FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF CLIMATE CHANGE ON AGRICULTURE

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This is to certify that the thesis entitled **"FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF CLIMATE CHANGE ON 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 **Md. Saiful Islam, Registration No. 15-07008** 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.

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DEDICATED

TO

MY BELOVED

GRAND PARENTS

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ABBREVIATIONS USED

UNFPA	United Nations Population Fund
AIS	Agriculture Information Service
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
GDP	Gross Domestic Product
IPCC	Intergovernmental Panel on Climate Change
OXFAM	Oxford Committee for Famine Relief
CEGIS	Center for Environmental and Geographic Information Services
FAO	Food and Agriculture Organization
WHO	World Health Organization
DAE	Department of Agriculture Extension
NGOs	Non-government Organizations
MoEF	Ministry of Environment Forests
DoE	Department Of Education
UNFCC	United Nations Framework Convention on Climate Change
SAAO	Sub-Assistant Agriculture Officer
IFAD	International Fund for Agricultural Development
UNDP	United Nations Development Program
NAPA	National Adaptation Programed of Action
WB	World Bank

FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF CLIMATE CHANGE ON AGRICULTURE

MD. SAIFUL ISLAM

ABSTRACT

The objectives of this study were to determine the farmers' perception towards harmful effects of climate change on agriculture and to describe the selected characteristics of the farmers and to identify the factors that influence farmers' perception towards harmful effects of climate change on agriculture. The study was conducted in four villages of Maizbari and Natuarpara union under Kazipur upazila of Sirajgonj district. Data were collected by using interview schedule from the randomly selected 113 respondents during 1 January to 30 January, 2018. Descriptive statistics, multiple regressions (B) were used for analysis. Majority (70.8 percent) of the respondents had moderately agreed perception while 18.8 percent and 10.6 percent of them had respectively lower agreed perception and highly 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. The remaining characteristics of the farmers, namely age, education, farm size, annual family income, training received and cosmopoliteness did not show any significant contribution with their perception. The findings of the study indicated that farmers' perception towards harmful effects of climate change on agriculture has not satisfactory. Still there is a scope to improve farmers' perception through more involving with organizational participation, extension media contact and increasing knowledge.

CHAPTER I

INTRODUCTION

1.1 General Background

Bangladesh is a South Asian developing country. It is the fifth most populous country in Asia and the seventh in the world. Its population growth rate is 1.36% and now its population is 150,790,000 (Economic Survey of Bangladesh, 2017). According to UNFPA (2009) the population of Bangladesh at 2050 will be 254,100,000. So this increasing population requires more food as a result dependence over agricultural sector is increasing day by day. 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).

Agriculture is always vulnerable to unfavorable weather events and climate conditions. Despite technological advances such as improved crop varieties and irrigation systems, weather and climate are important factors, which play a significant role to agricultural productivity. The impacts of climate change on agriculture food production are global concerns and for that matter Bangladesh, where lives and livelihoods depend mainly on agriculture, is exposed to a great danger, as the country is one of the most vulnerable countries to climate change.

Climate is generally or average conditions of a certain region, including temperature, rainfall and wind. On earth climate is most affected by latitude, the tilt of the earth axis, the movement of the earth wind belts, and 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). Climate change is defined as any change in global temperatures and precipitation over a period of time due to natural variability or as a result of human activity. It is the mother of all environmental changes.

The climate of Bangladesh can be characterized by high temperatures, heavy rainfall, high humidity, and fairly marked three seasonal variations like hot summer, shrinking winter and medium to heavy rains during the rainy season. In general, maximum summer temperatures range between 38 and 41°C (100.4 and 105.8°F). April is the hottest month in most parts of the country. January is the coolest month, when the average temperature for most of the country is 16– 20°C (61–68°F) during the day and around 10°C (50°F) at night. According to IPCC (2007) due to climate change effect sea level in the coastal region of Bangladesh has been predicted to rise up to 80 cm by 2100. Climate change in Bangladesh has become a threat to the farmers' perception towards harmful effects of climate change on agriculture.

Climate change and agriculture 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).

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 lives in rural areas, where agriculture is

their main source of income (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 (Khan, et al., 2010). In this context, the study has been conducted to assess the effects of climate change on agriculture. That is why the current study has been taken to understand the farmers of Sirajgonj district, a vulnerable district to flood, perception towards harmful effects of climate change on agriculture.

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 the context of the above circumstances the researcher intended to find out the answers of the following research questions:

1. What are the farmers' perceptions towards harmful effects of climate change on agriculture?
2. What are the selected characteristics of the targeted farmers?
3. What are the contributions of the selected characteristics of the targeted farmers on their perception to harmful effects of climate change on agriculture?

1.3 Specific Objectives of the study

In order to answer the above the questions the following specific objectives were formulated that supposed provide proper direction and to the study

1. To determine farmers' perception towards harmful effects of climate change on agriculture;

2. To describe the following selected characteristics of the farmers

i. Age
ii. Level of education
iii. Farm size
iv. Annual family income
v. Training received
vi. Organizational participation
vii. Extension media contact
viii. Knowledge on climate change
ix. Cosmopoliteness; and

3. To identify the contributing factors that influence farmers' perception towards harmful effects of climate change on agriculture.

1.4 Justification of the Study

Bangladesh is an innocent victim of climate change. Rural people living in the marginalized lands pursuing nature dependant agriculture are facing barriers and constraints earning well- being in the changing climate. The main focus of the study is to ascertain the farmers' perception towards harmful effects of climate change on agriculture. Climate change is forcing people to take diversified occupation to maintain their life. Lives lead on food, clothes, housing condition, and 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' perception towards harmful effects of climate change on agriculture will be visible due to climate change through this research. Thus, the findings of the study will have great importance to the agriculture of Bangladesh.

1.5 Assumption 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 harmful effect of climate change.
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.

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 Kazipur Upazila under Sirajgong 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 depend on the data as given by the respondents.
4. Only ten characteristics of the farmers were selected as independent variables.
5. For information about the study, the researcher has to depend on the data furnished by the selected respondent's instant memory during the interview time.
6. Time allocation and budget was also limitation in the study.

1.7 Definition of Important Terms

Perception can be defined as our recognition and interpretation of sensory information. Perception also includes how we respond to the information. We can think of perception as a process where we take in sensory information from our environment and use that information in order to interact with our environment. Perception allows us to take the sensory information in and make it into something meaningful.

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events). 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.

Climate change effects

It is projected that, by 2020, from 500 to 750 million people will be affected by water stress caused by climate change around the world. Low-lying coastal regions, such as Bangladesh, are vulnerable to sea level rise and the increased occurrence of intense, extreme weather conditions such as the cyclones of 2007–2009, as well as the melting of polar ice. In most countries like Bangladesh, yields from rain-fed agriculture could be reduced to 50 percent by 2020. For a country with increasing population and hunger, this will have an adverse effect on food security. Although effects of climate change are highly variable, by 2030, South Asia could lose 10 percent of rice and maize yields, while neighboring states like Pakistan could experience a 50 percent reduction in crop yield. As a result of all this, Bangladesh would need to prepare for long-term adaptation, which could be as drastic as changing sowing dates due to seasonal variations, introducing different varieties and species, to practicing novel water supply and irrigation systems.

Climatic effect parameters

Floods / Flash Floods are defined as rise of water of a natural stream above a level associated with the beginning of damage.

Cyclones and Storm Surges In meteorology, a cyclone is a large scale air mass that rotates around a strong center of low atmospheric pressure. Cyclones are characterized by inward spiraling winds that rotate about a zone of low pressure. The largest low-pressure systems are polar vortices and extra tropical cyclones of the largest scale. Warm-core cyclones such as tropical cyclones and subtropical cyclones also lie within the synoptic scale. Mesocyclones, tornadoes and dust devils lie within the smaller mesoscale. Upper level cyclones can exist without the presence of a surface low, and can pinch off from the base of the tropical upper tropospheric trough during the summer months in the Northern Hemisphere. Cyclones have also been seen on extraterrestrial planets, such as Mars and Neptune. Cyclogenesis describes the process of cyclone formation and intensification. Extra tropical cyclones begin as waves in large regions of enhanced mid-latitude temperature contrasts called bar clinic zones. These zones contract and form weather fronts as the cyclonic circulation closes and intensifies. Later in their life cycle, extra tropical cyclones occlude as cold air masses undercut the warmer air and become cold core systems. A cyclone's track is guided over the course of its 2 to 6 day life cycle by the steering flow of the subtropical jet stream.

Temperature the degree of hotness of a body, substance, or medium; a physical property related to the average kinetic energy of the atoms or molecules of a substance or A measure of the ability of a substance, or more generally of any physical system, to transfer heat energy to another physical system. The temperature of a substance is closely related to the average kinetic energy of its molecules. Temperature of the country varies from 36.66 to 40.55^0C and from 10 to 27.5^0C during summer and winter, respectively. It may be mentioned that the winter temperature sometimes goes as below as 7.22^0C. High temperature accompanying with scanty or no rainfall accelerates the severity of drought especially at the later part of the Kharif-1 season, which results in crop loss. On the other hand, sterility or failure in grain setting is a common feature for wheat rice (early Boro and late Aman)

due to prevalence of high and low temperatures, respectively at the period of grain setting.

Rainfall Crop production in Bangladesh is predominantly rain fed. The annual average rainfall of the country ranges from 1194 mm to 3454 mm. The occurrence of rainfall before and during Kharif-1 season helps to cultivate crops normally escaping any drought. On the other hand, the occurrence of excessive monsoon rainfall (80% of the total rainfall concentrates during July to September) causes unusually early, high or late floods, which damage crops. The uneven distribution of monsoon rains in space and time over different parts of the country may lead to cause periodic drought and flood situations. Therefore, high variability of rainfall is the single environmental factor which influences the fluctuations of crop yields at different parts of the country.

Sea level rise increasing sea level rise is one of the most critical climate change issues for coastal areas. The Intergovernmental Panel on Climate Change (IPCC) projected that an average rise of 9 to 88 cm could be expected by the end of the century. Increasing temperatures result in sea level rise by the thermal expansion of water and through the addition of water to the oceans from the melting of continental ice sheets. Thermal expansion, which is well-quantified, is currently the primary contributor to sea level rise and is expected to be the primary contributor over the course of the next century. A 1 meter sea level rise is estimated to impact 13 million people in Bangladesh, with 6% of national rice production lost (Nicholls and Leatherman, 1995). Sea level rise may also influence the extent of the tides (currently the lower third of the country experiences tidal effects) and alter the salinity quality of both surface and groundwater. Currently, because of the low topography in these coastal areas about 50% typically becomes inundated during the annual monsoons.

Agriculture is the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products.

CHAPTER II

REVIEW OF LITERATURE

The chapter deals with the past literature relevant to the objective of this study. In this aspect, information was collected from various published and unpublished thesis, journals and organizational reports etc. Information collected from these sources, therefore, this chapter divided into five sections.

Section 1: Climate change and its effects on agriculture

Section 2: Farmers perception towards various events including climate change

Section 3: The relationship between farmers' characteristics and their perception towards various issues

Section 4: Research gap of the study and

Section 5: The conceptual framework of the study

2.1 Climate Change and its effects on agriculture

The effects of climate change are heterogeneous and region specific. For example, a rise in temperature with reduced and more variable rainfall has already affected the natural and physical ecosystems of Bangladesh, predominantly the northwest with its recurrent droughts and the southwest with rising soil salinity (Ahsan et al. 2011).

The temperature is rising all over the world due to global warming as a result of gas emission and anthropogenic activities. The ice-sheets of the Antarctica and glaciers of the Himalayas are melting quickly due to increased temperature. Being situated at the base of the Himalayas, Bangladesh suffers from various natural calamities which impacted negatively on fish and fisheries of the country (Rahman, 2008). Global average temperature has warmed and cooled many times in the twentieth century and is likely to rise constantly in the future mainly due to an increased concentration of Green House Gas (GHG) in the atmosphere. Without GHGs, the earth surface temperature was raised by 0.740 and 0.180 (1.33± 6.0F) during 20th century and scientists estimated that it could increase as much as 6.40C average in the 21th century (UNFCC, 2007).

Edward H. Allison (2004) predicted that during the next 50 years, temperatures in Bangladesh are predicted to increase by 1.1° C during the flood season and by 1.8° C

during the dry season. The effect of temperature on agriculture is complex due to a number of interplaying factors: However, while higher Carbon-dioxide levels and solar radiation theoretically can increase food production, heat stress, shorter growing seasons and higher evapro-transpiration resulting in soil moisture levels being lowered counteract the former influences leading to overall lower production of most foodstuffs such as most varieties of rice, wheat and potato. Reductions in yield could potentially be as high as a 17 28% decline for rice and 31-68% decline in wheat production (Karim et al, 1999). So 8% smaller rice harvests and a 32% smaller wheat harvests by 2050 now look likely (IPCC in Reid et al, 2007).

Alam et al. (2009) found that the highest monthly rainfall (362.4mm) was occurred in July 2007 and no rain in December 2006 in the Basantapur beel under Natore district. The highest rainy day was recorded in 26th July, 2007. According to Quadir, D. A. (2003) the annual profile of monsoon precipitation occurs during July and August. Sylhet shows very high precipitation and Rajshahi a relatively monsoon precipitation compared to the other stations. It was clear that the north eastern and southeaster part of Bangladesh gets high precipitation than other western part. Changes in rainfall can affect soil erosion rates and soil moisture, both of which are important for crop yields. The IPCC predicts that precipitation will increase in high latitudes, and decrease in most subtropical land regions some by as much as about 20 percent. (IPCC, 2007). A holistic perspective on changing rainfall-driven flood risk is provided for the late 20th and early 21st centuries (Kundzewicz, et al., 2014).

Sea levels continue to rise due to climate change. It has already been observed that the mean annual water level in the south-west region is increasing by 5.5 millimetres per year (Rahman et al., 2011). The effects of sea level rise go beyond the gradual inundation of coastal land areas to include the intrusion of saline water into freshwater rivers and aquifers and the intensification of impacts from cyclones and storm surges. As sea levels rise, saline water will intrude directly into rivers and streams, advancing not only as a function of the water level but also according to changes in river discharge that may result from climate change (Islam, 2004). About 10 to 25 millimetres of sea-level rise was observed over the 20th century and models predict continued rise in a range of anywhere from 20 to 90 centimetres within the 21st century (IPCC, 2013). In Khulna, Bagerhat and Satkhira districts of southwest region

of Bangladesh found that the suitable area for transplanted Aman rice cultivation will reduce from 88% to 60% with 32 cm rise in sea level and 12% with an 88 cm rise in sea level (CEGIS, 2005)

The inundation of land areas through sea-level rise and increased precipitation is not the only worrisome effect of global climate change. In the final decades of the 20th century roughly 2.7 million ha of land in Bangladesh alone were vulnerable to annual drought with a 10% probability that 41%–50% of the country experiencing drought in a given year and those figures are forecast to increase in both geographic scope and event intensity (IPCC, 2013).

Agrawala et al. (2003) studied Development and Climate Change in Bangladesh and they observed south-west and north-west regions were particularly susceptible to drought. Islam et al. (2002) described that ascent and descent of severity of drought mostly depended on fluctuation in rainfall distribution. Higher fluctuation was responsible for higher drought; while less varied distribution causes somewhat lower drought. Rice is the main crop in Bangladesh covering 80% of the total cultivated area of the country and is important both in terms of the nutrition and income it gives to the people of Bangladesh. However, drought can affect the rice crop in three different seasons: Firstly Pre-Karif droughts in March and April prevent land preparation and ploughing, delaying the planting of crops during the monsoon season; secondly Karif droughts in July and August delay the transplantation of aman rice in highland and medium high areas, as well as in Modhupur Tract and western Rajshahi Division, while Karif droughts in September and October reduce yields of both broadcast and transplanted aman rice and delay sowing of pulses and potatoes in the west of Rajshahi Division and along major rivers. Meanwhile Rabi droughts in winter months affect boro rice, wheat and other crops grown in the dry season, most severely in the Barind Tract and west of Khulna division, severely in areas of the Chittagong Hilltracts, southern Sylhet Division and other parts of Rajshahi Division and slightly in remaining areas of western, northern and central Bangladesh (Selvaraju et al, 2006; Agricultural Research Council, 2005).

Flooding is a regular occurrence in Bangladesh. On average, nearly one quarter of Bangladesh is flooded each year (Ahmed and Mirza, 2000). Bangladesh experiences four types of floods: flash floods, rain floods (due to poor drainage), monsoon floods,

and coastal floods (IPCC, 2012: 254). Das (2009) conducted an analysis on the adverse effects of flood. He concluded that, floods can cause enormous damage, destroying standing crops, houses, lives and livestock. Floods also deposit layers of sand on existing crops, which can cause irreversible harm. Climate change is believed to affect Bangladesh river system badly as the melting of Himalayan glaciers will result in higher flow of water in the river, which in turn will result into flood and water logging in huge urban areas. (Daily Star, 2011).

Food supply will be another problem caused by river floods; for the 1998 flood reduced agricultural production by 45% (Ahmed, 2006). It will also effect on rural incomes, where agriculture still employs 70% of the population. High-yielding aman rice varieties are very easily destroyed by floods as they 34 are unable to grow fast enough to keep up with the increasing depth of flood water and if the flood water rises faster than 4-5cm deep per day other rice varieties will also be lost. Monsoon vegetables also die when under water (Karim et al, 1999). The quality of floodwater may also be reducing, threatening rice production, including the bumper harvests of boro rice after flooding. For instead of depositing silt, that boosts soil fertility, floods are now carrying more sands which often cover whole fields making them useless for agriculture (Chowdhury, 2002).

Bangladesh's vulnerability to cyclones is exacerbated by the shape of the coastline and low, flat terrain combined with high population density and poorly built infrastructure (World Bank, 2000). In fact, 60 percent of the cyclone related deaths that occurred worldwide between 1980 and 2000 were in Bangladesh (Nicholls et al., 2007). In 1991, a devastating cyclone hit the coastal region, accompanied by a tidal bore, which was between five and eight metres high with winds of up to 240 kilometres per hour (Paul, 2009).

Ali (2003) showed that Bangladesh currently has extreme vulnerability to cyclones, both on account of its somewhat unique location and topography (that creates an inverted funnel effect), and because of the low (though growing) capacity of its society and institutions to cope with such extreme events. A cyclone in 1970 resulted in close to 300,000 deaths, and another, in 1991 led to the loss of 138,000 lives, although in recent years greater success in disaster management has significantly reduced the lives lost (World Bank, 2000).

FAO (2008) reported that fisheries, aquaculture and fish habitats are at risk in the developing world. For example, saltwater intrusion into the Mekong delta from sea level rise and reduced flows threatens the viability of the aquaculture industry for catfish in the delta, which currently produces 1 million tons valued at $1 billion a year and provides over 150,000farmer's perception opportunities for mostly rural women, unless saltwater tolerant strains can be developed. About 6.0 million people are already exposed to high salinity (>5 ppt), but due to climate change this is expected to increase to 13.6 million in year 2050 and 14.8 million in 2080 and the population in Khulna, Satkhira and Bagerhat will be most affected (Mohal and Hossain, 2007). This will be due to the boundary to the area of high salinity „the salinity front" moving gradually north by 40 km (Mohal et al., 2006) to 60 km (NAPA, 2005a) inland from the coast by 2100. But as well as making household water supply problematic, salinity negatively affects agricultural production.

Livelihoods can be defined as the bundle of different types of assets, abilities and activities that enable a person or household to survive (FAO, 2003). These assets include physical assets such as infrastructure and household items; financial assets such as stocks of money, savings and pensions; natural assets such as natural resources; social assets, which are based on the cohesiveness of people and societies; and human assets, which depend on the status of individuals and can involve education and skill (FAO, 2003).

Climate change will affect farmer's perceptions, or "the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living" (Chambers and Conway, 1992). Many, though by no means all, farmer's perceptions are dependent on natural resources (e.g. agriculture, fishing, and forestry), and their availability will vary in a changing climate. This will have effects on human security and wellbeing (Kumssa and Jones, 2010). Some farmer's perceptions are directly climate-sensitive, such as rain fed smallholder agriculture, seasonal employment in agriculture (e.g. tea, coffee, and sugar), fishing, pastoralism, and tourism. Climate change also affects households dependent on informal farmer's perceptions or wage labour in poor urban settlements, directly through unsafe settlement structures or indirectly through rises in food prices or migration reassess in evaporation, and water vapour.

2.2 Farmers` perception towards various events including climate change

Climate change has on natural systems threatens the farmer's perceptions, food intake and health of poor people. Climate change will mean that many semi-arid parts of the developing world will become even hotter and drier, with even less predictable rainfall. Climate-induced changes to crop yields (Rahman and Mallick, 2011). 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 farmer's perceptions (UNDP, 2007; Leary et al., 2008; Adger, 2010; Quinn et al., 2011).

Weather events and climate affect the lives and farmer's 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).

The tropical cyclone of 2007 caused loss of valuable mangroves, social and physical resources and farmer's perception bases that post-disaster recovery has not yet been possible in Bangladesh (Mallick et al., 2011). With changing frequency of cyclonic wind and storm surges and inundation coastal agriculture and domestic fisheries and open fishing have been highly affected which are significant farmers' perceptions sources to majority coastal people. Salinity level is slowly increasing over the time and causing serious threats to traditional agriculture farming and mangrove ecosystems (Moniruzzaman, 2012). Changes in temperature and rainfall may change the geographic range of vector-borne diseases such as malaria and dengue fever, exposing new populations to these diseases. Young children as well as pregnant women and their unborn children are especially vulnerable to malaria. Malaria contributes to prenatal mortality, low birth weight, and maternal anaemia (WHO, 2002).

Thomas et al. (2013) Bangladesh is extremely vulnerable to the impact of climate change because it is a low-lying, flat country subject to both riverine flooding and sea level rise, and because a large portion of its population is dependent on agriculture for its farmer's perception. The effect of the climate changes on farmers' perceptions, poverty and family food security is significant. A gradual decline in yields affects the viability of agriculture as a dependable base for subsistence and income. An increase in extreme events causes yields to fall abruptly or total loss of crops (IFAD, 2013). Seasonal variations have also diverse influence on fishing, hatchery operations, fish production and farmer's perceptions of a wide range of people (Hague, 2007).

2.3 The relationships between farmers' characteristics and their perception on various issues

2.3.1 Age and farmers' perception

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by the farmers in Ogbomoso, Nigeria. Adeola found that age had a significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. Pal found that age had no significant relationship with farmer's perception.

Majlish (2007) conducted a study regarding perception of participant women on social forestry program of BRAC. The study revealed that the relationship between age and perception of social forestry program was negatively significant.

Afique (Z006) mentioned that there was no significant relationship between the age of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Islam (2005) found that age of the farmers had no significant relationship with their perception of cause's und remedies of Monga in Kurigram district.

Sharmin (2005) stated that age of the rural women had no significant relationship with the perception of benefits of involvement in IGAs under a NGO.

Uddin (2004) conducted a study on perception of sustainable agriculture. The findings revealed that age of the respondents had negative significant relationship with their perception of sustainable agriculture.

Sayeed (2003) found that age had negative relation with farmers' perception of benefit from using manure towards INM for sustainable crop production by the farmers. Ismail (1979), Chowdhury (2001) and Alom (2001) obtained similar type of findings in their respective studies.

Kabir (2002) studied perception of farmers on the effects of integrated area development project towards environmental upgradation. The study revealed that there was no significant relationship between age and perception of environmental upgradation. Similar finding was obtained by Fardous (2002) in his study.

Islam (2000) stated that age of farmers had no significant relationship with their perception of the harmful effect of agro-chemical with regard to environmental pollution. Hossain (2000) and Parveen (1995) obtained similar result in their studies.

2.3.2 Education and farmers' perception

Kabir and Rainis (2012) conducted a study on farmers' perception on the adverse effects of pesticides on environment: the case of Bangladesh. They found that education had a significant influence on the farmers' perception.

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by farmers in Ogbomoso, Nigeria. The study revealed that education had a significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study revealed that education had a positive significant influence on the farmers' perception.

Majlish (2007) found that the relationship between education of participant women and their perception of social forestry program of BRAC was positively significant.

Afique (2006) mentioned negatively significant relationship between personal education of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Snmity, (SUS).

Sharmin (2005) found that personal education of the rural women had significant positive relationship with their perception of benefits of involvement of IGAs under a NGO.

Uddin(2004) concluded that the level education of the farmers had a significant positive relationship with their perception of sustainable agriculture.

Sayeed (2003) revealed that the education of the respondents had significant positive relationship with their perception from using manure towards Integrated Nutrient Management (INM) for sustainable crop production.

Fardous (2002) found a significant positive relationship between education of the farmers' and their perception of the forestry development activities of Village and Farm Forestry Program (VFFP) towards sustainable forestry development.

Alam (2001) found that education of farmers 'had a significant and positive relationship with their perception of Binamoog-5 as a summer crop. Majydyan (1996) and Sarker (1999) and Islam (2001) found similar type of result. But, Kashem and Mikuni (1998) did not find any relationship between education of farmers and their perception about benefit of using Indigenous Technical Knowledge (ITK).

2.3.3 Farm size and farmers' perception

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by farmers in Ogbomoso, Nigeria. The study revealed that household size had a non-significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study revealed that farm size had no significant relationship with farmer's perception.

Majlish (2007) revealed from her study that the relationship between farm size of participant women and perception of social forestry program of BRAC was non-significant and followed a positive trend.

Afique (2006) stated that there was no significant relationship between family farm size of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Islam (2005) found that farm size of farmers had no significant relationship with their perception of both causes and remedies of Monga in Kurigram district.

Sharmin (2005) found in her study that farm size of the rural women had no significant relationship with their perception of benefits of involvement in IGAs under a NGO.

Uddin (2004) found that farm size of the farmers had significant and positive relationship with their perception of sustainable agriculture.

Sayeed (2003) observed that farm size of the farmers had a significant positive relationship with their perception of benefit from using manure towards Integrated Nutrient Management (INM) for sustainable crop productions.

Fardous (2002) found that there was no significant relationship between farm size of the farmers and their perception of Village and Farm Forestry Program (VFFP) towards sustainable forestry development. Hossain (2001), Hossain (1999) and Majydyan (1996) found similar findings in their respective studies.

2.3.4 Annual family income and farmers' perception

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study showed that annual family income had no significant relationship with farmer's perception.

Majlish (2007) found that the relationship between family income of participant women and perception of social forestry program of BRAC was non-significant but followed a negative trend.

Afique (2006) found no significant relationship between annual family income of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Islam (2005) found that annual income of the farmers had positive significant relationship with their perception regarding causes and remedies of Monga in Kurigram district. Uddin (2004) concluded that annual family income of the farmers had significant and positive relationship with their perception of sustainable agriculture.

Sayeed (2003) found that annual family income of the farmers had a significant relationship with their perception of benefit from using manure towards Integrated Nutrient Management (INM) for sustainable crop production.

Kabir (2002) found that there was non-significant relationship between annual family income of the farmers and their perception of the effects of BIADP towards environmental upgradation.

2.3.5 Training received and farmers' perception

Kabir and Rainis (2012) conducted a study on farmers' perception on the adverse effects of pesticides on environment: the case of Bangladesh. They found that training had a significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study revealed that training received had a positive significant influence on the farmers' perception.

Majlish (2007) found from her study that the relationship between training experience of participant women and perception of social forestry program of BRAC was positively significant.

Afique (2006) mentioned that there was no significant relationship between training exposure of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Sharmin (2005) reported from her study that training exposure of the rural women had no significant relationship with their perception of benefits of involvement in Income Generating Activities (IGAs) under a NGO.

Uddin (2004) from his study concluded that farmers' training exposure had a significant positive relationship with their perception of sustainable agriculture.

Kabir (2002) found that training experience of the farmers had a significant positive relationship with their perception of the effects of BIADP on environmental upgradation.

Fardous (2002) observed that training exposure of the farmers was significantly correlated with the perception of the respondents of VFFP towards sustainable forestry development.

2.3.6 Organizational participation and farmers' perception

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study revealed that organizational participation had no significant relationship with farmer's perception.

Uddin (2004) studied on fanners' perception of sustainable agriculture and concluded that organizational participation of the farmers had a significant positive relationship with their perception of sustainable agriculture.

Sayeed (2003) reported that organizational participation of the farmers had no significant effect on their perception of benefit from using manure towards INM for sustainable crop production.

Fardous (2002) found that organizational participation of the farmers had significant positive relationship with their perception of VFFP towards sustainable forestry development.

Chowdhury (2001) found a significant relationship between organizational participation and the impact of afforestation as perceived by the farmers.

Alam (2001) reported that organizational participation of the farmers had significant positive relationship with their perception of Binamoog-5 as a summer crop.

2.3.7 Extension media contact and farmers' perception

Islam (2005) observed in his study that media contact of the farmers had no significant relationship with the perception of both causes and remedies of monga.

Sharmin (2005) in her study that extension media contact of the rural women had a significant relationship with their perception of benefits of involvement in IGAs under a NGO.

Sayeed (2003) reported that extension media contact of the farmers was a significant positive relationship between media contact of the farmers and their perception of benefit from using manure towards INM for sustainable crop production.

Fardous (2002) conducted a study and found that there was no significant relationship between knowledge of forestry of farmers and their perception of VFFP towards sustainable forestry development.

Kabir (2002) found that extension media contact of the farmers had a significant positive relationship with their perception of the effects of BIADP on environmental up gradation.

Sarker (1999) conducted a study on perception regarding environmental degradation due to use agro-chemicals and found that media contact of the farmers had a significant relationship with their perception.

Hamid (1997) observed a positive relationship between extension media contact of the farmers and their awareness on the environment pollution. Such findings were supported by Miah and Rahman (1995) and Islam (1994) in their research studies.

2.3.8 Knowledge and farmers' perception

Kabir and Rainis (2012) conducted a study on Farmers' Perception on the Adverse Effects of Pesticides on Environment: The Case of Bangladesh. They found that experience of farmers had a significant influence on the farmers' perception.

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by farmers in Ogbomoso, Nigeria. The study revealed that farming knowledge had a significant influence on the farmers' perception.

Majlish (2007) conducted her study regarding perception of participant women on social forestry program of BRAC. She found from her study that the relationship between knowledge on tree plantation and perception of social forestry program of BRAC was positively significant.

Uddin (2004) conducted his study on farmers' perception of sustainable agriculture. He found that knowledge of environment friendly farming had significant and positive relationship with their perception of sustainable agriculture. He further conduct environment friendly farming had higher perception of sustainable agriculture.

Fardous (2002) conducted a study and found that there was a significant positive relationship between knowledge of forestry of farmers and their perception of VFFP towards sustainable forestry development.

2.3.9 Cosmopoliteness and farmers perception

Islam (2005) observed in his study that cosmopoliteness of the farmers had no significant relationship with the perception of both causes and remedies of monga.

Sharmin (2005) in her study that cosmopoliteness of the rural women had no significant relationship with their perception of benefits of involvement in IGAs under a NGO.

Hossain (2002) found that there was no relationship between cosmopoliteness of the farmers perception of Binadhan-6.

Alam (2001) found that cosmopoliteness of the farmers had a significant positive relationship with their perception of Binamoog-5 as a summer crops.

Hamid (1997) observed a positive relationship between cosmopoliteness of the farmers and their awareness on the environment pollution.

Islam (1993) also found a significant relationship between cosmopoliteness of the farmers and their adoption of recommended dose of fertilizer and plant protection measure in potato cultivation.

2.4 Research Gap of the Study

There are lots of researches on farmers' perception towards various issues. Few researches conducted on farmers' perception towards negative effects of agro-chemicals on environment (Islam, 2008). Others research occurred on perception of fish farmers towards flood coping mechanisms in Dewanganj upazila under Jamalpur district and farmer's perception of soil quality degradation due to less use of organic materials (Alam, 2008). To the best of my knowledge vary little attempts were made to farmer's perception towards harmful effects of climate change on agriculture.

2.5 The Conceptual Framework of the Study

The contribution between the experimental variables and the main focus of the study can be clearly delineated with the help of conceptual framework of the study. The researcher was made an attempt to ascertain the harmful effect of climate change on agriculture of Kazipur upazila under Sirajgong district as the main focus of the study. It was conceptualized in the research that the harmful effect of climate change on agriculture may be influenced and affected by the interacting forces of many socio-economic and others characteristics of the farmers. To make the process conspicuously interpretable a conceptual framework has been presented in a schematic Figure 2.1.

INDEPEPDENT VARIABLES DEPENDENT VARIABLE

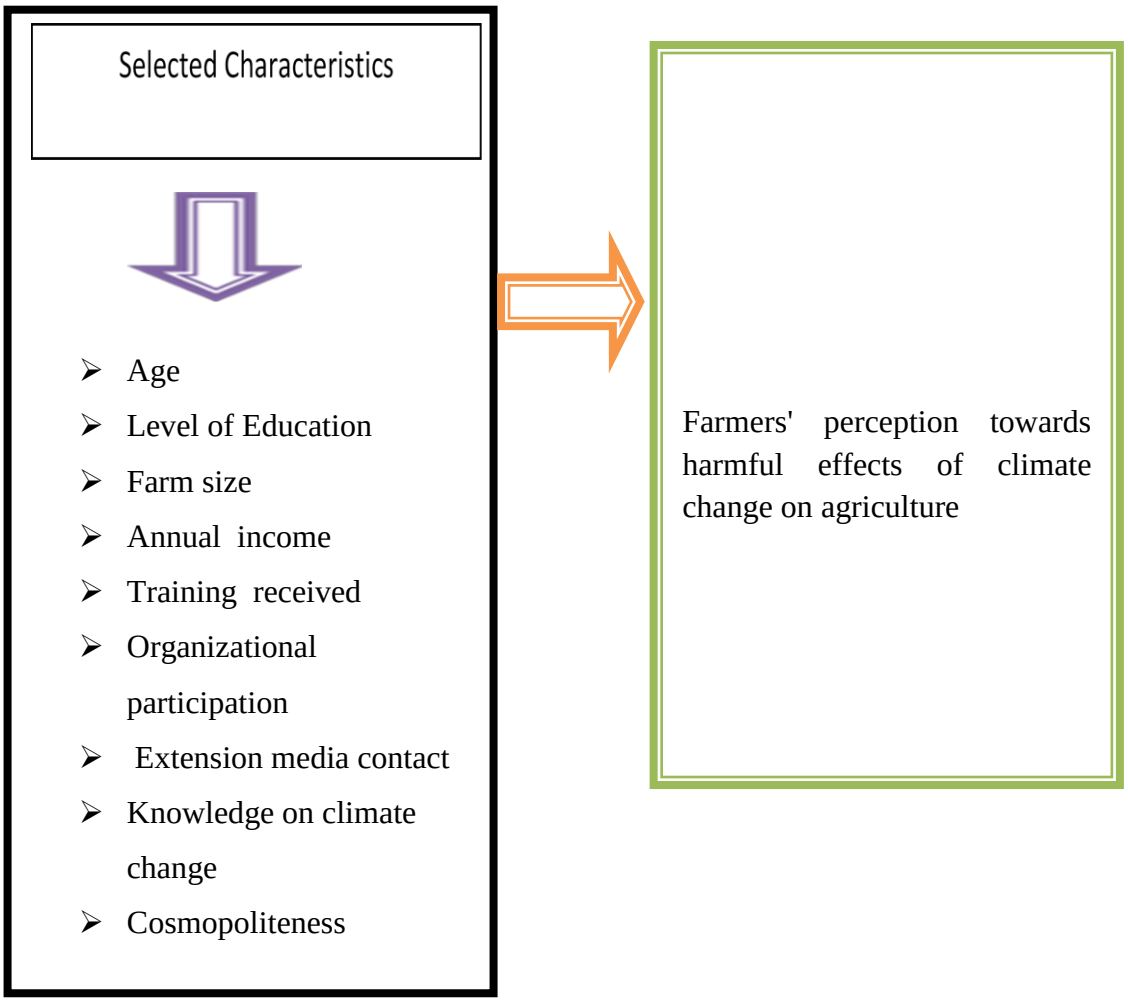

Figure 2.1: A conceptual framework of the study

CHAPTER III

METHODOLOGY

The method and procedure used in the study are presented in this chapter. The principal method used in this study was field survey using structured interview schedule. In any scientific research methodology plays an important role. To perform a research work systematically, careful consideration of appropriate methodology was a must. It should be such that it would enable the researcher to collect valid and reliable information to arrive at correct decisions. The methods and procedures followed in conducting this study have been described in this chapter in the following sections.

3.1 Locale of the Study

The study was conducted at Kazipur upazila under Sirajgong district of Bangladesh where people were affected by climate change especially flood. Two unions namely, Maizbari and Natuarpara under kazipur upazila of Sirajgonj district were selected purposively. Four villages from each union were selected randomly as the locale of the study. A purposive sampling procedure was followed to selected one district from all over the Bangladesh. A map of Sirajgong district showing the Kazipur upazila and a map of Kazipur upazila showing the union of the study area are presented in Figure 3.1 and 3.2.

3.2 Population and sampling procedure

The study location was in Kazipur upazila. Separate lists of farmers of the study villages were prepared by the researcher with the help of Sub-Assistant Agriculture Officer (SAAO) of Kazipur Upazila agriculture Office. The lists comprised of 1293 famers which served as population of the study. Among 1293 farmers, 113 farmers were selected following Yamane's formula (1967). Proportionate random sampling technique was used in order to select the respondents. An appropriate sample reserve list was determined to avoid the uncertainty related with the availability of sample during data collection. As indicated by Yamane's (1967) formula, the sample size was resolved as 113.

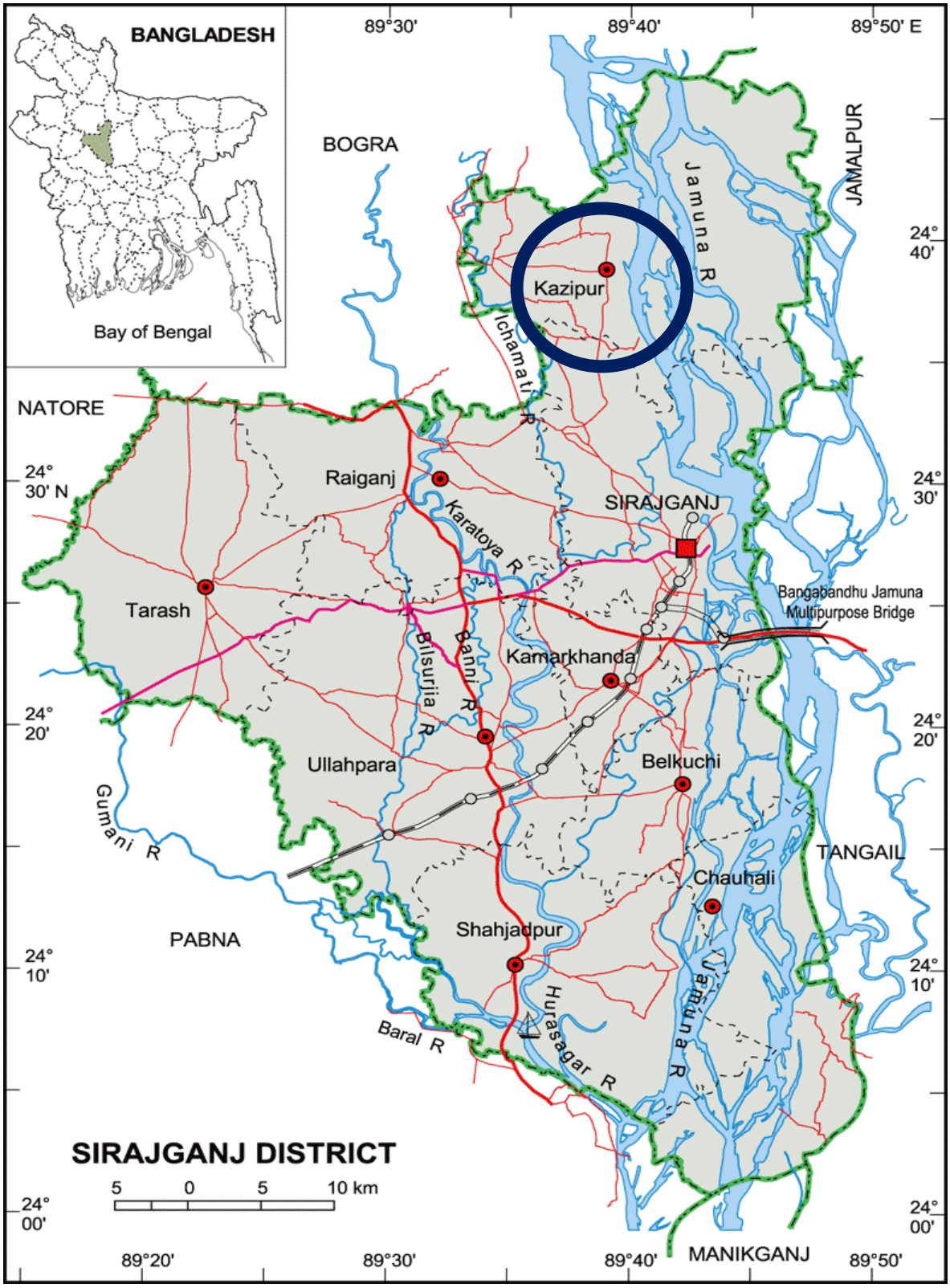

Figure: 3.1 Map of Sirajgonj District showing Kazipur Upazila

Figure: 3.2 Map of Kazipur Upazila showing the study area- Maizbari and Natuarpara Union

The formula is shown below:

$$n = \frac{z^2 P(1-P)}{z P(1-P)+N(e)^2}$$

Where,

n = sample size

N = population size

e = the level of precision

z = the value of the standard normal variable given the chosen confidence level

p = the proportion or degree of variability

Then 113 climate victim farmers were selected from the population by using proportionate random sampling technique. A reserve list of 12 (10% of total sample size) farmers was also prepared. Farmers in the reserve list were used only when a respondent in the original list was not available. The distribution of the sample farmers and those in the reserved list from the villages is shown in the table 3.1.

Table 3.1 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	27	3
	Salavora	342	30	3
Natuarpara	Natuarpara	316	27	3
	Ghoragacha	327	29	3
Total		1293	113	12

3.3 Development of Instrument

The face to face interviewing method was used for data collection. A structured interview schedule containing both closed and open form questions was prepared in this purpose. The question included was simple and direct to ascertain the opinion of the farmers. Pre-test with the draft interview schedule with 10 farmers was accomplished. Data was collected by face to face interviewing of the respondents. The duration for this imposes was from 15 November to 20 November, 2017. Based on the pre-test result, necessary corrections, modifications, addition, alternation were made in the interview schedule and then finalized it.

3.4 Data Collection Procedure

Data were collected from the selected 113 farmers by face to face interview. 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. The investigator faced no serious problems. 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.

3.5 Variables to be used

A variable is any characteristics, which can assume varying or different values in successive individual cases (Ezekiel and Fox, 1959). An organized piece of research usually contains at least two important variables viz., dependent and independent variables.

3.6.1 Dependent variable

Dependent variable is the variable that is being measured in an experiment. Or the variables those are affect during research are called dependent variable. In this study the dependent variable that is farmers' perception towards harmful effects of climate change on agriculture was measured based on farmers agree or disagreeness on some statements related to effects of climate change on agriculture.

3.6.2 Independent variables

Independent variables are the variables that the researcher changes to test their dependent variables. Or the variables that can take different values and can cause corresponding changes in other variables. In this research, the researcher selected ten characteristics of the respondent as the independent variables. The independent variables for this study are- age, education, farm size, annual family income, training received, organizational participation, extension media contact, knowledge on climate change and cosmopoliteness.

3.6.3 Measurement of Independent Variables

For conducting the study in accordance with the objectives it was necessary to measure the independent variables. The independent variables were age, level of education, farm size, annual family income, training received, organizational participation, agricultural extension media contact, knowledge on climate change, Cosmo politeness, Farmers' perception towards harmful effects of climate change on agriculture. Procedures for measuring these variables are described below:

3.6.3.1 Age

Age of the farmers was measured in terms of actual years from his birth to the time of interview, which was found on the basis of the verbal response of the rural people (Rashid, 2014). A score of one (1) was assigned for each year of one's age. This variable appears in item number 1 in the interview schedule as presented in Appendix-I.

3.6.3.2 Level of education

Level of education was measured as the ability of an in individual respondent to read and write or the formal education received up to a certain standard. If a respondent did not attain formal education, his score was assigned as zero (0). A score of 0.5 was given to a respondent who only could sign his/her name. A score of one (1) was assigned for each year of schooling. If a respondent passed the S.S.C examination, his education score was given as 10, 12 for H.S.C., and so on. This variable appears in item number 2 in the interview schedule as presented in Appendix-I.

3.6.3.3 Farm Size

Farm size of the respondents' farmer was measured using the following formula. The farm size was expressed in hectare.

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

Where,

A= Homestead area including pond
B= Own land under own cultivation
C= Land given to others as borga
D = Land taken from others as borga
E=Land taken from others as lease

Total farm size of each respondent was categorized into 4 types (Islam, 2007). The farmers who had land bellow 0.20 hectare were considered as marginal farmer. The farmers who had land between >0.20 to 1.00 hectare were considered as small farmers; the farmers who had land >1.00 hectare were considered as medium farmers. This variable appears in item number 3 in the interview schedule as presented in Appendix-I.

3.6.3.4 Annual family income

Annual family income indicates total earning of a farmer and the members of his family both from agriculture and other socially acceptable regular means such as business, service, etc. during a year. The value of all the agricultural products encompassing crops, livestock, vegetables, etc. were taken into consideration. For calculation, a score of one (1) was assigned for each one thousand (1000) taka of the annual income of a family. According to their annual income, farmers' income was categorized as low income, medium income and high income. This variable appears in item number 4 in the interview schedule as presented in Appendix-I.

3.6.3.5 Training Received

Training received was measured by total number of days of agricultural training received by the farmer in his/her whole life. One score was assigned for each day of training received. According to training received, the respondents` farmers were categorized as having no training, low training and medium training. This variable appears in item number 5 in the interview schedule as presented in Appendix-I.

3.6.3.6 Organizational participation

Organizational participation of a respondent was measured by computing an organizational participation score according to his/her nature and duration of participation in five (5) selected different organizations upto the time of interview. The organisational participation score was evaluated for each respondent on the basis of his/her membership with those organisations. The following scale was used for computing the organisational participation score. The nature of participation was no participation, participation as ordinary member, participation as executive member and participation as secretary/president. The score was 0, 1, 2 and 3 respectively. Organisational participation score of a respondent was determined by adding together

the scores obtained from each of the five types of participation. Organisational participation score of the respondents could range from 0 to 15, where, 0 indicating no participation and 15 indicating high participation. This variable appears in item number 6 in the interview schedule as presented in Appendix-I.

3.6.3.7 Extension media contact

The extension media contact of a respondent was measured on the basis of the response of the media contact user farmers against the extent of his using of selected seven media by putting tick mark against any one of the five responses: regularly, frequently, occasionally, rarely, not at all. The responses were scored as 4, 3, 2, 1 and 0 respectively. The use of extension media contact score of the respondents ranged from 0 to 28 where, 0 indicates no use and 28 indicates very high use. Based on their extension media contact, the respondents were classified into three categories as low contact, medium contact, and high contact. This variable appears in item number 7 in the interview schedule as presented in Appendix-I.

3.6.3.8 Knowledge on climate change

Knowledge of the farmers towards climate change was measured on 10 basic open ended questions. Each question contains 2 marks. Knowledge of rural farmers was determined by summing up the weights for their responses to all the ten statements. Thus knowledge of the farmers towards climate change score of the respondents could range from 0 to 20, where zero (0) indicating no knowledge and 20 indicate sound knowledge. Based on their climate change knowledge, the respondents were classified into three categories as low knowledge, medium knowledge and high knowledge. This variable appears in item number 8 in the interview schedule as presented in Appendix-I.

3.6.3.9 Cosmopoliteness

Cosmopoliteness of a respondent was measured in terms of his nature of visits to the six (6) different places external to his own social system. The cosmopoliteness of a respondent was measured by computing cosmopoliteness score on the basis of his/her visits with six selected cosmopoliteness. Respondents mentioned the nature on his/her visits by putting a tick mark against any one of 4 responses, not at all, rarely, frequently, occasionally and regularly. The score for each respondent was determined

by his/her response to all the items on the basis of his/her frequency of visits with a score of 0, 1, 2 and 3 respectively. The cosmopoliteness score of the respondents could range from 0 to 24, where, 0 indicates low cosmopoliteness and 24 indicates high cosmopoliteness towards negative effects of climate change on agriculture. This variable appears in item number 9 in the interview schedule as presented in Appendix-I.

3.6.4 Measurement of dependent variable

Fourteen relevant statements were carefully constructed to develop perception scale. The Likert scale was used to serve the purpose. A respondent was asked to indicate his/her degree of agreement about each of the statements along with a five-point scale as, strongly agree, agree, neutral, disagree and strongly disagree. Scores were assigned to these five alternate responses as 4, 3, 2, 1, and 0 respectively for each statement. However, the score of a respondent was obtained by adding his/her scores for all the 14 statements. 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. This variable appears in item number 10 in the interview schedule as presented in Appendix-I.

3.7 Statement of the Hypotheses

Hypothesis may be divided into two categories such as research hypothesis and null hypothesis.

3.7.1 Research hypotheses

The following research hypothesis was put forward to test contribution of the selected characteristics of the farmers' perception towards harmful effects of climate change on agriculture. The research hypothesis was “each of the” selected characteristics of the farmers have significant contribution to their farmers' perception towards harmful effects of climate change on agriculture.

3.7.2 Null hypotheses

In order to conduct statistical tests, the research hypotheses were converted to null form. Hence, the null hypotheses were as follows:

"Each of the selected characteristics of the farmers had no significant contribution to their perception towards harmful effects of climate change on agriculture.

3.8 Data Processing and Analysis

3.8.1 Compilation of data

After completion of field survey, data from all the interview schedules were coded, compiled, tabulated and analysed in accordance with the objectives of the study. In this process, all responses in the interview schedule were given numerical coded values. Local units were converted into standard units and qualitative data were converted into quantitative data by assigning suitable scores whenever necessary. The responses of the questions in the interview schedule were transferred to a master sheet to facilitate tabulation.

3.8.2 Categorization of data

For describing the different characteristics and their farmers' perception towards harmful effects of climate change on agriculture, the respondents were classified into several categories. These categories were developed by considering the nature of distribution of data, general understanding prevailing in the social system and possible observed scoring system. The procedure for categorization of data in respect of different variable is elaborately being discussed.

3.9 Statistical Technique

The analysis was performed using Statistical Package for Social Sciences (SPSS V 20) computer package. Descriptive analyses such as range, number, percentage, mean, standard deviation were used whenever possible. To find out the contribution of identified characteristics of the farmers' perception towards harmful effects of climate change on agriculture, multiple regression was used. Throughout the study, at least five percent (0.05) level of probability was used as basis of rejecting a null hypothesis.

CHAPTER IV

RESULTS AND DISCUSSION

The findings of the study and their interpretation have been presented in this chapter. This chapter has been divided into three sections. The first section deals with the selected individual characteristics of the farmers according to the objective of the study, while the second section deals with the farmers' perception towards harmful effects of climate change on agriculture. Finally, in the thirds section deals with contribution of the farmers' selected characteristics on their perception towards harmful effects of climate change on agriculture has been discussed.

4.1 Selected Characteristics of the Farmers

The findings of the farmers' selected characteristics have been presented and discussed (Table 4.1) in this section. The selected characteristics are: age, level of education, farm size, annual family income, training received, organizational participation, extension media contact, knowledge on climate change and cosmopoliteness.

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

Categories	Measuring unit	Rang		Mean	S D
		possible	observed		
Age	Year	-	25-70	49.27	12.08
Level of education	Year of schooling	-	0.00-16	5.4159	3.81
Farm size	Hectare	-	0.09-2.16	0.42	0.33
Annual family income	'000'taka	-	46-531	175.42	121.26
Training received	No of days	-	0-15	4.25	4.20
Organizational participation	Score	0-12	0-12	2.91	2.84
Extension media contact	Score	0-28	10-24	16.72	3.59
Knowledge on climate change	Score	0-20	12-18	14.54	1.58
Cosmo politeness	Score	0-24	9-19	13.29	2.38

4.1.1 Age

The age of the farmers has been varied from 25 to 70 years with a mean and standard deviation of 49.27 and 12.08 respectively. Based on their age, the farmers were classified into three categories namely 'young'; 'middle' and 'old' aged (Rashid, 2014). The distribution of the farmers in accordance of their age is presented in Table 4.2.

Table 4.2 Distribution of the farmers according to their age

Categories	Range (Years)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Young aged	Up to 35	25-70	18	15.9	49.27	12.08
Middle aged	36-50		58	49.6		
Old aged	Above 50		37	34.5		
Total			**113**	**100**		

Table 4.2 reveals that the middle aged farmers comprised the highest proportion (53.2%) followed by old aged (34.5%) and the lowest proportion were made by young aged (15.9%). Data also indicates that the middle and old aged respondents constitute almost (84.1%) of total respondents. The middle and old aged respondents had generally more knowledge on climate change.

4.1.2 Level of Education

The level of education scores of the respondents ranged from 0 to 16 with the mean of 5.41 and the standard deviation was 3.81. Based on their educational scores, the farmers were classified into four categories namely 'illiterate', 'primary level', 'secondary level' and 'above secondary level'. The distributions of the respondents according to their level of education are presented in Table 4.3.

Table 4.3 Distribution of the farmers according to their Level of education

Categories	Range (School years)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Illiterate	Up to 0-0.5	0-16	28	24.8	3.79	3.61
Primary level	1-5		30	26.5		
Secondary level	6-10		47	41.6		
Above Secondary level	10-16		8	7.1		
Total			113	100		

Table 4.3 shows that farmers under secondary education category constitute the highest proportion (41.6%) followed by the primary education (26.5%).On the other hand, the lowest (7.1%) above secondary education and (24.8%) illiterate category. Education broadens the horizon of outlook of farmers and expands their capability to analyse any situation related to climate change. An educated farmer is likely to be more responsive to the modern facts, ideas, technology and information of climate change. To adjust with the same, they would be progressive minded to adopt as well as involve with modern agril-base facilities of agriculture along with searching for the opportunities to improved our soil to produces more crops.

4.1.3 Farm size

The farm size of the farmers in the study area varied from 0.09-2.16 hectares (ha.). The average farm size was 0.42 hectare and the standard deviation was 0.33. This farm size average was higher than the national average of 0.91 hectare (BBS, 2013). On the basis of farm size, the respondents were classified into three categories (according to DAE, 1999) namely 'marginal farm', 'small farm' and 'medium farm' as shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their farm size

Categories	Range (ha)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Marginal farm	Up to 0.02-0.20	0.09-2.16	26	23.00	0.42	0.33
Small farm	0.21-1.00		79	69.9		
Medium farm	>1.00		8	7.1		
Total			**113**	**100**		

Data in the Table 4.4 reveals that the majority of the respondents (69.9%) had small farm size, while (23.0%) have marginal farm and (7.1%) have medium farm size. The normal farm size of the farmers of the study area (0.42 ha.) was two and half times higher than that of national average (0.15 ha.) of Bangladesh (BBS, 2017). The small farmers is the more victim to adverse climate change on agriculture than the others two categories of the farmers.

4.1.4 Annual family income

Annual family income scores of the respondents ranged from Tk.46 to Tk. 531 thousand with the average of Tk. 177.71 and the standard deviation was Tk. 130.12. From the observed range, on the basis of the annual family income, the respondents were classified into three categories (observed range) namely "low income", "medium income" and "high income" as shown on Table 4.5.

Table 4.5 Distribution of the farmers according to their annual family income

Categories	Range ('000' Taka)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low income	Up to 177	46-531	73	64.6	177.71	130.12
Medium income	178-354		26	23.0		
High income	Above 354		14	12.4		
Total			**113**	**100**		

From Table 4.5 it was observed that the highest portion (64.6%) of the respondents had low annual family income while (23.0%) respondents had medium and (12.4%) had high annual family income. That is also indicate that the majority of the farmers has low family income because they are more sufferer than others farmers. Overwhelming majority (87.6 percent) farmers have low to medium level annual family income.

4.1.5 Training received

Training received scores of the respondents were found to be varying from 0 to 15 days there with the average of 4.25 and the standard deviation was 4.20. From the observed range, on the basis of training received, the respondents were classified into three categories (observed range) namely 'no training received', 'low training received' and 'medium training received' as shown in Table. 4.6.

Table 4.6 Distribution of the farmers according to their training received

Categories	Range (No of days)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
No training	0	0-15	41	36.3	4.25	4.20
Low training	1-7		42	37.2		
Medium training	Above 7		30	26.5		
Total			**113**	**100**		

Data presented in the Table 4.6 showed that the highest proportion (37.2%) of the respondents belonged to low training received category as compared to (36.2%) and (26.5%) having no and medium training received category respectively. Overwhelming majority (73.5%) farmers have no to low training received. Who received training in any agricultural base they are more conscious about harmful effects of climate change.

4.1.6 Organizational participation

The observed organizational participation score of the respondents ranged from 0 to 12. The mean score was 2.91 with the standard deviation 2.84. From the observed range, on the basis of organisational participation, the respondents were classified into

four categories **(**observed range) namely ‘no participation”, “low organizational participation”, “medium organizational participation” and “high organisational participation”, as shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their organizational participation

Categories	Range (score)		Respondents’		Mean	SD
	Score	Observed	Number	Percent		
No participation	0	0-12	41	36.3	2.91	2.84
Low participation	1-4		46	40.7		
Medium participation	5-8		24	21.2		
High participation	Above 8		2	1.8		
Total			**113**	**100**		

Data contained in the Table 4.7 revealed that the majority (40.7%) of the farmers had low organisational participation as compared to (36.3%) and (21.2%) having no and medium organisational participation respectively, while (1.8%) of the respondents belongs to high organisational participation. The majority (77.0 %) of the farmers had in no to low organizational participation. To know about harmful effects of climate change organizational participation play an important role.

4.1.7 Extension Media contact

An extension contact score was computed for each respondent on his extent of contact with 7 selected media. Each respondent was asked to mention the frequency of his contact with each of the 7 selected media. Extension media contact scores of the farmers ranged from 10 to 24 with an average of 16.72 and standard deviation of 3.59. It was measured as one's extent of exposure with different information sources. On the basis of their extension 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 extension contact score of a respondent is given table 4.8.

Table 4.8 Distribution of the farmers according to their extension media contact

Categories	Range (Score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low contact	Up to 13	10-24	27	23.9	16.72	3.59
Medium contact	14-19		54	47.8		
High contact	Above 19		32	28.3		
Total			**113**	**100**		

Data contained in the Table 4.8 indicated that the highest proportion (47.8%) of the respondents had medium extension media contact as compared to (28.3%) and (23.9%) having high and low extension media contact respectively. It was assumed that the more contact an individual would have with different information sources, the more he becomes educated and knowledgeable.

4.1.8 Knowledge on climate change

The score of the knowledge on climate change ranged from 12-18 with a mean and standard deviation of 14.12 and 1.53 respectively. On the basis of knowledge on climate change farmers were classified into three categories (Mean±SD) such as, 'low knowledge', 'medium knowledge' and 'high knowledge' on climate change. The distribution of the farmers according to their knowledge on climate change scores is shown in the table 4.9.

Table 4.9 Distribution of the farmers according to their knowledge on climate change

Categories	Range (Score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low knowledge	Up to 13	12-18	24	21.2	14.12	1.53
Medium knowledge	14-15		52	46.1		
High knowledge	Above 15		37	32.7		
Total			**113**	**100**		

Data presented in the Table 4.9 shown that the majority (46.1%) of the respondents had medium knowledge on climate change while (32.7%) had high knowledge and (21.2%) of the farmers had low knowledge on climate change. The majority of the farmers (76%) have medium to high knowledge on climate change on agriculture.

4.1.9 Cosmopoliteness

The score of cosmopoliteness of the farmers ranged from 9-19 with a mean and standard deviation of 13.15 and 2.30. On the basis of cosmopoliteness, the respondents were classified into three categories (Mean±SD) namely, 'low', 'medium' and 'high'. The scale used for computing the Cosmopoliteness score is presented in the Table 4.10.

Table 4.10 Distribution of the farmers according to their cosmopoliteness

Categories	Range (Score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low cosmopoliteness	Up to 11	9-19	29	25.7	13.15	2.30
Medium cosmopoliteness	12-15		63	55.7		
High cosmopoliteness	Above 15		21	18.6		
Total			**113**	**100**		

Data contained in the Table 4.10 shows that the highest proportion (55.7%) of the respondents had medium cosmopoliteness while (25.7%) and (18.6%) of them had low and high cosmopoliteness categories. The majority of the farmers (81.4%) have low to medium cosmopoliteness. Cosmopoliteness of the farmers increases their knowledge about climate change on agriculture.

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

The observed perception scores of the respondents ranged from 28 to 45 against the possible range of 0-56. The mean scores were 37.05 with the standard deviation of

3.19. Based on their perception, the respondents were classified into three categories (Mean±SD) namely, 'lower agree', 'moderately agree' and 'highly agree'. The distribution of the farmers' according to their perception is shown in the Table 4.11.

Table 4.11 Distribution of the farmers according to their perception

Categories	Basis of categorisation (Score)	Respondents'		Mean	SD
		Number	Percent		
Lower agreed	(≤mean-sd) ,i.e up to 34	21	18.6	37.05	3.19
Moderately agreed	(mean±sd), i.e 35-40	80	70.8		
Highly agreed	Above (mean+sd) 40	12	10.6		
Total		**113**	**100**		

Findings shown in the Table 4.11 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 and they can minimize the 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.

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

In order to estimate the farmers perception towards harmful effects of climate change on agriculture, the multiple regression analysis was used which is shown in the Table 4.12.

Table 4.12 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 change	0.164	0.021*			
	cosmopoliteness	-0.025	0.719			

** Significant at p<0.01; *Significant at p<0.05

Table 4.12 shows that there is a significant contribution of the respondents, organisational participation, extension media contact and knowledge on climate change. Of these, organisational participation was the most important contributing factors (significant at the 1% level of significant) and extension media contact and knowledge on climate change (significant at 5% level of significant) while coefficients of other selected variables don't have any contribution on farmers perception towards harmful effects of climate change on agriculture.

The value of R^2 is a measure of how of the variability in the dependent variable is accounted by the independent variables. So, the value of R^2 = 0.676 means that independent variables accounts for 67% of the variation in farmers perception towards harmful effects of climate change on agriculture. The F ratio is 31.023 which is highly significant (ρ<0).

However, each predictor may explain some of the variance in respondents perception towards harmful effects of climate change on agriculture simply by chanced. The adjusted R^2 value penalises the addition of extraneous predictors in the model, but values 0.653 is still show that variance is farmers perception towards harmful effects of climate change on agriculture can be attributed to the predictor variables rather than by chanced the suitable model (Table 4.12). In summary, the models suggest that the respective authority should be consider the farmers organisational participation, extension media contact and knowledge on climate change and in this connection some predictive importance has been discussed below:

4.3.1 Significant contribution of organizational participation to the farmers' perception towards harmful effects of climate change on agriculture

The contribution of organisational participation to farmers' perception towards harmful effects of climate change on agriculture was measured by the testing the following null hypothesis;

"There is no contribution of organisational participation to the farmers' perception towards harmful effects of climate change on agriculture".

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. The contribution of the organisational participation was at 1% significance level (p=0.00).
b. So, the null hypothesis could be rejected.
c. The b-value of level organisational participation was (0.566). So, it can be stated that as organisational participation increased by one unit, farmers' perception towards harmful effects of climate change on agriculture increased by 0.566 units. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that farmers' have more organisational participation increased the farmers' perception towards harmful effects of climate change on agriculture. This implies that with the increase of organisational participation of the farmers will increase their perception towards harmful effects of climate change on agriculture.

4.3.2 Significant contribution of knowledge on climate change to the farmers' perception towards harmful effects of climate change on agriculture

From the multiple regression, it was concluded that the contribution of knowledge on climate change to the farmers' perception towards harmful effects of climate change agriculture was measured by the testing the following null hypothesis;

"There is no contribution of knowledge on climate change to the farmers' perception towards harmful effects of climate change on agriculture".

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. The contribution of the knowledge on climate change was significant at 5% level (0.021).
b. So, the null hypothesis could be rejected.
c. The b-value of knowledge on climate change was (0.164). So, it can be stated that as knowledge on climate change increased by one unit, farmers' perception towards harmful effects of climate change on agriculture increased by 0.164 units. Considering the effects of all other predictors are held constant.

Multiple regressions showed that knowledge on climate change of the farmers was second highest positive contribution to their perception towards harmful effects of climate change on agriculture. This implies that with the increase of knowledge on climate change of the farmers will also increase their perception towards harmful effects of climate change on agriculture. Knowledge helps farmers to make favourable possess- as which ultimately help them to take adaptation.

4.3.3 Significant contribution of extension media contact to the farmers' perception towards harmful effects of climate change on agriculture

From the multiple regression, it was concluded that the contribution of extension media contact to the farmers' perception towards harmful effects of climate change agriculture was measured by the testing the following null hypothesis;

"There is no contribution of extension media contact to the farmers' perception towards harmful effects of climate change on agriculture".

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. The contribution of extension media contact was significant at 5% level (0.025).
b. So, the null hypothesis could be rejected.

c. The b-value of extension media contact was (0.168). So, it can be stated that as extension media contact increased by one unit, farmers' perception towards harmful effects of climate change on agriculture increased by 0.168 units. Considering the effects of all other predictors are held constant.

From the multiple regressions, it was concluded that extension media contact of the farmers had third highest positive contribution to their perception towards harmful effects of climate change on agriculture. This implies that with the increase of extension media contact of the farmers will increase their perception towards harmful effects of climate change on agriculture.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

The study was conducted in the Maizbari and Natuarpara union of Kazipur Upazila under Sirajgonj district to find out the farmers' perception towards harmful effects of climate change on agriculture. Total 1293 farmers' were selected from the study area as the population and according to Yamane's formula, the respondents comprised of 113 constituted the sample of the study. A well-structured interview schedule was developed based on objectives of the study for collecting information. The independent variables were: age, level of education, farm size, annual family income, training received, organizational participation, extension media contact, knowledge on climate change and cosmopoliteness. Data collection was started from 1 January and completed in 30 January, 2018. Various statistical measures such as frequency counts, percentage distribution, mean and standard deviation were used in describing data. In order to estimate the contribution of the selected characteristics of the respondents to their perception towards harmful effects of climate change on agriculture, multiple regression analysis was used. The major findings of the study are summarized below:

5.1 Major findings

5.1.1 Selected characteristics of the respondents

Age

The highest proportion (49.6%) of the respondents was in middle aged category, compared to (34.5%) and (15.9%) of them being old and young aged category, respectively.

Level of education

Secondary education constituted the highest proportion (41.6%) and the lowest 7.1% in above secondary.

Farm size

The small farm size holder constitutes the highest proportion (69.9%) followed by medium size farm (7.1%).

Annual family income

The highest proportion of the farmers' (64.6%) had low income; whereas, (23.0%) and (12.4%) of them had medium and high income respectively.

Training received

The highest proportion (37.2%) of the farmers had low training received and the lowest (26.5%) farmers had medium training received.

Organizational participation

The most elevated extent (40.7%) of the respondents had low participation while (36.3%) had no participation and (1.8%) had high organizational participation.

Extension media contact

The most astounding extents (47.8%) of the farmers had medium agricultural extension media contact, whereas (28.3%) and (23.9%) had high and low extension media contact.

Knowledge on climate change

The most noteworthy extent (46.1%) of the respondents had medium knowledge on climate change, while (32.7%) of them had high and (21.2%) had low knowledge on climate change.

Cosmopoliteness

The most noteworthy extent (55.7%) of the respondents had medium cosmopoliteness, while (25.7%) of them had low and (18.6%) had high cosmopoliteness.

5.1.2. Farmers' perception towards harmful effects of climate change on agriculture

The highest proportion (70.8%) of the respondents had moderately agreed perception, while (18.6%) had lower agreed and (10.6%) had highly agreed perception towards harmful effects of climate change on agriculture.

5.1.3 Contribution of the selected characteristics of the farmers' perception towards harmful effects of climate change on agriculture

Organizational participation, agricultural extension media contact and knowledge on climate change had significant positive contribution to their perception towards harmful effects of climate change on agriculture.

Characteristics of the farmers like age, education. farm size, annual family income, training received, and cosmopoliteness had no contribution to their perception towards harmful effects of climate change on agriculture.

5.2 Conclusions

Conclusion is the final decision or judgment, which is placed through contention at the end or termination of a research work. Conclusion should be so constructive that its words and contentions must draw the attention of the concerned individual/organizations. The findings and relevant facts of research work prompted the researcher to draw following conclusions.

i. The findings revealed that an overwhelming majority (89.4%) of the respondents had lower agreed to moderately agreed perception towards harmful effects of climate change on agriculture at the study area. Still there is a scope to improve farmers' perception through more involving with organizational participation, extension media contact and increasing knowledge.

ii. Organizational participation had 1st highest contribution to the farmers' perception towards harmful effects of climate change on agriculture. It also showed that majority of the respondents had lower organizational participation. The result concluded that establishment of more organization and farmers' involvement will increase the farmers' perception towards harmful effects of climate change on agriculture.

iii. Knowledge on climate change of the respondents had a significant contribution to the farmers' perception towards harmful effects of climate

change on agriculture, consequently. The majority (46.1%) of the respondents had medium knowledge on climate change while (32.7%) had high knowledge and (21.2%) of the farmers had low knowledge on climate change. Knowledge helps the farmers to make favourable perception towards harmful effects of climate change on agriculture which ultimately helps the farmers to follow coping strategies.

iv. Maximum 47.8% of the respondents had medium extension media contact as compared to (28.3%) and (23.9%) having high and low extension media contact respectively on farmers' perception towards harmful effects of climate change on agriculture. The regression analysis revealed that extension media contact of the respondents was a contributing factor to the farmers' perception towards harmful effects of climate change on agriculture. Therefore, it may be said that the higher the media contact of the respondents higher the perception of the farmers.

5.3 Recommendations

5.3.1 Recommendation for policy implications

On the basis of the observation and conclusions drawn from the findings of the study following recommendation is made:

i. Organizational participation had the highest contribution to the farmers' perception towards harmful effects of climate change on agriculture. Therefore, it was recommended that steps should be taken by the different government and non-government organizations like DAE and others to maximize individual, involvement with organization. In order to increase organizational participation of farmers, some incentives like cultural activities, food programmed and logistic support etc. should be done.

ii. Extension media contact increases farmers' diversified knowledge and make them able to cope with adverse situations. So, policies should be taken to engage farmer's with diversified extension media to broaden their outlook and to develop favorable perception towards harmful effects of climate change on agriculture. GOs and NGOs can also play a vital role in this regard.

iii. Majority (46.1%) of the farmers of the study area had medium knowledge on perception towards harmful effects of climate change on agriculture. So to increase knowledge on perception towards harmful effects of climate change on agriculture, expert experienced trainer is prerequisite. Department of Agricultural Extension (DAE) along with experts NGOs representatives, different social media and mass media can play a key role in this regard.

5.3.2 Recommendations for further research

A single research work is very inadequate to have in-depth understanding of the farmers' perception towards effects of climate change on agriculture. Further studies should be undertaken covering more dimensions of the same issue. Therefore, the following suggestions are made for further research work:

i. The present study was conducted in Kazipur upazila under Sirajgonj district. It is recommended that similar studies should be conducted in other areas of the country.

ii. This study investigated the relationship of only nine characteristics of the farmers with their perception on harmful effects of climate change on agriculture. Therefore, it is recommended that further study should be conducted with other independent and dependent variables**.**

iii. In this research the author conducted his survey in all category farmers who were affected by climate. So, further study can be taken with specific farmer group or/and compare among these group.

iv. Researcher will have opportunity or scope to identify the factors causing hindrance towards adaptation of farming practices by farmers in agriculture.

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Appendix - I

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University, Dhaka-1207

An interview schedule for data collection of the research study entitled

"FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF CLIMATE CHANGE ON AGRICULTURE"

Serial No……

Respondent Name:

Village:…….

Union:…….

Upazila:…….

District:…….

(Please answer the following questions. Put tick wherever necessary)

1. Age:

What is your present age?.....Years.

2. Level of Education:

a) Cannot read and write……

b) Can sign only……

c) I read up to class ……

d) I passed ……class

3. Farm Size:

Please mention the area of your land possession

Sl. No.	Types of land ownership	**Area of land**		**Total Area** (Hectare)
		Local unit	Hectare	
1	Homestead area (Including pond) (A)			
2	Own land under own cultivation (B)			
3	Land given to others as borga (C)			
4	Land taken from others as borga (D)			
5	Land taken from others as lease (E)			
	Total=A+B+1\2(C+D)+E			

4. Annual family income:

Please state the income from different sources during the last one year:

A. On farm income:

SL. NO.	Sources of income	Total production Kg/unit	Price per kg/unit	**Total price (Tk)**
1	Rice			
2	Maize			
3	Jute			
4	Oilseeds			
5	Vegetables			
6	Livestock			
	Total			

B. Off farm income:

SL. NO	Sources of income	Tk/ month	Tk/ years	Total (Tk)
1	Business			
2	Services			
3	Day labour			
	Total			

5. Training Received:

Have you attended any agricultural training programme?

Yes…… No……..

If yes, please mention the following information:

Sl. No	Name of the training course	Name of the organization	Duration of training (days)
1			
2			
3			
	Total		

6. Organizational participation:

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

SL. NO.	Duration/Nature of the participation (yrs)				
	Name of the organizations	No Participation (0)	Ordinary member (1)	Executive Committee Member (2)	Executive Committee Officer (3)
1	Cooperative Society				
2	IPM Club				
3	Mosque Committee/ Madrasa committee				
4	School committee				
5	Bazaar Committee				
	Total				

7. 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	Upazila level agricultural organization					
6	Agricultural program through electronic media (radio/TV)					
7	Agricultural features in printing media (daily newspaper, leaflet, booklet, magazine etc.)					
	Total					

8. Knowledge on climate change

Please answer the following questions

SL. NO	Questions	Full Marks (2)	Marks obtained
1	What is your idea about Climate Change?	2	
2	What are the elements of climate change?	2	
3	Which month does the temperature highest and lowest?	2	
4	What are the effects of temperature?	2	
5	Which month do we call the rainy season?	2	
6	When does the rain fall highest?	2	
7	Why does flood occur?	2	
8	What are the effects of flood?	2	
9	When do we call drought?	2	
10	What are the effects of drought?	2	
	Total	20	

9**. Cosmopoliteness**

Are you visits in the following places?

SL. NO.	Place of visit	Extent of visit				
		Regularly (4)	Frequently (3)	Occasionally (2)	Rarely (1)	Not at all (0)
1	Neighbour villages	≥6 times/month	5-6 times/month	3-4 times/month	1-2 times\month	0 times/month
2	Others union	≥5 times/month	4-5 times/month	3-2 times/month	1 times/month	0 times/month
3	Upazila sadder	≥4 times/month	3-4 times/month	2 times/month	1 times\month	0 times/month
4	Other Upazila sadder	≥6 times/year	5-6 times/year	3-4 times/year	1-2 times\year	0 times/year
5	Own district town	≥5 times/year	4-5 times/year	3-4 times/year	1-2 times\year	0 times/year
6	Other district town	≥4 times\ year	3 times\ year	2 times\year	1 times\year	0 times\ year
	Total					

10. Farmers' perception towards harmful effects of climate change on agriculture

Please give your agreement on the following statements:

SL. NO.	Farmers' perception	Extent of farmer's perception				
		Strongly agree (4)	Agree (3)	Neutral (2)	Disagree (1)	Strongly disagree (0)
1	Crops yield decrease due to climate change					
2	Vegetables yield decrease because of climate change					
3	Irrigations facility hampered due to climate change					
4	Quality of crops decrease because of climate change					
5	Climate change negatively influence the quality of agricultural products					
6	Water level go deep					
7	Climate change hampered fish production					
8	Poultry production hampered due to climate change					
9	Drought increase due to climate change					
10	Floods increase due to uneven rainfall					
11	Duration of rainy season become shorter due to climate change					
12	Climate change increase natural disaster					
13	Climate change hampered market facilities					
14	Climate change influence to increase labour price					
	Total					

Thank you for your kind co-operations

Signature of the interviewer