affected by climate change especially flood. Barishal district was purposively selected as the locale of the study. The location of the study area is depicted in Fig. 3.1 and Fig. 3.2.

3.2 Population and Sampling Procedure

The numbers of villages of two unions were 22. It was much difficult to conduct on all the farmers of 22 villages within a short period of time. So out of 22 villages four villages were selected purposively and the farmers of these four selected villages constituted the population of the study. The number of farm families of these four selected villages were 227, 199, 348 and 153 respectively. Thus, a total of 927 farmers constituted the population of the study. Out of these 927 farmers around 10 % were selected randomly as the sample of the study (Kaisar, 2018). Thus ninety three (93) farm farmers were selected as the sample of the study. The village- wise distribution of population and sample of farmers are shown in Table 3.1.

Another 9 farmers were selected for the reserve list who were supposed to be interviewed only when a respondent in the original sample list was unavailable during data collection.

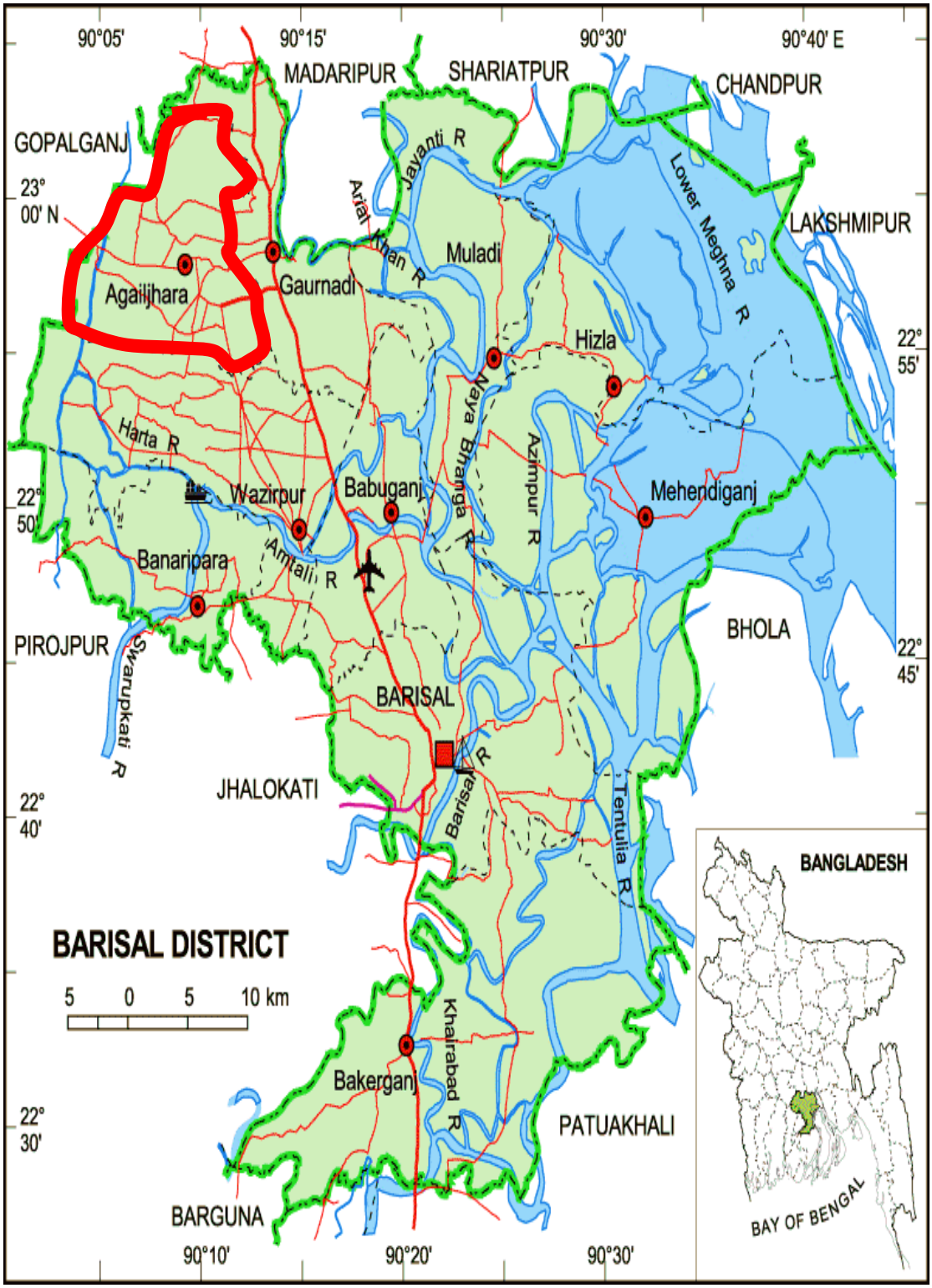

Figure 3.1 A Map of Barishal district showing Agailjhara Upazila

Figure 3.2 A Map of Agailjhara Upazila showing study areas

Table 3.1 Distribution of population, sample and reserve list

Upazila	Unions	Villages	Population	Sample size	Reserved list
Agailjhara	Gaila	Ashoksen	227	23	2
		Rahutpara	199	20	2
	Bakal	Bakal	348	35	4
		Pakurita	153	15	1
Total			**927**	**93**	**9**

3.3 The Research Instrument

For the purpose of data collection an interview schedule was prepared keeping the objectives of the research in view. The schedule contained both open and closed form questions. Most of the questions were simple and direct, while some scales were included in the schedule to collect data regarding the knowledge on adverse effects of climate change in agriculture and relevant matters. The draft schedule was prepared in Bangla and pre-tested before using it for collections of data.

Based on the pre-test experience, necessary corrections, addition, alterations and rearrangements were made in the schedule. Thus, the schedule was prepared for final use. The schedule was prepared both in the Bangla and English version. The Bangla version of interview schedule was multiplied as per requirements to collect data from the respondents. An English version of the interview schedule has been presented at Appendix-I.

3.4 Variables and their Measurement

3.4.1 Measurement of independent variables

Eleven characteristics of farmers were selected as independent variables of this study. Procedures followed in marauding the selected characteristics are described in the subsequent sections.

3.4.1.1 Age

Age of an individual was defined as the period of time from the birth to the time of interview and was operationally measured in terms of yeas. It was

located in the serial no. 1 of the interview schedule.

3.4.1.2 Education

Education of a respondent was measured by the highest grade of formal schooling completed by him or her in any educational institute. If a respondent was found illiterate, he/she was given a score of "0". In case of can sign only the score was given "0.5". A score of 1 was assigned for each class one formally completed or passed. The literate assigned for each class one formally completed or passed. The literate respondents with no formal schooling were assigned scores that seemed appropriate. This variable appears in the serial no. 2 of the interview schedule.

3.4.1.3 Family size

Family size was operationally measured by assigning a score of one for each member of the family who jointly lived and ate together. The members included the respondent himself, his wife, children and other dependent members.

3.4.1.4 Farm size

Farm size of a respondent was measured as the size of his/her farm on which he/she continued his farming operations during the period of study. It included the area of farm owned by her/him, farm area given or taken under share cropping (borga), lease or mortgage. The farm size of a respondent was measured by using the following formula:

Farm size = A+B+1/2(C+D)+E

Where,

A= homestead Area (with pond)

B= own land under own cultivation

C= given to others as borga

D= Taken from others as borga

E= taken lease from others

The data was first recorded in terms of local measurement unit i.e. decimal and then converted into hectare. The total area, thus, obtained is considered as his farm size score (assigning a score of one for each hectare of land). This variable appears in item number four (4) in the interview schedule as presented in Appendix-I.

3.4.1.5 Farming experience

Experience in farming was operationalized by counting the number of years a respondent actively involved in farming (i. e., in crop production including animal husbandry and fish farming). For each year of farming experience the respondents was assigned by a score of 1 and so on. It was located in the item number 5 of the interview schedule.

3.4.1.6 Annual family income

Roy (2015) stated that annual income refers to the total annual earnings of all family members of a respondent from agriculture, livestock, fisheries and other accessible sources (business, service, daily working etc.) during a year. Income is essential component of building resilience livelihood. In calculating the annual income from agriculture of a respondent, income from different sources of farming were added together to obtain total annual income of a respondent. Income of a respondent was measured in term of Taka. A score of 1 was assigned for less than Tk.50, 000 income; 2 for Tk.50,000 to Tk.1,00,000; 3 for Tk.1,00,000 to Tk.1,50,000; and 4 for over Tk.1,50,000 income. It was located in the item number 6 of the interview schedule.

3.4.1.7 Access to ICTs

GIZ (2015) defined ICTs as technologies that facilitate communication and the processing and transferring of information by electronic means to those that need them. This definition encompasses the full range of ICTs from Radio and

Television to Telephone (Fixed and Mobile), Computers and the Internet. It can be said that if information on improved farming systems are made available for the womenfolk with effective communication system, their productivity in agriculture will fully be enhanced and the cumulative effect will reduce or alleviate rural poverty (Islam, 2012). ICTs' contact of a respondent was measured by his extent of contact for information with various media of communication (Appendix-I). Each Item indicated his extent of contact with each selected communication media by checking any one of the 3 responses namely, "Sustained access", "Intermittent access", "No access" (Appendix-I). Scores were assigned to the responses as follows:

Response category	Score
Sustained access	2
Intermittent access	1
No access	0

The scores obtained by all the 6 items were added together to compute his access to ICTs' scores. These scores of a respondent could range from 0 to 12, where '0' indicates no ICTs' access and '12' indicates very high access of ICTs'.

3.4.1.8 Organizational participation

Organizational participation of respondent was measured on the basis of the nature of their participation in 5 selected organizations. Final score was computed by adding all the scores of selected organizations.

Organizational participation score = P X D

Where, P= Participation Score

D= Duration (no. of years)

Following scores were assigned for nature of participation:

Nature of participation	Scores assigned
No participation	0
Participation as ordinary member	1
Participation as executive member	2
Participation as executive committee officer	3

This variable appears in item number eight (8) in the interview schedule as presented in Appendix-I.

3.4.1.9 Extension contact

The extension contact of a respondent was measured with seven selected extension media. A scale was developed arranging the weights for 0, 1, 2, 3 and 4 for the responses for not at all, rarely, occasionally, frequently and regularly contact with these media respectively. Extension contact score of the respondents could range from 0 to 28, while '0' indicating no extension contact and '28' indicating very high extension contact (Appendix-I).

3.4.1.10 Perception on climate change

It reveals whether the respondent is aware of climate changes or not and it is measured by the number of changes he noticed in last year from a list of changes. Again, over the last ten years if he observed any changes relating to the weather or not. Then it is measured by the number of ways he uses to get that information. Here, 1=positive response and 0=negative response (Ahmed, 2017). Again, the perception was determined by adding up the total scores he received. The score could range from 0 to 10 while, 0 indicates the least consciousness and 10 indicates maximum consciousness.

3.4.1.11 Use of Climate-Smart Agricultural Technologies

The indicator signifies how frequently farmers use selected ecologically sound practices and technologies. The scores were assigned as 0, 1, 2, 3 and 4

respectively. For all categories of use: 4 = adequately; 3 = moderately; 2 = occasionally; 1= rarely and 0 = never (Ahmed, 2017). The sum of the total score reveals the extent of using climate smart agricultural practices by the respondent. Here, the score could range from 0 to 24 while '0' indicating no use and '24' indicating maximum use.

3.5 Measurement of Knowledge on Adverse Effect of Climate Change

There were one dependent variables in this study, namely farmers' knowledge on adverse effects of climate change in relation to agriculture. A scale consisting of 15 questions was used to determine the knowledge score of the respondents. The questions were selected from different dimensions of adverse effects of climate change after thorough consultation with the relevant experts and review of relevant literatures as shown in Appendix I. The score allotted for each question was 2. A respondent could get 2 score against each question for correct response and 0 for wrong or no response and partial score was assigned for partially correct answer. Thus, knowledge score of the respondents could range from 0 to 30, where 0 indicated very poor knowledge on adverse effects of climate change in agriculture and 30 indicated very high knowledge on adverse effects of climate change in agriculture. This variable appears in item number six (12) in the interview schedule as presented in Appendix-I.

3.7 Hypothesis test

A null hypothesis states that there is no relationship between the concerned variable. If a null hypothesis is rejected on the basis of statistical test, it is concluded that there is a contribution with the concerned variables. However, following null hypotheses was formulated for the present study:

There was no contribution of the selected characteristics of the farmers to their knowledge on adverse effects of climate change in agriculture.

The selected characteristics are: age, education, family size, farm size, farming

experience, annual family income, access to ICTs, organizational participation, agricultural extension contact, access to information on climate change and use of climate smart agricultural technologies.

3.8Collection of Data

Data were collected by the researcher herself during 10th November to 30th November 2019.A valid pertinent information the researcher made all possible efforts to explain the purpose of the study to the respondents.

Interviews were conducted with the respondents in their homes and farms. While staring interview with respondent, the researcher look all possible care lo establish rapport with him/her so that she/he did not feel hesitant or hesitate to furnish proper response to the questions and statements in the schedule. The questions were clearly explained wherever any respondent felt difficulty in understanding properly.

3.8.1 Compilation of Data

After completion of field survey data from all the interview schedules were compiled, tabulated and analyzed according to the objectives of the study. In this process, all the responses in the interview schedule were given numerical coded values. Local units were converted into standard units. The responses to the questions in the interview schedules were transferred to a master sheet to facilitate tabulation. Tabulations and cross tabulations were done on the basis of categories developed by the investigator himself.

3.8.2 Categorization of data

For describing the various independent and dependent variables the respondents were classified into various categories. In developing categories, the researcher was guided by the nature of data and general consideration prevailing on the social system. The procedures have been discussed while describing the variable in the sub-sequent sections of next chapter.

3.9 Statistical Analysis

Data collected from the respondents were analyzed and interpreted in accordance with the objectives of the study. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Sciences) computer program, version 20. Statistical measures like number, range, mean, standard deviation were used in describing the variables whenever applicable. Step wise multiple regression analysis was used to determine the contribution of farmers' selected characteristics to their knowledge on adverse effects of climate change in agriculture. Throughout the study the 0.05 levels of probability was used as the basis of rejection or accepting a null hypothesis.

CHAPTER IV
RESULTS AND DISCUSSION

In this chapter the findings of this study have been discussed in relation to the present findings and also to those found in other studies. The study investigated the knowledge on adverse effects of climate change in agriculture by the farmers of Barishal district in Bangladesh. In accordance with the objectives of the study, presentation of the findings has been made in three sections. The first sections deals about selected characteristics of the farmers. The second section deals with extent of knowledge on adverse effects of climate change in agriculture and the third section deals with contribution with their selected characteristics of the farmers and their knowledge on adverse effects of climate change in agriculture.

4.1 Selected Characteristics of the Farmers

Eleven characteristics of the farmers were selected for this research. The characteristics include: age, education, family size, farm size, farming experience, annual family income, access to ICTs, organizational participation, extension media contact, perception on climate change and use of climate smart agricultural technologies. Some descriptive statistics of these features are given in Table 4.1 Data contained in the Table 4.1 reveal the salient features of the characteristics of the farmers in order to have an overall picture of these characteristics at a glance. However, for ready reference, separate tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics in this chapter.

Table 4.1 The salient features of the selected characteristics of the farmers

Categories	Measuring Unit	Range		Mean	S D
		possible	observed		
Age	Years	-	19-75	45.51	14.06
Education	Year of schooling	-	00-18.00	6.25	4.24
Family size	Number		2-17	5.39	2.37
Farm size	Hectare	-	.07-3.34	0.58	0.56
Farming experience	Years		3-55	24.58	13.49
Annual family income	Score	1-4	1-4	2.87	.95
Access to ICTs	Score	0-12	2-10	4.98	2.10
Organizational participation	Score	-	0-55	14.11	10.69
Extension media contact	Score	0-28	4-19	11.00	3.94
Perception on climate change	Score	0-10	2-10	5.63	2.06
Use of climate smart agricultural technologies	Score	0-24	4-16	10.77	3.33

4.1.1 Age

Age of the farmers ranged from 19 to 75 years, the average being 45.51 years and the standard deviation, 14.06.Age was categorized based on the classification provided by the Ministry of Youth and Sports, Government of the People's Republic of Bangladesh. The distribution of the farmers according to their age is shown in Table 4.2.

Table 4.2 Distribution of the farmers according to their age

Categories	Farmers		Mean	SD
	Number	Percent		
Young aged (up to 35)	30	32.25	45.51	14.06
Middle-aged (36-50)	35	37.63		
Old(>50)	28	30.12		
Total	**93**	**100**		

Table 4.2 showed that the highest proportion 37.63 percent of the farmers fell in the "middle aged" category, while 30.12 percent of them fell in the "old aged" category and 32.25 percent in the "young aged" category. The findings

indicate that a large proportion (67.75) of the farmers were middle to old aged.

4.1.2 Education

The education scores of the farmers ranged from 0 to 18. The average was 6.25 and the standard deviation was 4.24. On the basis of their educational scores, the farmers were classified into four categories, namely "illiterate (0-0.5), primary (1-5), secondary (6-10) and above secondary (above 10). This distribution was supported by Hoque (2016) and Masud, (2007) and shown in the Table 4.3.

Table 4.3 Distribution of the farmers according to their education

Categories	Farmers		Mean	SD
	Number	Percent		
Illiterate(0-0.5)	20	21.5		
Primary level(1-5)	24	25.8		
Secondary level(6-10)	37	39.8	6.25	4.24
Above secondary level(>10)	12	12.9		
Total	**93**	**100**		

Table 4.3 indicated that the majority (39.8 percent) of the farmers had secondary level of education compared to 12.9 percent of them had above secondary and 25.8 percent had primary level of education. Rest 21.5% farmers were illiterate. It means that overwhelming majority (78.5%) of the farmers of the study area were literate.

4.1.3 Family size

To describe the family size of the respondents, the category has been followed as represented by Poddar (2015). Family size scores of the farmers ranged from 2 to 17 with an average of 5.39 and standard deviation of 2.37. According to family size, the respondents were classified into three categories as shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their family size

Categories	Farmers		Mean	S D
	Number	Percent		
Small family (up to 3)	9	9.7	5.39	2.37
Medium family (4-7)	72	77.4		
Large family (above 7)	12	12.9		
Total	**93**	**100**		

Data contained in Table 4.4 indicated that (77.4%) of the farmers had medium family while 12.9 percent of them had large family and 9.7 percent of them had small family.

4.1.4 Farm size

The farm size of the respondents varied from 0.07 to 3.34 hectares. The average farm size was 0.58 hectare with a standard deviation of 0.56. The respondents were classified into four categories based on their farm size as followed by DAE (DAE, 1999): "marginal farm" (upto 0.2 ha), "small farm" (0.21 – 1.0 ha), "medium farm" (1.0 -3.0 ha) “and large farm” (above 3.01 ha). The distribution of the farmers according to their farm size is shown in Table 4.5.

Table 4.5 Distribution of the farmers according to their farm size

Categories	**Farmers**		Mean	SD
	Number	Percent		
Marginal farm (up to 0.2 ha)	20	21.5	0.58	0.56
Small farm (0.21-1.0 ha)	60	64.5		
Medium farm (1.01-3.0 ha)	11	11.8		
Large farm (>3.01 ha)	2	2.2		
Total	**93**	**100**		

Table 4.5 indicated that more than half (64.5 percent) of the farmers possessed small farms compared to 11.8 percent of them having medium farms and 21.5 percent marginal farms and 2.2 % of the farmers having large farm. Thus, the overwhelming majority 86.0 percent of the farmers were the owners of marginal to small farms. Majority of the farmers were under small farmer’s

category which is consistent with national scenario.

4.1.5 Experience in farming

Computed scores of the farmers about experience in farming ranged from 3 to 55 years with a mean of 24.58 and standard deviation of 13.49. On the basis of farming experience, the respondents were classified into three categories as follows in Table 4.6.

Table 4.6 Distribution of the farmers according to their farming experience

Categories	Farmers		Mean	SD
	Number	Percent		
Low experience (up to 11)	13	13.9	24.58	13.49
Medium experience (12-38)	62	66.7		
High experience (above 38)	18	19.4		
Total	**93**	**100**		

Data contained in Table 4.6 showed that 66.7 percent of the farmers had medium farming experience, whereas 19.4 percent had high farming experience and 13.9 percent had low farming experience. Farming experience is helpful to increase knowledge, improve skill and change attitude of the farmers. It also builds confidence of the farmers for making appropriate decisions at the time of need. Overwhelming majority (86.1 percent) of the farmers had medium to high farming experience.

4.1.6 Annual family income

Annual income score of the respondents ranged from 1 to 4 with an average of 2.87 and standard deviation 0.95. On the basis of the observed scores, the respondents were classified into three categories as shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their annual income

Categories	Farmers		Mean	SD
	Number	Percent		
Very low income (Under 50,000 BDT)	8	8.6	2.87	0.95
Low income (50,001-100,000 BDT)	24	25.8		
Medium income (100,001-150,000 BDT)	33	35.5		
High income (Above 150,000 BDT)	28	30.1		
Total	**93**	**100**		

Data presented in Table 4.7 indicate that the highest proportion (35.5 percent) of the respondent had 100,001-150,000 BDT annual family income, while (8.6 percent) had under 50,000 BDT annual income, (25.8%) and (30.1 percent) had 50,001-100,000 BDT and above 150,000 BDT annual income.

4.1.7 Access to ICT

The observed access to ICT score of the respondents ranged from 2 to 12. The mean score was 4.98 with the standard deviation 2.10. Based on the access to finance scores, the respondents were classified into three categories namely 'low access to ICT", "medium access to ICT" and "high access to ICT" as shown in Table 4.8.

Table 4.8 Distribution of the farmers according to their access to ICT

Categories	Farmers		Mean	SD
	Number	Percent		
Low access to ICT (up to 2)	13	14.0	4.98	2.10
Medium access to ICT (3-7)	63	67.7		
High access to ICT (above 7)	17	18.3		
Total	**93**	**100**		

Data contained in the Table 4.8, revealed that the majority (67.7%) of the farmers had medium access to ICT as compared to (14.0%) and (18.3%) having low and high access to ICT respectively. Overwhelming majority (86.0

percent) of the farmers had medium to high access to ICT.

4.1.8 Organizational participation

The observed organizational participation score of the respondents ranged from 0 to 55. The mean score was 14.11 with the standard deviation 10.69. On the basis of organizational participation scores, the respondents were classified into three categories namely, low organizational participation, medium organizational participation and high organizational participation, as shown in Table 4.9.

Table 4.9 Distribution of the farmers according to their organizational participation

Categories (Scores)	Farmers		Mean	SD
	Number	Percent		
Low (up to 4)	9	9.7	14.11	10.69
Medium (5-24)	72	77.4		
High (above 24)	12	12.9		
Total	**93**	**100**		

Data contained in the Table 4.9 revealed that the majority (77.4%) of the farmers had medium organizational participation as compared to (9.7%) and (12.9%) having low and high organizational participation respectively. The majority (90.3%) of the respondents had medium to high organizational participation.

4.1.9 Extension Media contact

Extension media contact scores of the farmers ranged from 4 to 19 against the possible range of 0-28 with an average of 11.00 and standard deviation of 3.94. On the basis of their media contact, the respondents were classified into three categories (Mean ±SD) namely, low contact, medium contact and high contact. The scale used for computing the media contact score of a respondent is given Table 4.10.

Table 4.10 Distribution of the farmers according to their media contact

Categories (Scores)	Farmers		Mean	SD
	Number	Percent		
Low (up to 8)	27	29.0	11.00	3.94
Medium (9-14)	46	49.5		
High (above 14)	20	21.5		
Total	**93**	**100**		

Data contained in the Table 4.10 indicated that the highest proportion (49.5%) of the respondents had medium extension media contact as compared to (21.5%) and (29.0%) having high and low extension media contact respectively. Overwhelming majority (78.5%) of the respondents had low to medium extension contact.

4.1.10 Perception on climate change

Perception on climate change of the respondents ranged from 2 to 10 scores against the possible scale of 0-14 with an average of 5.63 and standard deviation of 2.06. The respondents of the study area were classified into three categories on the basis of their access to financial institution. Distribution of the respondents according to their perception on climate change has been shown in the Table 4.11.

Table 4.11 Distribution of the respondents according to their perception on climate change

Categories (Scores)	Farmers		Mean	SD
	Number	Percent		
Low (up to 3)	12	12.9	5.63	2.06
Medium (4-7)	64	68.8		
High (above 7)	17	18.3		
Total	**93**	**100**		

Data contained in the Table 4.11 indicated that the highest proportion (68.8%) of the respondents had medium perception on climate change as compared to (12.9%) and (18.3%) having low and high perception on climate change respectively. Overwhelming majority (87.1%) of the respondents had medium

to high perception on climate change.

4.1.11 Use of climate smart agricultural technologies

Use of climate smart agricultural technologies of the respondents ranged from 4 to 16 scores against the possible scale of 0-24 with an average of 10.77 and standard deviation of 3.33. The respondents of the study area were classified into three categories on the basis of their use of climate smart agricultural technologies. Distribution of the respondents according to their use of climate smart agricultural technologies has been shown in the Table 4.12.

Table 4.12 Distribution of the respondents according to their use of climate smart agricultural technologies

Categories (Scores)	Farmers		Mean	SD
	Number	Percent		
Low (up to 7)	15	16.1	10.77	3.33
Medium (8-14)	53	57.0		
High (above 14)	25	26.9		
Total	**93**	**100**		

Data contained in the Table 4.12 indicated that the highest proportion (57.0%) of the respondents had use of climate smart agricultural technologies as compared to (16.1%) and (26.9%) having low and high use of climate smart agricultural technologies respectively. Overwhelming majority (83.9%) of the farmers had medium to high use of climate smart agricultural technologies

4.2 Famers' knowledge on adverse effects of climate change in relation to agriculture

Knowledge on adverse effects of climate change of the farmers ranged from 17 to 27 against the possible range of 0-30. The average was 20.28 with a standard deviation of 2.24. On the basis of their knowledge, the farmers were classified into the following three categories: "low knowledge" (up to18), "medium knowledge" (19-22) and "high knowledge" (above 22). Table 4.13 contains the distribution of the farmers according to their knowledge on adverse effects

climate change.

Table 4.13 Distribution of farmers according to their knowledge on adverse effects climate change in agriculture

Categories	Farmers		Mean	SD
	Number	Percent		
Low knowledge (<Mean-sd, i.e, up to 18)	22	23.7	20.28	2.24
Medium knowledge (Mean ±SD, i.e, 19-22)	53	58.0		
High knowledge (> Mean+sd, i.e, >22)	17	18.3		
Total	**93**	**100**		

Table 4.13 showed that the majority of the 58.0 percent of the farmers had medium knowledge compared to 23.7 percent of them had low knowledge and 18.23 percent had high knowledge on adverse effect of climate change in Agriculture. Thus Overwhelming majority (81.7 percent) of the farmers had low to medium knowledge on adverse effect of climate change in Agriculture.

4.3 Contribution of the selected characteristics of the farmers to their knowledge on adverse effects of climate change in agriculture

In order to estimate the contribution of the selected characteristics of the farmers to their knowledge on adverse effects of climate change in agriculture, step wise multiple regression analysis was used which is shown in the Table 4.14.

Table 4.14 Summary of stepwise multiple regression analysis showing the contribution of all the 11 independent variables to the farmers' knowledge on adverse effects of climate change in agriculture

Variables entered	Standardized Partial 'b' coefficient	Value of 't' (with probability level)	Adjusted R^2	Increase in R^2	Variation explained in percent
Extension media contact (X9)	0.203	1.824 (0.007)	0.485	0.485	48.5
Access to ICTs' (X7)	0.238	2.890 (0.005)	0.544	0.059	5.9
Use of climate smart agricultural technologies (X11)	0.210	2.248 (0.027)	0.577	0.033	3.3
Education (X2)	0.229	3.190 (0.002)	0.604	0.027	2.7
Farming experience (X5)	0.216	2.420 (0.017)	0.625	0.021	2.1
		Total		**0.625**	**62.5**

Multiple R = 0.803
R-square = 0.645
Adjusted R-square = 0.625
F-ratio = 31.643 at 0.000 level of significance

The remaining variables i.e. age (X1), family size (X3), farm size (X4), annual family income size (X6), organizational participation (X8), and access to information on climate change (X10) were not entered into the regression equation.

Data presented in Table 4.14 indicated that the multiple R, R^2 and adjusted R^2 in the step-wise multiple regression analysis were 0.803, 0.645 and 0.625 respectively, and the corresponding F-ratio of 31.643 were significant at 0.000 levels. The regression equation so obtained is presented below:

$$Y = 14.589 + 0.203X_9 + 0.238X_7 + 0.210X_{11} + 0.229\ X_2 + 0.216X_5$$

This indicated that the whole model of 11 variables explained 62.5 percent of the total variation in farmers' knowledge on adverse effects of climate change on agriculture. But since the standardized regression coefficients (Beta weight)

of 5 variables formed the equation and were significant, it might be assumed that whatever contribution was there, it was due to these 5 variables.

On the basis of stepwise regression analysis, contributions of significant 5 independent variables to farmers' knowledge on adverse effects of climate change on agriculture as the dependent variable are presented below in order of importance.

4.3.1 Contribution of access to ICTs' of the farmers' to their knowledge on adverse effects of climate change in agriculture

From the multiple regression, it was concluded that the contribution of access to ICTs' of the farmers' to their knowledge on adverse effects of climate change in agriculture was measured by testing the following null hypothesis:

"There is no contribution of access to ICTs of the farmers' to their knowledge on adverse effects of climate change in agriculture".

The following observations were made on the basis of the 'b' value of the concerned variable of the study under consideration:

a. The contribution of the access to ICTs' was significant at 5% level (0.005).
b. So, the null hypothesis could be rejected.
c. The b-value of access to ICTs' was 0.238. So, it can be stated that as access to ICTs' of the farmers increased by one unit, their knowledge on adverse effects of climate change in agriculture increased by 0.238 units, considering the effects of all other predictors were constant.

Multiple regressions showed that access to ICTs' of the farmers was the highest positive contributor to their knowledge on adverse effects of climate change in agriculture. This implies that with the increase of access to ICTs' of the farmers

could increase their knowledge on adverse effects of climate change in agriculture. Knowledge helps farmers to make favorable possess as which ultimately help them to take adaptation.

4.3.2 Contribution of education of the farmers' to their knowledge on adverse effects of climate change in agriculture

From the multiple regression, it was concluded that the contribution of education of the farmers' to their knowledge on adverse effects of climate change in agriculture was measured by the testing the following null hypothesis:

"There is no contribution of education of the farmers' to their knowledge on adverse effects of climate change in agriculture".

The following observations were made on the basis of the 'b' value of the concerned variable of the study under consideration:

a. The contribution of education was significant at 1% level (0.002).

b. So, the null hypothesis could be rejected.

c. The b-value of education was 0.229. So, it can be stated that as education of the farmers increased by one unit, their knowledge on adverse effects of climate change in agriculture increased by 0.229 units, considering the effects of all other predictors were held constant.

From the multiple regressions, it was concluded that education of the farmers had 2nd highest positive contribution to their knowledge on adverse effects of climate change in agriculture. This implies that with the increase of education of the farmers could increase their knowledge on adverse effects of climate change in agriculture.

4.3.3 Contribution of farming experience of the farmers' to their knowledge on adverse effects of climate change in agriculture

From the multiple regression, it was concluded that the contribution of farming experience of the farmers' to their knowledge on adverse effects of climate change in agriculture was measured by the testing the following null hypothesis:

"There is no contribution of farming experience of the farmers' to their knowledge on adverse effects of climate change in agriculture".

The following observations were made on the basis of the 'b' value of the concerned variable of the study under consideration:

a. The contribution of farming experience was significant at 5% level (0.017).
b. So, the null hypothesis could be rejected.
c. The b-value of farming experience was 0.216. So, it can be stated that as farming experience of the farmers increased by one unit, knowledge on adverse effects of climate change in agriculture increased by 0.216 units, considering the effects of all other predictors were constant.

From the multiple regressions, it was concluded that farming experience of the farmers had third highest positive contribution to their knowledge on adverse effects of climate change in agriculture. This implies that with the increase of farming experience of the farmers could increase their knowledge on adverse effects of climate change in agriculture.

4.3.4 Contribution of use of climate smart agricultural technologies of the farmers' to their knowledge on adverse effects of climate change in agriculture

From the multiple regression, it was concluded that the contribution of use of climate smart agricultural technologies of the farmers' to their knowledge on adverse effects of climate change in agriculture was measured by the testing the following null hypothesis:

"There is no contribution of use of climate smart agricultural technologies of the farmers' to their knowledge on adverse effects of climate change in agriculture".

The following observations were made on the basis of the 'b' value of the concerned variable of the study under consideration:

a. Contribution of use of climate smart agricultural technologies was significant at 5% level (0.027).
b. So, the null hypothesis could be rejected.

c. The b-value of use of climate smart agricultural technologies was 0.210. So, it can be stated that as use of climate smart agricultural technologies of the farmers increased by one unit, their knowledge on adverse effects of climate change in agriculture increased by 0.210 units, considering the effects of all other predictors were constant.

From the multiple regressions, it was concluded that use of climate smart agricultural technologies of the farmers had fourth highest positive contribution to their knowledge on adverse effects of climate change in agriculture. This implies that with the increase of use of climate smart agricultural technologies of the farmers could increase their knowledge on adverse effects of climate change in agriculture.

4.3.5 Contribution of extension media contact of the farmers' to their knowledge on adverse effects of climate change in agriculture

The contribution of extension media contact of the farmers' to their knowledge on adverse effects of climate change in agriculture was measured by the testing the following null hypothesis;

"There is no contribution of extension media contact of the farmers' to their knowledge on adverse effects of climate change in agriculture".

The following observations were made on the basis of the 'b' value of the concerned variable of the study under consideration:

a. The contribution of the extension media contact was at significant at1% level (p=0.007).

b. So, the null hypothesis could be rejected.
c. The b-value of level agricultural extension media contact was 0.203. So, it can be stated that as extension media contact of the farmers increased by one unit, their knowledge on adverse effects of climate change in agriculture increased by 0.203 units, considering the effects of all other predictors were constant.

Based on the above finding, it can be said that farmers' having more extension media contact increased their knowledge on adverse effects of climate change in agriculture. This implies that with the increase of agricultural extension media contact of the farmers could increase their knowledge on adverse effects of climate change in agriculture.

CHAPTER V
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents summary of major findings, conclusion and recommendation of the study. The study entitled "farmers' knowledge adverse effects of climate change on agriculture." The main purpose of the study was to ascertain farmers' knowledge on adverse effects of climate change in relation to agriculture and to determine the contribution of the selected characteristics of the farmers to their knowledge on adverse effects of climate change in relation to agriculture. The location of the study was two unions of Agailjhara Upazila under Barishal district.

5.1 Summary of Findings

5.1.1 Selected characteristics of the farmers

The major findings of the study are summarized below:

Age: Age of the farmers ranged from 19 to 75 years with the average of 45.51 years and the standard deviation was 14.06. Highest proportion (37.63 percent) of the farmers were under middle aged category.

Level of education: Education score of the respondents ranged from 0 to 18 with the average of 6.25 and the standard deviation was 4.24. Highest proportion (39.8 percent) of the farmers had secondary level of education.

Family size: Above the half (77.4%) of the respondent had medium family size compare to 9.7% and 12.9% had small and large family size respectively.

Farm size: The small farm size constituted the highest proportion (64.5%), whereas the only 2.2% of the farm holder had large farm size.

Experience in farming: Medium experience constituted the highest proportion

(66.7%) and low experience constituted the lowest proportion (13.9%).

Annual family income: Annual family income scores of the respondents were ranged from 1 to 4 and less than half (35.5 %) of the respondents had 100,001-150,000 BDT annual family income.

Access to ICTs': Access to ICTs' scores of the households ranged from 2 to 12 and the highest proportion (67.7 percent) of the respondents had medium access to ICTs', 18.3 percent of the respondents had high and 14 percent of the respondents had low access to ICTs' respectively.

Organizational participation: The highest proportion ((77.4%) of the respondents had medium organizational participation as compared to (9.7%) and (12.9%) having low and high organizational participation respectively.

Extension media contact: The highest proportion ((49.5%) of the respondents had medium extension media contact as compared to (29.0%) and (21.5%) having low and high extension media contact respectively.

Perception on climate change: Perception on climate change scores of the respondents ranged from 2 to 10 and majority (68.8 percent) of the households had medium perception on climate change, 18.3 percent had high perception on climate change and 12.9 percent had low perception on climate change.

Use of climate smart agricultural technologies: Use of climate smart agricultural technologies (CSA) scores of the households ranged from 4 to 16. About 57.0 percent of the respondents showed medium CSA, 16.1 percent showed low CSA and 26.9 percent showed high use of climate smart agricultural technologies.

5.1.2 Farmers' knowledge on adverse effects of climate change in agriculture

The highest proportion (58.0 percent) of the farmers had medium knowledge on adverse effects of climate change in agriculture, while 23.7 percent had low knowledge on adverse effects of climate change in agriculture and the rest 18.3 percent had high knowledge on adverse effects of climate change in agriculture.

5.1.3 Contribution of the farmers' selected characteristics to their knowledge on adverse effects of climate change in agriculture

Access to ICTs, education, farming experience, use of climate smart agricultural technologies and extension media contact of the farmers had significant positive contribution to their knowledge on adverse effects of climate change in agriculture. Age, family size, farm size, annual family income, organizational participation, and perception on climate change of the farmers had no significant contribution with their knowledge on adverse effects of climate change in agriculture.

5.2 Conclusions

Conclusions drawn on the basis of the findings of this study and their logical interpretation in the light of the other relevant factors are furnished below:

1. Overwhelming majority (81.7%) of the farmers had low to medium knowledge on adverse effects of climate change in agriculture. Therefore, it may be concluded that all the farmers of the study area had knowledge on the adverse effects of climate change in agriculture in different degrees. They are quite aware of the climate change adverse effects in agriculture.

2. Overwhelming majority (86.0 percent) of the farmers had medium to high access to ICT. Access to ICT of the farmers had a very strong positive significant contribution to their knowledge on adverse effects of climate change in agriculture. Therefore, it may be concluded that, farmers who had

higher access to ICTs had more knowledge on adverse effects of climate change in agriculture.

3. Majority (78.5 percent) of the farmers were literate.There existed a positive significant contribution of education of the farmers to their knowledge on adverse effects of climate change in agriculture. Therefore, it may be concluded that, high educated farmers had more knowledge on adverse effects of climate change in agriculture while the less educated ones are deficient.

4. Overwhelming majority (86.1 percent) of the farmers had medium to high farming experience. Farming experience of the farmers had a positive significant contribution to their knowledge on adverse effects of climate change in agriculture. Therefore, it may be concluded that, farmers having higher experience in farming, possesses more knowledge on adverse effects of climate change in agriculture.

5. Overwhelming majority (83.9%) of the farmers had medium to high use of climate smart agricultural technologies. Use of climate smart agricultural technologies of the farmers had positive significant contribution to their knowledge on adverse effects of climate change in agriculture. Therefore, it may be concluded that, with the increase in use of climate smart agricultural technologies of the farmers tends to increase their rate of knowledge on adverse effects of climate change in agriculture.

6. Overwhelming majority (78.5%) of the farmers had low to medium extension contact. Extension contact of the farmers had positive significant contribution to their knowledge on adverse effects of climate change in agriculture. Therefore, it may be concluded that, farmers having lower agricultural extension media contact had lower knowledge on adverse effects of climate change in agriculture and with the increase of agricultural

extension media contact of the farmers tends to increase their extent of knowledge on adverse effects of climate change in agriculture.

5.3 Recommendations

5.3.1 Recommendations for policy implications

Recommendations based on the findings and conclusions of the study are presented below:

1. Overwhelming majority (81.7 percent) of the farmers had low to medium knowledge on adverse effects of climate change in agriculture. Therefore, it may be recommended that necessary steps should be taken to increase their knowledge on adverse effects of climate change in agriculture in the study area.

2. Access to ICT had significant positive contribution with knowledge on adverse effects of climate change in agriculture. Therefore, it may be recommended that, GOs and different NGOs should give more access to ICTs that would make the farmers more conscious to knowledge on adverse effects of climate change in agriculture.

3. Education of the farmers had significant positive contribution to their knowledge on adverse effects of climate change in agriculture. Therefore, it may be recommended that adult education should be provided to the farmers so that they could increase their educational level which might be helpful to increase their knowledge on adverse effects of climate change in agriculture.

4. Experience in farming of the farmers had significant positive contribution to their knowledge on adverse effects of climate change in agriculture. Therefore, it may be recommended that government and non-government extension service providing organizations should provide motivational campaigning to the lower experienced farmers so that their knowledge

on adverse effects of climate change in agriculture could increase.

5. Use of climate smart agricultural technologies of the farmers had significant positive contribution to their knowledge on adverse effects of climate change in agriculture. Therefore, it may be recommended that extension service providers as well as other parties should increase their contact with farmers so that they could increase their use of climate smart agricultural technologies to increase their knowledge about adverse effects of climate change in agriculture. of farmers could increase.

6. Extension Media contact of the farmers had significant positive contribution to their knowledge on adverse effects of climate change in agriculture. Therefore, it may be recommended that agricultural extension service providing organizations should increase their contact with farmers so that they could increase their knowledge on adverse effects of climate change in agriculture.

5.3.2 Recommendations for further study

This study investigated farmers' knowledge on adverse effects of climate change in agriculture of Agailjhara Upazila under Barishal district. As a small and limited research has been conducted in the present study cannot provide much information related to this aspect. Further studies should be undertaken to cover more information in the relevant matters. So the following suggestions were put forward for further research:

1. It is difficult to determine the extent farmers' knowledge on adverse effects of climate change in agriculture. Measurement of farmers' knowledge on adverse effects of climate change in agriculture is not free from questions. More reliable measurement of concerned variables is necessary for further study.

2. The present study was conducted only in four villages of Agailjhara Upazila under Barishal district. Findings of the study need further verification through similar research in other parts of the country.

3. The study investigated the contribution of 11 characteristics of the farmers to their knowledge on adverse effects of climate change in agriculture. So, it is recommended that further study would be conducted with other characteristics of the farmers.

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APPENDIX-I

English Version of Interview Schedule

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University, Dhaka-1207

An interview schedule for a research study entitle

FARMERS' KNOWLEDGE ON ADVERSE EFFECTS OF CLIMATE CHANGE IN RELATION TO AGRICULTURE

Serial No……
Respondent Name:
Village:
Union:
Upazila:
District:
Mobile No:

Please answer the following questions:

1. **Age**
   What is your present age?.....Years
2. **Education**
   What is your level of education?
   a) Cannot read and write: ----------
   b) Can sign only: ----------
   c) I read up to class: ----------
   d) I passed ---------- class

3. Family Size

Please mention the number of your family members including yourself. (…….. persons)

4.Farm Size

Please indicate the area of land under your possession:

Sl No.	Types of land use	Land area	
		Local unit	Hectare
1.	Homestead area(A)		
2.	Own land under own cultivation(B)		
3.	Given to others as borga(C)		
4.	Taken from othesr as borga(D)		
5.	Taken lease from others(E)		
	Total=A+B+1/2(C+D)+E		

4. Farming Experience

How long are you engaged in Agricultural Farming?

……. Years

6. Annual Family Income:

Which of the following categories best describes your household's family income?

a. Under 50,000 BDT []

b. 50,001 to 100,000 BDT []

c. 100,001 to 150,000 BDT []

d. Over 150,000 BDT []

7. Access to ICTs':

Item	Sustained Access (2)	Intermittent Access (1)	No Access (0)
Mobile phone/Smart phone			
Television			
Radio			
Dish connection/Internet connection			
Computer/Tab			
Digital Information centre			

8. Organizational participation:

Please mention the nature and duration of your participation in the following organizations

Sl no.	Name of the organizations	Nature of participation			
		No participation (0)	Ordinary member (1)	Executive committee member (2)	Executive committee officer (3)
1.	Farmers' cooperative society				
2.	Mosque committee				
3.	Bazaar committee				
4.	School committee				
5.	NGO (BRAC, Poshikha, ASHA, Grameen bank etc.)				
	Total				

9. Extension Media contact

Please indicate the extent of contact in following sources

Sl no.	Name of information sources		Extent of contact			
		Regularly (4)	Frequently (3)	Occasionally (2)	Rarely (1)	Not at all (0)
1.	Contact/Model farmers					
2.	Agricultural input (Seed, fertilizer, pesticide, equipment dealers)					
3.	SAAO					
4.	NGO worker					
5.	Upazilla level agricultural organization					
6.	Agricultural program through mass media (radio, TV)					
7.	Agricultural features in printing media (daily newspaper, leaflet, booklet, magazine etc.)					
	Total					

10. Perception on climate change

*Are you aware of climate change?				Yes		No	
If yes, what changes have you noticed?							
Increased rainfall	Decreased rainfall	Drought	Increased rainfall variability	Increased temperature		Flooding	
*Over the last ten years, have you observed any changes relating to the weather?					Yes		No
If yes, how did these impact your farm systems?							
Crop failure	Less farm income		Migration/off farm income		Outbreak of pest		

11. Use of climate smart agricultural technologies

Do you use any climate-smart technology or practice?			Yes		No
If yes please specify from the list					
Name of the Practices and Technologies	Adequately (4)	Moderately (3)	Occasionally (2)	Rarely (2)	Never (0)
Integrated farming system					
Homestead farming					
Legume crop/pulse crop					
Farm Yard manure					
Cultivation of flood resistant crop varieties					
Deep placement of guti urea					

12. Farmers' knowledge on Adverse Effects of Climate Change in Relation to Agriculture

Please answer the following questions:

Sl.no.	Questions	Full marks	Marks obtained
1.	What is your idea about Climate Change?	2	
2.	What are the elements of climate change?	2	
3.	Why is climate change a problem?	2	
4.	How does climate change affect food supply?	2	
5.	What are the effects of high temperature in agriculture?	2	
6.	Which month does the temperature highest and lowest?	2	
7.	What are the effects of frequent rainfall in Agriculture?	2	
8.	When does the rain fall highest?	2	
9.	Why does flood occur?	2	
10.	What are the effects of flood in Agriculture?	2	
11.	What is Salinity of land?	2	
12.	How salinity of land affects Agriculture?	2	
13.	What is cyclone?	2	
14.	What are the effects of cyclone/tidal surge in standing crop?	2	
15.	What are the effects of prolonged waterlogging condition in crop field?	2	
	Total		

Thank you very much for your cooperation Signature of the interviewer

APPENDIX-II

Some photos snapped during data collection period