FARMERS ADJUSTMENTS TO RICE PRODUCTION IN RESPONSE TO FLOOD HAZARD IN HAOR BASIN AREAS OF BANGLADESH

A Dissertation for the degree of Master in Disaster Management

By

Jakia Quamrun Nahar

Student ID: 15168002

Summer 2016

Postgraduate Programs in Disaster Management (PPDM)
BRAC University, Dhaka, Bangladesh

DEDICATED

TO

MY BELOVED PARENTS

ACKNOWLEDGEMENTS

All praises to Almightly and Kindfull trust on to “Omnipotent Allah” for His never-ending blessing and deems it a great pleasure to express my profound gratefulness to my respected parents, who entiled much hardship inspiring for prosecuting my studies, receiving proper education.

I would like to express my deepest appreciation and immense thanks to all those who provided me the possibility to complete this dissertation. It would not have been possible without the kind support and help of these individuals. I would like to extend my sincere thanks to all of them.

I am highly indebted to Professor Dr. Fuad H Mallick, the Director of Postgraduate Programs in Disaster Management, BRAC University for giving me opportunity to complete my masters.

I wish to express my gratefulness to M Aminur Rahman, Ex-Assistant Professor, Post Graduate Program in Disaster Management (PPDM), BRAC University, for his valuable advice, time, wishes, Inspiration and providing necessary facilities for the completion of this paper.

The author likes to acknowledge the amiable and professional contribution of Dissertation Supervisor Professor Dr. Md. Humayun Kabir, coordinator of Postgraduate Programs in Disaster Management, BRAC University for his constant guidance and precious advice towards the successful completion of the study.

With pleasure and admiration I owe my profound gratitude to all of my classmates for their cooperation in providing information and Inspiration.

My thanks and appreciations also go to BRAC University and associated people who have willingly helped me out with their abilities.

I would like to express my gratitude towards my parents, husband, all of the family members and friends for their kind cooperation and encouragement which help me in completion of this paper.

Jakia Quamrun Nahar

ABSTRACT

The study was conducted in the Dingapota Haor of Mohangonj upazila under Netrokona district and it have been selected purposively as the study area. The boro rice growers of Dingapota Haor constituted the population of the study. An update list of 1032 boro rice growers from the selected Haor area was collected from Upazila Agricultural Offices of this locality. Around 10% of the populations were randomly selected as the sample of the study by using random sampling method. Thus, 103 boro rice growers constituted the sample of the study. A well structured interview schedule was developed based on objectives for collecting information. The researcher herself collected data through personal contact. The independent variables were: age, level of education, family size, farm size, annual income, organizational participation, communication exposure and agricultural knowledge. The dependent variable of this study was the farmers adjustments to rice production in response to flood hazard in Haor basin areas of Bangladesh. Data collection was started in 07 April, 2016 and completed in 26 April, 2016. Among the respondents, rice growers in Haor basin area in adjustment of flood hazard, the highest 55.34 percent rice growers belong to the group of lowest adjustment compared to 37.86 percent in moderate adjustment, whereas the lowest 6.80 percent rice growers belong to the group of high adjustment in response to flood hazard in Haor basin area. Pearson Product Moment Correlation Co-efficient between dependent and independent variable revealed that age, level of education, farm size, organizational participation, communication exposure and agricultural knowledge had significant positive relationships with farmers' adjustments to rice production in response to flood hazard in Haor basin area. Annual income had non significant positive relationships, while family size had significant negative relationship with farmers' adjustments to rice production in response to flood hazard in Haor basin area under the present study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURE

LIST OF APPENDIX

CHAPTER I

INTRODUCTION

1.1 General Background

Bangladesh is an agro-based country and agriculture accounts for 19.42% of country's GDP (Bangladesh Economic Census, 2013) and source of employment of 44.4% of its people (Labour Force Survey, 2010). About 85% of the total population in this country living in rural areas and are directly or indirectly engaged in a wide range of agriculture (World Bank, 2005). Bangladesh is a thickly populated country with an area of 147,570 km^2 and the population is 142.3 million with the growth rate of 1.34% and the present population stands as 155 million (BBS, 2013). Rice occupies about three-fourths of cultivable land and remaining lands are distributed for other crops. Farmers deployed their best efforts to produce rice and as a result they have allotted about 75% of their land for rice cultivation which is the staple food of Bangladesh. From this effort the country could produce about 3.80 core tons of rice in 2011-2012 fiscal years (BRRI, 2013). The Haor areas of Bangladesh are producing a significant amount of rice mainly in boro season although most of the year they faced early flash flood in harvesting time.

Haor is a Bangla word which refers to flood prone land and other low lying areas that remain inundated with water for several months each year. Haor is being used to indicate a unique geographical site of Bangladesh that added a splendid diversity to the nature of the country to the north-eastern part of Bangladesh, covering 858,460 hectare of land (MOWR, 2012). The huge marshy land consists of several districts though none of these districts is completely marshy. This wetland covers parts of Netrakona, Kishoreganj, Sunamganj, Habiganj, Brahmanbaria and Sylhet district (Haor Task Force Report, 2005). The wetland has unique geographical characteristics, significantly different from the rest of the country. During this period the aggregate wetland looks like a sea, full of water to every horizon. Vicinities and villages become completely isolated individually they each seem to be an island with water surrounding from all sides. As all lands merge into water, any kind of crop cultivation or grazing is beyond imagination during this period. Fishing becomes the most typical economic job as well as several businesses like grocery and boating. Usually, most of the people stay unemployed, spending literally complete idle time for 4-6 months every year.

In Bangladesh the Haor basin contains about 47 Haors and some 6300 beels of which 3500 are permanent and 2800 are seasonal (Bulletin of First Haor conference, 2010). In terms of ecosystem, crop production practices, economic activities and over all livelihood of the rice growers of Haor areas are quite different from those of the other parts of the country. Since the cropped land area is being continuously shrinking over time leading to serious challenge towards increasing productivity and thus to the mission of attaining self-sufficiency in food production for the land scarce economy of Bangladesh, it has indeed become imperative to exploit the crop production potentiality of the large Haor areas; it is because those areas usually remain under-utilized with quite low cropping intensity (Jabber and Alam, 1996). For the unique geographical characteristics, people can produce rice in boro season only. Several robi crops, jute, linseed, cucumber and so on are also cultivated here in a limited range, but boro rice production is predominantly unrivaled in all kinds of agricultural activities. Highly fertile lands, abundance of water and small population density have made this whole wetland magnificently important resource for boro rice production with sudden unexpected floods as the main risk factor.

Flash flood is the main disaster in the Haor area which engulfs the primary production sector and thus threatens the lives and livelihoods of the people. Excess rainfall in the upstream hilly areas and subsequent runoff, sedimentation in the rivers, deforestation and hill cuts, landslide, improper drainage, unplanned road and water management infrastructure and the effect of climate variability can be viewed as the main reasons for the devastations caused by the floods. The cropping practices particularly boro rice crop mainly depends on nature. Early flood, hailstorm and drought are the main constraints to grow modern boro rice. The available statistics indicate that, the total cultivated area in the Haor districts is about 1.26 million hectares of which 0.68 million hectares (nearly 66%) is under Haor (Bulletin of First Haor conference, 2010). Almost 80% of this area is covered by boro rice, while only about 10% area is covered by T. aman production (Huda, 2004). This area is gradually increasing in different locations of Haor districts (Husain *et al.,* 2001). The present study site is a flash flood prone area. Early flooding is the common problem for that area. Viewing and analyzing the aforesaid conditions the researcher has become interested to undertake a research entitled, ‘Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Areas of Bangladesh’.

1.2 Rationale of the Study

The productive efficiency in agricultural production is an important issue from the standpoint of agricultural development in developing countries since it gives pertinent information useful for making sound management decisions in resource allocations for formulating agricultural policies and institutional improvements. Scarcity of resources has led production economists to think about the reallocation of existing resources to have more output with given level of input combinations or to produce a prescribed level of output with the minimum cost without changing the production technology. In the productive efficiency arena, we are familiar with three types of efficiency, namely, technical, allocative and economic efficiencies. Technical efficiency refers to the ability of a farm to obtain maximal output from a given set of inputs under certain production technology whereas allocative efficiency reflects the ability of a farm to use the inputs in optimal proportions, given their respective prices. Economic efficiency which combines technical and allocative efficiencies reflects the ability of a production unit to produce a well-specified output at the minimum cost (Rahman, 2002).

However, it is necessary to concentrate the attention on technical efficiency only for attaining the maximum benefit from the land of Haor areas. In Haor area of Bangladesh, where resources are scarce and opportunities for new technologies are lacking, efficiency (or inefficiency) studies will be able to show that it is possible to raise productivity by improving efficiency without new investment or developing new technology. It is generally assumed that in Haor region of Bangladesh farmers are inefficient at producing boro rice crops and there are significant efficiency differences due to the uncertainty of natural calamities. After the measurement of efficiency differences, proper measures can be undertaken to reduce them; different components of agricultural policy, agricultural subsidies and extension policies, land ceiling and distribution policies can be adopted as well. Thus, the findings of this study will be useful in a wide range of decision-making situations affecting the development of agriculture in the Haor areas as well as country. It is widely believed that the people living in different Haor areas of Bangladesh have been suffering from lack of food security. There are many reasons attributed to it such as: production of single crop throughout the year, seasonal unemployment, flood, other natural disasters, lack of communication and other infrastructure facilities, employment opportunities, lack of due attention of the government, and other service providers.

Anecdotal evidence reveals that basic avenues for smooth and economically secured livelihood are almost absent for most of the Haor people. Reliable percentage of the people of Haor areas living below the poverty line, it is assumed that a considerable percentage of people living in these areas could be defined as ultra-poor. Since people do not have ample employment opportunity all over the year, their food security situation is very vulnerable. Majority of the people in Haor areas are involved in mono-crop cultivation and especially boro rice and fishing, and they remain frequently unemployed due to lack of alternative income generating activities. Sometimes, flood and other natural disasters create a famine-like situation for them. Apart from that, these areas do not have good communication system and most of the people hardly have concrete connection with the people living outside the Haor areas and the food insecurity becomes perpetual phenomenon for them. The coverage and efficacy of safety nets by different public and private organizations is not adequate to address the food security of that area. The Haor areas have inadequate educational arrangements for children and even adults for livelihood training. As a result, the literacy rate is very low and employment-oriented education is almost non-existent. This is another vital cause of unemployment, which is mostly responsible for the situation of food insecurity in the Haor areas.

In Haor region of Bangladesh in producing boro rice although there are a possibilities of uncertainty of natural calamities especially flash flood. Rice growers make preparation for the adjustment of flash flood but it was not identified as a prescribed form. Even it is not scientifically proved and also not to be generally recommended. Taking the above factors into consideration, Haor areas were selected for the study so that the food security strategies of the people could be analyzed and explored in order to better planning and suggest relevant adjustments of flash flood. Haor area has a major contribution in total rice production of Bangladesh. Because of the abundance of water and sediments entire Haor area serves as a prominent resource of rice production. But it allows only boro rice production and its operational strategy and factors affecting the rice production are significantly different from that of the rest of the country due to the different natural calamities in Haro areas especially flash flood during the harvesting of boro rice and rice growers make adjustments to rice production in response to flood hazard in Haor basin area of Bangladesh. That is why, total Haor area deserves to be observed and studied thoroughly so that the best suited policy and operational strategy can be implemented.

1.3 Statement of Problems

Bangladesh is losing every year a valuable amount of GDP to severe natural disasters, like flood, cyclone, riverbank erosion, salinity etc. According to a World Bank (WB) report, the losses associated with environmental degradation are estimated at more than 4.3% of Bangladesh's GDP (World Bank, 2006). Poor people, women, marginalized communities and the farmers in the coastal, hilly and Haor areas are highly vulnerable to these natural calamities. Further increases in the intensity of rains in other parts of Bangladesh-particularly where the topography is broken and also soils eroded will experience increased flooding, cyclone, salinity etc threatening livelihood of millions of farmers (Rimi *et al*., 2009). Several adaptive practices are regularly considered by the farmers in the local agriculture but the relative success to overcome these condition and temporal variations gradually making them more vulnerable. In this situation, the adaptive/adjustments capacities of the targeted people need to be gradually increased to understand the probabilistic vulnerabilities and its consequences over the agriculture and agriculturally based livelihoods (CEGIS, 2005). Agricultural activities are largely hampered by different types of climatic hazards especially early flash flood in Haor areas during boro rice harvesting. So adjustments of flood hazards practices are very much essential for the Haor areas in boro rice cultivation. Thus, in this situation it is necessary to know the extent of adjustment of farm practices in response to flood hazards in Haor basin areas. The following research questions on adjustments in Haor basin areas by the rice growers in response to flood hazards were framed:

- How do the rice growers make adjustments for rice production in response to flood hazard in Haor basin areas of Bangladesh?
- What is the extent of adjustments in response to flood hazards in Haor basin areas by the rice growers?
- What are the factors that influencing adjustments in Haor basin areas by the rice growers in response to flood hazards?
- What is the relationship of adjustments for rice production in response to flood hazard in Haor basin areas with the selected characteristics of rice growers?

In considering the above facts and research questions the researchers designed to conduct a research entitled, 'Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Areas of Bangladesh'.

1.4 Specific Objectives

The study is undertaken to have a careful observation of the Haro areas basically from agricultural and economic point of view. Generally boro rice production surprisingly predominating agricultural sector. Flash flood is the main disaster in the Haor area which engulfs the production of boro rice and the disruption of boro production threatens the lives and livelihoods of the people of Haor areas. So productivity and efficiency of boro rice due to flood hazards and farmers adjustments of these hazards will mainly be focused in this study. The study is designed to run an investigation into the pattern and trend of resource use and to estimate per hectare boro rice production in the vast wetland of Bangladesh with adjustments of flash flood. Haor areas were selected for the study so that the food security strategies of the people could be analyzed and explored in order to better planning and suggest relevant adjustments of flash flood. Nevertheless, the rice growers in Haor basin areas are very hopeful and enthusiastic in adjustment various farming practices in response to flood hazards. To find out the adjustment to rice production in response to flood hazard in Haor basin areas of Bangladesh the following specific objectives were set in order to give proper direction to the study:

1. To find out the extent of adjustment to rice production in response to flood hazard in Haor basin areas of Bangladesh.
2. To identify and describe some selected characteristics of rice growers. The selected characteristics are:
    - Age
    - Level of education
    - Family size
    - Farm size
    - Annual income
    - Organizational participation
    - Communication exposure
    - Agricultural knowledge
3. To explore the relationship between rice growers' selected characteristics and adjustment to rice production in response to flood hazard in Haor basin areas of Bangladesh by themselves.

1.5 Statement of Hypothesis

According to Karlinger (1973), a hypothesis is a conjectural statement of the relation between two or more variables. A null hypothesis states that there is no relationship between the concerned variables. The following null hypothesis was undertaken for the present study:

There is no relationship between the selected characteristics of rice growers with the adjustment to rice production in response to flood hazard in Haor basin areas. The related and relevant characteristics of the rice growers are age, level of education, family size, farm size, annual income, organizational participation, communication exposure and agricultural knowledge.

1.6 Assumptions of the Study

An assumption has been defined as the supposition that an apparent fact or principle is true in the light of the available evidence (Goode, 1945). The researcher had the following assumptions in mind while undertaking this study:

- The respondents, included in the sample were capable of furnishing proper responses to the questions included in the interview schedule.
- Views and opinions furnished by the respondents were the representative views and opinions of the whole population of the study.
- The pattern and nature of flash flood were more or less similar for the different Haor areas of Bangladesh.
- The nature of flash flood in Haor areas only confined for boro seasons.
- The responses furnished by the respondents were reliable. The researcher was well adjusted to the social environment of the study area. So the respondents gave their opinions without any hesitation.
- All the data concerning the independent and dependent variables were normally and independently distributed with the basis of their respective means and standard deviation.
- The findings of the study would have general applications to other parts of the country with similar personal, socio-economic and cultural conditions.

1.7 Limitation and Scope of the Study

Considering the time, money and other necessary resources available to the researcher and to make the study manageable and meaningful it became necessary to impose certain limitations & scopes and also to make meaningful and manageable. The limitations were as follows:

i) The study was confined to Dingapota Haor of Mohangonj upazila under Netrokona district.

ii) Population for the present study was kept confined within the rice growers at the Dingapota Haor of Mohangonj upazila under Netrokona district.

iii) The pattern and nature of flash flood varied for different Hoar to Haor areas but the present study was confined on Dingapota Haor of Mohangonj upazila under Netrokona district.

iv) Adjustments were determined on the basis of some issues that commonly practices as per the long history of that locality and score of extent of adjustments of the selected issues.

v) There were many characteristics of the rice growers but only eight characteristics of them were selected for investigation.

vi) For information about the study, the researcher depended on the data furnished by the selected respondents during their interview under at the Dingapota Haor of Mohangonj upazila under Netrokona district.

vii) Facts and figures collected by the researcher applied to the situation prevailing during the year 2016.

Findings of the study will be particularly applicable in a selected area of Dingapota Haor of Mohangonj upazila under Netrokona district. However, the findings may also have applications for other areas of Bangladesh where the physical, socio-economic and cultural condition do not differ much from those of the study area. Thus the findings will be helpful to the researchers, planner, policy makers and extension workers for diffusion of knowledge related to the adjustments of early flash flood for boro cultivation in the Haor areas of Bangladesh.

1.8 Definition of Terms

A concept is an abstract of observed thing events or phenomenon or in other words, it is a short hand representation of variety of facts. A researcher needs to know the meaning and contents of every term that used for a study. It should clarify the issue as well as explain the fact to the investigator and readers. However, for clarity of understanding, a number of key concepts/terms frequently used throughout the study defined are interpreted as follows:

Respondents

People who have answered the questions by an interviewer for a social survey are known as respondents. They are the people from whom a social research worker usually gets most data required for his research. In this study the respondents are the rice growers of the community people of Dingapota Haor of Mohangonj upazila under Netrokona district.

Rice Growers

The persons who were involved in rice cultivation in their land and they mainly cultivated aus, aman and boro rice as per cropping seasons. They also participated in different farm and community level activities like crops, livestock, fisheries, other farming activities etc.

Variable

A general indication in statistical research of characteristic that occurs in a number of individuals, objects, groups etc. and that can take on various values, for example the age of an individual.

Assumption

An assumption is “The supposition that an apparent fact or principle is true in the light of the available evidence” (Goode and Hatt, 1952).

Technology

A technology is a device being generated through the combination of knowledge, inputs and management practices, which are used together with productive resources to gain a desired output.

Hypothesis

Defined by Goode and Hatt (1952), a proposition this can be put to "a test to determine its validity". It may be true or false, it may seem contrary to or in accord with common sense. However, it leads to an empirical test.

Null Hypothesis

The hypothesis which we pick for statistical test is null hypothesis (Ho). In this study the null hypothesis is stated that there is no relationship between the selected characteristics of the rice growers and their adjustments in to rice production in response to flood hazard in Haor basin areas.

Age

Age of a respondent is defined as the span of life and is operationally measured by the number of years from his/her birth to the time of interviewing.

Level of Education

Empirically it was defined to the development of desirable changes in knowledge, skill and attitudes in an individual through reading, writing, observation and other selected activities. It was measured on the basis of classes a respondent has passed from a formal educational institution. If a respondent received education from the school, their education was assessed in terms of year of schooling, i.e. one (1) score was given for one year of schooling.

Family Size

Family size refers to the number of member including the respondent himself/herself, his/her wife/husband children and other permanent dependents, who live and live together in a family unit.

Farm Size

The term related to the hectare of land owned by a rice growers on which he carried his rice cultivation and other farming activities, the area being estimated in terms of full benefit to the rice growers. A rice growers was considered to have full benefit from cultivated area either owned by himself or obtained or, lease from others and half benefit from the area which was either cultivated by borga or given to others for cultivation on borga basis.

Annual Income

Annual income of a respondent referred to the total earning by him and other members of his family from agricultural (field crop, fish, livestock, poultry, fruits and vegetables and timbers, etc.) and other sources (service, business, etc.) during a year. Annual family income of the respondent also included the cost of maintaining his family. It was expressed in Taka.

Organizational Participation

Organizational participation of the respondent is measured in two dimension status of his participation and duration of participation in different organizations during the time of interviewing.

Communication Exposure

This term referred to an individual's access to or contact with the different communication media and source being used for dispersion of new technologies and for other perspectives.

Agricultural Knowledge

Literally knowledge means knowing or what one knows about a subject, fact, person etc. Agricultural knowledge referred to the understanding of the rice growers about the different aspects of scientific agriculture such as improved seed, fertilizer, plant protection, irrigation, etc.

Adjustment of Flood Hazards

Adjustments to rice production in response to flood hazard in Haor basin areas of Bangladesh mean are the copping mechanisms or preparation that were made by the rice growers in response to flood hazard during last ten years tenure.

CHAPTER II

REVIEW OF LITERTURE

Review of literature gives the clear and concise direction of the researcher for conducting the experiment. In this chapter, review of literatures relevant to the objectives of this study was presented. This was mainly concerned with ‘adjustment/adoption of adverse situation. There was serious dearth of literature with respect to research studies on this aspect. So the directly related literatures were not readily available for this study. Some researchers addressed various aspects of the adjustments/adoption of adverse situation and its effect on client group and suggesting strategies for their emancipation from socio-economic deprivations. A few of these studies relevant to this research are briefly discussed in this chapter under the following four sections:

Section 2.1 Information Related of the Socio-economic Condition of the Study Area

Section 2.2 Literature Related to Adjustments/Adoption

Section 2.3 Review Concerning the Relationship between Farmers’ Characteristics and their Adjustments/Adoption

Section 2.4 Conceptual Framework of the Study

2.1 Information Related of the Socio-economic Condition of the Study Area

The description of the information of the study area includes physical features and topography such as climate, temperature and rainfall, population, agriculture, occupation, cropping patterns, and communication facilities of the study area. The selected area is located at Mohangonj upazila in Netrokona district. Dingapota Haor is around 2 to 3 km of the upazila headquarters.

2.1.1 Topography and Soil Condition

The study area consists of low land. Dingapota Haor is deep Haor area. The soil of the study area is alluvial) and loamy to silty loam. During the rainy season the entire flood pair (Haors and beels) rivers and khals become a single sheet of water.

2.1.2 Climate, Temperature and Rainfall

In the study area, there is no local arrangement for recording temperature, rainfall and humidity. This climate is not much different from that of Mohanganj upazila (Table 2.1).

Table 2.1 Monthly and average rainfall study area

Particulars	January	February	March	April	May	June	July	August	September	October	November	December
Extreme maximum	29	33	38	42	41	37	36	36	36	36	33	30
Average maximum	24	27	31	33	31	31	31	31	31	30	29	26
Extreme minimum	4.4	4.4	8.3	15	16	20	22	22	21	16	11	7.2
Average minimum	11	13	17	21	23	24	25	25	25	23	18	13
Average	18	20	24	27	27	28	28	28	28	27	23	17

Source: Bangladesh Water Development Board, 2014

2.1.3 Area and Population

The area Mohangonj Upazila is 243.20 km^2 and the total population is about 129,415. Among them male is about 66525 and female 63890, Muslim 80.57 percent and Hindu 19.09 percent, Christian and Buddhist 0.17 percent and others 0.17 percent. The population density is 960 per km^2 (Upazila Offices, 2016).

2.1.4 Land and Agriculture

The Haor basin is mainly a mono-cropped area. Rice alone covers about 97 percent of the total cropped area, of which HYV's share is about 60 percent. Boro is the major crop grown in these areas and local boro is practiced in the deeper part of the Haor where boro rice varieties are usually transplanted from the second week of December to the middle of January. The life cycle of HYV boro rice is approximately 120-130 days after transplanting. The life cycles of the local varieties are on an average 90-110 days after transplanting making it less vulnerable to early flash flood. The harvesting period of both local and HYV boro starts from the middle of April and continues till the first May. Crop production in most of the area is unstable and low yields are common because of present risk of flood. Typical crop yields are below than the national average. Damage estimation of the past show that floods could result in the loss of thousands of tons of food grain. These losses could only be avoided of farmers were not to attempt growing crops in the flood risk area, but economic circumstances, however, are such that farmers have no option but to take risks in order to produce food for maintaining their own livelihood. Maximum plots of these areas are low land. Besides the boro rice, mustard, potato, tomato, brinjal, chilli is grown in some high land. Total 35 percent agro-land of

Haor districts is low land and remains more than 6 feet under water level in rainy season (Upazila Land Office, 2015). Most of the lands of Haor areas are of single crop but fertile. Most of the Haor area is a surplus paddy production area by developing farming systems. In a country characterized by chronic food insecurity, the World Food Program which uses a set of ten indicators to Haor region as one of the most food insecure area of Bangladesh.

2.1.5 Occupations

The major occupations of the peoples under study area are agriculture, agricultural labour, fishing, small trades, boating, rickshaw pulling, etc. There is interrelation among the fishing, agricultural labour and day-labour. Normally peoples who work as fishermen in rainy season, they work as agricultural labourers in harvesting period and they may also work as day labourer in the winter.

2.1.6 Schooling

In Haor area, there is no primary school in every *Hati* (A *Hati* is a high land of Haor area where people used to construct their houses for residential purposes). It is 15-20 feet higher than plain land. In Haor, all residences are situated on liati. Normally it is over populated. Regularity on school going of *Hati'*s children depends on the location of the school. The students are regular school goes if their school is located at their own *Hati*.

2.1.7 Transportation

Transportation system in Haor areas is very much limited. In rainy season main vehicles of transportation are boat and trawler (engine boat). Nashimon, Tempoo, Trawly are main vehicles in the dry season. A few numbers of rickshaws are seen in some of Upazilasadar, Mohongonj Upazila is connected by bus and train with Dhaka city.

2.1.8 Health and Sanitation

In Haor area, one or more than one member of every family suffers from various types of general diseases (i.e. fever, skin diseases, diarrohea, dysentery, sneezing, gastric, etc) throughout the whole year. Poor and extreme poor have no access for proper treatment for this kind of general diseases. They don't get proper health services from respective government division. Normally local peoples go to dispensaries, village doctors, upazila health complex to take treatment. According to respondents 3 or 4 government doctors are available in hospital out of 11 in Mohangonj sadar hospital. Government doctors

charge fee from the every patient in hospital. This amount is Taka 30.00-100.00. It depends on nature of diseases and patient's financial condition. Sometime it is not possible to take a serious patient to hospital in proper time because of poor communication.

Sanitary condition of Haor area is extremely poor. Most of the respondents use *Kacha* toilet. This kind of toilets situated outside of *Hati*. Structured *Kacha* toilet floated every year by water wave in rainy season. Peoples cannot establish these kinds of *Kacha* toilet in homestead because of lacking sufficient high land. Local people have negative impact of *Kacha* toilet and at present NGOs are trying to bring them under sanitation program.

2.1.9 Farming/Livelihood Systems

Different farming systems were being practiced by the farmers in the Research Site. Among them eleven farming systems (Table 2.2) were identified as major (systems consisting of 10 or more households). The main farming system was fish catching-labour selling which was approximately 19.23 percent. Moreover, 15.87 percent households practiced crop-livestock-poultry-fish catching system. 12.50 percent households practiced poultry-fish catching-labour selling system also. Over 7.21 percent households had crop-livestock, crop-livestock-fish catching and labour selling systems.

Table 2.2 Major farming/livelihood systems identified in Dingapota Haor areas of Mohangonj upazila in Netrokona district

SL. No.	Farming/Livelihood Systems	Total Percentage (%)
1.	Crop-livestock	7.21
2.	Crop-livestock-fish catching	7.21
3.	Crop-livestock-poultry	5.29
4.	Crop-livestock-poultry-fish catching	15.87
5.	Crop-poultry-fish catching-labour selling	6.25
6.	Fish catching	9.62
7.	Fish catching-labour selling	19.22
8.	Labour selling	7.21
9.	Livestock	9.62
10.	Poultry-fish catching-labour selling	12.50
Total		**100.00**

Source: Upazila Offices, 2016

2.2 Literature Related to Adjustments/Adoption

Rai Grover and Gangwar (1989) conducted a study on identifying factors responsible for acreage substitution and low yield of maize. This study showed a general downward trend in area and productivity of maize in Haryana, India. It argued that maize acreage in given year was influenced by size of irrigated area, lag year maize acreage and lag year relative income.

Bembridge and Williams (1990) studied the personal, sociological, socio-psychological and communication characteristics that influence the adoption of maize practice in Farmer Support Program in South Africa. The study revealed less than 50 percent of the farmers who adopted practices were implementing them according to recommendations and many did not have a clear concept that the practices were interrelated.

Kariuka (1990) studied the economic impact of the adoption of hybrid maize in Swaziland. The study revealed the sensitivity of hybrid maize adoption to different farming systems and the limited usefulness of a partial analysis in evaluating the impact of innovations. A macro level cost-benefit analysis was used in an ex-post appraisal if impact of maize research, complemented by an ex-ante projection of the potential benefits and costs of its component maize breeding program. Moderate increase in production cost would not effect the area of land devoted to maize, farm families are unlikely to produce beyond subsistence requirements without a considerable increase in output prices.

Hossain (1991) studied the extent of adoption behavior of contact wheat growers in sadar upazila of Jamalpur district. He found that more than half (52 percent) of the growers had medium adoption of improved farm practices compared to 34 percent having low adoption and only 14 percent high adoption.

Hoque (1993) conducted an investigation on the adoption of improved practices of sugarcane cultivation in Sreepur upazila of Gazipur district. The study revealed that 31 percent of the sugarcane growers had high adoption while 37 percent had medium and 32 percent had low adoption of improved practices in sugarcane cultivation.

Nikhade *et al*. (1993) observed on adoption of improved practices of soybean cultivation that 100% adopted improved varieties. More than 82 percent had adoption of package

practices like line sowing, spacing and intercultural operations. Partial adoption was observed in majority of the soybean growers (74.6 percent) with regard to recommended seed rate.

Akanda (1995) studied the adoption of recommended dose of fertilizer and found that 36.64 percent respondents used recommended dose of urea 6.93 percent used recommended dose of MP, 11.88 percent used T.S.P and only 2 respondents used gypsum in their potato cultivation.

Muttaleb (1995) studied the extent of the adoption of improved technologies of potato cultivation by the farmers in Haibatpur union under sadar thana of Jessore district. The study revealed that 8 percent of the potato growers had high adoption of improved technologies, 43 percent has medium and 49 percent had low adoption.

Chowdhury (1997) conducted an investigation on adoption of selected BINA technologies by the farmers of Boura union in Mymensingh district. The study revealed that the majority (53 percent) of the respondents had no adoption of BINA technologies and 42 percent were adopted BINA technologies.

Sarker (1997) studied the extent of adoption of improved potato cultivation practices by the farmers in Comilla district. The study revealed that more than half (55 percent) of the respondents had medium adoption compared to 23 percent having low adoption and 22 percent high adoption of improved potato cultivation practices.

Podder (1999) concluded a research study on the adoption of Mehersagar Banana by the farmers. He found 47 percent of the respondents had medium adoption compared to 14 percent having low and 39 percent high adoption.

Rahman (1999) conducted an investigation on adoption of balanced fertilizer by the farmers of Ishargonj upazila in Mymensingh district. The study revealed that the majority (71 percent) of the respondents had medium adoption compared to 29 percent having below optimum level.

Hussen (2001) conducted investigation on adoption of modern sugarcane cultivation practices by the farmers of Daweangonj Upazila in Jamalpur district. The study revealed that about ninety one percent (91 percent) of the farmers had medium adoption compared

to 7 percent having low adoption and only 2 percent having high adoption of modern sugarcane cultivation practices.

Rahman (2001) conducted an investigation on knowledge attitude and adoption of Aalok-6201 hybrid rice by the farmers of sadar upazila in Mymenshingh district. The study revealed that the majority (75 percent) of the farmers had medium adoption while 18 percent and 7 percent had high and low adoption in Aalok-6201 hybrid rice cultivation respectively.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. The study revealed that 69 percent of the farmers had medium adoption while 13 percent had low adoption and 18 percent had high adoption of modern agricultural technologies.

Rahman (2003) revealed that about half (47 percent) of the growers had medium adoption 44 percent had low and I percent had high adoption of year round homestead fruit cultivation practices.

Hasan (2003) found that majority (60 percent) of the farmers had medium adoption while 33 percent had low adoption and 7 percent had high adoption of recommended potato cultivation practices.

Hossain (2003) found that majority (67 percent) of the boro rice farmers had medium adoption, 17 percent had low adoption and 16 percent high adoption of modern boro rice cultivation practices.

Haque (2003) found that the majority (47 percent) of the growers had medium adoption of modern maize cultivation technologies while 28 percent had high adoption and 25 percent low adoption.

Adaptation refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. The main goals of climate change adaptation are to reduce vulnerability and build resilience to the impacts brought by climate change (IPCC, 2007).

2.3 Review Concerning the Relationship between Farmers' Characteristics and their Adjustments/Adoption

2.3.1 Age

Hamid (1995) conducted a study on adoption of recommended sugarcane cultivation practices by the farmers. He found that age had a significant negative relationship with the adoption of recommended sugarcane cultivation practices.

Chowdhury (1997) observed that the age of the farmers had no significant relationship with their adoption of selected BINA technologies.

Sarkar (1997) observed that there was no significant relationship between age of the farmers and their adoption of improved potato cultivation practices. Rahman (1999) also found similar result in this study.

Rahman (2001) observed that there was no significant relationship between age and adoption of Aalok-6201 hybrid rice cultivation practices. Podder (1999) and Hossain (1999) are found similar results in their respective studies.

Hussen (2001) conducted a study, which concluded that age of the sugarcane growers had a significant negative relationship with their adoption of modern sugarcane cultivation practices.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that age of the farmers was not related to their adoption of modern agricultural technologies.

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there was a significant negative relationship between age and adoption of integrated homestead farming Technologies.

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that age of the farmers had a negatively significant relationship with their adoption of IPM practices.

Islam (2003) concluded that the farmers had a positive and significant relationship with their adoption of organic manures.

Hossain (2003) revealed that age of the farmers had a significant and positive relationship with their adoption of modern boro rice cultivation practices.

2.3.2 Level of Education

Muttaleb (1995) studied the relationship of education with adoption of improved potato technologies. The study observed that education had a positive relationship with their adoption potato technologies.

Hasan (1996) conducted a study on adoption of some selected agricultural technologies among the farmers perceived by the frontline GO and NGO workers. He observed that education has no significant relationship with the perceived adoption of selected agricultural technologies.

Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato growers and their adoption of improved potato cultivation practices in five villages of Comilla district. He found that education of potato growers had significant relationship with their adoption of improved potato cultivation practices.

Hussen (2001) conducted a study on farmers' knowledge and adoption of modern sugarcane cultivation practices. He found that education of the growers had a positive significant relationship with their adoption of modern sugarcane cultivation practices.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding AaIok-6201 hybrid rice in sadar upazila in Mymensingh district. He found that academic qualification of the farmers had a significant positive relationship with their adoption regarding Aalok-6201 hybrid rice.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that education of the farmers had a positive significant relationship with their adoption of modern agricultural technologies.

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that education of the farmers had a positive significant relationship with their adoption of IPM practices.

Aurangozeb (2002) conducted a study on adoption of integrated farming technologies by the rural women in RDRS. He found that there was a positive relationship between education and their adoption on integrated farming technologies.

Hossain (2003) concluded that education of the farmers had a significant and positive relationship with their adoption and modern boro rice cultivation practices.

2.3.3 Family Size

Chowdhury (1997) observed that family size of the farmers had no significant relationship with their adoption of selected BINA technologies.

Sarkar (1997) observed that there was no significant relationship between family size of the farmers and their adoption of improved potato cultivation practices.

Rahman (2001) observed that there was no significant relationship between family size and adoption of Aalok-6201 hybrid rice cultivation practices.

Hussen (2001) conducted a study, which concluded that family size of the sugarcane growers had no significant negative relationship with their adoption of modern sugarcane cultivation practices.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that family size of the farmers was not related to their adoption of modern agricultural technologies.

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that family size of the farmers had no significant relationship with their adoption of IPM practices.

Hossain (2003) revealed that family size of the farmers had no significant relationship with their adoption of modern boro rice cultivation practices.

2.3.4 Farm Size

Gogoi and Gogoi (1989) in their study observed that size of land holding of farmers had a significant relationship and positive effect on their adoption of plant protection practices.

Pal (1995) conducted a research study on adoption of sugarcane practices by the farmers. He observed the significant and positive relationship between the farm size of the respondent farmers and their adoption of sugarcane cultivation practices.

Chowdhury (1997) conducted a research study on adoption of selected BINA technologies by the farmers of Boira union in Mymensingh district. He indicated that farm size had strongly positive significant relationship with the adoption of selected BINA technologies.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Aalok 6201 hybrid rice in sadar upazila of Mymensingh district. He found that farm size of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there was no relationship between homestead area and adoption of integrated homestead farming technologies.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He observed that the farm size of the farmers had a positive significant relationship with their adoption of modern agricultural technologies.

2.3.5 Annual Income

Hamid (1995) conducted a study on adoption of recommended sugarcane cultivation practices by the farmers. He found that annual income had a significant negative relationship with the adoption of recommended sugarcane cultivation practices.

Sarkar (1997) observed that there was no significant relationship between annual income of the farmers and their adoption of improved potato cultivation practices.

Rahman (2001) observed that there was no significant relationship between annual income and adoption of Aalok-6201 hybrid rice cultivation practices.

Hussen (2001) conducted a study, which concluded that annual income of the sugarcane growers had a significant negative relationship with their adoption of modern sugarcane cultivation practices.

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there was no relationship between annual income and adoption of integrated homestead farming Technologies.

2.3.6 Organizational Participation

Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato growers and their adoption of improved potato cultivation practices in five villages of Comilla district and observed that organizational participation of potato growers had significant relationship with their adoption of improved potato cultivation practices.

Hussen (2001) conducted a study on farmers' knowledge and adoption of modern sugarcane cultivation practices. He found that organizational participation of the growers had a positive significant relationship with their adoption of modern sugarcane cultivation practices.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding AaIok-6201 hybrid rice in sadar upazila in Mymensingh district. He found that organizational participation of the farmers had a significant positive relationship with their adoption regarding Aalok-6201 hybrid rice.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that organizational participation of the farmers had a positive significant relationship with their adoption of modern agricultural technologies.

Aurangozeb (2002) conducted a study on adoption of integrated farming technologies by the rural women in RDRS. He found that there was a positive relationship between organizational participation and their adoption on integrated farming technologies.

Hossain (2003) concluded that organizational participation of the farmers had a significant and positive relationship with their adoption and modern boro rice cultivation practices.

2.3.7 Communication Exposure

Rahman (2001) conducted an investigation on knowledge, attitude and adoption of Aalok-6201 hybrid rice by the farmers of sadar upazila in Mymensingh district. He observed that there was a significant positive relationship between communication exposure of the farmers and their adoption of Aalok-6201 hybrid rice.

Hussen (2001) conducted an investigation on adoption of modern sugarcane cultivation practices by the farmers of Dewangonj upazila in Jamalpur district. He observed that there was a positive significant relationship between communication exposure of the farmers and their adoption of modern sugarcane cultivation practices.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that communication exposure, contact of the farmers had no significant relationship with their adoption of modern agricultural technologies.

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there was a positive significant relationship between contact with communication exposure of the respondents and their adoption of integrated homestead farming technologies.

2.3.8 Agricultural Knowledge

Nahar (1996) found that there was a significant positive relationship in agricultural knowledge on farm women in homestead farming and their level of contact with information sources.

Sarkar (1997) found that potato production knowledge of potato growers had a positive and significant relationship with their adoption of improved potato cultivation practices.

Islam (2002) reported that agricultural knowledge had significant relationship with the adoption of modern agricultural technologies by the farmers of Sandwip.

2.4 Conceptual Framework of the Study

In scientific research, selection and measurement of variables constitute an important task. The hypothesis of a research while constructed properly consist at least two important elements i.e.: a dependent variable and an independent variable. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variables (Townsend, 1953)**.** An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. Variables together are the causes and the phenomenon is effect and thus, there is cause effect relationship everywhere in the universe for a specific events or issues.

This study is concerned with the 'Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Areas of Bangladesh' and it was the dependent variable and 08 selected characteristics of the rice growers were considered as the independent variables. Dependent variable may be affected through interacting forces of many independent variables. It is not possible to deal with all of the independent variables in a single study. Age, level of education, family size, farm size, annual income, organizational participation, communication exposure and agricultural knowledge included as independent variable for this study. For this study a conceptual framework has been developed and diagrammatically presented in the following Figure 2.1.

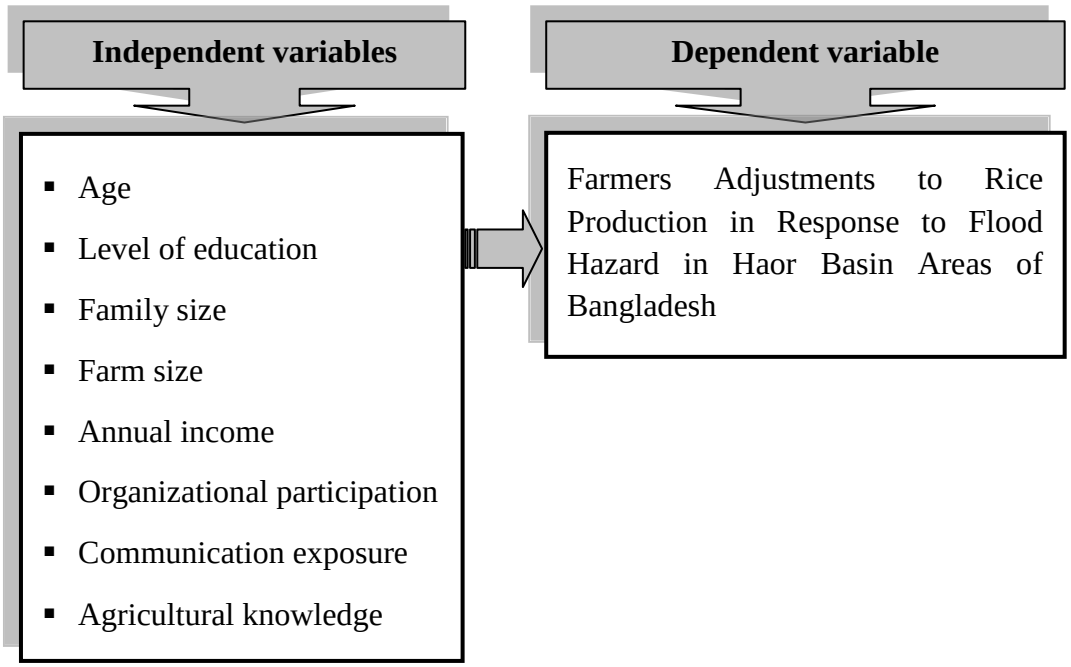

Figure 2.1 The conceptual framework of the study

CHAPTER III

METHODOLOGY

This chapter deals with the procedures for the collection of valid information as well as procedure of data coding and also data analysis. For conduction a research work smoothly proper methodology is an obligatory one and it is very difficult to address the study objectives with a scientific manner without a define methodology. A sequential description of the methodologies that was followed in conducting this research work has been presented in this chapter under the following headings-

3.1 Locale of the Study

The locations for the present study were selected purposively at Dingapota Haor. The Haor is located in Tentulia union at Mohangonj Upazila under district of Netrokona. The boro rice growers of this Haor area were the respondent's for this study. Maps of Mohanganj upazila under Manikgonj district area are presented in Figure 3.1.

3.2 Sample Size

The boro rice growers of Dingapota Haor of Mohangonj upazila under Netrokona district constituted the population of the study. An update list of 1032 boro rice growers from the selected Haor area was collected from Upazila Agricultural Offices of this locality. Around 10% of the populations were randomly selected as the sample of the study by using random sampling method. Thus, 103 boro rice growers constituted the sample of the study. A reserve list of 15 boro rice growers was also prepared so that the respondents of this list could be used for interview if the respondents included in the original sample were not available at the time of conduction of interview.

3.3 The Research Instrument

A well structured interview schedule was developed based on objectives of the study for collecting information with containing direct and simple questions in open and close form keeping in view the dependent and independent variables. Appropriate scales were developed to measure both the variables. The questionnaire was pre-tested with ten boro rice growers in Dingapota Haor to finalize it for collection of research data. Necessary corrections, additions, alternations and adjustments were made in the interview schedule based on pretest experience. The questionnaire was then multiplied by printing in its final form. A copy of the interview schedule presented into Appendix I.

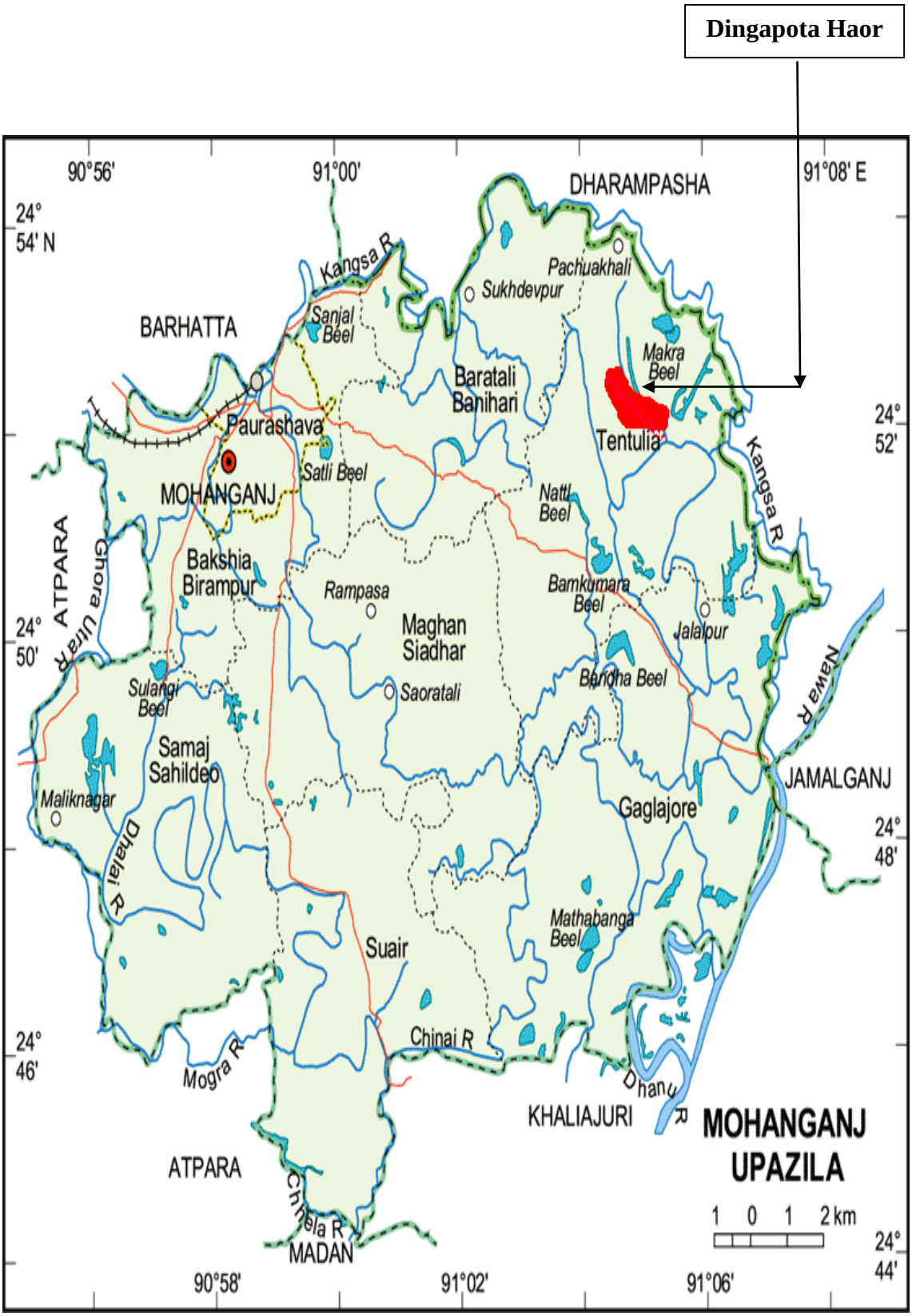

Figure 3.1 A map of Dingapota Haor of Mohangonj upazila under Netrokona district showing the study area

3.4 Data Collection Procedure

The researcher herself collected data from the sample respondents through personal contact with the help a pre-tested interview schedule. Whenever any respondent faced difficulty in understanding questions, more attention was taken to explain the same with a view to enabling the respondent's to answer properly. No serious problem was faced by the investigator during data collection but obtained cooperation from the respondents. Data collection was started in 07 April, 2016 and completed in 26 April, 2016.

3.5 Measurement of Variables

The variable is a characteristic, which can assume varying, or different values in successive individual cases. A research work usually contains at least two important variables viz. independent and dependent variables. An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variable (Townsend, 1953). In the scientific research, the selection and measurement of variable constitute a significant task. Following this conception, the researcher reviewed literature to widen this understanding about the natures and scopes of the variables relevant to this research. At last she had selected 8 independent variables and one dependent variable. The independent variables were: age, level of education, family size, farm size, annual income, organizational participation, communication exposure and agricultural knowledge. The dependent variable was the 'Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Areas of Bangladesh'. The methods and procedures in measuring these variables are presented below:

3.6 Measurement of Independent Variables

The 8 characteristics of the rice growers mentioned above constitute the independent variables of this study. The following procedures were followed for measuring the independent variables.

3.6.1 Age

Age of respondent rice growers was measured by the period of time from their birth to the time of conducting interview and it was measured in terms of complete years on the basis of their response. A score of one (1) was assigned for each year age.

3.6.2 Level of Education

Level of education was measured in terms of class passed by respondent rice growers. If a respondent received education from any educational institute or recognized the school or college or university, their education was assessed in terms of year of schooling, i.e. one (1) score was given for one year of schooling. For example, if the respondent passed the final examination of class VI, their education score was taken as 6. If the respondent had education outside the school and the level of education was equivalent to that of class VI of the school than his education score was taken as 6. Each illiterate person was given a score of zero. The respondent who did not know how to read or write but able to sign only was given a score of 0.5.

3.6.3 Family Size

The family size of a respondent rice growers was measured in terms of actual number of members in his family including himself, spouse, children, brothers, sisters, parents and other person who jointly live and ate together during the period of interviewing.

3.6.4 Farm Size

Farm size of respondent rice growers referred to the total area of land on which his family carried out farming operation and received full benefit for his family. It was measured in hectares for each respondent using the following formula:

$$FS = A + B + {}^{1}/_{2}\,(C + D) + E$$

Where,

FS = Farm size

A = Homestead area with pond

B = Own land under own cultivation

C = Area taken by a respondent to others on borga system

D = Area given by a respondent to others on borga system

E = Cultivated area taken as lease by respondent from other

3.6.5 Annual income

The term annual income refers to the annual gross income of respondent's rice growers and the members of his family from different sources. It was expressed in taka. In measuring this variable, total earning in taka of an individual respondent was converted into score. A score of one was given for every one thousand taka. The method of

ascertaining income form involved two phases. Firstly, the income from agricultural sector income like the income from crops, livestock, poultry and fishery in the preceding year was noted and converted into taka. Secondly, non-agricultural sector income included earning form small business, service, other family members' income, day labourer, fishing and others if any.

3.6.6 Organizational participation

Organizational participation of respondent rice growers was measured on the basis of the nature of their participation in a selected organization. Score was computed by adding all the score of selected organization.

Following scores were assigned for nature of participation (N):

Nature of participation	**Scores assigned**
No participation	0
Participation as ordinary member	1
Participation as executive member	2
Participation as president/secretary	3

The nature of participation seems ranged from '0'-30 where '0' indicated no participation and 30 indicated very high nature of participation.

The duration (D) as a nature of participation for the corresponding organization also collected and the organization participation score for a rice growers was obtained by using the following formula:

$$\text{Organizational participation score} = \sum\{(N) \times (R)\}$$

Where,

E = Score nature of participation

R = Score for the duration of participation

3.6.7 Communication Exposure

Communication exposure of respondents' rice growers was measured by computing a "communication exposure score" on the basis of their frequency of contact with 20

selected information sources within a given time frame. The selected rice growers were asked to mention the frequency of contact with each of the 20 selected information sources and their responses were assigned weights in the following manner.

Scoring of communication exposure

Sl. No.	Communication media	Basis of score				
		0	1	2	3	4
01.	Sub Assistant Agricultural Officer (per 3 months)	Not even once	1 time	2 time	3 time	4 or more times
02.	Upazilla level Agricultural Officers (per 6 months)	Not even once	1 time	2 time	3 time	4 or more times
03.	Neighbour (per month)	Not even once	1-2 time	2-3 time	5-6 time	7 or more times
04.	Friends (per month)	Not even once	1-2 time	3-4 time	5-6 time	7 or more times
05.	Relatives (per month)	Not even once	1-2 time	3-4 time	5-6 time	7 or more times
06.	Experienced farmer (per month)	Not even once	1-2 time	3-4 time	5-6 time	7 or more times
07.	Model farmer (per month)	Not even once	1-2 time	3-4 time	5-6 time	7 or more times
08.	Agricultural input dealer (per 3 month)	Not even once	1 time	2 time	3 time	4 or more times
09.	Development worker (per 3 month)	Not even once	1 time	2 time	3 time	4 or more times
10.	Group discussion meeting (per year)	Not even once	1 time	4-7 time	8-11 time	12 or more times
11.	Result demonstration meetings/Field days (per six month)	Not even once	1 time	2-3 time	4-5 time	6 or more times
12.	Method demonstrations (per six month)	Not even once	1 time	2-3 time	4-5 time	6 or more times
13.	News paper (weekly)	Not even once	1-2 time	2-3 time	5-6 time	7 or more times
14.	Agricultural poster (six month)	Not even once	1 time	2 time	3 time	4 or more times
15.	Agricultural leaflet (yearly)	Not even once	1 time	2 time	3 time	4 or more times
16.	Agricultural booklet (yearly)	Not even once	1 time	2 time	3 time	4 or more times
17.	Agricultural magazine /periodicals (yearly)	Not even once	1 time	2 time	3 time	4 or more times
18.	Agricultural fair (yearly)	Not even once	1 time	2 time	3 time	4 or more times
19.	Agricultural radio program (monthly)	Not even once	1-7 time	8-14 time	15-20 time	21 or more times
20.	Agricultural television program (per month)	Not even once	1 time	2 time	3 time	4 or more times

3.6.8 Agricultural Knowledge

Agricultural knowledge of the respondents' rice growers referred to the knowledge gained by the respondent in agricultural related activities. Thirty (30) questions on different aspect of agriculture were asked to the respondent rice growers to ascertain their knowledge score. The score was assigned as 2 for full correct answer and zero (0) for incorrect or no answer for each question. Partial score 1 was assigned for partial answers. Thus agricultural knowledge scores of the respondents could range from '0' to 60 where zero (0) indicated very low and 60 indicated very high agricultural knowledge.

3.7 Measurement of Dependent Variable

Adjustments to rice production in response to flood hazard in Haor basin area was measured in the following ways:

(i) The different issues related to adjustments/adoption to rice production in response to flood hazard in Haor basin area was first identified. In this regard 12 defined issues and 01 opened option also included in the questionnaire.

(ii) Then each rice growers was asked to indicate the extent of adjustments of the selected issues. The extents of adjustments of 13 issues were added together.

iii) Then adjustments to rice production in response to flood hazard in Haor basin area was categorized on the basis of summated frequency 'lowest adjustments, 'moderate adjustments' and 'highest adjustments'.

3.8 Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Area

Farmer's adjustments to rice production in response to flood hazard in Haor basin area were measured by using 13 different issues for 103 respondents. The adjustments had been selected based on the issues of adjustment. The rice growers were requested to indicate their extent of adjustment towards the selected issues of adjustments to rice production in response to flood hazard in Haor basin area, a 5 point scale such as 'very good, 'good, 'medium, 'low' and 'very low' were used in this purpose and weights were assigned to each of the scale responses as 5 for 'very good, 4 for 'good, 3 for 'medium', 2 for 'low' and 1 for 'very low'. The possible score could range from '0' to '515' where 0 indicating lowest extent of adjustment and 515 indicating highest extent of adjustment to rice production in response to flood hazard in Haor basin area.

3.9 Hypothesis of the study

In the present study the following null hypotheses were formulated:

"There are no relationships between each of 08 selected characteristics of the boro rice growers and their adjustments to rice production in response to flood hazard in Haor basin area".

3.10 Data processing

For data processing and analysis the following steps were followed:

3.10.1 Compilation of data

After completion of field survey all the interview schedule were compiled, tabulated and analyzed according to the objectives of the study. In this process all the responses in the interview schedule were given numerical coded values. The responses to the question in the interview schedule were transferred to a master sheet to facilitate tabulation. Tabulation was done on the basis of categories developed by the investigator herself.

3.10.2 Categorization of respondents

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

3.11 Data Analysis

Data collected from the respondents were complied, coded, tabulated and analyzed in accordance with the objectives of the study. Various statistical measures such as frequency counts, percentage distribution, average, and standard deviation were used in describing data. SPSS (version 11.5) computer program were used for analyzing the data. The categories and tables were used in describing data. The categories and tables were also used in presenting data for better understanding.

For determining the association of the selected characteristics of the boro rice growers with their adjustments to rice production in response to flood hazard Pearson Product Moment Correlation was used. Five percent (0.05) level of probability was used as the basis for rejecting any null hypothesis. In order to find out the relationship between the selected dependent and independent variables correlation co-efficient was done.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter deals with the findings that were recorded in accordance with the objective of the study with the help of an interview schedule with interpretation. The chapter content in three (3) sections. The first section of this chapter deals with the characteristics of the rice growers in Haor basin area. The second section deals with farmers adjustments to rice production in response to flood hazard in Haor basin area. The third section deals with the relationship between individual characteristics of the rice growers in Haro basin area with their adjustments to rice production in response to flood hazard in Haor basin areas.

4.1 Characteristics of the Rice Growers

An individual possesses various interrelated characteristics of the rice growers in Haor basin area were collected under the present study. It was therefore, hypothesized that the characteristics of the rice growers in Haor basin area. However, the 08 selected salient features of the rice growers such as age, level of education, family size, farm size, annual income, organizational participation, communication exposure and agricultural knowledge that are presented below-

4.1.1 Age

The age of the rice growers in Haor basin area ranged from 25 to 58 with a mean and standard deviation of 40.89 and 8.29, respectively. The observed age of the rice growers was classified into three categories namely young, middle and old aged. The distributions of the respondents according to their age are presented in Table 4.1.

Table 4.1 Distribution of the respondents' rice growers in Haor basin area according to their age

Categories	Respondents'		Mean	Standard deviation
	Number	Percent		
Young aged (below 35 years)	23	22.33	40.89	8.29
Middle aged (35-50 years)	66	64.08		
Old aged (above 50 years)	14	13.59		
Total	103	100		

Table 4.1 indicates that the middle aged rice growers comprised the highest proportion (64.08 percent) followed by young aged category (22.23 percent) and the lowest proportion were made by the old aged category (13.59 percent). Data also indicates that the middle and young aged farmers constitute about 86.41 of the respondents. The young and middle aged farmers were generally tended to involve in rice cultivation in Haor basin areas of Bangladesh.

4.1.2 Level of Education

The level of education of the respondent rice growers ranged from 0 to 14 with a mean and standard deviation of 5.30 and 3.55, respectively. Based on their educational scores, the rice growers were classified into five categories such as illiterate (0), can sign only (0.5), primary education (1 to 5), secondary education (6 to 10), above secondary (above 10). The distribution of the rice growers according to their level of education has been presented in Table 4.2.

Table 4.2 Distribution of the respondents' rice growers in Haor basin area according to their level of education

Categories	Respondents'		Mean	Standard deviation
	Number	Percent		
Illiterate (0)	8	7.77	5.30	3.55
Can sign only (0.5)	16	15.53		
Primary education (1-5)	37	35.92		
Secondary education (6-10)	38	36.89		
Above secondary (above 10)	4	3.88		
Total	103	100		

Table 4.2 shows that rice growers under secondary education category constitute the highest proportion (36.89 percent) followed by 'primary level category (35.92 percent) and can sign only (15.53 percent). On the other hand the lowest 3.88 percent above secondary level category which was followed by illiterate category (7.77 percent). Education broadens the horizon of outlook of farmers and expands their capability to analyze any situation related to adjustments of any adverse situation. It was found that only (40.77 percent) of the rice growers in Haor basin areas were secondary to above secondary level educated. An educated farmer is likely to be more responsive to the modern facts, ideas, technology and information for adjustments.

4.1.3 Family Size

Family size of the respondent rice growers in Haor basin areas ranged from 3 to 9 with the mean and standard deviation of 5.08 and 1.47, respectively. According to family size the respondents were classified into three categories viz. small, medium and large family as per the observed data and the socio-economic condition of Bangladesh. The distribution of the respondents' rice growers in Haor basin areas according to their family size is presented in Table 4.3.

Table 4.3 Distribution of the respondents' rice growers in Haor basin area according to their family size

Categories	Respondents'		Mean	Standard deviation
	Number	Percent		
Small family (4)	43	41.75	5.08	1.47
Medium family (5-7)	52	50.49		
Large family (above 7)	8	7.77		
Total	103	100		

Data in Table 4.3 indicate that the medium size family constitute the highest proportion (50.49 percent) followed by the small size family (41.75 percent). Only 7.77 percent respondents had large family size. Such finding is quite normal as per the situation of Bangladesh. Table 4.3 also showed that average family size of the respondents rice growers of the Haor basin areas of Bangladesh was comparatively lower than that of national average of 5.40.

4.1.4 Farm Size

The farm size of the respondent's rice growers of Haro basin areas varied from 0.41 hectare to 4.60 hectare with a mean and standard deviation of 1.47 and 0.94, respectively. Data indicated that the rice growers of the Haor basin areas are generally rich in land. Based on the farm size, the respondents' rice growers in the Haor basin areas were classified into three categories following the categorization of Department of Agricultural Extension (DAE, 1999). These categories were small farm holder (0.21-1.0 ha), medium farm holder (1.01-2.0 ha) and large farm holder (above 2.0 ha). The distribution of the rice growers of Haor basin areas according to their farm size categories has been presented in Table 4.4.

Table 4.4 Distribution of the respondents' rice growers in Haor basin area according to their farm size

Categories	Respondents'		Mean	Standard deviation
	Number	Percent		
Small farmers (0.21-1.0 ha)	44	42.72	1.47	0.94
Medium farmers (1.01-2.0 ha)	35	33.98		
Large farmers (above 2.0 ha)	24	23.30		
Total	103	100		

Table 4.4 indicates that the small farm holder constitute the highest proportion (42.72 percent) followed by the medium farmers (33.98 percent) and the lowest in large farm holder (23.30 percent). The findings reveald that the rice growers were small to large sized. The average farm size of the rice growers in Haor basin areas of 1.47 hectares was almost double than that of national average of 0.78 hectares in Bangladesh (BBS, 2008).

4.1.5 Annual Income

Annual income of the respondents' rice growers ranged from 120 to 224 thousand taka with a mean and standard deviation of 100.99 and 39.99, respectively. On the basis of their annual income, the respondents' were classified into three categories, viz. low, medium and high income. The distribution of the rice growers in Haor basin areas according to the annual income categories has been presented in Table 4.5.

Table 4.5 Distribution of the respondents' rice growers in Haor basin area according to their annual income

Categories	Respondents'		Mean	Standard deviation
	Number	Percent		
Low income (below 90,000)	43	41.75	100.99	39.99
Medium income (90,000-140,000)	43	41.75		
High income (above 140,000)	17	16.50		
Total	103	100		

Data in table 4.5 revealed that the low and medium income constituted the highest proportion (41.75 percent) and high income constituted the lowest proportion (16.50 percent). Low to medium income level constitutes the highest percentage (83.50 percent). Income of an individual allows him to participation in different activities and different communication exposure.

4.1.6 Organizational Participation

Organizational participation score of the respondent rice growers in Haor basin areas ranged from 10 to 26 with a mean and standard deviation of 16.25 and 4.09, respectively. Based on their organizational participation score, the respondents were classified into three categories. These categories were low, medium and high level organizational participation. The distribution of the respondent rice growers in Haor basin areas according to their organizational participation score is presented in Table 4.6.

Table 4.6 Distribution of the respondents' rice growers in Haor basin area according to their organizational participation

Categories	Respondents'		Mean	Standard deviation
	Number	Percent		
Low participation (below 15)	35	33.98	16.25	4.09
Medium participation (15-20)	46	44.66		
High participation (above 20)	22	21.36		
Total	103	100		

Data revealed that about 44.66 percent of the respondents had medium level organizational participation which was followed by low level organizational participation (33.98 percent), while 21.36 percent had high level organizational participation.

4.1.7 Communication Exposure

Communication exposure of the respondent's rice growers ranged from 21 to 51 with a mean and standard deviation of 40.49 and 6.63, respectively. Communication exposure score, the respondents were classified into three categories as low, medium and high communication exposure which is presented in Table 4.7.

Table 4.7 Distribution of the respondents' rice growers in Haor basin area according to their communication exposure

Categories	Respondents'		Mean	Standard Deviation
	Number	Percent		
Low exposure (below 30)	9	8.74	40.49	6.63
Medium exposure (30-40)	32	31.07		
High exposure (Above 40)	62	60.19		
Total	103	100		

About (60.19 percent) of the respondents' rice growers in Haor basin areas had high communication exposure group, while 31.07 percent had medium communication exposure and only 8.74 percent had low level of communication exposure. Data revealed that around 91 percent of the rice growers in Haor areas have medium to high level communication exposure that is why they are maintaining communication frequently with the information sources which are available in Haor areas.

4.1.8 Agricultural Knowledge

Agricultural knowledge score of the respondent rice growers in Haor basin areas could range from 21 to 58. The mean and standard deviation of agricultural knowledge score was 37.37 and 11.52, respectively. On the basis of agricultural knowledge scores, the respondents were classified into three categories namely, poor, moderate and sound knowledge. The distribution of the respondents according to their agricultural knowledge is given in Table 4.8.

Table 4.8 Distribution of the respondents' rice growers in Haor basin area according to their agricultural knowledge

Categories ('000)	Respondents'		Mean	Standard deviation
	Number	Percent		
Poor knowledge (below 35)	46	44.66	37.37	11.52
Moderate knowledge (35-45)	27	26.21		
Sound knowledge (Above 45)	30	29.13		
Total	103	100		

Data of Table 4.8 reveals that majority (44.66 percent) of the respondents felt in poor knowledge category, whereas the lowest 26.21 percent in moderate knowledge category followed by 29.13 percent in sound knowledge category. The findings of the present study reveal that around 71 percent of the respondent rice growers in Haor basin areas had low to moderate knowledge on agricultural activities. It was observed that the knowledge of the respondents' rice growers in Haor areas generally poor to moderate based on different modern technology.

4.2 Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Area

Farmers' adjustments to rice production in response to flood hazard in Haor basin area ranged from 10-41% with mean and standard deviation of 20.46 and 6.69, respectively.

Farmers' adjustments to rice production in response to flood hazard in Haor basin area was measured using 12 defined issues and 01 opened option. Adjustment of flood hazard in Haor basin areas was measured by summation of extent of adjustment on different issues. Based on score in rice growers' adjustment to flood hazard in Haor basin area were classified into three categories as shown in Table 4.9.

Table 4.9 Distribution of the respondents' rice growers in Haor basin area to adjustments to rice production in response to flood hazard

Categories	Respondents'		Mean	Standard deviation
	Number	Percent		
Lowest adjustment (below 20)	57	55.34	20.46	6.69
Moderate adjustment (20-30)	39	37.86		
Highest adjustment (above 30)	7	6.80		
Total	103	100		

Among the respondents, rice growers in Haor basin area in adjustment of flood hazard, the highest 55.34 percent rice growers belong to the group of lowest adjustment in response to flood hazard in Haor basin area compared to 37.86 percent in moderate adjustment, whereas the lowest 6.80 percent rice growers belong to the group of high adjustment in response to flood hazard in Haor basin area. So, it was observed that around 93 percent rice growers have low to moderate adjustment plan to rice production in response to flood hazard in Haor basin area. In Haor region of Bangladesh farmers are inefficient at producing boro rice crops and there are significant efficiency differences due to the uncertainty of natural calamities. For that although Haor basin is a highly fertile lands, abundance of water and small population density have made this whole wetland magnificently important resource for boro rice production but sudden unexpected floods can damage the rice crop in Haor basin areas. Flash flood is the main disaster in the Haor area which engulfs the primary production sector and thus threatens the lives and livelihoods of the people.

4.3 Rank Order of Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Area

The respondents were make adjustment with twelve different issues to rice production in response to flood hazard in Haor basin area in varying extent of adjustment. They are presented below in rank order. A Farmers Adjustment Index (FAI) for selected twelve aspects was computed to serve the purpose by using the following formula:

$$\text{Farmers Adjustment Index (FAI)} = Pvl \times 1 + Pl \times 2 + Pm \times 3 + Pg \times 4 + Pvg \times 5$$

Where,

Pvl = Farmers make very low extent of adjustment

Pl = Farmers make low extent of adjustment

Pm = Farmers make medium extent of adjustment

Pg = Farmers make good extent of adjustment

Pvg = Farmers make very good extent of adjustment

Farmers Adjustment Index (FAI) for rice growers in Haor basin area could range from 0 to 515, where 0 indicating no adjustment and 515 indicating highest adjustment. However, computed Farmers Adjustment Index (FAI) ranged from 127-378.

Table 4.10 Rank order of problem faced in awareness of rural women

Issues Related to Extent of Adjustment	Farmers Adjustment Index (FAI)	Rank
Use of short duration boro rice variety	378	1
Seedlings raising in high land or homestead area for early transplanting in main field	344	2
Use of early planting boro rice variety	312	3
Make drainage system for early removal of water	276	4
Arrangement of early preparation of field for early transplanting of boro rice	214	5
Make small pond surroundings of the field	205	6
Always ready to harvest in short notice	187	7
Make of channel near by the crop field	182	8
Raising of field surrounding	165	9
Arrangement for removal of water through machine in case of early flood	163	10
Maintenance of surrounding embankments that can helps to prevent flood water	153	11
Early preparation for threshing place with preservation for few days after harvest	127	12

Table 4.10 represents the twelve aspects of issues of adjustment flood hazard in Haor basin area by the rice growers. As per Farmers Adjustment Index (FAI), use of short duration boro rice variety positioned the 1st, seedlings raising in high land or homestead area for early transplanting in main field in 2nd, use of early planting boro rice variety in 3rd, make drainage system for early removal of water in 4th, arrangement of early preparation of field for early transplanting of boro rice in 5th, make small pond surroundings of the field in 6th, always ready to harvest in short notice in 7th, make of channel near by the crop field in 8th, Raising of field surrounding in 9th, arrangement for removal of water through machine in case of early flood in 10th, maintenance of surrounding embankments that can helps to prevent flood water in 11th and early preparation for threshing place with preservation for few days after harvest in 12th.

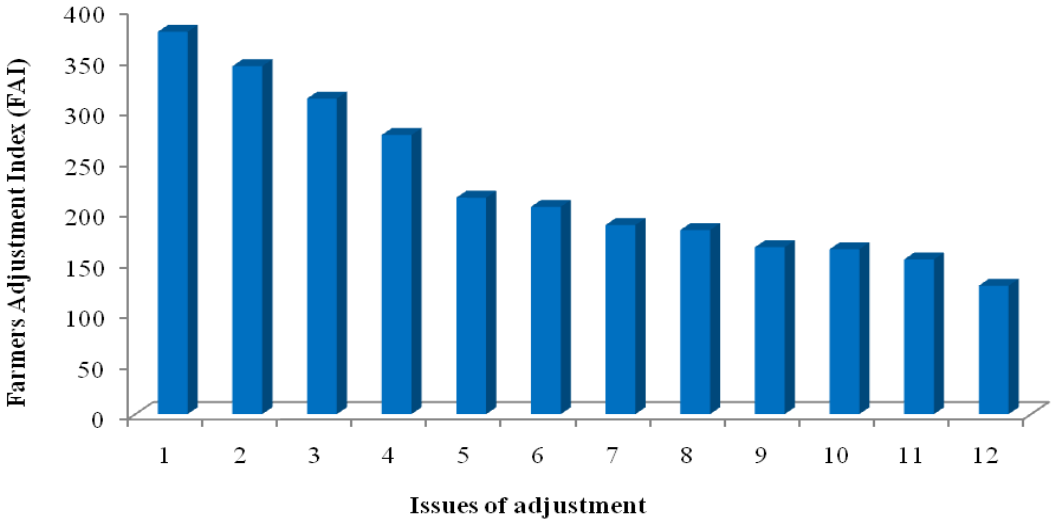

Figure 4.1. Graphical presentation of issues of flood hazard adjustments in Haor basin area based on Farmers Adjustment Index (FAI)

Legend,

1: Use of short duration boro rice variety
2: Seedlings raising in high land or homestead area for early transplanting in main field
3: Use of early planting boro rice variety
4: Make drainage system for early removal of water
5: Arrangement of early preparation of field for early transplanting of boro rice
6: Make small pond surroundings of the field
7: Always ready to harvest in short notice
8: Make of channel near by the crop field
9: Raising of field surrounding
10: Arrangement for removal of water through machine in case of early flood
11: Maintenance of surrounding embankments that can helps to prevent flood water
12: Early preparation for threshing place with preservation for few days after harvest

4.4 Relationship of the selected characteristics of rice growers with their adjustments to rice production in response to flood hazard in Haor basin area

Pearson Product Moment Correlation Co-efficient was computed in order to find out the extent of relationship between the dependent variable and independent variables. To reject or accept the null hypothesis at 0.05 and 0.01 level of probability was used. Results of correlation have been shown in Table 4.11.

4.4.1 Age and farmers' adjustments to rice production in response to flood hazard in Haor basin area

Relationship between age and farmers' adjustments to rice production in response to flood hazard in Haor basin area was determined by Pearson product moment correlation coefficient.

The coefficient of correlation between age and farmers' adjustments to rice production in response to flood hazard in Haor basin area is presented in Table 4.11. The coefficient of correlation between the concerned variables was found 0.371. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study.

a. *The observed value between the concerned variables "r" (0.371) was found to be greater than the tabulated value (r = 0.245) with 101 degrees of freedom at 0.01 level of probability.*
b. *The null hypothesis could be rejected.*
c. *The relationship between the concerned variables was statistically significant at 0.01 level of probability.*
d. *The relationship showed a positive trend between the concerned variables.*

Based on the above findings it could be concluded that age had significant positive relationships with the farmers' adjustments to rice production in response to flood hazard in Haor basin area. This represents that age of the respondent rice growers was an important factor for adjustments to rice production in response to flood hazard in Haor basin area and with the increases of age farmers' adjustments to rice production in response to flood hazard in Haor basin area will also increases.

Table 4.11 Pearson's product moment co-efficient of correlation showing relationship between dependent and independent variables

N =103

Dependent variable	Independent variables	Tabulated value		Value of co-efficient of correlation
		0.05 level	0.01 level	
Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Areas of Bangladesh	Age	0.191	0.245	0.371**
	Level of education			0.822*
	Family size			-0.302**
	Farm size			0.595**
	Annual income			0.184
	Organizational participation			0.237*
	Communication exposure			0.222*
	Agricultural knowledge			0.552**

**: Correlation is significant at the 0.01 level; *: Correlation is significant at the 0.05 level

4.4.2 Level of education and farmers' adjustments to rice production in response to flood hazard in Haor basin area

Relationship between level of education and farmers' adjustments to rice production in response to flood hazard in Haor basin area was determined by Pearson product moment correlation coefficient.

The coefficient of correlation between level of education and farmers' adjustments to rice production in response to flood hazard in Haor basin area is presented in Table 4.11. The coefficient of correlation between the concerned variables was found 0.822. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study.

a. *The observed value between the concerned variables "r" (0.822) was found to be greater than the tabulated value (r = 0.245) with 101 degrees of freedom at 0.01 level of probability.*

b. *The null hypothesis could be rejected.*

c. *The relationship between the concerned variables was statistically significant at 0.01 level of probability.*

d. *The relationship showed a positive trend between the concerned variables.*

Based on the above findings it could be concluded that level of education had significant positive relationships with the farmers' adjustments to rice production in response to flood hazard in Haor basin area. This represents that level of education of the respondent rice growers was an important factor for adjustments to rice production in response to flood hazard in Haor basin area and with the increases of level of education farmers' adjustments to rice production in response to flood hazard in Haor basin area will also increases.

4.4.3 Family size and farmers' adjustments to rice production in response to flood hazard in Haor basin area

Relationship between family size and farmers' adjustments to rice production in response to flood hazard in Haor basin area was determined by Pearson product moment correlation coefficient.

The coefficient of correlation between family size and farmers' adjustments to rice production in response to flood hazard in Haor basin area is presented in Table 4.11. The coefficient of correlation between the concerned variables was found -0.302. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study.

a. *The observed value between the concerned variables "r" (-0.302) was found to be greater than the tabulated value (r = 0.245) with 101 degrees of freedom at 0.01 level of probability.*

b. *The null hypothesis could be rejected.*

c. *The relationship between the concerned variables was statistically significant at 0.01 level of probability.*

d. *The relationship showed a negative trend between the concerned variables.*

Based on the above findings it could be concluded that family size had significant negative relationships with the farmers' adjustments to rice production in response to

flood hazard in Haor basin area. This represents that family size of the respondent rice growers was an important factor for adjustments to rice production in response to flood hazard in Haor basin area and with the increases of family size farmers' adjustments to rice production in response to flood hazard in Haor basin area will also decreases.

4.4.4 Farm size and farmers' adjustments to rice production in response to flood hazard in Haor basin area

Relationship between farm size and farmers' adjustments to rice production in response to flood hazard in Haor basin area was determined by Pearson product moment correlation coefficient.

The coefficient of correlation between farm size and farmers' adjustments to rice production in response to flood hazard in Haor basin area is presented in Table 4.11. The coefficient of correlation between the concerned variables was found 0.595. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study.

a. *The observed value between the concerned variables "r" (0.595) was found to be greater than the tabulated value (r = 0.245) with 101 degrees of freedom at 0.01 level of probability.*
b. *The null hypothesis could be rejected.*
c. *The relationship between the concerned variables was statistically significant at 0.01 level of probability.*
d. *The relationship showed a positive trend between the concerned variables.*

Based on the above findings it could be concluded that farm size had significant positive relationships with the farmers' adjustments to rice production in response to flood hazard in Haor basin area. This represents that farm size of the respondent rice growers was an important factor for adjustments to rice production in response to flood hazard in Haor basin area and with the increases of farm size farmers' adjustments to rice production in response to flood hazard in Haor basin area will also increases.

4.4.5 Annual income and farmers' adjustments to rice production in response to flood hazard in Haor basin area

Relationship between annual income and farmers' adjustments to rice production in response to flood hazard in Haor basin area was determined by Pearson product moment correlation coefficient.

The coefficient of correlation between annual income and farmers' adjustments to rice production in response to flood hazard in Haor basin area is presented in Table 4.11. The coefficient of correlation between the concerned variables was found 0.184. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study.

a. *The observed value between the concerned variables "r" (0.184) was found to be smaller than the tabulated value (r = 0.191) with 101 degrees of freedom at 0.05 level of probability.*
b. *The null hypothesis could not be rejected.*
c. *The relationship between the concerned variables was statistically non significant at 0.05 level of probability.*
d. *The relationship showed a positive trend between the concerned variables.*

Based on the above findings it could be concluded that annual income had non significant positive relationships with the farmers' adjustments to rice production in response to flood hazard in Haor basin area. This represents that annual income of the respondent rice growers was not an important factor for adjustments to rice production in response to flood hazard in Haor basin area but with the increases of annual income farmers' adjustments to rice production in response to flood hazard in Haor basin area will also increases.

4.4.6 Organizational participation and farmers' adjustments to rice production in response to flood hazard in Haor basin area

Relationship between organizational participation and farmers' adjustments to rice production in response to flood hazard in Haor basin area was determined by Pearson product moment correlation coefficient.

The coefficient of correlation between organizational participation and farmers' adjustments to rice production in response to flood hazard in Haor basin area is presented in Table 4.11. The coefficient of correlation between the concerned variables was found 0.237. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study.

a. *The observed value between the concerned variables "r" (0.237) was found to be greater than the tabulated value (r = 0.191) with 101 degrees of freedom at 0.05 level of probability.*
b. *The null hypothesis could be rejected.*
c. *The relationship between the concerned variables was statistically significant at 0.05 level of probability.*
d. *The relationship showed a positive trend between the concerned variables.*

Based on the above findings it could be concluded that organizational participation had significant positive relationships with the farmers' adjustments to rice production in response to flood hazard in Haor basin area. This represents that organizational participation of the respondent rice growers was an important factor for adjustments to rice production in response to flood hazard in Haor basin area and with the increases of organizational participation farmers' adjustments to rice production in response to flood hazard in Haor basin area will also increases.

4.4.7 Communication exposure and farmers' adjustments to rice production in response to flood hazard in Haor basin area

Relationship between communication exposure and farmers' adjustments to rice production in response to flood hazard in Haor basin area was determined by Pearson product moment correlation coefficient.

The coefficient of correlation between communication exposure and farmers' adjustments to rice production in response to flood hazard in Haor basin area is presented in Table 4.11. The coefficient of correlation between the concerned variables was found 0.222. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study.

a. *The observed value between the concerned variables "r" (0.222) was found to be greater than the tabulated value (r = 0.191) with 101 degrees of freedom at 0.05 level of probability.*

b. *The null hypothesis could be rejected.*

c. *The relationship between the concerned variables was statistically significant at 0.05 level of probability.*

d. *The relationship showed a positive trend between the concerned variables.*

Based on the above findings it could be concluded that communication exposure had significant positive relationships with the farmers' adjustments to rice production in response to flood hazard in Haor basin area. This represents that communication exposure of the respondent rice growers was an important factor for adjustments to rice production in response to flood hazard in Haor basin area and with the increases of communication exposure farmers' adjustments to rice production in response to flood hazard in Haor basin area will also increases.

4.4.8 Agricultural knowledge and farmers' adjustments to rice production in response to flood hazard in Haor basin area

Relationship between agricultural knowledge and farmers' adjustments to rice production in response to flood hazard in Haor basin area was determined by Pearson product moment correlation coefficient.

The coefficient of correlation between agricultural knowledge and farmers' adjustments to rice production in response to flood hazard in Haor basin area is presented in Table 4.11. The coefficient of correlation between the concerned variables was found 0.552. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study.

a. *The observed value between the concerned variables "r" (0.552) was found to be greater than the tabulated value (r = 0.245) with 101 degrees of freedom at 0.01 level of probability.*

b. *The null hypothesis could be rejected.*

c. *The relationship between the concerned variables was statistically significant at 0.01 level of probability.*

d. *The relationship showed a positive trend between the concerned variables.*

Based on the above findings it could be concluded that agricultural knowledge had significant positive relationships with the farmers' adjustments to rice production in response to flood hazard in Haor basin area. This represents that agricultural knowledge of the respondent rice growers was an important factor for adjustments to rice production in response to flood hazard in Haor basin area and with the increases of agricultural knowledge farmers' adjustments to rice production in response to flood hazard in Haor basin area will also increases.

Pearson Product Moment Correlation Co-efficient between dependent and independent variable revealed that age, level of education, farm size, organizational participation, communication exposure and agricultural knowledge had significant positive relationships with farmers' adjustments to rice production in response to flood hazard in Haor basin area. Annual income had non significant positive relationships, while family size had significant negative relationship with farmers' adjustments to rice production in response to flood hazard in Haor basin area under the present study.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The study was conducted with the objectives too find out the adjustment to rice production in response to flood hazard in Haor basin areas of Bangladesh. Dingapota Haor of Mohangonj upazila under Netrokona district have been selected purposively as the study area. The boro rice growers of Dingapota Haor constituted the population of the study. An update list of 1032 boro rice growers from the selected Haor area was collected from Upazila Agricultural Offices of this locality. Around 10% of the populations were randomly selected as the sample of the study by using random sampling method. Thus, 103 boro rice growers constituted the sample of the study. A well structured interview schedule was developed based on objectives for collecting information. The researcher herself collected data through personal contact. The independent variables were: age, level of education, family size, farm size, annual income, organizational participation, communication exposure and agricultural knowledge. The dependent variable of this study was the farmers adjustments to rice production in response to flood hazard in Haor basin areas of Bangladesh. Data collection was started in 07 April, 2016 and completed in 26 April, 2016. Various statistical measures such as frequency counts, percentage distribution, average, and standard deviation were used in describing data. Co-efficient of correlation test was used to explore relationship between the concerned variables. The major findings of the study are summarized below:

5.1 Major Findings

5.1.1 Characteristics of the Rice Growers

Age: The middle aged rice growers comprised the highest proportion (64.08 percent) and the lowest proportion were made by the old aged category (13.59 percent)..

Level of Education: Rice growers under secondary education category constitute the highest proportion (36.89 percent), while the lowest 3.88 percent above secondary level category.

Family Size: The medium size family constitutes the highest proportion (50.49 percent) and only 7.77 percent respondents had large family size.

Farm Size: The small farm holder constitutes the highest proportion (42.72 percent) and the lowest in large farm holder (23.30 percent).

Annual Income: The low and medium income constituted the highest proportion (41.75 percent) and high income constituted the lowest proportion (16.50 percent).

Organizational Participation: About 44.66 percent of the respondents had medium level organizational participation, while 21.36 percent had high level organizational participation.

Communication Exposure: About (60.19 percent) of the respondents' had high communication exposure group, while only 8.74 percent had low communication exposure.

Agricultural Knowledge: The majority (44.66 percent) of the respondents felt in poor knowledge category, whereas the lowest 26.21 percent in moderate knowledge category.

5.1.2 Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Area

Among the respondents, rice growers in Haor basin area in adjustment of flood hazard, the highest 55.34 percent rice growers belong to the group of lowest adjustment compared to 37.86 percent in moderate adjustment, whereas the lowest 6.80 percent rice growers belong to the group of high adjustment in response to flood hazard in Haor basin area.

5.1.3 Rank Order of Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Area

As per Farmers Adjustment Index (FAI), use of short duration boro rice variety positioned the 1st, seedlings raising in high land or homestead area for early transplanting in main field in 2nd, use of early planting boro rice variety in 3rd, make drainage system for early removal of water in 4th, arrangement of early preparation of field for early transplanting of boro rice in 5th, make small pond surroundings of the field in 6th, always ready to harvest in short notice in 7th, make of channel near by the crop field in 8th, Raising of field surrounding in 9th, arrangement for removal of water through machine in case of early flood in 10th, maintenance of surrounding embankments that can helps to prevent flood water in 11th and early preparation for threshing place with preservation for few days after harvest in 12th.

5.1.4 Relationship of the selected characteristics of rice growers with their adjustments to rice production in response to flood hazard in Haor basin area

Pearson Product Moment Correlation Co-efficient between dependent and independent variable revealed that age, level of education, farm size, organizational participation, communication exposure and agricultural knowledge had significant positive relationships with farmers' adjustments to rice production in response to flood hazard in Haor basin area. Annual income had non significant positive relationships, while family size had significant negative relationship with farmers' adjustments to rice production in response to flood hazard in Haor basin area under the present study.

5.2 Conclusions

1. The findings indicated that the around 93 percent rice growers have low to moderate adjustment plan to rice production in response to flood hazard in Haor basin area. Conclusion can be drawn that proper technology was highly emphasized for Haor area for protecting their rice from flood hazards.

2. Age, level of education, farm size, organizational participation, communication exposure and agricultural knowledge had significant positive relationships with farmers' adjustments to rice production in response to flood hazard in Haor basin area. Conclusion can be drawn that socio-economic characteristics should be given priority to farmers' adjustments to rice production in response to flood hazard in Haor basin area.

3. Family size had significant negative relationships with farmers' adjustments to rice production in response to flood hazard in Haor basin area. Conclusion can be drawn that family size is a considerable socio-economic characteristics and should be given priority to farmers' adjustments to rice production in response to flood hazard in Haor basin area.

4. Annual income of the respondents was not found important factors in farmers' adjustments to rice production in response to flood hazard in Haor basin area. Conclusion that livelihood pattern in important for farmers' adjustments to rice production in response to flood hazard in Haor basin area.

5.3 Recommendations

5.3.1 Recommendations for policy implications

On the basis of observation and conclusions drawn from the findings of the study following recommendations are made:

1. Among the respondents, rice growers in Haor basin area in adjustment of flood hazard, the highest 55.34 percent rice growers belong to the group of lowest adjustment. So, it is recommended that proper training and motivation are needed of increasing farmers' adjustment in response to flood hazards in Haor basin area.
2. Level of education is highly significant with farmers' adjustments to rice production in response to flood hazard. It is recommended that to undertake necessary step for increasing the level of education of the rice growers in Haor basin areas.
3. Organization participation and communication exposure is highly significant with farmers' adjustments to rice production in response to flood hazard in Haor basin areas. So, is recommended for proper steps for increasing organization participation and communication exposure of the rice growers in Haor basin areas.
4. Agricultural knowledge is also highly significant with farmers' adjustments to rice production in response to flood hazard in Haor basin area. It is recommended that to undertake necessary steps for improving the assistance of DAE personnel for increasing their agricultural knowledge of the rice growers in Haor basin areas.

5.3.2 Recommendations for further study

On the basis of scope and limitations of the present study and observation made by the researcher, the following recommendations are made for future study.

1. Other factors might have influence on adjustments to rice production in response to flood hazard in Haor basin area that need to be identified through further study.
2. This study was conducted in Dingapota Haor of Mohangonj upazila under Netrokona district. Similar studies are required to be conducted in other Haor areas where similar environmental, socio-economic and physical conditions exist.
3. The study investigated the direct and indirect effects of certain variables. Further studies should be conducted to explore the direct and indirect effects of all the variables under investigation.

REFERENCES

Akanda, M. (1995). Adoption of recommended dose of fertilizer in potato cultivation. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh. P. 89.

Aurangozeb, M.K. (2002). Adoption of Integrated Homestead Farming Technologies by the Rural Womens in RDRS. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh. P. 90.

Bangladesh Economic Census, (2013). Current affairs. Monthly Professors Current Affairs. 37/1, Banglabazar, Dhaka-1100. P. 234.

Bangladesh Water Development Board (2014). Annual report 2013-2014. P. 134

BBS. (2013). Year Book of Agricultural Statistics of Bangladesh. Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Govt. of the Peoples Republic of Bangladesh, Dhaka. P. 156.

Bembridge, T.J. and Williams, J.L.H. (1990). Factor affecting adoption of maize growing practices in small scale farmer support programmes. *South African Journal of Agricultural Extension*, **19**, PP. 53-61.

BRRI (Bangladesh Rice Research Institute). (2013). Adunik Dhaner Chas (Modern Rice Cultivation). Publication and public relation division, BRRI. P. 43.

Bulletin of First Haor conference, (2010). Ministry in Planning, Government of the Peoples' Republic of Bangladesh, Dhaka. P. 8.

CEGIS. (2005). Final Report of study on Livelihood Systems Assessments, vulnerable groups profiling and livelihood adaptation to climate hazard and long term climate change in saline prone areas. Under support to the strengthening of CSMP Project. Dhaka, Bangladesh. November 2005. P. 523

Chowdhury, M.S.A. (1997). Adoption of BINA Technologies by the Farmers of Boira Union in Mymensmgh District. MS. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension and Education. Bangladesh Agricultural University, Mymensingh. P.78.

Gogoi, S.K. and Gogoi, D.K. (1989). Adoption of recommended plant protection practices in rice. *Indian Journal Extension Education*, **25**(1&2), PP. 26-29.

Good C.V. (1945). Dictionary of Education. New York: McGraw-Hill Book Company, Inc. pp. 56-89.

Goode, W.J. and Hatt, P.K. (1952). Methods in Social Research. New York: McGraw-Hill Book Company, Inc. PP. 34-56.

Hamid, M.A. (1995). Farmers' Awareness on Environmental Pollution Caused by the Use of Agro-chemicals in Two Selected Villages of Bangladesh Agricultural University Extension Centre. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education Bangladesh Agricultural University, Mymensingh. P. 84.

Haor Task Report, (2010). Ministry in Planning, Government of the Peoples' Republic of Bangladesh, Dhaka. P. 15.

Haque, M.S. (2003). A study on the Adoption of Improved Practices in Sugarcane Cultivation in Some Selected Areas of Jossore District. M.Sc (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh. P. 89.

Hasan, M.M. (2003). Adoption of recommended potato cultivation practices by the farmers in some selected area of rajshahi district. *M.S. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh. P.103.

Hasan, M.Z. (1996). Adoption of some selected agricultural technologies among the farmers as perceived by the frontline go and ngo workers. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh, Bangladesh. P. 84.

Hoque, M.M. (1993). Adoption of Improved Practices in Sugarcane Cultivation by the Sugarcane Growers in Sreepur Thana under Gazipur District. M,Sc. (Ag. Ext. Ed.) Thesis Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh. P. 89.

Hossain, M.A. (1991). Adoption of Contact Wheat Growers in Sadar Upazilla of Jamalpur District. M.S. (Ag. Ext. Edn.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh. P. 112.

Hossain, M.M. (2003). Farmers' knowledge and adoption of modern boro rice cultivation practices. *M.S. (Ag.Ext.Ed.) Thesis,* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh. P. 94.

Huda, M.K. (2004). Experience with modern and hybrid rice varieties in haor ecosystem: Emerging Technologies for Sustainable Rice Production. Twentieth National Workshop on Rice Research and Extension in Bangladesh. Bangladesh Rice Research Institute. Gazipur-1701, 19-21, April 2004.

Husain A.M, Hossain, M. and Janaiah, A. (2001). Hybrid Rice Adoption in Bangladesh: A Socio-economic Assessment of Farmers' Experiences, Research Report, Social Sciences Division, International Rice Research Institute (IRRI), LosBanos, Philippines. PP. 56.

Hussen, M.A.M. (2001). Farmers' Knowledge and Adoption of Modern Sugarcane Cultivation Practices. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh. P. 78.

IPCC. (2007). Glossary of Terms. In *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Parry ML, Canziani OF, Palutik of JP, van der Linden PJ, and Hanson CE (eds), Cambridge University Press, Cambridge, United Kingdom. P. 76.

Islam, M.S. (2002). Adoption of Modern Agricultural Technologies by the Farmers of Sandip. M.S. (Ag Ext Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University. Mymensingh. P. 91.

Jabber M.A. and Alam, M.S. (1996). Adoption of Modern Rice Varieties in Bangladesh. *The Bangladesh Journal of Agricultural Economics*, 16(2), PP. 77-95.

Kariuka, K.G. (1990). The economic impact of the adoption of hybrid maize in Swaziland. Farming System and Resource Economics in the Tropics, 9: P. 498.

Kerlinger, F.N. (1973). *Foundations of Behabioural Research*. 2nd Edn. Delhi: Surjeet Publications. P. 67.

Labour Force Survey. (2010). Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning. P. 228.

MOWR (2012). "Master Plan of Haor Area". Volume 1, Summary Report, April 2012, Ministry of Water Resources, Government of Peoples' Republic of Bangladesh. PP. 312.

Muttaleb, A. (1995). Relationship of Selected Characteristics of Potato Growers with their Adoption of Improved Potato Technologies. M. S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh. P. 88.

Nahar, N. (1996). Relationship of Selected Characteristics of the Farm Women with Usefulness of Agricultural Radio Program and Homestead Farming Knowledge. M. S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh. P. 78.

Nikhade, M.D., Bhople, S.R. and Shakar, S.V. (1993). Adoption of improved practices of soybean cultivation. Indian Journal of Extension Education, 7(1&2), PP. 45-52.

Pal, S.K. (1995). Adoption of Recommended Sugarcane Cultivation Practices by the Farmers in Two selected Centres of North Bengal Sugar Mills. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensmgh. P. 81.

Podder, S.K. (1999). Adoption of Mehersagar Banana by the Farmers of Gazaria Union under Sakhipur Thana of Tangail District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh. P. 78.

Rahman, M.H. (2003). Adoption of year round homestead fruit cultivation practices in selected area of meherpur district. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh. P.101.

Rahman, M.L. (2002). Farmers' Knowledge on Improved Practices of Potato Cultivation. M.S. (Ag Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh. P. 74.

Rahman, M.M. (1999). Adoption of Balanced Fertilizer by the Boro Rice Farmers of Ishwarganj Thana. M.S. (Ag. Ext. Ed.) Thesis Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh. P. 84.

Rahman, M.S. (2001). Knowledge, Attitude and Adoption of the Farmers Regarding Aalok 6201 Hybrid Rice in Sadar Upazila of Mymensingh District. MS. (Ag Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh. P. 91.

Rai Graver, R.K. and Gangwar, A.C. (1989). Study To identify factors responsible for acreage substitution and low yield of Maize in North-eastern region of Haryana: Wallingford, UK. P. 23.

Rimi, R. H., Rahman, S. and Bahar, H. (2009). Trend Analysis of Climate Change and Investigation on its Probable Impacts on Rice Production at Satkhira, Bangladesh, *Pakistan Journal on Metrology*, 6(3), PP. 124-130.

Sardar, M.H.U. (2002). Adoption of IPM Practices by the Farmers under PETRRA Project of RDRS M.S. (Ag. Ext Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh. P. 73.

Sarkar, D.C. (1997). Correlation of Selected Characteristics of Potato Growers with their Adoption of Improved Potato Cultivation Practices in Five Villages of Commilla District. M.S (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh. P. 67.

Townsend, J.C. (1953). Introduction to Experimental Methods. International Student Edition. New York: McGraw Hill Book Company, Inc. P. 54.

Upazila Offices. (2016). Mohangonj Upazila, Netrokona districts.

World Bank. (2005). Revitalizing the Agricultural Technology System in Bangladesh: Bangladesh Development Series Paper-7. The World Bank Office, Dhaka. PP.45-49.

World Bank. (2006). *Bangladesh Country Environmental Analysis*, Bangladesh Development Series Paper No. 12. PP. 23-25.

APPENDICES

Appendix I. An Interview Schedule for the Study

Postgraduate Programs in Disaster Management (PPDM)
BRAC University, Dhaka, Bangladesh

An interview schedule for a research study entitle

"FARMERS ADJUSTMENTS TO RICE PRODUCTION IN RESPONSE TO FLOOD HAZARD IN HAOR BASIN AREA OF BANGLADESH"

Serial No. : .....

Respondent Name : ……

Village : …… Union: …….……. Upazila:……..

[Please provide following information. Your information will be kept confidential and will be used for research purpose only]

1. Age

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

2. Level of Education

What is the level of your education?

a. Illiterate ( ) b. Can sign only ( ) c. Have passed class.....

d. Did not read in School/Madrasha but can read and write and level of education is equivalent to class.....

3. Family Size

State the number of your family members.....

4. Farm Size

Please mention the area of your land according to use

Sl. No.	Type of land use	Area of land	
		Local unit (Decimal/Bigha	Hectare
A	Homestead area with pond		
B	Own land under own cultivation		
C	Area taken by a respondent to others on borga system		
D	Area given by a respondent to others on borga system		
E	Cultivated area taken as lease by respondent from other		
Total = A+B+1/2(C+D)+E			

5. Annual Income

Please mention the income of your family in last year

Sl. No.	Source of income	Total Income (Tk.)/Year
A	**Agricultural Sector**	
	Crops	
	Livestock	
	Poultry	
	Fishery	
	Sub-Total (A)	
B	**Non-agricultural Sector**	
	Small Business	
	Service	
	Other family members' income	
	Day labourer	
	Fishing	
	Others (if any, please specify)	
	Sub-total (B)	
	Total (A+B)	

6. Organizational Participation

Please mention the nature of your participation with the following organizations (Tick mark in right place)

Sl. No.	Organizations	No. Participation	Nature and duration of participation		
			Ordinary Member	Executive Member	President/ Secretary
1.	NGO Organized Group				
2.	Rural Arbitration Committee				
3.	Ansar/VDP				
4.	School Committee				
5.	Madrasha/Temple Committee				
6.	Farmer Co-operative Society				
7.	Mosque/Puja Committee				
8.	Hat/Bazaar Committee				
9.	Youth Club/Committee				
10.	Others (Please specify)				

7. Communication Exposure

Indicate communication with the following media (How much)

Sl. No.	Communication media	Basis of score				
		0	1	2	3	4
1.	Sub Assistant Agricultural Officer (per 3 months)	Not even once	1 time	2 time	3 time	4 or more times
2.	Upazilla level Agricultural Officers (per 6 months)	Not even once	1 time	2 time	3 time	4 or more times
3.	Neighbour (per month)	Not even once	1-2 time	2-3 time	5-6 time	7 or more times
4.	Friends (per month)	Not even once	1-2 time	3-4 time	5-6 time	7 or more times
5.	Relatives (per month)	Not even once	1-2 time	3-4 time	5-6 time	7 or more times
6.	Experienced farmer (per month)	Not even once	1-2 time	3-4 time	5-6 time	7 or more times
7.	Model farmer (per month)	Not even once	1-2 time	3-4 time	5-6 time	7 or more times
8.	Agricultural input dealer (per 3 month)	Not even once	1 time	2 time	3 time	4 or more times
9.	Development worker (per 3 month)	Not even once	1 time	2 time	3 time	4 or more times
10.	Group discussion meeting (per year)	Not even once	1 time	4-7 time	8-11 time	12 or more times
11.	Result demonstration meetings/Field days (per six month)	Not even once	1 time	2-3 time	4-5 time	6 or more times
12.	Method demonstrations (per six month)	Not even once	1 time	2-3 time	4-5 time	6 or more times
13.	News paper (weekly)	Not even once	1-2 time	2-3 time	5-6 time	7 or more times
14.	Agricultural poster (six month)	Not even once	1 time	2 time	3 time	4 or more times
15.	Agricultural leaflet (yearly)	Not even once	1 time	2 time	3 time	4 or more times
16.	Agricultural booklet (yearly)	Not even once	1 time	2 time	3 time	4 or more times
17.	Agricultural magazine /periodicals (yearly)	Not even once	1 time	2 time	3 time	4 or more times
18.	Agricultural fair (yearly)	Not even once	1 time	2 time	3 time	4 or more times
19.	Agricultural radio program (monthly)	Not even once	1-7 time	8-14 time	15-20 time	21 or more times
20.	Agricultural television program (per month)	Not even once	1 time	2 time	3 time	4 or more times

8. Agricultural Knowledge

Please answer the following questions

Sl. No.	Questions	Assigned score	Obtained marks
1.	Mention the cropping seasons of Bangladesh	2	
2.	Mention the name of five rice variety that available in Haor areas	2	
3.	Mention two short duration boro rice variety	2	
4.	Mention the life span of these two varieties	2	
5.	Mention per hectare yield of these two varieties	2	
6.	Mention the Importance of organic materials in rice cultivation	2	
7.	Mention three name of chemical fertilizers	2	
8.	Mention fertilizer dose for boro rice cultivation	2	
9.	What is the function of urea fertilizer	2	
10.	What is the function of TSP fertilizer	2	
11.	What is the function of MoP fertilizer	2	
12.	Mention the process of irrigation for boro rice	2	
13.	Mention two major insect of rice	2	
14.	Mention the name of two beneficial insect	2	
15.	What is the qualities of good seeds	2	
16.	Difference of local and modern rice variety	2	
17.	Briefly describe the importance of use of HYV	2	
18.	Briefly describe the process of rice threshing	2	
19.	Briefly describe the process rice seed storage with maintaining seed quality	2	
20.	Mention two name of winter vegetables	2	
21.	Name of two year round fruit producing plant	2	
22.	Mention the name of two pulse crops	2	
23.	What is IPM?	2	
24.	What is light trap?	2	
25.	Mention two variety of potato	2	
26.	When to irrigate in tomato?	2	
27.	Mention on disease of tomato	2	
28.	Mention one disease of potato	2	
29.	Mention name of two disease of Hen and Duck	2	
30.	Mention two name of disease of cattle and goat	2	
Total		60	

9. Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Area:

Please mention the extent of adjustment

Sl. No.	Issues	Extent of Adjustment				
		Very good (5)	Good (4)	Medium (3)	Low (2)	Very low (1)
1.	Use of short duration boro rice variety					
2.	Use of early planting boro rice variety					
3.	Seedlings raising in high land or homestead area for early transplanting in main field					
4.	Arrangement of early preparation of field for early transplanting of boro rice					
5.	Make small pond surroundings of the field					
6.	Make drainage system for early removal of water					
7.	Make of channel near by the crop field					
8.	Arrangement for removal of water through machine in case of early flood					
9.	Always ready to harvest in short notice					
10.	Early preparation for threshing place with preservation for few days after harvest					
11.	Raising of field surrounding					
12.	Maintenance of surrounding embankments that can helps to prevent flood water					
13.	Others (Please specify)					

Thanks for your Cordial Cooperation.

Signature of the Interviewer with Date

Appendix II. Correlation Matrix

Characters	A	B	C	D	E	F	G	H	I
A	1.00								
B	0.226*	1.00							
C	-0.063	-0.276**	1.00						
D	0.294**	0.420**	-.013	1.00					
E	0.079	0.151	0.161	0.047	1.00				
F	0.090	0.210*	-0.059	0.308**	0.015	1.00			
G	0.106	0.111	0.013	0.132	0.035	-0.127	1.00		
H	0.390**	0.420**	-0.140	0.333**	0.070	0.178	0.359**	1.00	
I	0.371**	0.822**	-0.302**	0.595**	0.184	0.237*	0.222*	0.552**	1.00

A: Age B: Level of education C: Family size

D: Farm size E: Annual income F: Organizational participation

G: Communication exposure H: Agricultural knowledge

I: Farmers Adjustments to Rice Production in Response to Flood Hazard in Haor Basin Area

**: Correlation is significant at the 0.01 level; *: Correlation is significant at the 0.05 level