ADOPTION OF MODERN PRACTICES IN RICE CULTIVATION BY THE FARMERS OF MADHUKHALI UPAZILA UNDER FARIDPUR DISTRICT

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CERTIFICATE

This is to certify that the thesis entitled, **"ADOPTION OF MODERN PRACTICES IN RICE CULTIVATION BY THE FARMERS OF MADHUKHALI UPAZILA UNDER FARIDPUR DISTRICT"** submitted to the faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **Master of Science (MS) in Agricultural Extension,** embodies the result of a piece of bona fide research work carried out by **Mehedi Hasan,** Registration No. 09-03576, under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma.

I further certify that any help or sources of information, as has been availed of during the course of investigation have been duly acknowledged.

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DEDICATION

DEDICATED TO

THIS THESIS IS LOVINGLY DEDICATED

TO

MY PARENTS

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ABSTRACT

The purpose of this study was to determine the adoption of modern practices by the farmers for rice cultivation and to explore the contribution of the selected characteristics of the farmers to their adoption of modern practices by the farmers for rice cultivation**.** The selected characteristics were age, education, farm size, family size, annual family income, organizational participation, innovativeness, extension contact, training exposure and rice production knowledge. Data were gathered from 107 farmers of two villages namely Noapara and Kuraniarchor of Modhukhali upazila under Faridpur district by using a pre evaluated interview schedule during the period from 15 March to 30 June, 2015. Descriptive analysis, stepwise multiple regression were used for data analysis. More than half of the respondents (56.1%) had medium adoption where 15.9 percent had low adoption and only 24.3 percent had high adoption of modern practices for rice cultivation**.** There was 3.7 percent respondents were in no adoption of selected modern practices for rice cultivation**.** Among the influential variables respondents' education, extension contact, age were significant contributor and provided 47.0 percent contribution on modern practices for rice cultivation.

Key words: Modern practices, rice cultivation;

Chapter 1

INTRODUCTION

1.1. General Background

Bangladesh is predominantly an agricultural country. Comprising 147,610 square kilometres (56,990 sq mi) and extends 820 kilometres (510 mi) north to south and 600 kilometres (370 mi) east to west (Wiki, 2016) with an estimated population is 162718172 (Countrymeters, 2016). This country is regarded as one of the most densely populated area of the world. 48.4 percent of the country's total labor force are engaged in Agriculture (BNP, 2016). According to the BBS (2014) report, agriculture output prices have been found to contribute 23.50% to the GDP in which 13.44% comes from crops, 1.90% from forestry, 2.93% from livestock and 5.23% from fisheries (BBS 2014). Agriculture plays a vital role in the development of Bangladesh economy through production, employment generation and poverty alleviation. As the population of the country is ever increasing, the farm holding size of a family is ever decreasing. Practically nowadays all cultivable land is in use and the pressure of increasing population reduced the average size of the farm holding from 1.69 acres in 1996 to 1.48 acres (BBS-2014).Almost all of the 13 million farm families of the country grow rice. Rice is grown on about 10.5 million hectares which has remained almost stable over the past three decades. The population of Bangladesh is still growing by two million every year and may increase by another 30 millions over the next 20 years. Thus, Bangladesh will require about 27.26 million tons of rice for the year 2020. During this time total rice area will also shrink to 10.28 million hectares. Rice yield therefore, needs to be increased from the present 2.74 to 3.74 t/ha. the country is now producing about 25.0 million tons to feed her 135 million people (BRKB, 2016).Rice is the major food crop in Bangladesh. It is the people's main food and energy source. The average rice yields of some countries are: USA 6.62 t/ha, South Korea 6.87 t/ha, Japan 6.41 t/ha and China 6.32 t/ha (FAO, 2000).

Increasing agricultural productivity is critical to meet expected rising demand and, as such, it is instructive to examine recent performance in cases of modern agricultural technologies (Challa, 2013). Agricultural technologies include all kinds of improved techniques and practices which affect the growth of agricultural output (Jain et al., 2009). According to Loevinsohn et al. (2013) the most common areas of technology development and promotion for crops include new varieties and management regimes; soil as well as soil fertility management; weed and pest management; irrigation and water management. By virtue of improved input/output relationships, new technology tends to raise output and reduces average cost of production which in turn results in substantial gains in farm income (Challa, 2013). Adopters of improved technologies increase their productions, leading to constant socio-economic development. Adoption of improved agricultural technologies has been associated with: higher earnings and lower poverty; improved nutritional status; lower staple food prices; increased employment opportunities as well as earnings for landless laborers (Kasirye, 2010). Adoption of improved technologies is believed to be a major factor in the success of the green revolution experienced by Asian countries (Kasirye, 2010).On the other hand, non-adopters can hardly maintain their marginal livelihood with socio-economic stagnation leading to deprivation (Jain et al., 2009).

Various authors define technology in different ways. Loevinsohn et al.,(2013)define technology as the means and methods of producing goods and services, including methods of organization as well as physical technique. According to these authors new technology is new to a particular place or group of farmers, or represents a new use of technology that is already in use within a particular place or amongst a group of farmers. Technology is the knowledge/information that permits some tasks to be accomplished more easily, some service to be rendered or the manufacture of a product (Lavison 2013). Technology itself is aimed at improving a given situation or changing the status quo to a more desirable level. It assists the applicant to do work easier than he would have in

the absence of the technology hence it helps save time and labor (Bonabana-Wabbi 2002)

An individual usually doesn't adopt a new technology unless he finds the benefit of it by himself. Even if he is convinced about its benefit still he may not use the same due to lack of financial capability. Sometimes he may have means to use the technology but his social norms and traditions does not encourage him to use the same for prestigious factors. All these personality socio-economy, socio-cultural and psychological factors work on an individual when he is confronted with a new situation or with a changed program.

Faridpur district sometimes is considered as surplus rice production zone of the country, where rice production was a major enterprise. Modhukhali upazila area, therefore, considered a most suitable location to study the phenomena of adoption of modern technologies for rice production by the rice growers.

Studies on individual, group and society revealed that acceptance of modem technologies is conditional upon many factors. Some of these are social, personal, economical and situational factors. While conducting any study on the adoption of modem technologies, these factors need to be taken into account. A very few previous research work tried to find out the above facts. Therefore, the present research felt necessity to conduct a research entitled "Adoption of modern practices by the farmers for rice cultivation of Modhukhali upazila under Faridpur district".

1.2Statement of the Problem

The success of any technology depends on its dissemination among the potential users, which ultimately is measured by the level of adoption of that technology. When an innovation is introduced to the farmer, it may be readily accepted, partly accepted, fully accepted and it may also happen that the adoption of innovation is discontinued or totally stopped.

Rice is the most important cereal crops in Bangladesh. The importance of the cultivation of this crop is increasingly recognized by the implement as of agricultural extension programs as well as policy makers. As a main crop, rice has much potentiality for widespread and stability for cultivation by the respondents. But before undertaking any massive programme for its increased production in Bangladesh, it is first necessary to know the existing situation of the extent of rice cultivation in the most potential areas of Bangladesh.

Modhukhali upazila of Faridpur district is an important place of rice cultivation in this country. To expand the cultivation of this crop in other parts of the country, the knowledge on the present situation of rice production in this region would be significantly contributory to design appropriate programs for its widespread cultivation.

These happenings are certainly due to a number of factors. Adoptions of modern technologies for rice cultivation are influenced by the farmer's demographic and socio-economic position. An understanding about the same will be useful to the researchers, planners and extension workers in doing research, planning and execution of extension programs for enhancing adoption of rice cultivation.

In these respects, the answers to the following questions would be very much pertinent.

1. To what extent of rice production technologies have been adopted by the rice growers?
2. What was the trend of rice cultivation by the growers?
3. What were the important characteristics of the rice growers influencing their adoption of rice production technologies?

1.3 Objectives of the Study

The following objectives were formulated to give clear direction to the study:

1. To determine the extent of adoption of rice production technologies by the farmers;
2. To determine and describe some selected characteristics of the farmers. The selected characteristics include:
    a) Age
    b) Education
    c) Family size
    d) Farm size
    e) Annual income
    f) Organizational participation
    g) Innovativeness
    h) Extension Contact
    i) Training exposure
    j) Knowledge on rice production;
3. To explore the contribution of the selected characteristics of the farmers on their adoption of modern technologies of rice production

1.4 Justification of the Study

The concept and benefits of the rice cultivation should be disseminated to the farmers in a convincing and attractive manner, so that farmers response quickly to adopt modern technologies of rice cultivation. This is undoubtedly an educative process and it possible through Extension Education System, concerned mainly with increasing agricultural production and improving living standards of the farmers. A substantial portion of that, rice cultivation play a great role for decreasing food crisis. To increase rice production efficiency, transfer of modem technology is essential and to get necessary information related to rice production would be the key factor for the farmers in adoption of

rice cultivation. Now considerable effort is being made through research and extension delivery system to increase rice production through adoption of improved technologies in our country. But the actual increase in production will depend on the activities of the rice growers. The behavior of a farmer is influenced by his personal, economic, social and physiological characteristics (Hossain, 1991). Modhukhali upazila under Faridpur district was considered as a suitable location to study the phenomenon of adoption of rice production technologies by the rice growers.

1.5 Scope of the Study

The main focus of the study was to determine the adoption of modern production technologies of rice. The findings of the study would be specifically applicable to Faridpur district. However, the findings would also have implications for other areas of the country having relevance to the socio-cultural context of the study area. The investigator believes that the findings of the study would reveal the phenomenon related to diffusion of innovation. These would be of special interest to the policy makers and planners in formulating and redesigning the extension programmes especially for rice cultivation. The findings were expected to be helpful to the field workers of different nation building departments and organizations to develop appropriate extension strategies for effective working with the rural people.

1.6.Limitations of the Study

Considering the time, money and other necessary resources available to make the study manageable and meaningful, it was necessary to consider the following limitations:

1. The study was confined in two villages of one union under Modhukhali upazila of Faridpur district.
2. Ten characteristics of rice growers were selected.
3. Head of the farm families were considered as the population of the study.
4. There are many technologies associated with rice production. Here,seasonal abundance, broadcasting method, seedling growing method, seedling age, line transplanting method, balance fertilizer dose, supplementary irrigation and plant protection measures were considered.
5. The study was confined with the rice growers during one season of the year 2014-2015.

1.7. Assumptions of the Study

An assumption is the supposition that an apparent fact or principle is true in the light of available evidence (Goode and Hatt, 1952). The researcher had the following assumptions in mind while undertaking this study:

1. The respondent included in the sample was capable of providing proper answer to the question in the interview schedule.
2. The researcher who acted as interviewer was adjusted to social and environmental condition of the study area. Hence, the data collected by him and the respondents were free from bias.
3. The responses furnished by the respondents were reliable. They expressed the truth about their conviction and opinions.

4. Views and opinions furnished by farmers included in the sample were representative views and opinions of the whole population of the study.
5. The finding of the study will have general application to other parts of the country with similar, socio-economic, cultural and agro-ecological conditions of the study area.
6. The respondents were more or less conscious about the use of rice production technologies.

1.8. Definition of Key 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 (Wilkinson and Bhandarkar, 1977). A researcher needs to know the meaning and contents of every term that he used. 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 are interpreted as follows:

Adoption: It is the decision to make full use of an innovation as the best course of action available (Rogers 1983)

Age: It refers to the period of time from his birth to the time of investigation. In this study the age of rice growers were considered only.

Agricultural knowledge: It is the extent of basic understanding of the farmers in different aspects of agricultural subject matters i.e. crops, livestock, fisheries, agro forestry, soil, seed, fertilizer, insects and diseases of crops, high yielding variety etc. It includes the basic understanding of the use of different agricultural inputs and practices.

Annual family Income: It refers to the earning by the respondents himself and the members of his family from agriculture and other sources during a year. It is expressed in Taka.

Assumption: An assumption is "The supposition that an apparent fact of principle is true in the light of the available evidences" (Good, 1945).

Attitude towards rice cultivation: The term attitude towards rice cultivation of an individual was used to refer to his feelings, belief and action tendencies towards the various aspects of rice cultivation i.e. knowledge + beliefs + action = attitude

Balanced fertilizer dose: The balanced fertilizer dose is refers the recommended doses of various chemical fertilizer for Modhukhali upzilla, Faridpur.

Commercialization: It refers to the sold price of crops out of his produced price of crops of a rice grower in a year.

Cosmopoliteness: It refers to the degree of external orientation of a rice grower to his own social system.

Education: Education refers to the desirable change of human behavior, i.e. change in knowledge, skill and attitude of an individual through reading, writing and other related activities. In this study education status of rice growers of Modhukhali upazila under Faridpur district was taken into consideration.

Extension contact: It is referred to the respondent's becoming accessible to the influence of different information media through different extension teaching methods.

Extent of adoption: Ray (1991), defined extent of adoption as "The degree to which the farmer has actually adopted a practice"

Family size: It refers to the total number of family members of selected rice growers.

Farmers/growers: The persons who were involved in farming activities are called farmers. They participated in different farm and community level activities like crops, livestock, fisheries, other farming activities etc.

Farm size: Farm size refers to the total area of rice grower on which family carry out farming operation. The area was estimated in terms of full benefit of the farmer's family.

Hypothesis: Defined by Goode and Hatt (1952), a proposition which 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.

Innovation: An innovation is an idea, practices or object perceived as new by an individual. In this study, rice crop is treated as innovation.

Innovativeness: According to Rogers (1995) Innovativeness is the degree to which an individual is relatively earlier in adopting agricultural innovations, new ideas, practices and things than the other members of a social system.

Null hypothesis: The hypothesis which is picked for statistical test is null hypothesis (Ho). In this study the null hypothesis was stated that there was no relationship between the concerned variables and adoption of selected recommended rice technologies.

Organizational participation: Organizational participation of a rice growers refers to his direct contact with various organizations within a specific period of time. An individual could take part in various activities of organization as ordinary member, executive committee member or officer (president, secretary etc). All these forms of participation were considered to operationalize the variable.

Problem: Problem referred to a difficulty about which something to be done. Problem faced by the farmers in this study was defined as the extent of difficulties faced by growers in the way of adoption of rice production technologies.

Research methodology: Research methodology is the description, explanation and justification of various methods of conducting research. It may be understood as a science of studying how research is done scientifically. In it we study the various steps that are generally adopted by a researcher in studying the research problem along with the logic behind them.

Respondents: People who have answered questions by an interviewer for a social survey. They are the people from whom a social research worker usually gets most data required for his research.

Chapter 2

REVIEW OF LITERATURE

The purpose of this Chapter is to review the literature having relevance to the present study. The researcher made an elaborate search of available literature for the above purpose. The researcher attempted to search the literatures on a number of studies have been conducted on the adoption of innovations by the farmers. Therefore, the findings of such studies related to the extent of adoption of selected rice cultivation by the farmers and other partial studies have been reviewed in this Chapter. This Chapter is divided into four sections; the first section deals with the concept of diffusion and adoption of innovation, the second section with past research findings relating to adoption of innovations, the third section with past research findings relating to the relationships of farmers adoption of innovations with their selected characteristics and the fourth section with the conceptual framework of the study.

2.1 Concept of Adoption, diffusion, adoption process and innovation-decision process:

2.1.1 Adoption

Adoption is decision to use and continue to use of the innovation for a certain period of time. Adoption is a decision to make full use of innovation as the best course of action available (Ray, 1991). When an individual takes up a new idea as the best course of action and practices it, the phenomenon is known as adoption.

2.1.2 Diffusion

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of social system (Rogers, 1995). Adoption process: Rogers and Shoemaker (1971) stated the adoption process as: the traditional view of the innovation-decision process, called "adoption process" was postulated by a committee of rural sociologists in 1955 as consisting of five stages:

Awareness stage: The individual learns of the existence of the new idea but lacks detailed information about it.

Interest stage: The individual develops interest in the innovation and seeks additional information about it.

Evaluation stage: The individual makes mental application of the new idea to his present and anticipated future situation and decides whether or not try it.

Trail stage: The individual actually applies the new idea on a small scale in order to determine its utility in its own situation.

Adoption stage: The individual uses the new idea continuously on a full scale.

2.1.3 Innovation-decision process

The innovation-decision process is the process through which individual (or other decision making unit) passes from knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of new idea and to confirmation of this decision (Rogers, 1995). This process consists of series of actions and choice over time through which an individual or organization evaluates a new idea into ongoing practices. The behavior consists essentially of dealing with the uncertainty that is inherently involved in deciding about a new alternative to those previously in existence. It is the perceived newness of the innovation and the uncertainty associated with this newness that is a distinctive aspect of innovation-decision making.

2.2 Review of literature on general content of adoption

Hossain (2006) revealed that the highest proportion (49 percent) of farmers had medium adoption , while 26 percent had high adoption and 25 percent had low adoption of selected high yielding varieties of rice.

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 modem Boro rice cultivation practices.

Rahman (2003) revealed that about half (47 percent) of the growers had medium adoption, 44 percent had low and 1 percent had high adoption of year round homestead fruit 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.

Rahman (2003) found that ninety seven percent of the pineapple growers adopted 2-4 intercrops *viz*, Zinger, turmeric, sweet ground and aroid in pineapple cultivation.

Salam (2003) found that an overwhelming majority (94 percent) of the respondents were found having high constraints in adopting environmentally friendly farming practices while 6 percent had medium constraints. No farmer was found having low constraint.

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.

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.

Rahman (2003) revealed that about half (47 percent) of the growers had medium adoption, 44 percent had low and 9 percent had high adoption of year-round homestead fruit cultivation practices.

Sardar (2002) studied on adoption of IPM practices by the farmers under PETRRA Project of RDRS. He observed that majority (45.9 percent) of the farmers had medium, 38.3 percent had low and 15.8 percent had high adoption of IPM practices.

Zegeye *et al*. (2002) studied the determinants of adoption of improved maize technologies in major maize growing region of Ethiopia. He found that the rate of adoption of improved maize varieties and chemical fertilizer, factors affecting the adoption of improved maize varieties and the determinant factors affecting adoption of chemical fertilizers are also highlighted.

Gebre (2002) conducted a study on Maize technology adoption in Ethiopia. This study presents the results of the Sasakawa-Global 2000 Agriculture program in Ethiopia and its influence on agricultural research and maize production in the region. The Sasakawa-Global 2000 is an international non-government organization initiated in 1986 because of the 1984-85 famine in Ethiopia, with the aim of empowering Africa to produce its own food through the adoption of improved agricultural technologies.

Alexznder and Goodhue (2002) conducted the study on pricing of innovations. They evaluate the producer's returns to planting patented seed innovation, using a calibrated optimization model of a south-central maize producer's adoption decision in Iowa, USA. Their results suggest that patented seed innovations do not increase the market power of biotechnology firm in the relevant market for production system.

Swinkels *et al*. (2002) studied assessing the adoption potential of hedgerow intercropping for improving soil fertility, in western Kenya. They conduct thatthe average cost of hedgerow intercropping was 10.5% (SD = 5.5) when based on returns to land and 17.5% (SD = 6.5) based on returns to labour. Fifth planted additional hedges and only 14% did so to improve soil fertility. It thus appears that the potential for its adoption as a soil fertility practices. Hedgerow intercropping appears to have greater adopter potential if its aim is to provide feed for an intensive dairy operation or for curbing soil erosion.

Sardar (2002) studied on "adoption of IPM practices by the farmers under PETRRA Project of RDRS. He observed that majority (45.9 percent) of the farmers had medium, 38.3 percent had low and 15.8 percent had high adoption of IPM practices.

Aurangojeb (2002) studied on the extent of adoption of integrated farming technology by the rural women in RDRS. He observed that the highest percent of rural women (64%) used high level, 28% of the women used medium level and only 8% used low level integrated homestead farming technologies.

Haider *et al*. (2001) observed that one-third (37 percent) of the farmers fell in low adopter category compared to 32.5 percent falling in optimum adopter 23.5 percent above optimum adopter and only 7 percent had non-adopter on Nitrogenous fertilizer. In respect of extent of phosphoric fertilizer two thirds (68 percent) of the farmers had non adopter category compared to 23 percent having above optimum adopter, 5 percent optimum adopter and only 4 percent had below optimum adopter of phosphoric (P) fertilizer. In respect of extent of potassic fertilizer three quarters categories compared to 10 percent falling bellow optimum adopter, 8 percent optimum adopter and only 3 percent above optimum adopter of potassic (K) fertilizer.

Haider *et al*. (2001) studied the adoption level of improved Package of practices for T. aman rice cultivation in Gouripur upazila of Mymensingh district. He found that the adoption level of farmers categories were 5 percent non adoption, 62 percent low adoption, 24.5 percent medium adopter and 8.5 percent high adopter. Vast majority (95 percent) of the farmers adopted MV programme of T. aman rice.

Podder and Kashem (2000) studied on, Use of Extension Contact Media by the farmers in the Adoption of Mehersagar banana. They concluded that about half (47%) of the growers had medium adoption compare to 14 percent low adoption and 39 percent high adoption of Mehersagar banana.

Rahman (1999) studied the adoption of balanced fertilizer by the boro rice farmers of Ishwarganj thana. He found that the extent of use of balanced

nitrogenous fertilizer, 48.57 percent of the farmers had optimum adoption and above optimum respectively. In respect of extent of use of balanced phosphoric fertilizer, 79.05 percent of the farmers had below optimum adoption compared to 20.95 percent having optimum adoption. Regarding the extent of use of balanced potassic fertilizer, 80.95 percent of the farmers had below optimum adoption compare to 18.10 and 0.95 percent having optimum and above optimum adoption, respectively.

Mostafa (1999) studied the adoption of recommended mango cultivation practices by the mango growers of Nawabganj Sadar thana. He found that about half (49 percent) of the mango growers had "low adoption" 31 percent "very low" adoption and 20 percent had "medium" adoption of fertilizers.

Muttaleb *et al*. (1998) found that over all adoption of plant protection practices was medium. Among the plant protection practices high adoption were observed in fungicides, insecticide and soil treatment and low adoption were found that treatment and low adoption were found in suberization of cut tuber hand picking of cutworm and rouging of diseased plant.

Islam (1996) carried out a study on farmer's use of indigenous technical knowledge (ITK) in the context of sustainable agricultural development. He found the extent use of ITK by individual farmers that, the highest proportion (42.73 percent) of the respondents belonged to the lower user category as compared to 41.82 percent in the moderate user category and 15.45 percent in the higher user category, respectively.

Hasan (1996) found in his study that the highest proportion (44 percent) of the respondents perceived the existence of medium adoption, compared to 26 percent low adoption and 3 percent high adoption in respect of selected agricultural technologies.

Siddaramaiha *et al*. (1995) studied adoption of improved Seri-cultural practices among big and small farmers. They indicate that there was cent percent adoption in following the recommended system of planting by both big and small farmers. Other practices adoption by a large percentage of farmers was:

optimum time of planting (95%), adoption of recommended irrigation schedule (93.75%), recommended spacing (91.25%) and the use of improve variety of mulberry crop (87.50%). Nearly half of the respondents used the recommended quantity of farmyard manure and plant protection chemicals in mulberry cultivation.

Nikhade *et al*. (1995) found that the adoption gap about the use of recommended technology of cotton among cotton growers was found to be about 30 percent which was quite high.

Nikhade *et al*. (1993) observed in their study on adoption of improved practices of soybean cultivation that cent percent adopted improved varieties. More than 82 percent had complete adoption of package practices like timely sowing, spacing and inter cultural operations. Partial adoption was observed in majority of the soybean growers (74.6 percent) with regard to recommended seed rate.

Kashem *et al.* (1992) conducted a study on adoption behaviour of sugarcane growers of Zilbangla Sugar Mill, Dewanganj. Jamalpur, Bangladesh. They found among the sugarcane growers, 89 percent had high level of adoption of recommended practices of sugarcane.

Singh *et al*. (1992) undertook a research study in India on factors affecting the adoption of improved sugarcane production technology. They observed that majority of sugarcane growers had the medium level of adoption and were partial adopters of scientific recommendations of sugarcane production technology.

Juliana *et al*. (1991) undertook a study on adoption of integrated pest management practices in five villages of vasusdevanallar block in Tirunelvi district, Tamilnaru, India. They found that about 50 percent of marginal farmers, 47.50 percent of small farmers and 52.50 percent of big farmers had medium adoption and 42.50 percent of big farmers, 22.50 percent of small farmers and 5 percent of the marginal farmers had high level of adoption. In both adoptions level of big farmers' participation was higher in comparison to other categories of farmers.

Gogoi and Gogoi (1989) conducted a study on adoption of recommended plant protection practices in rice in Zorhat district of Assam state in India. The study revealed that among the respondents, 50 percent had low level of adoption, 35.36 percent medium level of adoption and 13.64 percent had high level of adoption of recommended plant protection practices.

Karim and Mahboob (1986) studied the adoption of HYV wheat in Kushtia union of Mymensingh district. They found that among the respondent wheat farmers 74 percent adopted HYV wheat cultivation and 26 percent farmers were non-adopters.

Rahman (1986) conducted a research study on the extent of adoption of four improved practices, which were use of fertilizers, line sowing, irrigation and use of insecticides in transplanted aman rice cultivation in two village of Mymensingh district. It revealed that 22 percent of the farmers adopted all the four practices compared to 49 percent adopted three practices, 22 percent adopted two practices, 5 percent adopted one practices and only 2 percent adopted of the four practices.

Hossain (1983) studied the extent of adoption of HYV rice as transplanted aman and other related aspect in Bhabalhali union of Mymensingh district. He observed that among the respondent farmers, 54 percent had high adoption of HYV rice and 46 percent had medium adoption of HYV rice as transplanted aman.

Razzaque (1977) studied on the extent of adoption of HYV rice in three villages of Bangladesh Agricultural University Extension Project area. He observed that among the respondent growers, 6.6 percent of the farmers had high adoption of HYV rice, 33.3 percent had medium adoption and 40 percent low adoption.

Sobhan (1975) studied on the extent of adoption of ten winter vegetables namely tomato, radish, lettuce and potato in Boilar union of Mymensingh district. Over all winter vegetable adoption scores of the farmers could range from 0 to 140. Over all adoption scores indicated that 27 percent of the farmers

did not adopted winter vegetables cultivation while 28 percent had low adoption and 55 percent high adoption.

Mohammad (1974) studied the extent of adoption of insect control measures by the farmers in Khamar union of Rajshahi district. He found that among the respondent farmers, 25 percent did not adopt insect control measure; 28 percent had high level of adoption; 32 percent had medium level of adoption and 25 percent had low level of adoption.

Rahman (1974) studied the adoption of IR-20 variety of paddy in Bhabakhali union of Mymensingh districts. He found that 29 percent of the growers had medium apoption of IR-20 while 31 percent of the growers did not adopt the innovation.

Karim (1973) conducted a study on the adoption of fertilizers by transplanting aman growers in former Keyotkhali union of Mymensingh district. He studied the adoption of three fertilizers-urea, super phosphate (TSP) and muriate of potash (MP). He found that 4 percent of the respondent growers had high adoption of fertilizers while 9 percent had medium adoption and 41 percent low adoption. Remaining forty six percent (46 percent) of the respondent growers did not use any of the three fertilizers.

Hossain (1971) carried out a research study on the adoption of four improved practices in Gouripur of Mymensingh district. The practices were (i) plant protection measure, (ii) recommended variety of paddy, (iii) line transplanting and (iv) recommended dose of fertilizers. It revealed that among the respondedfarmers 57.40 percent adopted plant protection measure, 35.51 percent adopted recommended variety of paddy, 25.36 percent adopted line transplanting and 11.52 percent adopted recommended dose of fertilizers.

2.3 Relationship between Farmers' Characteristics with their Adoption of Production Technologies

2.3.1 Age and adoption

Sardar (2002) found that the age of the farmers had positive significant negative correlation with their adoption of IPM practices.

Aurangozeb (2002) observed that there was significant negative relationship between age and adoption of integrated homestead farming technologies.

Hussen (2001) found that the age of the farmers had negative significant relationship with their adoption of modern sugarcane cultivation practices.

Sarker (1997) observed that there was no significant relationship between ages of the farmers with their adoption of improved potato cultivation practices.

Islam (1996) conducted a study on farmers' use of indigenous technical knowledge (ITK) in the context of sustainable agricultural development. He found that age of the farmers had significant negative relationship with their extent of use of ITK.

Islam (1993) observed that there was no relationship between the age of potato growers with their adoption of improved practices in potato cultivation. Similar results were observed by Karim and Mahaboob (1986), Rahman (1986), Singh (1992), Kher (1992), Pathak *et al*. (1992),

Kashem (1991) observed that there was positive and significant relationship between the age of the marginal farmers with their adoption of jute technologies. Similar results were found by Ali *et al*. (1986), Singh and Rajendra (1990), Okoro *et al*. (1992), Narwal *et al*. (1991) and Hossain *et al*. (1991).

2.3.2 Education and adoption

Hossain (2006) concluded that the education of the farmers had a significant and positive relationship with their adoption selected of HYV rice. Similar findings were also observed by Humid (1995, khan (1993) and Haque (1993).

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

Sardar (2002) found that the education of the farmers had significant positive relationship with their adoption of IPM practices.

Aurangozeb (2002) studied on the extent of adoption of integrated homestead farming technologies by the rural women in RDRS. He observed that there was positive relationship between education and adoption of integrated homestead farming technologies.

Hussen (2001) indicate that the education had positive significant relationship with their adoption of modern sugarcane cultivation practices.

Sarker (1997) conducted a study to determine the relationship between selected characteristics of 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. Similar results were found by

Kashem (1991). Hasan (1996) concluded a study on adoption of some selected agricultural technologies among the farmers as perceived by the frontline GO and NGO workers. He observed that education have no significant relationship with the perceived adoption of selected agricultural technologies. Similar results were found by Kher (1992) and Islam (1996). Bavalatti and Soundaarswamy (1990) observed no significant relationship between education of the farmers and their adoption of dry land farming practices.

Kaur (1988) found that education influenced the opinion of the women about adoption of vegetable gardening animal husbandry etc.

2.3.3 Family size and adoption

Hossain (2006) concluded that family size of the farmers had significant relationship with their adoption of HYV rice.

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

Sardar (2002) found that the family size of the farmers had significant positive relationship with their adoption of IPM practices.

Hossain (1999) conducted a study to determine the farmers' perception of the effects of agro-chemicals on environment. He found no relationship between the farmer's family sizes with their adoption of fertilizer.

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

Hossain (1991) in his study in sadar thana of Jamalpur observed that family size of the farmers had no significant effect on their adoption of improved farm practices. Similar results were observed by Sobhan (1975), Hoque (1993), Bashar (1993),

Hossain (1999) also found that family size of the farmers had positive significant relationship with the adoption of agro-chemical. Similar results were also observed by Pal (1995), Muttalab (1995), Sarker (1997), Chowhdury (1997), Rahman (1986), Hoque (1993) and Khan (1993).

2.3.4 Farm size and adoption

Hossain (2006) found that the farm size of the farmers had an insignificant relationship with their adoption of selected HYV rice.

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

Sardar (2002) found that the farm size of the farmers had significant positive relationship with their adoption of IPM practices.

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 of Aalok 6201 hybrid rice.

Hussen (2001) found that the farm size had positive significant relation with their adoption of modern sugarcane cultivation practices.

Alam (1997) studied the use of improved farm practices in rice cultivation by the farmers. The findings of the study showed that the farm size had a significant relationship with their use of improved farm practices in rice cultivation. Islam (1996) found that there was significant and negative relationship between the farm size of the farmers with their extent of use of indigenous technical knowledge. Ali et at. (1986), Hoque (1993), Hasan (1996), and Rao (1976) observed similar relationships.

Hossain and Crouch (1992) studied the relationship of farm size with adoption of farm practices. They found positive relationship between the farm size and adoption of farm practices. Similar result was found by Kashem (1991). 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.

Hossain (1983) found that size of the farm of transplanted aman farmers in Bhabakhali union of Mymensingh district had a negative relationship with their adoption of HYVT-aman rice.

2.3.5 Annual family income and adoption

Hossain (2003) revealed that annual income of the farmers had a significant relationship with their adoption at modern Boro rice cultivation practices.

Aurangozeb (2002) observed that there was a positive relationship between annual income from field crop and adoption of integrated homestead farming technologies.

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

Hussen (2001) found that the annual income had positive significant relationship with their adoption of modern sugarcane cultivation practices.

Sarker (1997) found that family income of potato growers had a significant positive relation with their adoption of improved potato cultivation practices. Similar results were observed by Hossain (1999), Rahman (1986), Kashem (1991), Pal (1995), Islam (1993), and Khan (1993).

Islam (1996) found a significant negative relationship between the annual income of the farmers and their extent of use of ITK. Hossain (1983) and Hoque (1993) found similar results.

Singh (1991) in a study found that income of the farmers was significantly associated with the level of adoption of plant protection measures.

2.3.6 Organizational participation and Adoption

Hossain (2006) revealed that organizational participation of the farmers had no significant relationship with their adoption of HYV rice.

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

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 organizational participation of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

Mostafa (1999) conducted a study on adoption of recommended mango cultivation practices by the mango growers of Nawabganj Sadar thana. He found that organizational participation of mango growers had a significant positive relationship with their adoption of recommended mango cultivation practices.

Sarker (1997) conducted a study on correlates of selected characteristics of potato growers with their adoption of improved potato cultivation practices in five village of Comilla district. He observed that organizational participation of the potato growers had no relationship with their adoption of improved potato cultivation practices.

Kher (1992) carried out a research study on the adoption of improved wheat cultivation practices by the farmers in selected village Rajouri block, India. He observed that there was no significant relationship between the farmers' social participation and their adoption of improved wheat cultivation practices.

2.3.7 Innovativeness and Adoption

Aurangozeb (2002) observed that there was significant relationship between innovativeness with adoption of integrated homestead farming technologies.

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

Hossain (1999) found a positive significant relationship between innovativeness of the farmers and their adoption of fertilizer and also observed no relationship with adoption of pesticides.

Rahman (1973) found a positive relationship between modernism and adoption of farm practices. He defined modernism as leading for new experience or opener to innovation. So, modernism as used by him is synonymous with the innovativeness of the present study.

2.3.8 Extension media contact and adoption

Hossain (2006) concluded that the extension contact of the farmers had positive significant relationship with their adoption of selected HYV rice.

Haque (2003) concluded that extension contact of the farmers had significant positive relationship with their adoption of modern maize cultivation technologies.

Sardar (2002) concluded that the extension contact had positively significant relationship with their adoption of IPM practices.

Aurangozeb (2002) observed that there was significant relationship between contact with extension media and adoption of integrated homestead farming 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 extension contact of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

Hussen (2001) found that the extension media contact had positive significant relationship with their adoption of modern sugarcane cultivation practices.

Sarker (1997) observed a positive and significant relationship between extension contact and adoption of improved potato cultivation practices. Karim (1973), Kashem *et al*. (1990), Kashem (1991), Pathak *et al*. (1992), Kher (1992), Islam (1993), Hoque (1993) and Pal (1995) also found the similar results.

Slade *et al*. (1988) studied that adoption rates among farmers receiving one or more VEW visits per month were generally higher than those farmers who were not visited by VEW'S contact farmers were better adopter of some technologies that non contact farmers.

Osunloogun *et al*. (1996) studied adoption of improved Agricultural practices by co-operative farmers in Nigeria. The findings of the study indicated a positive relationship between extension contact and adoption improved practices.

Bezbora (1980) studied adoption of improved agricultural technology by the farmers of Assam. The study indicated a positive relationship between extension contact and adoption of improved cultivation practices.

2.3.9 Training exposure and Adoption

Islam (2002) conducted a study on farmers' knowledge and adoption of ecological agricultural practices under the supervision of Proshika. He found that agricultural training experience of the farmers had no significant relationship with their adoption of ecological agricultural practices.

Rahman (2001) observed in study that training received of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

2.3.10 Rice Production knowledge and adoption

Reddy *et al*. (1987) found significant association between knowledge and use of improved package of practices in paddy production by participant and non-participant farmers.

2.4 The Conceptual Framework of the study

In scientific research, selection and measurement of variables constitute an important task. The hypothesis of a research while constructed properly contains at least two important elements i.e. “a dependent variable” and “an independent variable”. A dependent variable is that factors 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. In view of prime findings of review of literature, the researcher constructed a conceptual framework of the study that is self-explanatory and is presented in Fig. 2.1.

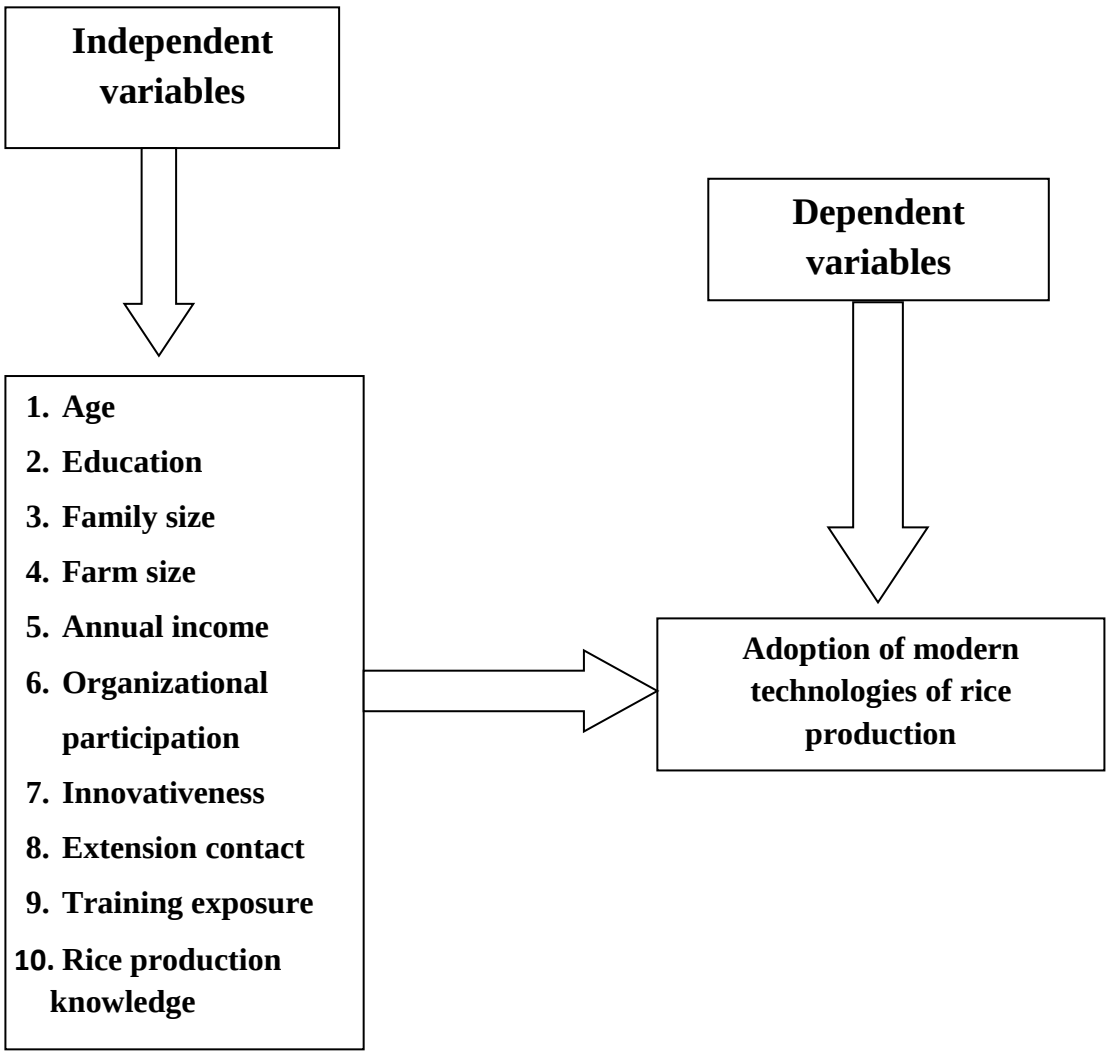

Fig. 2.1 Conceptual Framework of the study

Chapter 3

METHODOLOGY

Methodology is one of the most important components for a scientific research. It refers to the methods and procedures in the research work. For any scientific investigation methods and procedures are very important and require a very careful observation. The researcher was very much careful for using proper methods in all aspects of the investigation. Methods and procedures followed in conducting the study have been discussed in this chapter. Further, the chapter includes the operational format and comparative reflection of some variables used in the study. Also statistical methods and their use have been mention in this chapter.

3.1 Locale of the Study

Two villages namely Noapara and Kuraniarchor of Modhukhaliupazila under Faridpur district were randomly selected as the locale of the study. This location was selected due to easy communication as well as easy contact with the rice growers of the study. The study area is about 50 km from the district head quarter and situated south-west side of the district. Fig. No.3.1and 3.2 shows the map of the locale of the study.

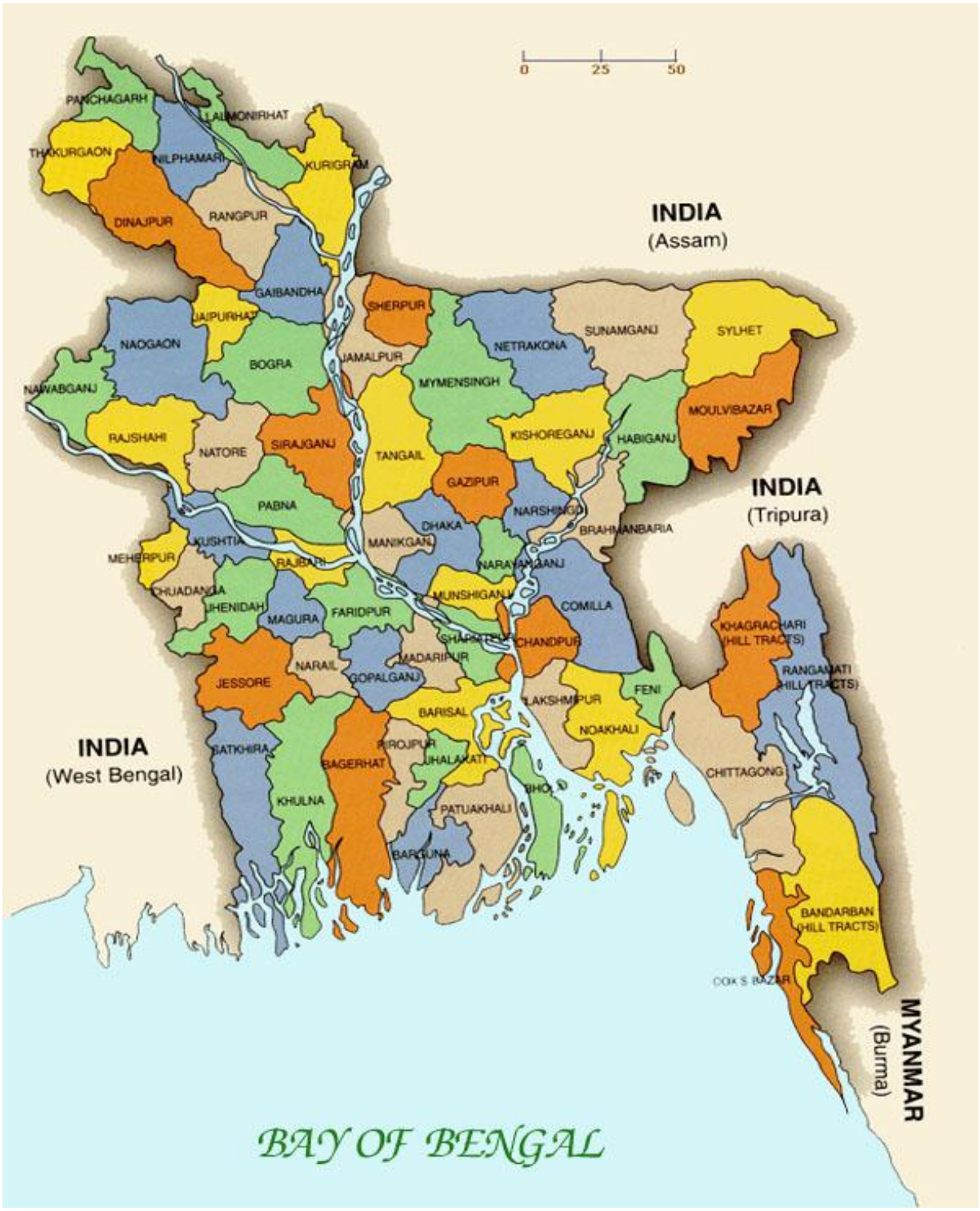

Figure 3.1 Map of Bangladesh showing Faridpur district

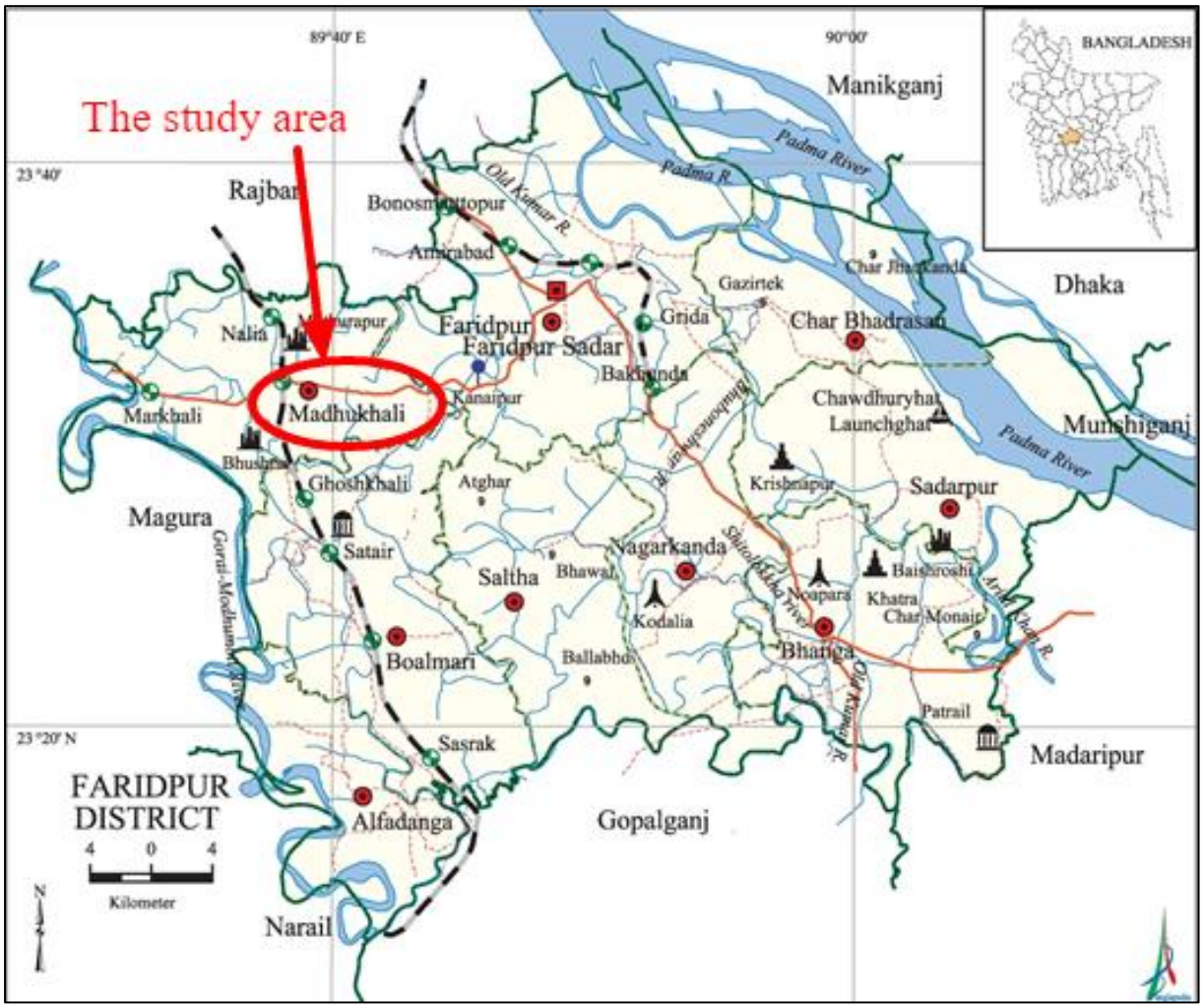

Fig. 3.2 Map of Faridpur showing Madhukhali upazila

3.2. Population and Sampling Design

All rice growers of Noapara and Kuraniarchor villages of the selected union of Modhukhali upazila constituted the population of the study. Update lists of all farm family heads of the selected villages were prepared with the help of Sub-Assistant Agriculture officer (SAAO) andUpazilla Agricultural Office (UAO). There were 1107 farmers in Noapara and Kuraniarchor of Modhukhalivillages which constituted the population of the study.

3.2.1. Study Group (SG) Sampling

There are several methods for determining the sample size. Here, researcher used Yamane's (1967) formula for study group:

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

Where,

n = Sample size;

N, Population size = 1107;

e, The level of precision = 9% ;

z = the value of the standard normal variable given the chosen confidence level (e.g., z = 1.96 with a confidence level of 95 %) and

P, The proportion or degree of variability = 50%;

So, the sample size (n) is = 107.

3.2.2.Distribution of the Population of Sample Size

According to Yamane's formula, the respondent comprising 107 farmers.

Respondents were selected as the sample of the study by using Yamane's formula. Thus, the sample size of the study was 107 rice growers. A reserve list of ten farmers was also prepared by the same method 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 data collection. The distribution of the population sample and number of farmers in the reserve list are shown in Table 3.1

Table 3.1 Distribution of population and sample of respondents in two selected villages of Modhukhali upazila.

Sl. No.	Name of the villages	Total Population	Sample size	Number of farmers in the reserve list
01.	Noapara	658	62	6
02.	Kuraniarchor	449	54	4
Total		1107	107	10

3.3. Development of the Instrument

In order to collect necessary information from respondents,an easy and realizable interview schedule was carefully designed focusing the objectives of the research work. Both open and close format ofquestions that asked to the respondents simply and directly were included in the interview schedule.The questions were systematically arranged to help the respondents to understand the consequence easily. Scales were developed for collecting information required for measuring the selected characteristics.

3.4 Validity and reliability

An instrument is considered as valid when it measures what it claims to measure. It is usually considered to be valid when the objectives of the study are reflected in the instrument. The termvalidity refers as "Descriptive term used for a measure that accurately reflects the concept that is included to measure" Bobbie (1986). A test or scale is reliable if it yields consistent results when repeated measurements are taken on the same subjects under the similar condition. In the present study adequate care was taken to prepare the data collecting instruments in general and the scales in particular. Based on the comments and suggestions made by the experts, the interview schedule was modified and used for pilot testing.

3.5 Pilot Testing and Final Version

Borg and Gall (1979) indicated that the instrument with a sample of instrument with a sample of individuals similar to the groups one wishes to use in the research should be tested in a pilot programme before using the instrument in the actual study. Accordingly the interview schedule that was initially developed was tested with a similar group of farmers to be excluded for sampling. The rice growers were interviewed by using the instrument. The pretest helped to examine the suitability of different questions and statements of the instrument.

Necessary corrections, additions, alterations and rearrangements were made in the schedule on the basis of the experience of the pretest. Thus, the final version of the instrument was developed for collation of data from intended respondents.

3.6 Data Collection

Data were collected personally by the researcher himself by taking interview of the target people with the help of interview schedule. The researcher made all possible efforts to explain the purpose of the study to the farmers. Rapport was established with the farmers prior to interview and the objectives were clearly explained by using local language as far as possible. As a result, the respondents did not hesitate to furnish proper responses to the questions and statements which were collected during the period from 15 March to 30 June, 2015.The researcher required the help from the local leaders and the Sub-Assistant Agricultural officer for this purpose. Excellent co-operation was obtained from the respondents, the concerned local leaders,Sub-Assistant Agriculture Officer and Upazila Agriculture Officer of Modhukhaliupazila.

3.7 Data Coding and Tabulation

A detailed coding plan was prepared with the help of experts concerned about the survey data. Data were coded into a coding sheet. These were then compiled, analyzed in accordance with the objectives of the study by usingstatistical data analysis software of a computer system. Qualitative data were converted into quantitative form by means of suitable scoring techniques for the purpose of analysis.

3.8. Variables of the Study

Selection and measurement of variables is very essential task for any descriptive research. A research hypothesis contains at least two important components first one is independent variable and second one is dependent variable. An independent variable is the factor which is manipulated by the experimenter to ascertain its relationship to an observed phenomenon. A dependent variable is the factor which appears, disappears or varies as the experimenter introduces, removes or varies the independent variable (Townsend, 1953).Measurement of the variables of the study are discussed below:

3.8.1 Measurement of independent variables

The independent variables of this study were ten (10) selected characteristics of the rice cultivation farmers. These were: age, education, family size, farm size, annual family income, organizational participation, Organizational participation, Innovativeness,extension contact, Training exposure and Rice production knowledge**.** The procedures followed in measuring the independent variables are briefly discussed below:

3.8.1.1 Age

The age of arespondent is one of the important factors pertaining to his personal characteristic (Smith and Zope, 1970) which can play an important role in his adoption behavior. The age of respondent was measured by counting the actual years from his birth to the time of taking interview. It was measured in terms of actual years. No fraction of year was considered. A score of one (1) was assigned for each years of age. Age was placed in item no. 1 of the interview schedule.

3.8.1.2 Education

Education was the most important factor to understand the modern practices of rice production. It measured by the number of classes passed by a respondent. Zero (0) for no schooling, A score half (0.5) was assigned to those respondents who could sign only, One (1) score was assigned for each year of schooling. For example, if a respondent passed class VIII his education score was 8.

3.8.1.3 Family size

Family size of a respondent was determined in term of actual numbers in his family including him. His wife, sons, daughters, brothers, sisters, parents and any other person who jointly live and eat together at the time of data collection. The scoring was done by the actual number mentioned. For example, if a respondent had seven members in his family then the family size score would be seven (7).

3.8.1.4 Farm size

Farm size was calculated as the size of his farm (including rice and other crops production) on which he continued his farming operations during the period of study. It included the area of farm owned by him as well as those obtained from others as sharecropping, lease or mortgage or borga. The area was being estimated in terms of full benefit to the growers in term of hectare. The farm size of a respondent was measured by using the following formula:

$FS = A_1 + A_2 + 1/2(A_3 + A_4) + A_5$

Where,

FS = Farm size

A_1 = Homestead area (with kitchen garden and pond)

A_2 = Own land under own cultivation

A_3 = Land taken from other on borga

A_4 = Own land given to others on borga

A_5 = Land taken from others on lease

3.8.1.5 Annual family income

Annual family income of respondents was determined on the basis of his earnings from agriculture and other various sources of his family during 2014 - 2015.For calculation of income score, one (l) was assigned for each one thousand taka income.

3.8.1.6 Organizational participation

Organizational participation of a respondent was computed on the basis of his/her participation in different organizations. This variable appears in item number six (6) in the interview schedule as presented in Appendix-A.

Scoring of the organizational participation was done using the following formula and in the following way-

OP = $P_{om} + P_{em} + P_{eo}$

Where, **OP =** Organizational participation score,

P_{om} = Participation as ordinary member,

P_{em} = Participation as executive member and

P_{eo} **=** Participation as executive officer (president/secretary).

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

For example, if a respondent participated as an executive committee member of school committee, an ordinary member at NGO organized society and no participation in other organizations, that respondent would have a total score 3.

3.8.1.7 Innovativeness

Innovativeness of a rice grower was measured by computing an 'innovativeness score' on the basis of his adoption of 10 selected modern rice production technologies. Innovativeness is the degree to which an individual adopts an innovation relatively earlier than other members in a social system (Rogers, 1995). Scores were assigned on the basis of time required by an

individual to adopt each of the technology in the following manner (Appendix-A):

Period of Adoption	Assigned Score
Within one year	4
Within one to two years	3
Within two to three years	2
Within three to four years	1
Do not use	0

The scores for all the 10 selected modern rice production technology were added together to constitute the innovativeness score of a respondent. Innovativeness score of a rice growers could range from 0 to 40 where 0 indicating no innovativeness and 40 indicating very high innovativeness.

3.8.1.8 Extension contact

This term refers to one's becoming accessible to the influence of extension programme through different communication media and sources. Here the score was measured as 0 for not at all, 1 for rarely, 2 for occasionally and 3 for frequently of the contact respectively. Logical frequencies of contacts were assigned to those alternative responses as indicated in question number 8 of the interview schedule. Respondent's extension contact score was obtained adding the weights for his responses to all sources listed in the instrument. The extension contact scores of individuals could range from 0 to 39. Where 0 indicate no extension media contact and 39 indicated the highest extension media contact.

3.8.1.9 Training Exposure

Training experience of a respondent was determined by the total number of day when he/she attended in different training programs in his/her life. A score of one (1) was assigned for each day of training attended. Data obtained in response to item no. 9 of the interview schedule as presented in Appendix-I.

Scoring was done according to survey results and was categorized into 4 levels as no, low, medium and high. According to obtained survey data no, low, medium and high training exposure were classified into 0, 1 – 5, 6 – 15 and > 15 respectively where 0 indicating no training exposure and > 15 indicating higher training exposure.

3.8.1.10Rice production knowledge

To measure the rice production knowledge of a respondent 20 questions were prepared in the interview schedule. Each respondent was asked to answer all the 20 questions. Out of assigned scores against each question, the summation of obtained scores against 20 questions represented the knowledge of modern technologies of rice productionof a respondent. It was measured by the total knowledge score about rice production. The total assigned score was 48 (Item no. 10 Appendix- A). But, the score of each question was not equal; it was determined according to the extent of difficulty. Full score was assigned for each correct answer and zero (0) for the wrong answer. However, for correct responses to all questions, a respondent could get a total score of 48, while wrong responses to all questions he could get 0 (zero). 0 indicating no rice production knowledge and 48 indicates the highest knowledge of modern technology of rice production among the respondents.

3.8.2 Measurement of dependent variable; Adoption of modern practices for rice cultivation

Ten modern practices were selected to measure the adoption behavior of the respondents. The procedure followed in measuring the dependent variable is presented below:

The adoption of modern practices for rice cultivation was measured by percentage of area coverage by the selected practices in last year by using the following formula developed by M.A. Kashem (2004).

$$\text{Extent of adoption} = \frac{\text{Cultivated area (ha) of the selected practices}}{\text{Potential area (ha)}} \times 100$$

Adoption of modern practices of rice cultivation by the farmers was measured by computing an 'adoption score' on the basis of his 10 selected modern practices for rice production technologies. Adoption is the degree to which an individual adopts a technology with an extent of his/her size of land (Rogers, 1995). Scores were assigned on the basis of size of land required by an individual to adopt each of the technology in the following manner (Item no. 11, Appendix-A):

Period of Adoption	Assigned Score
Receive with high extent (>50% land)	3
Receive with medium extent (>25%-50% land)	2
Receive with low extent (<25% land)	1
Do not use at all	0

The scores for all the 10 selected modern rice production technology were added together to constitute the adoption score of a respondent. Adoption score of a rice growers could range from 0 to 30 where 0 indicating no adoption and 30 indicating very high adoption of modern practices for rice cultivation.

3.9 Statement of the Hypothesis

As defined by Goode and Hatt (1952) "A hypothesis is a proposition, which can be put a test to determine its validity. It may observe contrary to, or in accordance with commonsense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test." In studying the relationship between variables, research hypotheses are formulated which state the anticipated relationship between the variables. However, for statistical test it becomes necessary to formulate null hypothesis. A null hypothesis states that

“There is no contribution on the selected characteristics of the farmers and their adoption of modern technologies of rice production.”

If a null hypothesis is rejected on the basis of a statistical test, it is assumed that there is a contribution of the concerned variables. There was no contribution of the selected characteristics of the farmers and their adoption of modern rice production technologies where selected characteristics were: Age, Education, Family size, Farm size, Annual income, Organizational participation, Innovativeness, Extension contact, Training exposure and Rice production knowledge.

3.10 Statistical analysis

The data were analyzed in accordance with the objectives of the proposed research work. Qualitative data were converted into quantitative data by means of suitable scoring technique wherever necessary. The statistical measures such as range, means, standard deviation, number and percentage distribution were used to describe the variables. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Sciences) computer program, version 20. In order to estimate the contribution of the selected characteristics of farmers in the adoption of modern practices in rice cultivation, step-wise regression analysis (B) analysis was used. Throughout the study, ten percent (0.1) level of significance was used as the basis for rejecting any null hypothesis. If the computed value of (B) was equal to or greater than the designated level of significance (*p*), the null hypothesis was rejected and it was concluded that there was a significant contribution between the concerned variable. Whenever the computed value of (B) was found to be smaller at the designated level of significance (*p*), the null hypothesis could not be rejected. Hence, it was concluded that there was no contribution of the concerned variables.

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

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_{9+}b_{10}x_{10+}e;$$

Where, Y= is the adoption of modern technologies of rice production,

Of the independent variables, x_1 is the respondent's age, x_2 is education, x_3 is farm size, x_4 is family size, x_5 is the annual family income, x_6 is organizational participation, x_7 is Innovativeness, x_8 is extension contact, x_9 is training exposure, x_{10} is knowledge on rice production. b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9, and b_{10} are regression coefficients of the corresponding independent variables, and e is random error, which is normally and independently distributed with zero mean and constant variance.

Chapter 4

RESULTS AND DISCUSSION

A consequential and detailed discussion on the findings of the scientific research study has been presented in this chapter. The chapter includes three sections. In the first section, independent variables i.e. characteristics of the respondents have been discussed. The second section dealt with dependent variable i.e., Adoption of selected modern practices for rice cultivation and finally, the relationship between the dependent and independent variables have been discussed in the third section.

4.1 Selected characteristics of the rice farmers

Ten characteristics of the several types of rice growing farmers were selected to describe and to find out their relationships with their adoption of selected modern practices for rice cultivation.

These selected characteristics were age, education, farm size, family size, annual family income, organizational participation, innovativeness, extension contact, training exposure and rice production knowledge. The noticeable topographies of the 10 characteristics of the rice growing farmers, each of which constituted an independent variable.

4.1.1 Age

The age of the sample farmers ranged from 27 to 65 years with an average of 46.58 and standard deviation of 10.435. The respondents were classified into three categories on the basis of their age (Table 4.1) following Rashid*et al*. (2014).

Table 4.1. Distribution of the farmers according to their age

Category	Age range	Observed range	Respondents		Mean	SD
			Number	Percent (%)		
Young	Up to 35	27 – 65	17	15.9	46.58	10.435
Middle	36 - 50		48	44.9		
Old	> 50		42	39.3		
Total	< 35 - > 50		107	100.00		

Data showing that the highest value of proportion 44.9percent of the rice growers were middle aged compared to 39.3percent old and 15.9 percent being young aged. According to Lionberger (1960) elderly farmers seem to be somewhat less motivated to adopt new farm practices than younger ones. Young and middle aged people generally show more favorable attitude towards trying new ideas. The extension agents can target those people in designing their extension activities.

4.1.2 Education

Education of the respondents was measured by following the procedure as discussed earlier in Chapter 3. The education score of the farmers ranged from 0-12, with an average of 5.15 and standard deviation of 3.58. The respondents were classified into five categories on the basis of their education (Table 4.2) following Hossain *et al*. (2011).

Table 4.2. Distribution of the farmers according to their education

Category	Scoring	Observed Range	Respondents		Mean	SD
			Number	Percent (%)		
Can’t read or sign	0	0-12	6	5.6	5.15	3.58
Can sign only	0.5		15	14.0		
Primary education	1 – 5		43	40.2		
Secondary education	6 – 10		37	34.6		
Higher secondary or above	> 10		6	5.6		
Total	0 – 12		107	100.00		

It is determined from the Table 4.2 that 34.6percent comprised secondary education, 40.2 percent comprised of primary education, 5.6percent of the respondents were under can't read or sign, 14.0percent comprised can sign only and only 5.6percent had above secondary education. Table 4.2 also showed that above 74.8 percent out of the selected respondents got primary to secondary level of education. Jalal (2009) also find similar findings.

4.1.3 Farm size

Farm size varied from .002 to 2.00ha with an average of .592ha and standard deviation of .521. The respondents were classified into five categories on the basis of their farm size (Table 4.3) following DAE (Department of Agricultural Extension).

Table 4.3. Distribution of the farmers according to their farm size

Category	Score range (ha)	Observed range	Respondents		Mean	SD
			Number	Percent (%)		
Landless	≤0.02 ha	.002-2.00	8	7.5	.592	.521
Marginal	0.021-0.20 ha		22	20.6		
Small	0.21-1.00 ha		57	53.3		
Medium	1.01-3 ha		20	18.6		
Large	>3 ha		00	00		
Total			107	100.00		

Data in the Table 4.3 reveal that 53.3% of the total respondent had small farm where, 7.5 percent had no own cultivable land, 18.6 percent had medium farm, 20.6percent had marginal farm and no respondent had large farm. Table 4.3 also shows that overwhelming majority (92.5%) of the total respondent as well as modern rice growing farmers had marginal to medium size of farm. Hossain *et al*. (2011) also found similar findings in his study. The average farm size of

the farmers of the study area (.592 hectares) was less than that of national average (0.60 hectare) of Bangladesh (BBS, 2014).

4.1.4 Family size

Family size of the respondents varied from 3 to 10 by family members with an average of 5.80 and standard deviation 1.72. On the basis of family size, the respondents were classified into three categories as shown in Table 4.4.

Table 4.4. Distribution of the farmers according to their family size

Category	Score range	Observed Range	Respondents		Mean	SD
			Number	Percent (%)		
Small	2 - 4	3 to 10	30	28.0	5.80	1.72
Medium	5 - 7		56	52.3		
Large	8 -10		21	19.6		
Total	2 - 10		107	100		

Data shown in the Table 4.4 revealed that 52.3percent of total respondents had medium family size followed by 28.0percent had small family size while 19.6percent had large family size. The findings indicated that average family size of the study area was greater than the national average which is4.85 (BBS, 2014). The fact is that joint family mostly characterized the large families.

4.1.5 Annual family income

The annual family income of the farmers ranges from 40 to 185 thousands taka with the mean and standard deviation of 98.88 and 35.25 respectively. According to their earning from rice cultivation and other sources, they were classified into three categories. The categories and distribution of the respondents were shown in Table 4.5.

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

Category	Scoring (Tk 000')	Observed range (Tk 000')	Respondents		Mean	SD
			Number	Percent (%)		
Low	< 75	40 – 185	24	22.4	98.88	35.25
Medium	75 - 150		68	63.6		

High	> 150		15	14.0		
Total	< 75 - > 150		107	100.00		

Data in the Table 4.5 showed that 63.6 percent of the farmers had medium annual income, 22.4 percent of the respondents had low annual income and 14.0percent had high annual income. Islam (2002) also found almost similar findings in his study. The observations showed that the average income of the farmers was 98.88 that were a medium category income because the percent of medium category farmers were higher than other two categories and more than half of the farmers belonged to medium category farmers. The other reason might be due to the fact that most of the farmers of the study area were not only engaged in agriculture, but also they were engaged service, business etc. Farmers with the low income generally hesitate to adopt innovations in their own farms because of their lower risk bearing ability and their inability to make necessary financial investment.

4.1.6 Organizational participation

The observed organizational participation scores of the farmers ranged from 0 to 8 with an average of 2.40 and standard deviation of 1.94. Depending on the organizational participation scores, the farmers were classified into three categories as shown in Table 4.6.

Table 4.6. Distribution of the farmers according to their organizational participation

Category	Scoring	Observed range	Respondents		Mean	SD
			Number	Percent (%)		
No participation	0	0 - 8	15	14.0	2.40	1.94
Low	1-5		83	77.6		
Medium	6-10		9	8.4		
Total			107	100.00		

Data contained in Table 4.6 revealed that the highest proportion (77.6%) of the farmers had medium organizational participation as compared to 14.0percent had low and only 8.4 percent had high organizational participation. It reveals that the majority of the farmers (91.6%) in the study area were in low to medium organizational participation category.

4.1.7 Innovativeness

The observed innovativeness scores of the respondents ranged from 8 to 38 against the possible range of 0 to 40. The average and standard deviation were 22.84 and 5.99 respectively. Based on the innovativeness scores the respondents were classified into three categories as shown in Table 4.7.

Table 4.7. Distribution of the farmers according to their innovativeness

Category	Scoring	Observed Range	Respondents		Mean	SD
			Number	Percent (%)		
Low	0 - 13	08 – 38	9	8.4	22.84	5.99
Medium	14 - 26		67	62.6		
High	27 - 40		31	29.0		
Total	0 - 40		107	100.00		

Data presented in Table 4.7 indicate that majority (62.6%) of the respondents had medium innovativeness as compared to 29.0percent had high and only 8.4percent had low innovativeness. Data also revealed that majority (91.6%) of the respondents were under medium to high innovativeness. The innovativeness also refers to proneness of an individual to accept new ideas and practices.

4.1.8. Extension contact

The computed extension contact scores of the respondents ranged from 6 to 36 with an average of 21.93 and standard deviation of 6.82 against the possible range of 0 to 42. On the basis of extension media contact scores, the respondents were classified into three categories: “low extension contact (up to 14)”, “medium extension contact (15 to 28)” and “high extension contact (29 to

42)". The distribution of the respondents according to their extension media contact is shown in Table 4.8.

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

Category	Scoring	Observed range	Respondents		Mean	SD
			Number	Percent (%)		
Low	0 - 13	6 – 36	17	15.9	21.93	6.82
Medium	14 - 26		63	58.9		
High	27 - 39		27	25.2		
Total	0- 39		107	100.00		

Data presented in Table 4.8 indicated that the highest proportion (58.9%) of the farmers of the study area had medium extension contact, while 15.9percent had low extension contact. The proportion of respondents having high extension contact was only 25.2percent. The findings of the study indicate that most of the respondents had low and medium extension contact with various information sources for getting necessary agricultural information. Bashar (1993), Pal (1995) and Hussen (2001) observed almost similar findings regarding contact for getting agricultural information.

4.1.9. Training exposure

In this study, the researcher finds out some field level data and knowledge about training exposure of the farmers. Their observed range about training exposure was from 0 to 18 with a mean and standard deviation of 10.45 and 4.97 respectively. According to their length of training score, the respondents were classified into four categories. The distribution of the respondents according to their training exposure has been presented in Table 4.9.

Table 4.9. Distribution of the farmers according to their training exposure

Category	Scoring	Observed Range	Respondents		Mean	SD
			Number	Percent (%)		
No training	0	0 – 18	12	11.2	10.45	4.97
Low	1 - 5		3	2.8		
Medium	6 - 15		76	71.0		
High	> 15		16	15.0		

Total	0- > 15		107	100.00		

The table showed that the percentage of no training, low training, medium training and high training were 11.2%, 2.8%, 71.0% and 15.0% respectively. The researcher found that, there 11.2% of total farmers had no any kind of training exposure, while 2.8% and 71.0% farmers had low and medium training exposure respectively. Farmers of high training exposure (15.0%) were very low compared to medium category. Training makes the farmers skilled and helps them to acquire deep knowledge about the respected aspects. Trained farmers can face any kind of challenges about the adverse situation in their cultivation. So, they show favorable attitude toward adoption of selected modern practices for rice cultivation.

4.1.10. Knowledge on Rice Production

Knowledge on rice production scores of the respondents ranged from 8 to 40 with an average of 24.81 and standard deviation of 7.71 against the possible range of 0 to 48. On the basis of rice production knowledge scores, the respondents were classified into three categories, "poor knowledge (up to 16)", "medium knowledge 17 to 32)" and "high knowledge (33 to 48)". The distribution of the respondents according to their knowledge on rice production is shown in Table 4.10.

Table4.10. Distribution of the farmers according to their rice production knowledge

Category	Scoring	Observed range	Respondents		Mean	SD
			Number	Percent (%)		
Low knowledge	0 - 16	08 - 40	14	13.1	24.81	7.71
Medium knowledge	17 – 32		77	72.0		
High knowledge	33 - 48		16	15.0		
Total knowledge	0 - 48		107	100.00		

Data contained in Table 4.10 indicated that the majority (72.0%) of the respondents had medium knowledge compared to 13.1 percent felt in low knowledge and only 15.0 percent possesses high knowledge. It therefore

revealed that majority of the farmers (87%) in the study area were under medium to high knowledge category.

4.2 Adoption of selected modern practices for rice cultivation

Percentage of adoption of selected modern practices for rice cultivation, based on the score of different terms about adoption of selected modern practices ranged from 0 to 26 against the possible range from 0 to 30 with an average of 15.74 and standard deviation of 6.04. On the basis of percentage of adoption of selected modern practices for rice cultivation, the respondents were classified into three categories that were shown in Table 4.11.

Table 4.11. Distribution of the farmers according to adoption of modern practices for rice cultivation

Category	Scoring	Observed range	Respondents		Mean	SD
			Number	Percent (%)		
No adoption at all (0 % land)	0	0 - 26	4	3.7	15.74	6.04
Low adoption (< 25 % land)	1 – 10		17	15.9		
Medium adoption (25 - 50 % land)	11 – 20		60	56.1		
High adoption (>50 % land)	21 – 30		26	24.3		
Total	0 – 30		107	100		

Data in the Table 4.11 showed that near about more than half of the respondents (56.1%) had medium adoption where 15.9 percent had low adoption and only 24.3 percent had high adoption of selected modern practices for rice cultivation. Sardar (2002) also found almost similar. The findings of the present study revealed that adoption of selected modern practices for rice cultivationby farmers was not satisfactory. Maximum rice growers (80.4%) had medium to high adoption of selected modern practices for rice cultivation.

4.3 Comparison among adoption of the different modern practices by the farmers for rice cultivation in Modhukhali upazila under Faridpur district

To compare the adoption of selected modern practices for rice cultivation, Modern Practices Use Index (MPUI) was calculated. A Modern Practices Use Index (MPUI) for each of the practices could range from 0 to 321. The ten commonly used modern practices have arranged in rank order in Table 4.13 on the basis of their MPUI. The observed MPUI ranged from 33 to 272.

Table 4.12. Rank order of the adoption of modern practices by the farmers for rice cultivation

Sl.	Name of modern rice cultivation practices	Assigned score to responses of farmers				MPUI	Rank order
		Do not use at all	Receive with low extent (<25% land)	Receive with medium extent (>25%-50% land)	Receive with high extent (>50% land)		
1.	HYV seed	0	4	41	62	272	1
2.	Organic manure	0	15	61	31	230	2
3.	Use of Integrated Pest Management (IPM)	0	21	57	29	222	3
4.	Seedling of recommended age	0	35	47	25	204	4
5.	Balanced fertilizer	14	17	56	20	189	5
6.	Line transplanting	16	26	45	22	178	6
7.	Improved irrigation	12	31	47	17	176	7
8.	Improved seedbed	26	31	26	24	155	8
9.	Green manure	42	31	21	13	112	9
10	Azola	86	11	8	2	33	10

MPUI = Modern Practices Use Index

4.3.1 Modern Practices Use Index

On the basis of computed MPUI, it was observed that the Use of HYV were adopted by the farmers to the highest extent (272) and it was closely followed by the use of organic manure in the crop field for higher productivity of soil (230), use of IPM (222) and use of recommended aged seedling (204). On the other hand, use of azola as bio-fertilizer was given the lowest score (33),

followed by use of green manure (112) and use of Improved seedbed were adopted by the farmers to the lowest extent.

The findings indicated that seed of a crop is the main key factor for successful crop production. To increase production there is no alternative of using quality seed. Almost all of the farmers in the study area collect healthy and disease free seed from local seed dealers or from BADC. That is why farmers adopt these practices to the highest extent. Use of organic manure is a good practice for successful crop production and also environment friendly. Soil fertility and productivity is increased with this practice. In rural areas organic manure is comparatively available and cost effective than the other practice. That is why farmers adopt these practices to a higher extent. On the other hand, use of azola as bio-fertilizer is not a common practice among the farmers. It is not also available everywhere and technical knowledge is required for the proper use of it. So, it was the least practice.

All adoption of selected modern practices for rice cultivation that are cited in the present study, was found to be a rank order in variation might be due to cause of importance, availability, required technical knowledge and performance and also cost effectively. Based on these criteria, the selected practices used by the rice farmers were ranked. The gradually less popular practices were as use of HYV seed, organic manure, use of integrated pest management (IPM), seedling of recommended age, balanced fertilizer, line transplanting, improved irrigation, improved seedbed, green manure and azola.

4.4. Contribution of the selected characteristics of the respondents on adoption of modern technologies of rice cultivation

For this study ten characteristics of the respondent were selected and each of the characteristics was treated as independent variable. The selected characteristics were age (X_1), education (X_2), farm size (X_3), family size (X_4), annual family income (X_5), organizational participation (X_6), Innovativeness (X_7),extension contact (X_8),training exposure (X_9) and knowledge on rice production (X_{10}). Adoption of modern practices by the farmers of rice cultivation (Y) was the only dependent variable of this study.

Full model regression analysis was initially run with the 10 independent variables. But it was observed that the full model regression results were misleading due to the existence of interrelationships among the independent variables. Therefore, in order to avoid the misleading results and to determine the best explanatory variables, the method of stepwise multiple regressions was administrated and 10 independent variables were fitted together in step-wise multiple regression analysis. Table 4.13 shows the summarized results of step-wise multiple regression analysis with 10 independent variables on adoption of modern practices in rice cultivation. It was observed that out of 10 variables only 3 independent variables namely education (X_3), extension contact (X_4), age (X_5) were entered into the regression equation. The other seven variables were not entered into regression equation. The regression equation so obtained is presented below:

$$Y= 10.024+ 0.357X_2 + 0.282X_8 + 0.146\ X_1$$

Table 4.13. Summary of step wise multiple regression analysis showing the contribution of selected characteristics of the respondents on adoption of modern technologies of rice cultivation

Variables entered	Standardized Partial 'b' Coefficients	Value of 't' (with probability level)	Adjusted R^2	Increase in R^2	Variation explained in percent
Education (X_2)	.357	1.446 (000)	0.428	0.428	42.8
Extension contact (X_8)	.282	2.741 (007)	0.456	0.028	2.8
Age (X_1)	.146	2.320 (022)	0.478	0.022	2.2
Total				0.470	47.0

R-square = 0.493
Adjusted R-square = 0.470
F-ratio = 80.315
Standard error of estimate = 4.3
Constant = 10.024

The R^2 values were found 0.493 and the corresponding F-ratio was 80.024 which were significant at 0.000 levels. For determining unique contribution of each of the three variables the increase in R^2 value was determined on adoption of modern practices in rice cultivation. These three variables combined explained 47.0 percent of the total variation on adoption of modern practices in rice cultivation. Education alone contribute 42.8 percent of the variation followed by extension contact (2.8 percent) and age (2.2 percent), on adoption of modern practices in rice cultivation.

4.4.1. Contribution of education on adoption of modern technologies of rice cultivation

The contribution of education on adoption of modern practices in rice cultivation was measured by testing the following null hypothesis; "There is no level of contribution of education on adoption of modern practices in rice cultivation".

The adjusted R^2 value of the education from stepwise multiple regressions was presented in Table 4.13. The adjusted R^2 value of the concerned variable was found 0.428. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. *The contribution of the education was**42.8 percent.***
b. *It was the highest contribution on adoption of modern practices in rice cultivation.*
c. *The null hypothesis could be rejected.*

Based on the above finding, it was concluded that a respondent had more education increased the capabilities of adoption on adoption of modern practices in rice cultivation. Education enhances the abilities of the respondents at a short time than others which transformed them to adopt of modern practices in rice cultivation.

4.4.2. Contribution of extension contact on adoption of modern technologies of rice cultivation

The contribution of extension contact on adoption of modern practices in rice cultivation was measured by testing the following null hypothesis; "There is no level of contribution of extension contact on adoption of modern practices in rice cultivation".

The adjusted R^2 value of the education from stepwise multiple regressions was presented in Table 4.13. The adjusted R^2 value of the concerned variable was found 0.28. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. *The contribution of the extension contact was**2.8 percent.***
b. *It was the second highest contribution on adoption of modern practices in rice cultivation.*
c. *The null hypothesis could be rejected.*

Based on the above finding, it was concluded that a respondent had more extension contact increased the capabilities of adoption modern practices in rice cultivation. Extension contact enhances the abilities of the respondents at a short time than others which transformed them to adopt of modern technologies of rice cultivation.

4.4.2. Contribution of age on adoption of modern technologies of rice cultivation

The contribution of age on adoption of modern technologies of rice cultivation was measured by testing the following null hypothesis: "There is no level of contribution of age on adoption of modern practices in rice cultivation".

The adjusted R^2 value of the education from stepwise multiple regressions was presented in Table 4.13. The adjusted R^2 value of the concerned variable was found 0.022. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. *The contribution of the age was**2.2 percent.***
b. *It was the third highest contribution on adoption of modern practices in rice cultivation.*
c. *The null hypothesis could be rejected.*

Based on the above finding, it was concluded that a respondent had more age increased the capabilities of adoption on adoption of modern practices in rice cultivation. Age enhances the abilities of the respondents to adopt of modern technologies of rice cultivation.

Chapter 5

SUMMARY, CONCLUSIONAND RECOMMENDATIONS

This chapter presents summary of findings, conclusions and recommendations of the study.

5.1 Summary of findings

The major findings of the study are summarized below:

5.1.1 Introduction

Increasing agricultural productivity is critical to meet expected rising demand and, as such, it is instructive to examine recent performance in cases of modern agricultural technologies (Challa, 2013). Agricultural technologies include all kinds of improved techniques and practices which affect the growth of agricultural output (Jain et al., 2009). According to Loevinsohn et al. (2013) the most common areas of technology development and promotion for crops include new varieties and management regimes; soil as well as soil fertility management; weed and pest management; irrigation and water management. By virtue of improved input/output relationships, new technology tends to raise output and reduces average cost of production which in turn results in substantial gains in farm income (Challa, 2013). Adopters of improved technologies increase their productions, leading to constant socio-economic development. Adoption of improved agricultural technologies has been associated with: higher earnings and lower poverty; improved nutritional status; lower staple food prices; increased employment opportunities as well as earnings for landless laborers (Kasirye, 2010). Adoption of improved technologies is believed to be a major factor in the success of the green revolution experienced by Asian countries (Kasirye, 2010).On the other hand, non-adopters can hardly maintain their marginal livelihood with socio-economic stagnation leading to deprivation (Jain et al., 2009).

Studies on individual, group and society revealed that acceptance of modem technologies is conditional upon many factors. Some of these are social, personal, economical and situational factors. While conducting any study on the adoption of modem technologies, these factors need to be taken into account. A very few previous research work tried to find out the above facts. Therefore, the present research felt necessity to conduct a research entitled "Adoption of modern practices by the farmers for rice cultivation of Modhukhali upazila under Faridpur district".

5.1.2. Objectives of the study

The following objectives were formulated to give clear direction to the study:

1. To determine the extent of adoption of rice production technologies by the farmers;
2. To determine and describe some selected characteristics of the farmers. The selected characters include:
    k) Age
    l) Education
    m) Family size
    n) Farm size
    o) Annual income
    p) Organizational participation
    q) Innovativeness
    r) Extension Contact
    s) Training exposure
    t) Knowledge on rice production;
3. To explore the contribution onthe selected characteristics of the farmers and their adoption of modern technologies of rice production;
4. To describe the extent of problems faced by the farmers in adopting modern technologies of rice production;

5.1.3. Materials and Methods

Locale of the Study

Two villages namely Noapara and Kuraniarchor of Modhukhali upazila under Faridpur district were randomly selected as the locale of the study.

Study Group (SG) Sampling

There are several methods for determining the sample size. Here, researcher used Yamane's (1967) formula for study group. So, the sample size (n) is = 107.

Measurement of independent variables

The independent variables of this study were ten (10) selected characteristics of the rice cultivation farmers. These were: age, education, family size, farm size, annual family income, organizational participation, Innovativeness, extension contact, Training exposure and Rice production knowledge.

5.1.4 Individual characteristics of the farmers

Findings in respect of the 10 selected characteristics of the farmers are summarized below:

Age: Overwhelming majority (60.8%) of the respondents was young to middle aged and 16.36% was old aged.

Education: Almost all of the farmers had different level of education. Among them 59.6% of the respondents were primary to no education and rest 40.4% were secondary to above education level.

Farm size:20.6% of the total respondent had small farm where, 7.5 percent had no own cultivable land, 18.6 percent had medium farm, 20.6percent had marginal farm.

Family size: 52.3percent of total respondents had medium family size followed by 28.0percent had small family size while 19.6percent had large family size.

Annual family income:63.6 percent of the farmers had medium annual income, 22.4 percent of the respondents had low annual income and 14.0percent had high annual income.

Organizational participation: the highest proportion (77.6%) of the farmers had medium organizational participation as compared to 14.0percent had low and only 8.4 percent had high organizational participation.

Innovativeness: Majority (62.6%) of the respondents had medium innovativeness as compared to 29.0percent had high and only 8.4percent had low innovativeness.

Extension contact: the highest proportion (58.9%) of the farmers of the study area had medium extension contact, while 15.9percent had low extension contact and 25.2% had High extension contact.

Training exposure:the percentage of no training, low training, medium training and high training were 11.2%, 2.8%, 71.0% and 15.0% respectively.

Rice production knowledge: The majority (72.0%) of the respondents had medium knowledge compared to 13.1 percent felt in low knowledge changing and only 15.0 percent possesses high knowledge.

Adoption of modern practices for rice cultivation: On the basis of percent of adoption on modern practices for rice cultivation, near about more than half of the respondents (56.1%) had medium adoption where 15.9percent had low adoption and only 24.3 percent had high adoption of modern practices for rice cultivation**.** There was 3.7percent respondents who had no adoption of selected modern practices for rice cultivation.

5.1.5Contribution of the selected characteristics of the respondents on adoption of modern technologies of rice cultivation

The R^2 values were found 0.493 and the corresponding F-ratio was 80.024 which were significant at 0.000 levels. For determining unique contribution of each of the three variables the increase in R^2 value was determined on adoption of modern technologies of rice cultivation. These three variables combined explained 47.0 percent of the total variation on adoption of modern technologies of rice cultivation. Education alone contribute 42.8 percent of the variation followed by extension contact (2.8 percent) and age (2.2 percent), on adoption of modern technologies of rice cultivation.

5.2 Conclusion

Findings of the present study and the logical interpretation of other relevant facts prompted the researcher to draw the following conclusions:

1. More than half of the respondents (56.1%) had medium adoption where 15.9percent had low adoption of modern practices for rice cultivation i.e. 80.4% of the respondents had medium to high adoption of modern practices for rice cultivation. The finding leads to the conclusion that there is necessity to increase with sustainability the adoption of modern practices for rice cultivation**.**

2. More than two-third (84.2%) of the respondents were middle to old aged and contribution revealed that age of the respondent had significant positive contribution with their adoption of modern practices for rice cultivation**.** Therefore, it may be concluded that modern practices were used frequently by older farmers than young aged farmers for rice cultivation**.**

3. More than three fourth (80.4%) of the respondents had different level of education and contribution revealed that education of the respondent had significant positive contribution with their adoption of modern practices

for rice cultivation**.** Therefore, it may be concluded that more educated farmers had more adoption of modern practices for rice cultivation.

4. More than half (58.9%) of the farmers of the study area had medium extension contact, while there existed a positive significant contribution with adoption of modern practices for rice cultivation. Therefore, it may be concluded that extension media contact increase their adoption of modern practices for rice cultivation**.**

5.3 Recommendations

5.3.1 Recommendations for policy implications

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

1. It is specified that more farmers had modern practices for rice cultivation, and is recommended that DAE may take effective steps for sustaining modern practices for rice cultivation.

2. Age of the respondent had significant contribution with their adoption of modern practices for rice cultivation. Therefore, it may be recommended that attempts should be taken by the concerned authorities to increase modern practices for rice cultivation especially for the young and middle aged farmers.

3. Education of the respondent had significant contribution with adoption of modern practices for rice cultivation. Therefore, it may be recommended that attempts should be taken to establish adult learning center to increase educational level of the farmers as well as modern practices for rice cultivation**.**

4. Extension contact of rice growers' had significant contribution with adoption of modern practices for rice cultivation. Therefore, it may be recommended that, DAE and other extension agencies should increases extension contact and take initiative to develop good rapport with rice farmers.

5.3.2 Recommendations for further study

It cannot be provided with a small and limited research work of unique and universal information related to adoption of modern practices for rice cultivation**.** Further studies should be undertaken on related matters. On the basis of scope and limitations of the present study and observations made by the researcher, the following recommendations are made for further study:

1. The study was conducted in Modhukhali upazila of Faridpur District. Similar studies should be conducted in other parts of the country to get a clear picture of the whole country which will be helpful for effective policy formulation.

2. It is difficult to determine actual adoption of modern practices for rice cultivation**.** Measurement of adoption of modern practices for rice cultivationby the farmers is not free from questions. Therefore, more reliable measurement of concerned variable is necessary for further study.

3. To measure adoption of modern practices for rice cultivation by the farmers, the researcher developed a scale and the validity of the scale may be verified by further studies using the same scale.

4. The present study was undertaken to explore contribution of 10 selected characteristics of the farmers with their adoption of modern practices for rice cultivation**.** Therefore, it could be recommended that further studies should be designed considering other agricultural and non-agricultural activities and including other characteristics of the farmers that might affect the adoption of modern practices for rice cultivation.

5. In the present study education, extension contact, age had contribution on their adoption of selected modern practices for rice cultivation**.** In this connection, further verification is necessary for non-contributing characteristics.

REFERENCES

Alam, M.S. 1997. Use of Improved Farm Practices in Rice Cultivation by the Farmers. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education and Teachers Training BAU, Mymensingh, Bangladesh.

Alexander, C. and Goodhue, R.E. 2002. The Pricing of Innovations: An Applications to Specialized corn traits. Agribusiness New York. 18 (3): 333-348.

Ali, M.K. 1993. Farmers Responses to Spaced Transplanting Technology of Sugarcane. M.Sc. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Ali, M.K. and S. A. Chowdhury 1983. Influence of Few Selected Factors on Adoption Behaviour of Sugarcane Growers of a Mills Zone. Bangladesh Journal of Sugarcane. 5: 77-83.

Ali, M.K., S.A. Chowhdury, M.A. Kader and M.O. Gani 1986. Factors Influencing Adoption of Improved Sugarcane Production Technologies Among the Growers of Sugar Mills Zone. Bangladesh Journal of Extension Education, 1(2): 25-31.

Anderson , L. and D. A. Krathwohl. 2001. A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. New York: Longman.

Anon. 2005. Bangladesh Economic Survey. Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Government of the People's Republic of Bangladesh. Anonymous, 1999. Krishi Diary. Agricultural Information Service (AIS), Ministry of Agriculture, Dhaka, Bangladesh.

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

Bashar, M.K. 1993. Adopton of Intercropping in Sugarcane Cultivation. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Bavalatti, V.G. and B. Sundaraswamy 1990. "Adoption of Dryland Farming Practices by the Farmers of Bijapur District". Indian Journal of Extension Education, 26 (3 & 4): 67-69.

BBS, 2014. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics. Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

Bezbora, S.N. 1980. Factors Affecting Adoption of Improved Agricultural Technologies for Paddy Cultivation by the Farmers of Assam. Summary of Extension Research. 6: 24-27. Department of Extension Education, Punjab Agricultural University, Ludhiana.

Bloom. B. S. and D. R. Krathwohl. 1956. Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook 1: Cognitive Domain. New York: Longmans. Green.

BNP. 2016. Bangladesh National Portal. Retrieved from: http://bangladesh.gov.bd/

Bonabana-Wabbi J. (2002). Assessing Factors Affecting Adoption of Agricultural Technologies: The Case of Integrated Pest Management (IPM) in Kumi District, Msc. Thesis Eastern Uganda

BRKB. 2016. Bangladesh Rice Knowledge Bank. Retrieved from: http://www.knowledgebank- brri.org/riceinban.php

Challa, Merga (2013).Determining Factors and Impacts of Modern Agricultural Technology Adoption in West Wollega, Munich, GRIN Publishing GmbH, Retrieved form: http://www.grin.com/en/e-book/280336/ determiningfactors-and-impacts-of-modern-agricultural-technology-adoption.

Chowdhury, M.S.A. 1997. Adoption of Selected BINA Technologies by the Farmers of Boyra Union in Mymensingh District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Countrymeters. 2016. A online portal to estimate the population in world. Retrieved from:http://countrymeters.info/en/Bangladesh

DAE, 1995. Agricultural Extension Manual. Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh.

District. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Ernest, R.S. 1973. Study on Communication Utilization Behaviour of Small and Big Farmers and Its Implication to Communication Strategy. A. Ph.D. Thesis. New Delhi, Div. of Agricultural Extension, IARI.

Ezekiel, M. and K.A. Fox 1959. Method of Correlation and Regression Analysis. 3rd Edn. New York, John Wiley and Sons, Inc.

Gebre, T.M. Nigussie and D. Tanner. 2002. Maize Technology Adoption in Ethiopia: experiences from the Sasakawa Globe 2000. Agriculture Programme. Enhancing the Contribution of Maize to Food Security in

Ethiopia. Proceedings of the second National Maize Workshop of Ethiopia, 12-16 November, 2001. 153-156, Addis Ababa.

Gogoi, S.K. and Gogoi, D.K. 1989. Adoption of Recommended Plant Protection Practices in Rice. Indian Journal Extension Education, 25 (1&2): 26-29.

Goode, W.J. and P.K. Hatt 1952. Methods of Social Research. New York: McGraw-Hill Book Company, Inc.

Grewal, I.S.I. 1980. Multivariate Analysis of Adoption of High Yielding Wheat Technology in Arid Central and West Zone of Punjab State. Summaries of Extension Research by Post-graduate Students, Punjab Agricultural University, Ludhiana, 6: 20-23.

Haider, M.R. Halim, A. and Kashem, M.A. 2001. Adoption of Improved Package of practices for Trans-planting Aman Rice Cultivation. Bangladesh Journal of Nuclear Agricultural, Vol. (16 & 17): 77-84.

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, Bangladesh.

Haque, M.M. 2003. Farmers' Adoption of Modern Maize Cultivation Technologies. M.S. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

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.

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. Hoffer, C.R. and D. Stangland, 1958. Farmers Attitude and Values in Relation to Adoption of Approved Practices in Corn Growers. Rural Sociology, 23: 112-120.

Hoque, M.M. 1993. Adoption of Improved Practices in Sugarcane Cultivation by the Sugarcane Growers of Sreepur Upazila Under Gazipur District. M.S. (Ag. Ext. Ed.). Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Hosain, M.A. 1971. Adoption of Improved Farm Practices by the Transplanted Aman Rice Growers in Gouripur Union of Mymensingh District. An M.Sc. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Hossain, K. 2006. Adoption of Selected High Yielding Variety of Rice by the Farmers of Rajpat Union Under Kasiani upzila in Gopalgonj District.

Hossain, M.A. 1983. Relationship of Farmers' Characteristics with Their Adoption of HYV as T. Aman and other Related Aspects in Bhabakhali Union of Mymensingh District. M.Sc. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

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

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.

Hossain, M.M.2003. Farmers Knowledge and adoption of Modem HYV cultivation practice. M.S. (Ag. Ext. Ed.). Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Hossain, M.N. 1999. Farmers Perception of the Effects of Agro-chemicals on Environment. M.S. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh, Bangladesh.

Hossain, S.M.A. and Crouch, B.R. 1992. "Patterns Determinations of Adoption of Farm Practices: Some Evidence from Bangladesh." Agricultural Systems, 38 (1): 1-15.

Hussen, M.A. 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, Bangladesh.

ILEIA 1991. Information Centre for Low-external Input and Sustainable Agriculture. Newsletter, 7(3): Leusden, the Nether lands.

Islam, M.M. 1993. Adoption of Improved Practices on Potato Cultivation by the Potato Farmers of Sonatola Union Under Bogra District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Islam, M.M. 1996. Farmers use of Indigenous Technical knowledge (ITK) in the Context of Sustainable Agricultural Development. M.S. (Ag. Ext.

Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

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

Jain R. Arora A & Raju S. (2009). A Novel Adoption Index of Selected Agricultural Technologies:Linkages with Infrastructure and Productivity: Agricultural Economics Research Review 22 ; pp 109-120

Jengcham, S. 1984. Garoder Shagskretik Jibondhara. Christodahea Dharmapalli, Jalchatra, Tangail, Bangladesh.

Julfiquar, A.W., M.M. Haque, A.K.G.M. Enamul Haque and M.A. Rashid. 1998. Current status of Hybrid Rice Research and Future programme in Bangladesh. A country Report presented in the workshop on use and Development of Hybrid rice in Bangladesh. May 18-19, BARC, Dhaka, Bangladesh.

Juliana, C.S., Annamalai, R. and S.S. Daram. 1991. Adoption of Integrated pest Management Practices. Indian Journal of Extension Education. 27 (3 & 4): 21-27.

Kariyasa, K., Dewi, A. (2011).Analysis of Factors Affecting Adoption of Integrated Crop Management Farmer Field School (Icm-Ffs) in Swampy Areas. International Journal of Food and Agricultural Economics 1(2): pp 29-38

Karim, A.S.M.Z. 1973. Adoption of Fertilizers by the Transplanted Aman Rice Growers in Keotkhali Union of Mymensingh District. M.Sc. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension and

Teachers' Training, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Karim, A.S.M.Z. and S.F. Mahaboob. 1986. Farmers Characteristics and other Factors Associated with Adoption of HYV Wheat in Kushtia Union of Mymensingh District. Bangladesh Journal of Extension Education, 1(1): 17-24.

Kashem, M.A. and M.A. Hossain. 1992. "Adoption Behaviour of Sugarcane Growers". Indian Journal of Extension Education. 28 (1 & 2): 92-96.

Kashem, M.A. and M.M. Islam 1990. Comparative Analysis of Knowledge, Attitude and Adoption of Agricultural Practices between the Contact and Non-contact Farmers Under the T & V System. Bangladesh Journal of Extension Education, 5 (1&2): 1-7.

Kashem, M.A.and Halim, A. 1991. Use of Communication Media in the Transfer of Technologies of Farmers: a Farm Level Study. Research Monograph No. 2, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh, Bangladesh.

Kaur, M.R. 1988. An Evaluation study of Women Development Programme under Indo-German Dhauhadhar Project Palampur District Kumgra, H.P. Harayana Agricultural University. Thesis Abstract. 16 (4): 258. Kerlinger, F.N. 1973. Foundations of Behabioural Research. 2nd Edn. Delhi: Surjeet Publications.

Khan, M.A. H. 1993. Adoption of Insecticides and Related Issues in the Villages of Pachon Union, Madaripur District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Kher, S.K. 1992. "Adoption of Wheat Cultivation Practices". Indian Journal of Extension Education, 22 (1 & 2): 97-99.

Lavison, R. (2013). Factors Influencing the Adoption of Organic Fertilizers in Vegetable Production in Accra, Msc Thesis, Accra Ghana.

Loevinsohn M, Sumberg J, Diagne A (2012) under what circumstances and conditions does adoption of technology result in increased agricultural productivity? Protocol. London: EPPI Centre, Social Science Research Unit, Institute of Education, University of London

Mohammad, A. 1974. A study on the Farmers' Adoption of Insect Control Measures and Related Aspects. M.Sc. (Ag.Ext.Ed.) Thesis, Department ofAgricultural Extension and Teachers' Training, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Mostofa, M.G. 1999. Adoption of Recommended Mango Cultivation Practices by the Mango Growers of Nawabganj Sadar Thana. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Moulik, T.K., J.P. Hrabovxzky and C.S. S. Rao 1966. Predictive Values of Some Factors of Adoption of Nitrogenous Fertilizers by the North Indian Farmers. Rural Sociology, 31(4): 467-477. Muttaleb, A. 1995. Relationship of Selected Characteristics of Potato Growers with their Adoption of Improved Potato Technologies. M.S. (Ag.Ext.Ed.) Thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Muttaleb, M.A., M.N. Islam and M.A. Hossain. 1998. Adoption of Selected Plant Protection Practices in Potato Cultivation. Bangladesh Journal of Extension Education. 9 (2): 2027-30.

Narwal, R.S., V.B. Dixit and S.S. Dahiya. 1991. Correlation of Farmers Attitude towards Buffalo Management Practices. Indian Journal of Extension Education, 27(1&2): 97-100.

Nikhade, D.M., R.S. Bhople and N.M. Kale, 1995. Adoption Gaps Among Small and Big Cotton Growers. Indian Journal of Extension Education. XXXI (1 to 4): 120-123.

Nikhade, M.D., S.R. Bhople and S.V. Sharkarkar. 1993. Adoption of Improved Practices of Soybean Cultivation. Indian Journal of Extension, 29 (3 & 4).

Okoro, F.U. and L.U. Obibuaka 1992. Factors Influencing the Adoption of Improved Oil Palm Management Practices Among Small Holders in IMO States, Nigeria. Bangladesh Journal of Extension Education, 7(1&2): 45-52.

Osunloogun, A., Ademoyo, R. and Anyanwu, E. 1996. "The Adoption of Innovations by Co-operative Farmers in Nigeria." Tropical Agriculture, 63 (2): 158-160.

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

Pathak, S. and B.C. Sasmal 1992. Adoption of Jute Technologies. Indian Journal of Extension Education, 27 (1&2): 77-80.

Playfair, M. A. 1975. The Garos. United publishers, Pan Bazal, 20–4, Lindsay Street, Gauhati-781001, Calcutta-700016, India.

Podder, S.K. and M.A. Kashem, 2000. Use of Extension Contract Media by the Farmers in the Adoption of Mehersagar banana. Bangladesh Journal of Extension Education, Vol. 11 & 12. No. 1 & 2: 89-94.

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.

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.

Rahman, M.M. 1986. "Correlates of Adoption of Improved Practices in Transplanted Aman Rice." Bangladesh Journal of Extension Education, 1(2):71-77.

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, Bangladesh.

Rahman, M.M. 2003. Adoption of Intercropping in Pineapple Cultivation in Three Selected Village. M.S. (Ag. Ext. Ed.). Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Rahman, M.S. 1974. Analysis of Factors in Relation to the Adoption of IR-20. M.Sc. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension and Teachers' Training, Bangladesh Agricultural University, Mymensingh.

Rahman, M.S. 2001. Knowledge, Attitude and Adoption of the Farmers Regarding Aalok 6201 Hybrid Rice in Sadar Upazila of Mymensingh

Ramachandran, P.K. 1974. A Multivariate Study of Information Sources Utilization by Big, Medium and Small Farmers. Div. Of Agricultural Extension, IARI. Cited in: Samasundaram, D. and S.N. Singh 1978.

Factors Affecting the Knowledge of Adopter and Non-adopter Small Farmers. Indian Journal of Extension Education, 14(1&2): 30-34. Ray, G.L. 1991. Extension Communication and Management. Calcutta: Naya Prokash.

Rashid, S. M. M., M. Z. Haque and M. R. Islam.2014. Empowering Farmers through e-Agriculture. M.Sc. (Ag. Ext.& Info. Sys.) Thesis, Department ofAgricultural Extension and Information System, Sher-e-Bangla Agricultural University,Dhaka.

Razzaque, M.A. 1977. Relationship of Selected Characteristics of the Farmers with Adoption of High Yielding Varieties of Rice in Three Villages of Agricultural University Project Area. M.Sc. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension and Teachers' Training, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Reddy, P.R., Reddy, M.M. and Reddy, D.R. 1987. "Impact of National Demonstration on Knowledge level Attitude and Adoption Behaviour of Farmers in Ranaga Reddy District of Andhra Pradesh state." Journal of Research APAU, 15 (1): 35-38. Rogers, E.M. 1995. Diffusion of innovations, 4th Edn. New York: The Free Press.

Ruram, J. 2002. Essay on Garo Society(compiled publication), Garo National Council Of Bangladesh, Birishiri, Netrakona, Bangladesh.

Salam, M.A. 2003. Constraints Faced by the Farmers in Adopting Environmentally Friendly Farming Practices. M.S. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

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

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

Sarker, D.C. 1997. Correlates of Selected Characteristics of Potato Growers with Their Adoption of Improved Potato Cultivation Practices in Five Village of Comilla District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Siddaramiaiah, B.S. Ranga, V.K., Naika and Kumar R.P. 1995. "Adoption of Improved Sericultural Practices Among Bio and small Farmers." Indian Journal of Extension Education. Vol. XXXI, NOS, 1 to 04.

Singh, P.K. 1991. Extent of Adoption of selected Recommended Practices by Kinnow Growers of Ferozepur and Faridkot Districts of Punjab. Directorate of Publication, Hariyana, Agricultural University, Thesis Abstract. 17 (3): 209-210.

Singh, S.P. and Rajendra 1990. A Study on Adoption of Sugarcane Variety. Indian Journal of Extension Education, 26 (1&2): 110-111.

Singh, S.P., R.S. Hoda and S.N. Laharia. 1992. Factors affecting the Adoption of Improved Sugarcane Production Technology. A regression analysis, Indian Sugar. 42: 687-690.

Slade, R.G. Feder and Shikaria 1988. Reforming Agricultural Extension. The Training and Visit System in India. Quarterly Journal of International Agricultural (3 & 4): 228-246.

Smith, T.L. and P.E. Zope 1970. Principles of Inductive Rural Sociology. Philadelphia: F.A. Davisc. Sobhan, M.A. 1975. Adoption of Winter Vegetable Cultivation by the Farmers in Boilor Union of

Mymensingh District. M.Sc. (Ag.Ext.Ed.) Thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Somasundaram, D. and S.N. Singh 1978. Factors Affecting the Knowledge of Adopter and Non-adopter Small Farmers. Indian Journal of Extension Education, 14:30-34.

Swinkeles, R.A., K.D. Shepherd, S. Franzel, J.K. Ndufa, E. Ohisson, H. Sjogren, S. Franzel, (ed.) and S.J. Scherr. 2002. Assessing the Adoption Potentialof Hedgerow Intercropping for improving Soil Fertility. Western Kenya. Trees on the farm: Assessing the Adoption Potential of Agroforestry Practices in Africa, 2002, 86-110.

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

Wiki. 2016. Wikipedia. Retrieved from:https://en.wikipedia.org/wiki/ Geography_of_Bangladesh

Yamane, T. 1967. Statistics: An Introductory Analysis, 2nd Ed., New York: Harper and Row.

Zegeye, T., B. Tadesse, S. Tesfaye, M.Nigussie, D. Tanner and S. Afriye. 2002. Determinants of Adoption of Improved Maize Technology in Major Maize Growing Regions of Ethiopia. Enhancing the Contribution of Maize of Food Security in Ethiopia. Proceeding of the National Maize Workshop of Ethipia, 12-16, November 2001. 125-136, Addis Ababa.

Appendix-A

English Version of the Interview Schedule

Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University, Dhaka-1207.

Interview schedule for data collection for the research on
"Adoption of modern practices in rice cultivation by the farmers of Modhukhali Upazila under Faridpur district"

Serial No. : …….

Name of the respondent : ……..

Address : ……..

: ……..

Please answer the following questions. Information given by you will be keptsecret and only be used for research work

1. Age

What is your age? ---------- Years.

2. Education:

State your level of education? Give (√) to appropriate place

What is your level of education?

a) I don't know how to read and write ( )

b) I don't know how to read and write but can sign only ( )

c) I studied up to class ( )

3.Family size

How many members in your family? ……. Person

4. Farm size

Please state your land

Sl.No.	Type of land be used	Land area	
		Local unit ( )	Hectare
1	Homestead		
2	Own land under own cultivation		
3	Own land given to other's on Modhukhali		
4	Land taken from other's on Modhukhali		
5	Land taken from others' on lease		
6	Others (write down specific)		
	Total		

5. Annual family income

Describe your annual family income

Sl. No.	Source of income	Amount of income (Taka)
1.	From agriculture	
2.	From domestic animal	
3.	From poultry	
4.	From fish	
5.	From job	
6.	From business	
7.	Others (write down specific)	
Total		

6. Organizational Participation

Please express your state regarding the following statements

Sl. No.	Name of the organization	Nature of participation (years)			
		No participation(0)	Ordinary member(1)	Executive member(2)	President/ Secretary (3)
1.	Farmers' association				
2.	School Committee				
3.	Bazar Committee				
4.	Co-operative society				
5.	NGO organized society				

7. Innovativeness

Please mention how many years after first hearing you use the following new technologies. Put (√) in appropriate place

Sl. No.	Name of Technology	Level of innovativeness				
		Used within 1 years (4)	Used within1-2 years (3)	Used within 2- 3 years (2)	Used within 3- 4 year (1)	Do not use (0)
1.	High Yielding Variety (HYV) seed					
2.	Improved seedbed					
3.	Seedling of recommended age					
4.	Line transplanting					
5.	Balanced fertilizer					
6.	Use of Integrated Pest Management (IPM)					
7.	Improved irrigation					
8.	Organic manure					
9.	Green manure					
10.	Azola					

8. Extension contact

Please state your frequency of visit to the following media. Put (√) to appropriate place

SL. No.	Extension Personnel/program	Extent of contact			
		Frequently (3)	Occasionally (2)	Rarely (1)	Not at all (0)
1.	Any officer of DAE(UAO, AAO, AEO)	1-2 time/ month	At least 1 time/ 2month	1-3 times/ year	0
2.	Visit to upazila agriculture officer	3-4 time/ month	1-2 times/ month	1-3 times/ year	0
3.	Officer of other extension agencies (ULO, UFO, VAS)	3-4 time/ month	1-2 times/ month	1-3 times/ year	0
4.	Other extension agents (e.g. Health worker)	3-4 time/ month	1 -2 times/ month	At least once a year	0
5.	NGO worker	3 times/ month	1-2 times/ month	At least once a year	0
6.	Input dealers	3 times a year or more	1-2 times/ month	At least once a year	0
7.	Participation in group meeting	3 times a year or more	1-2 times/ year	At least once a year	0
8.	Participation in demonstration (method and result)	3 times a year or more	1-2 times/ year	At least once a year	0
9.	Attending at agricultural fair, exhibition, farmers rally etc.	3 times a year or more	1-2 times/ year	At least once a year	0
10.	Hearing agricultural programmes at radio	4-7 days/ week	1-3 days/ week	1-3 days/ month	0
11.	Watching agricultural programmes at television	7-Aprdays/ week	2-3 days/ week	1-5days/ month	0
12.	Reading printed materials like leaflet, bulletin, magazines etc.	1 piece/ month	3-5 pieces/ year	1-2 piece/ year	0
13.	Watching agricultural posters, flip charts, advertisement (in newspaper)	1 piece/ month	3-5 pieces/ year	1-2 piece/ year	0

9. Training exposure

Please mention about your training exposure

Sl. No.	Name of the training course	Organization	Days
1.			
2.			
3.			
4.			
5.			

10. Rice production knowledge

Please answer the following question about rice cultivation

Sl. No.	Questions	Full marks	Marks obtain
1.	Mention 2 modern Boro rice variety	2	
2.	Mention 2 modern Amon rice variety	2	
3.	Mention 2 diseases of rice	2	
4.	Mention 2 harmful insect of rice	2	
5.	Mention 2 beneficial insect of rice	2	
6	What is the control measure of rat in the field?	3	
7.	What is soil fertility?	2	
8.	What is the Nitrogen deficiency symptom of rice?	2	
9.	How can improve soil fertility?	3	
10.	What is the pest control measure except insecticide?	2	
11.	How can produce Green manure?	2	
12.	How many type of rice based on season?	2	
13.	Distinguish between local variety and HYV?	4	
14.	What dissimilarities between manure and fertilizer	4	
15.	What is the benefit of intercropping?	2	
16.	What is the cause of empty grain of rice?	2	
17.	Which Amon variety should be cultivated in case of lengthy flood?	2	
18.	What is the control measure of rice borer?	2	
19.	What should be done when seedling die in different places?	4	
20.	What should be done for rice seed storage?	2	
Total marks		**48**	

11. Adoption of selected modern practices by the farmers

Please mention the amount of land, on which you use the following technologies related to selected rice production

Sl. No.	Name of technology	Extent of use			
		Do not use at all	Receive with low extent (<25% land)	Receive with medium extent (>25%-50% land)	Receive with high extent (>50% land)
		0	1	2	3
1.	HYV seed				
2.	Improved seedbed				
3.	Seedling of recommended age				
4.	Line transplanting				
5.	Balanced fertilizer				
6.	Use of Integrated Pest Management (IPM)				
7.	Improved irrigation				
8.	Organic manure				
9.	Green manure				
10.	Azola				

Thank you for your kind cooperation.

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Signature of the interviewer

Date: ……..