FACTORS AFFECTING ADOPTION OF FARM MECHANIZATION IN RICE FARMING IN SOME SELECTED AREAS OF BANGLADESH

ABIR MUHAMMAD NAEEM

DEPARTMENT OF AGRICULTURAL ECONOMICS

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

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BY

ABIR MUHAMMAD NAEEM

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Approved by:

Dr. Monoj Kumar Majumder	**Dr. Md. Mizanur Rahman Sarker**
Associate Professor	**Professor**
Dept. of Agricultural Economics	**Dept. of Agricultural Statistics**
Sher-e-Bangla Agricultural University	**Sher-e-Bangla Agricultural University**
Supervisor	**Co-supervisor**

Dr. Ripon Kumar Mondal
Chairman
Examination Committee
Department of Agricultural Economics
Sher-e-Bangla Agricultural University

Department of Agricultural Economics
Faculty of Agribusiness Management
Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka 1207

CERTIFICATE

This is to certify that the thesis entitled "**FACTORS AFFECTING ADOPTION OF FARM MECHANIZATION IN RICE FARMING IN SOME SELECTED AREAS OF BANGLADESH**" submitted to the Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in AGRICULTURAL ECONOMICS**, embodies the result of a piece of bona fide research work carried out by **ABIR MUHAMMAD NAEEM**, Registration No. **14-05850** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:

Dhaka, Bangladesh

(Dr. Monoj Kumar Majumder)
Associate Professor
Department of Agricultural Economics
Sher-e-Bangla Agricultural University,
Dhaka 1207.
Supervisor

ABSTRACT

Rice is cultivated all the year round in Bangladesh. The sustainable growth of the agricultural sector critically depends on the adoption of improved, scale-appropriate and ecofriendly technologies which includes using scale-appropriate new agricultural machinery. The specific objective of the systemic study was to assess the socio-economic profile of the rice farmers, to identify the factors affecting the adoption of farm mechanization for rice cultivation and to identify the constrains of adopting farm mechanization. A structured questionnaire was used for data collection from adopters and non-adopters of farm mechanization from the rice cultivators of several villages of Homna and Meghna upazila in Cumilla district. To understand the factors affecting farm mechanization, econometric models like logistic regression technique was used. Results from the study shows that majority of individuals were between the ages of 50 and 59 which is 33 percent of the population, among the population the bulk of farmers in each upazila have a 1-5 years of education who are 60 percent of the respondents. About 31 percent of the respondents got training where 69 percent didn't and altogether 23 percent of the respondents had membership of different social and agricultural groups. A significant number (60 percent) of respondents had a medium experience level in case of adopter category. in case of non-adopter category 63.34 percent of respondents had a high experience level. On an average, about 48 percent of the respondents recieved extension contact when 52 percent did not. About 67 percent of the respondents had allowed women members in rice field from when 33 percent were not. Among the variables taken for estimating the adoption of farm mechanization, the most affecting and significant factors were education, farmer's training and field visit by the extension workers. Poor buying capacity and lack of training act as major constraints which can be solved by proper financing and training programs.

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ABBREVIATIONS AND ACRONYMS

BRRI	: Bangladesh Rice Research Institute
BBS	: Bangladesh Bureau of Statistic
BCR	: Benefit Cost Ratio
BDT	: Bangladeshi Taka
BER	: Bangladesh Economic Review
DAE	: Department of Agricultural Extension
et al.	: and others (at elli)
HIES	: Household Income and Expenditure Survey
HYV	: High Yielding Variety
IOC	: Interest on Operating Capital
kg	: Kilogram
NGO	: Non-Government Organization
$	: Dollar

CHAPTER 1
INTRODUCTION

1.1 Background of the study

Bangladesh is famously renowned to all over the world for the versatile practices of agriculture. The contribution of agriculture in our national GDP is 13.65 in 2018-2019. 40.6 percent of the total national labor force is associated directly with agriculture (BBS, 2020). The sustainable growth of the agricultural sector critically depends on the adoption of improved, scale-appropriate and ecofriendly technologies which includes using scale-appropriate new agricultural machinery.

The adoption of agricultural modern technologies can lead the whole agricultural sector to a rapid sustainable growth which can help us in alleviating poverty from our country. The poverty rate of Bangladesh is 20.5 percent and the extreme poverty rate is 10.5 percent according to BBS, 2020. It is reported that agricultural GDP growth is at least twice as effective in reducing poverty as GDP growth in other sectors. It means if a 1 percent increase in GDP in any non-farm sector can lead to a reduction of poverty by 1 percent, the poverty reduction will be 2 percent with 1 percent growth in the agricultural GDP (WB, 2008).

As rice covers the maximum portion of total grain production of this country, this rice production should be made sustainable and modernized enough to improve the livelihood of the people who are engaged with this sector directly or indirectly. But it is highly concerning that the adoption of new agricultural technology, including agricultural machinery, is seldom rapid among our rice farming people.

Mechanization is a process through which agricultural activities can be improved and optimum crop production can be achieved (Chowdhury *et al*, 2010). The mechanical inputs currently used in different farming activities in Bangladesh are pump for irrigation, power tiller and tractor, disc plough, disc harrow, subsoiler for tillage, weeder for weeding, sprayer for spraying pesticides, and thresher for threshing crops. The cropping intensity and production of food crops has recently been increased

significantly due to adoption of mechanized tillage, irrigation, and spraying operations (Sarker, 2000).

Examining farmers' degree of adoption of a new agricultural technology is, therefore, critically important to ensure the adoption and scaling up of the technologies, thereby, ensuring sustainable growth and development of the agriculture sector. The remarkable success in cereal production, and particularly in rice production, thereby achieving rice-food production with self-sufficiency, is mainly attributed to the rapid adoption of modern high yielding varieties (HYV) along with the expansion of the ground water based, private-led, small-scale shallow tube well-based irrigation system (Hossain, 2009).

Appropriate farm mechanization has been emphasized as an important policy and development goal in Bangladesh (Mandal, 2014). Compared to other South Asian nations, farm machinery use has advanced considerably in Bangladesh particularly for land preparation, irrigation, and post-harvest activities (Justice and Biggs, 2013).From a study, it can be reported the contrast like this, In 1996 there were only 0.1 million power tillers, 1.3 million pumps (including deep, shallow and surface water pumps), and 0.18 million rice-wheat threshers used in Bangladesh. But, by the early 2010s, these numbers increased to at 0.55 million power tillers (Ahmmed, 2014), 1.61 million pumps and 0.25 million threshers (BBS, 2011; BADC, 2013). As a result of globalization, farm mechanization becomes very pivotal factor for having a comparative cost advantage of farming practices. By the implementation of the farming machineries, the cost of rice cultivation may be reduced to substantial level. It will increase the marginal productivity of labor and most likely will have a higher return per unit of land and labor (Roy and Bezbaruah, 2002).

Government of Bangladesh has developed and approved a master plan for agricultural development in the whole agriculture sector as well as rice farming. Appropriate farm mechanization has been emphasized as an important policy and development goal in Bangladesh (Mandal, 2014).

But there are very few researches existed properly focusing on the social and economic factors which mainly influence the rice farmers in investing and adoption of modern farm mechanization. In this paper, that lacking of the past research works are tried to be recovered by estimating the relative real social and economic factors properly in a systematic way.

Cumilla district is very favorable and known for high amount profitable rice production. Rice cultivators seemed interested in using modern technology if they have opportunities for rice cultivation although there are great prospects for the cultivation of rice in this area. So, Cumilla district can be considered as a conducive location to study the phenomena or effects of adoption of modern technologies for rice production by the rice cultivators. In this paper, the researcher tried to analyze the factors associated with agricultural machinery and their effects on adoption or ownership of the machineries in Cumilla district. Using farm household census data, the study characterized rural farm households who invest in agricultural machinery to adopt and non-adopters. This study is initiated with intent of realizing the factors which effect vastly to the adoption of classical and modern technology by the rice farmers of different villages of Homna and Meghna Upazila of Cumilla.

1.2 Statement of the problem

Rice is the most important and commonly produced cereal crops in Bangladesh and has much potentiality for widespread and sustainable cultivation by the farmers. The policymakers and economists are putting great emphasis on the rapid productivity of rice with a view to meeting up the demand of the increasing population of our country. As existing in a natural disaster-prone geographical location, every year significant amount of crops are destroyed by different types natural hazards creating food deficiency which leads the country to get highly import oriented. The success of any mechanical technology depends on its dissemination and effective usage among the potential users, which ultimately is measured by its level of adoption. But very little is known about the adoption of farm mechanical technologies in rice production by the farmers in this country. For wider and vastly adoption of rice production farming technologies, it is exigent to have a clear and realistic understanding of the present condition of adoption of farm mechanical technologies of rice production by the farmers. It is also unavoidable to get the ability to understand and analyze factors which are actually making a significant contribution to the adoption of rice production technologies. Adoptions of modern technologies for rice cultivation are highly influenced by the farmer's demographic and socio-economic position and factors. An understanding about these factors and characteristics would be very to the researchers, planners and extension employees in performing research, planning and execution of policy implementation programs for sustainable and prolific rice cultivation through

adoption of modern farm technology. For these above reasons, the researcher took an initiative to conduct a research to aiming to answer the following research questions-

i. What personal and socio-economic characteristics influence farmers most to adopt modern technology in rice cultivation?
ii. What is the contribution of the selected characteristics of the rice cultivators on their adoption of modern technologies of rice production?
iii. What are the constraints faced by the rice farmers in case of adopting modern farm mechanization technologies?

Zohra (2016) showed the age significantly contributed to the adoption of BRRI dhan29 production technologies. Haque (2003) found a positive relationship with training exposure and adoption of modem technologies. Sardar (2002) concluded that the extension contact had positively significant relationship with their adoption of 1PM practices. Several studies along with these above mentioned inspired the researcher to get ideas of the work dimension and helped to set specific objectives seemed possible to achieve.

1.3 Specific objectives of the study

The following specific objectives were selected to guide the study to the right and direct pathway in order to proper direction to the study:

i. To assess the socio-economic profile of the rice farmers;
ii. To identify the factors affecting the adoption of farm mechanization for rice cultivation; and
iii. To identify the constrains of adopting farm mechanization.

1.4 Scope of the study

This particular study was conducted to have a realistic understanding of adoption farm mechanical technologies in rice farming by the farmers and to analyze its effect with their selected characteristics. The potential scope might be sum up like below:

i. The findings of this study will hopefully be applicable to the study area at Homna and Meghna upazila under Cumilla district. The findings may also be

applicable to other related personnel of Bangladesh where socio-cultural, psychological and economic condition are more likely to be same with those of the study areas.

ii. The findings of the study may also be beneficial to the policy maker to implement the policies in a feasible and effective manner. It can also help the extension service workers to realize and enhance their action strategies for adoption of new technologies.

iii. The study may also encourage the rice cultivators to use and adopt farm mechanization technologies by make them understand the comparative advantage of adopting mechanization.

iv. The findings are 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.

This study may also help in further academic research and practices in different academic institution and research centers to study and analyze more potential phenomenon to enrich the agricultural sector and its mechanization initiatives.

1.5 Justification of the study

The climate of Bangladesh is very conducive for rice production. That why rice is being the staple grain produced by the farmers from the ancient times. Now, Bangladesh is fourth largest rice producing country in the world (Statista.com). The economy of the country is vastly and mostly depended on rice production of every season. As the population across the country is booming day by day, the farming area getting smaller rapidly. Every year drought, flood, salinity, cyclones and other disasters are also act as a catalyst factor for decreasing the farming land. On the other hand, the demand for food is increasing day by day though the decreasing trend of farm land. That's why, the country's agriculture needs some cost effective and feasible technology to increase the total rice production in lower cost to meet the demand and support the economic condition of the rice cultivators. For that to enhance rice production efficiency, modern cultivation technologies play a great role. The concept and benefits of the adoption of farm mechanical should be disseminated to the farmers in a convincing and attractive manner, so that farmers respond quickly to adopt modern machineries and technologies. This is very sensitive and complicated educative process and is possible through implementation of planning and policies, concerned mainly with increasing agricultural

production and promoting living standards of the farmers. Although the in the selected study areas are cultivated with rice mostly with rice all the year round, the scenario of using modern technologies is not that impressive. That's why, this study can cut a good figure in the initiative to increase the adoption of farm mechanization among the farmers of that particular area.

1.6 Assumptions of the study

An assumption has been defined as the supposition that an apparent fact or principle is true in the light of the available evidence. The researcher had set the following assumptions in mind while undertaking the study "Factors Affecting Adoption of Farm Mechanization in Rice Farming in Some Selected Areas of Cumilla District:

i. The respondents in this study were efficient enough of furnishing proper answers to the questions included in the interview schedule.
ii. The rice cultivators were more or less conscious about the use of modern rice production technologies.
iii. The data collected by the researcher were free from any kind of favor and intentional errors were normally distributed.
iv. The responses which are given by the respondents in the survey were recognized as valid and reliable.
v. Views and opinions furnished and given by the rice cultivators were the representative views and opinions of the whole population of the study area.
vi. The researcher was well adjusted to himself with the social surroundings of the study area. Hence, the collected data from the respondents were free from bias.
vii. The findings of the study are expected to have general applications to other parts of the country with similar personal, socio-economic, cultural and agro-ecological conditions of the study area.

1.7 Limitations of the study

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

i. The study was confined to several villages of Homna Upazila and Meghna Upazila under Cumilla district.
ii. It was quite difficult to get accurate information regarding adoption factors and constraints from the farmers as many of them are illiterate in educational perspective.
iii. Characteristics and factors of the farmers were many and dissonant, but only some supposedly vital characteristics and factors were selected and considered for the research study.
iv. There were some data which were quite problematic and complicated to comprehend and also noty suitable for put into data entry process or criteria. So, the researcher had to develop and improvise some gloomy responses from the respondents to collect information with greater accuracy and to get a reasonable output from the study.
v. Population taken for the present study were kept confined within the heads of the rice producing families as because they were the major decision makers in the determinants of the adoption of farm mechanical technology.
vi. The study was confined mainly to determinants of the adoption of farm mechanical technologies.
vii. Rate of adoption was determined by the adoption of about a dozen modern technology of rice cultivation.

1.8 Definition of related terms

Age

Age of the respondent was defined as the period of time in actual years from his birth up to the time of interviewing.

Education

Education referred to the development of desirable knowledge, skill and attitude in the individual through reading, writing and other related activities. It was measured in terms of actual grades or class passed by a respondent.

Farm size

The term referred to the hectare of land owned by a farmer on which he carried his farming and family business, the area being estimated in terms of full benefit to the farmers.

Farming experiences

Farming experiences means how long the respondents involved in farming activities.

Organizational participation

An organization is defined as an association of persons which has a name of regular set of officials and at least one face to face meeting in a year. Participation in an organization by a respondent referred to his taking part in the organization as general member, executive member or office bearer.

Communication exposure

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

Accessibility to media services

It referred to an individual exposure to or contact with different communication media and sources and personalities being used for dissemination of new technologies among the farmers.

Extension contacts

It referred to an individual's (farmer) exposure to or contact with different communication media, source and personalities being used for dissemination of new technologies.

Agricultural knowledge

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

Mechanical cultivation

It referred to cultivate land by machine or equipment (Tractor/ Power tiller) which does not require more labor and it can cultivate a large field within a short time.

HYV

It refers to the variety (ies) those have the capability of high production per unit area.

ICT

Information and communication technology is the infrastructure and components that enable modern computing

Variable

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

Technology

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

Adoption

It is the decision to make full use of an innovation as the best course of action available (Rogers 2003).

Annual family income

Annual income referred to the total annual earnings of all the family members of a respondent from agriculture, livestock and fisheries and other accessible sources (business, service, daily working etc.)

Family size

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

CHAPTER 2
REVIEW OF LITERATURE

In this chapter, an attempt has been made to review of pertinent literature keeping in view the problem entitled, "**Factors Affecting Adoption of Farm Mechanization in Rice Farming in Some Selected Areas of Bangladesh**". Again, some of these studies may not entirely relevant to the present study, but their findings, methodology of analysis and suggestions have a great influence on the present study. Review of some research works relevant to the present studies, which have been conducted in the recent past, are discussed below.

2.1 Relationship between characteristics and adoption of farm mechanization

Age and Adoption

Talukder (2006) found that the age of the farmers had a significant positive relationship with their adoption of selected rice production practices. Sardar (2002), Zohra (2016) found the same result.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that age of the farmers was not related to their adoption of modern agricultural technologies. Hossain (2004) also showed the same results.

Rahman (2001) observed that there was no significant relationship between age and adoption of Aalok-6201 hybrid rice cultivation practices. Podder (1999), Sumon (2013) and Hossain (1999) are found similar results in their earlier studies.

Education and adoption

Hossain (2004) concluded that education of the farmers had a significant and positive relationship with their adoption of modern Boro rice cultivation practices. Sardar (2002), Sumon (2013) found similar outputs.

Mwaseba *et al.* (2006) reported that, education of household head has influence on adoption of recommended agricultural practices especially when the recommended agricultural practices require 20 managerial skills.

Islam (2007) conducted a study at Dhamrai upazila under Dhaka district in Bangladesh that showed a significant relationship of education on adoption of BRRI dhan29 production technologies. Amin (2015), Zohra (2016) also got the same results.

Haque (2017), Amin (2015) concluded that farmers education increased the farmers adoption of climate smart agriculture. So, education has significantly contributed to the farmers adoption of climate smart agriculture.

Chowdhury (1997) found a positive significant relationship between the education of the farmers and their adoption of selected BINA technologies.

Khan (2018) showed reasonably education had significant relationship with adoption of hybrid rice production technologies.

Ahmed (2006) concluded in his findings that the education of the Garo farmers had a significant and positive relationship with their adoption of selected rice production 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 academic qualifications of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

Uddin (2010) found that the farmers with higher level of education had more adoption of technologies for climate change adaption. Thus, adoption technologies by the farmers for climate change adaptation was higher among those who had higher education.

Mustafi *et al.* (1987) showed surprisingly education had no significant effect on individual's adoption decision of modem varieties of rice in Bangladesh.

Sarker (1997) and Chowdhury (1997) also found similar findings about the relationship between education and adoption of improved technologies.

Family size and adoption

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

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

Mussei *et al.* (2001) also adds that large household sizes are able to provide the requisite amount of labor required to adopt the recommended practice.

Amin (2015) conducted a study at Rajapur upazila under Jhalokathi district in Bangladesh that displayed a non-significant contribution of family size on adoption of modern technologies by the rice cultivators of that area. Sardar (2002), Rahman (2001) and Alam (1998) also found the same result.

Islam (2007) conducted a study at Dhamrai upazila under Dhaka district in Bangladesh that portrayed a non-significant relationship of family size on adoption of BRRI dhan29 production technologies.

Talukder (2006) also found that the family size of the farmers had no significant and negative relationship with their adoption of selected rice production practices

Mia (2005) conducted a study on adoption of integrated pest management practices in rice field by the vegetable growers of Magura district. He also found that family size of the vegetable growers had positive significant relationship with their adoption of IPM practices.

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

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

Chowdhury (1997) conducted a research on adoption of selected BINA technologies by the farmers. He indicated that farm size of the farmers had a strongly positive significant relationship with their adoption of selected BINA technologies. Rahman (1986), Okoro *et al.* (1992), Khan (1993). Hoque (1993) and Sarkar (1997) observed similar results in their respective studies.

Mustafi *et al.* (1987) in their study found that number of family members had no significant effect on adoption of modern varieties of rice in Bangladesh.

Khan (2006) showed in his study conducted at Ramail union in Brahmanbaria district that farmers with larger family were more likely to have more adoption.

Ahamed (2006) conducted a study on Garo farmers in several selected places concluded that the family size of the Garo farmers was not an important factor for adoption of selected rice production technologies.

Farm size and adoption

Aurangozeb (2002) observed that there was no relationship between homestead area and adoption of integrated homestead farming technologies. Hossain (2006) also showed the same results.

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

Hossain (2004) concluded that farm size of the farmers had significant and positive relationship with their adoption of modem Boro rice cultivation practices.

Hossain (2009) showed a study on use of integrated pest management practices by the farmers of Brahmanbaria district. He found that farm size of the farmers had positive significant relationship with their use of IPM practices. Sardar (2002) also achieved the same type of result.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He observed that the farm size of the 25 farmers had a positive significant relationship with their adoption of modern agricultural technologies.

Mia (2005) showed in a study on adoption of integrated pest management practices in Rice field by the vegetable growers‟ of Magura district. He found that farm size of the vegetable growers had positive significant relationship with their adoption of IPM practices.

Khan (2018) in his study done in Joypurhat district showed the findings indicated that farm size of the farmers had a significant positive relationship with their adoption of hybrid rice production technologies.

Annual income and adoption

Hossain (2006) found that annual income of the farmers had significant and positive relationship with their adoption of selected high yielding varieties of rice. Hossain (2004) showed the same impact in another study.

Sumon (2013) concluded that annual income of the famers had no significant relationship with the adoption of improved farm practices.

Kidane (2001) in his different recommended agricultural practices adoption studies conducted, indicated positive relationship between income and adoption of recommended agricultural practices. Amin (2015), Mia (2005) and Aurangozeb (2002) also given the same report.

Islam (2007) conducted a study at Dhamrai upazila under Dhaka district in Bangladesh that showed a significant relationship of annual family income on adoption of BRRI dhan29 production 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.

Amin (2015) showed in his study conducted in Jhalokathi district that the annual income significantly contributed to the adoption of modern technologies in rice cultivation.

Chowdhury (1997) found a significant and positive relationship between annual income and adoption of selected BINA technologies. Rahman (1986), Okoro *et al.* (1992), Islam (1993), Khan (1993), Sarker (1997) observed similar result in their respective studies.

Khan (2018) did a study on adoption of selected hybrid rice production technologies in Joypurhat district. What he found was concluded as the annual family income of the famers had significant relationships with the adoption of adoption of hybrid rice production technologies.

Khan (2006) showed the farmers having higher annual income were likely to have more adoption of modern technologies.

Ahamed (2006) concluded that annual income of the Garo farmers had a positive significant relationship with their adoption of selected rice production technologies.

Islam (2007) conducted a study on adoption of BRRI Dhan 29 production technologies. The researcher ended up saying that annual income of the farmers had a significant relationship with their adoption of BRRI dhan 29 production technologies.

Training exposure and adoption

Haque (2003) found a positive relationship with training exposure and adoption of modem technologies. Rahman (2001), Amin (2015) also showed the same result.

Amin (2015) conducted a study at Rajapur upazila under Jhalokathi district in Bangladesh that showed a significant contribution of training exposure on adoption of modern technologies by the rice cultivators.

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.

Sumon (2013) concluded that training exposure had highly significant positive relationship with the adoption of improved farm practices. Training increases courage and enable the farmers to do new or complicatcd farming activities.

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

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

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS and observed that training exposure of the farmers had a positive significant relationship with their adoption of IPM practices.

Chowdhury (1997) conducted a research on adoption of selected BINA technologies by the farmers. He indicated that training exposure of the farmers had a strongly positive significant relationship with their adoption of selected BINA technologies.

Ahamed (2006) showed that the training exposure of the Garo farmers was not an important factor for adoption of selected rice production technologies. This finding has conformity with the findings of Islam (2002) training exposure also found the similar findings.

Organizational participation and adoption

Amin (2015) conducted a study at Rajapur upazila under Jhalokathi district in Bangladesh that showed a non-significant contribution of organizational participation on adoption of modern technologies by the rice cultivators.

Hossain (2006) found that organizational participation of the farmers had no significant but positive relationship with their adoption of selected high yielding varieties of rice.

Sumon (2013) showed in his findings, concluded as organizational participation of the famers had significant relationship with the adoption of improved farm practices. Khan (2018), Zohra (2016) also showed the same result.

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.

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.

Rahman (2001) conduct 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.

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.

Haque (2017) said that farmers had more organizational participation increased farmers adoption of climate smart agriculture. So, Organizational participation has high significantly contributed to the farmers adoption of climate smart agriculture.

Extension media contact and adoption

Hossain (2004) revealed that extension media contact of the farmers had significant and positive relationship with their adoption of modern Boro rice cultivation practices.

Sumon (2013) found that extension media contact of the famers had significant positive relationship with the adoption of improved farm practices. Sardar (2002), Haque (2003), Nahar (1996) showed the same results.

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

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

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found from his observation 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 fanners 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 of Aalok 6201 hybrid rice.

Chowdhury (1997) conducted a research on adoption of selected BINA technologies by the farmers. He indicated that communication exposure of the farmers had a strongly positive significant relationship with their adoption of selected BINA technologies.

Sarker (1997) conducted an experiment on adoption of improved potato cultivation practices by the potato growers and observed a positive and significant relationship between extension contact and adoption of improved potato cultivation practices.

Amin (2015) conducted a study on the adoption of modern technologies by the rice cultivators in the selected areas of Jhalokathi district. He said that extension communication exposure has significantly contributed to the adoption of modern technologies in rice cultivation.

Rahman (1999) found that extension contact of the boro rice farmers had a significant positive relationship with their adoption of balanced fertilizers in boro rice cultivation.

Khan (2006) conducted a study on adoption of modern agricultural technologies and classification of the adopters at Ramrail union in brahman baria district where he came to conclusion that the extension contacts of the respondents had a positive and significant relationship with their adoption of modern technologies.

Cosmopoliteness and adoption

Hossain (2004) revealed that cosmopoliteness of the farmers had no relationship with their adoption of modem Boro rice cultivation practices.

Sumon (2013) concluded that cosmopoliteness of the famers had significant relationship with the adoption of improved farm practices. Cosmopolite farmers become adoptive by visiting and learning new things of agriculture.

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

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that cosmopoliteness of the respondents had a significant positive relationship with their adoption of integrated homestead farming technologies.

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

Hossain (1999) found a positive significant relationship between cosmopoliteness of the farmers and their adoption of fertilizer. Pal (1995), Haque (1993), Khan (1993), Islam (1986) and Halim (1985) observed similar results.

Chowdhury (1997) found that there was no significant relationship between the farmers' cosmopoliteness and their adoption of selected BINA technologies. Similar results were observed by Hossain (1991) and Islam (1986) in their respectivestudies.

Pal (1995) conducted a research study on the adoption of recommended sugarcane cultivation practices by the farmers. He observed that the cosmopoliteness of the farmers had significant positive relationship with their adoption of recommended sugarcane cultivation practices.

Khan (2006) reflected in his study the higher cosmopolite farmers were more likely to have more adoption of modern technologies. It also means that possession of cosmopoliteness will be helpful to enhance farmer adoption of modern technologies.

Ahamed (2006) conducted a study on the adoption of selected rice production technologies by the garo farmers of bangladesh indicated that the cosmopoliteness does not influence significantly to adopt selected rice production technologies. Alam (1997) found that cosmopoliteness had no significant relationship with their use of improved farm practices in rice cultivation. Hossain (1991) had also similar findings.

Farming experience and adoption

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

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

Zohra (2016) stated that farming experience increases cultivators' skills on the application of technologies in case of adoption of BRRI dhan29 production technologies in Bogra.

Amin (2015) conducted a study at Rajapur upazila under Jhalokathi district in Bangladesh that showed a non-significant contribution of training exposure on adoption of modern technologies by the rice cultivators.

Hossain (2003) revealed that farming experiences of the farmers had a significant relationship with their adoption at modern Boro rice cultivation practices. Haque (2003) concluded the same result.

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

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 farming experiences of the potato growers had significant relationship with their adoption of improved potato cultivation.

Farmer's knowledge and adoption

Amin (2015) conducted a study at Rajapur upazila under Jhalokathi district in Bangladesh that showed a significant contribution of knowledge on modern technologies on adoption of modern technologies by the rice cultivators.

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

Hossain (2009) showed that knowledge on IPM of the farmers had positive significant relationship with their use of IPM practices.

Chowdhury (1997) conducted a research on adoption of selected BINA technologies by the farmers. He indicated that knowledge of the farmers had a strongly positive significant relationship with their adoption of selected BINA technologies.

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

2.2 Conceptual framework of the study

In every scientific research, outcome and results are measured through proper estimation and establishment of dependent and independent variables. Previous studies conducted on this specific topic revealed that adoption of farm mechanization technologies is dependent upon many factors and many aspects. These factors can be categorized into social, personal, economical and situational factors and the behavior of rice cultivators are influenced by these characteristics. So, we need proper dependent and independent variables to construct the hypothesis adequately. The independent variable is the variable the experimenter manipulates or changes, and is assumed to have a direct effect on the dependent variable and the dependent variable is the variable being tested and measured in an experiment, and is 'dependent' on the independent variable.

This study is done to estimate the factors affecting adoption of farm mechanization in case of rice farming in some selected areas of Cumilla district. Adoption choice of the farmers are considered as the dependent variable and other 10 selected characteristics of the rice cultivators were considered as the independent variables of the study. Many interacting forces and factors of many independent variables in different aspects might affect the adoption choice of farm mechanization among the rice producers of the area. Bringing all these complicated factors into a single study is not convenient all time. That’s why some selected limited independent variables are taken for the right measurement of the study. Age, education, rice producing area, years involved in rice

production, women participation, organizational participation, field visits, training received, credit received, advice received are the independent variables selected for using in the study. Considering the above-mentioned situation and, a conceptual framework has been constructed for proper estimation of this study diagrammatically presented in the figure below.

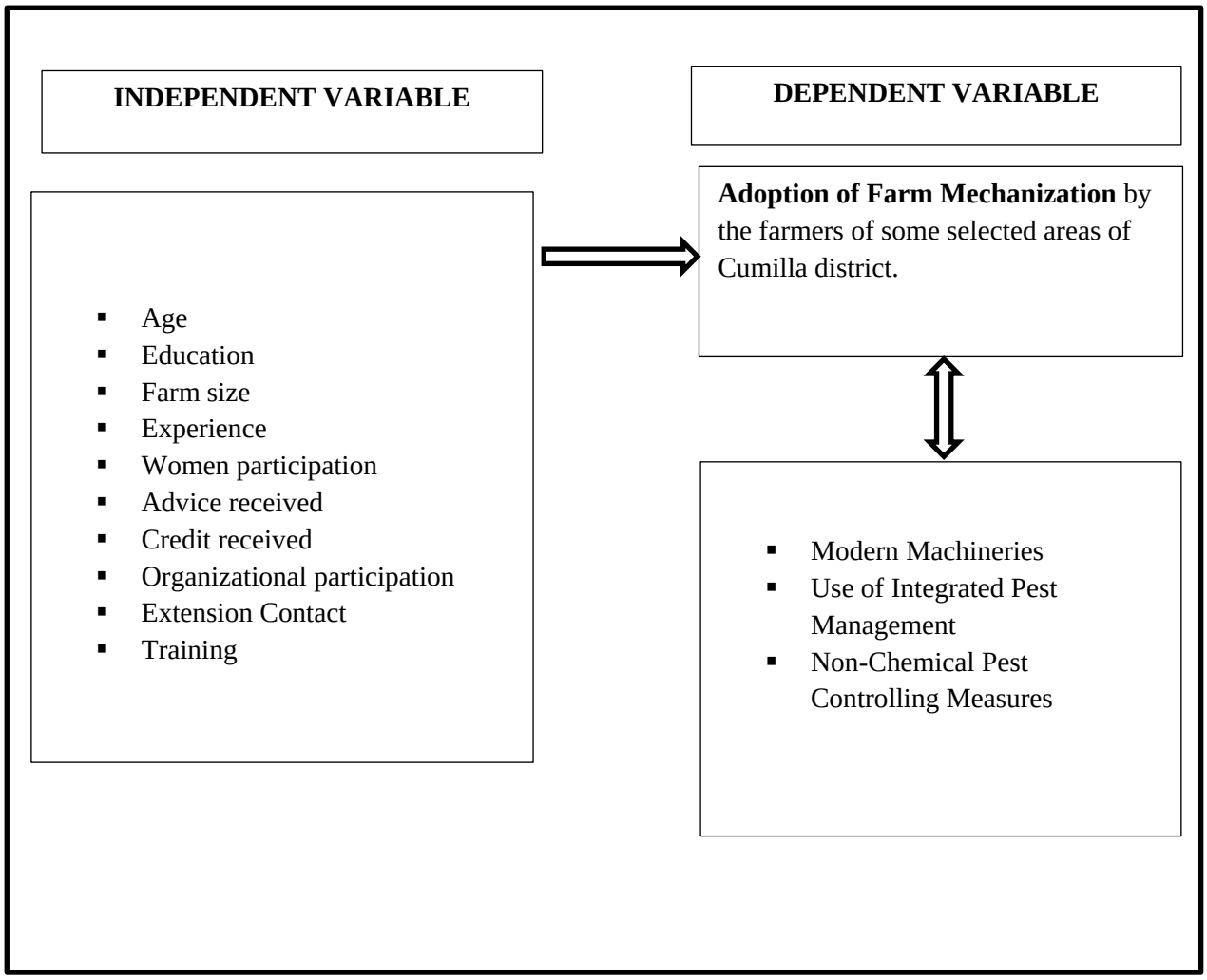


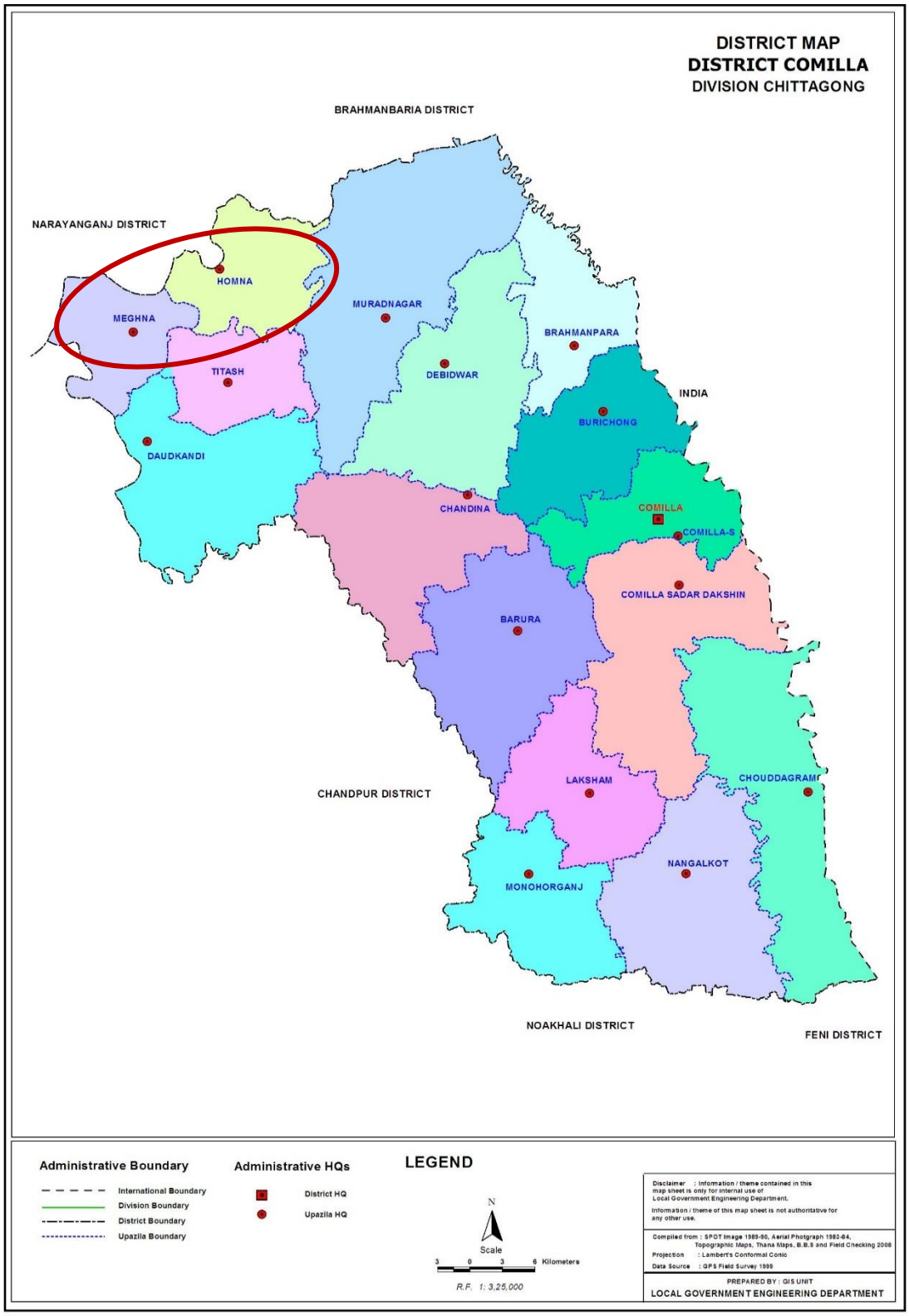
Figure 2.1: Conceptual Framework of the Study.

CHAPTER 3
METHODOLOGY

Research methodology is the specific procedures or techniques used to identify, select, process, and analyze information about a topic. In a research paper, the methodology section allows the reader to critically evaluate a study's overall validity and reliability. The methodology section answers two main questions: How was the data collected or generated? How was it analyzed? it comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge such that the methodologies employed from differing disciplines vary depending on their historical development. This creates a continuum of methodologies that stretch across competing understandings of how knowledge and reality are best understood. This situates methodologies within overarching philosophies and approaches. To address the study objectives with a scientific manner, A sequential description of the methodologies that was followed in conducting this research work has been presented in this chapter under the following headings.

3.1 Locale of the study

The study was conducted at six villages in two upazilas of Cumilla district. The districts of Bangladesh are divided into sub-districts called upazila (Sarker, 2010). Cumilla district has sixteen upazilas, among them six villages of Homna and Meghna upazila have been selected, the villages are named Homna, Darigaon, Goarivanga, Dulalpur, Manikarchar, Borokanda. A map of Bangladesh showing Cumilla district and a map of Homna and Meghna upazila showing the study area have been presented in Figure 3.1 and 3.2, respectively.



Source: www.google.com

Figure 3.1: Map of Cumilla District

Source: www.google.com

Figure 3.2 : Map of Homna and Meghna Upazila

3.2 Sample size and sampling technique

The population of the study is considered to the people who reside permanently in these six villages and cultivate rice all the year round. However, representative sample from the population was taken for collection of data following purposive sampling technique. The head of the farming family who mainly operates the family and the farming activities are the respondents. A total of 150 farmers were chosen among them 90 farmers already adopted the farm mechanization and rest 60 farmers had not.

3.3 Questionnaire design

Questionnaire surveys are administered in many different ways. Generally, the aim is to obtain information suitable for statistical analysis. As a result, attention is paid to how respondents are selected, the extent to which questions relate to underlying concepts, and completion rates. A proper must have specific objectives and goals of getting the estimate able and quantifiable data and information without iterating unnecessary useless questions. All of these points were followed and maintained to the best of my ability in order to construct the best survey questionnaire in this scenario.

3.4 Questionnaire pre-testing and data collection

To test the applicability, feasibility, reliability and the amount of time required to complete the whole interview program, a strong systematic pre testing is done before the original survey work starts. Necessary logistics and instruments can be made available and easier to find by a feasible pre testing of the questionnaire for the effective operation.

Pre-testing was conducted in rural villages of Homna Upazila including Dulalpur, Darigaon, Homna villages of Cumilla district. between the months of January and February, 2021 before to the survey to assure the optimal success of the questionnaire in data collecting, processing, and analyzing. After pre testing, a complete survey questionnaire is prepared to start interview in the selected areas. Following the questionnaire, a face-to face interview was conducted with the respondents of those rice cultivating areas.

3.5 Variables and their measurement

A variable in the field of research is an object, idea, or any other characteristic which can take any value that you are trying to measure. In analytical research there are generally two types of variables. Independent variables are what we expect will influence dependent variables. A dependent variable is what happens as a result of the independent variable. For example, if we want to explore whether high concentrations of vehicle exhaust impact incidence of asthma in children, vehicle exhaust is the independent variable while asthma is the dependent variable. A confounding variable, or confounder, affects the relationship between the independent and dependent variables.

The researcher carefully studied thoroughly and reviewed literature to widen the spectrum of utmost understanding about the natures and scopes of the possible dependent and independent variables pertinent and selected for this research. After a huge examining and sorting the possibilities and relevance eight independent variables and one dependent variable are selected purposively.

Age, education, farm size, experience, women participation, advice received, credit received, organization participation, extension contact and training are taken as the independent variables selected for using in the study. The dependent variable of this study was the adoption of farm mechanization of rice farming. The methods and procedures in measuring the variables of this
study is presented below:

3.6 Measurement of dependent variable

Adoption of farm mechanization technology in case of rice farming by the farmers was selected as the dependent variable for the study. Among some given machineries like power tiller, rice harvesting machine, thresher, tractor, shallow tube well, deep tube well, power sprayer, rice transplanter and combined harvester etc., the farmers who adopted at least three of these machineries was given a score of 1 as adopter and the farmers who didn’t adopt mechanization was given a score of 0 as non adopter. Thus, the range of adoption of farm mechanization in rice farming score was 0 to 1.

3.7 Measurement of independent variable

Age

Actual years from their birth to the time of the interview was measured as age which was found on the basis of the verbal response of the rural rice cultivating people (Rashid, 2014). A score of one (1) was assigned for each year of one's age. This variable appears in item number 1 in the interview schedule.

Education

Level of education was measured in terms of class (year of schooling) passed by rice cultivators of those areas. If a rice cultivator received education from any educational institute or recognized school or college or university, their education was expressed in terms of year of schooling, i.e. one (1) score was given for one year of schooling. Each illiterate person was given a score of zero. The rice cultivators who did not know how to read or write but able to sign only was given a score of 0.5.

Extension contact

Field Visit was measured based on the visits and communication and discussion with the local agricultural officer or block supervisors. Those whose fields were visited by the agricultural officers was given score 1otherwise 0.

Training received

Training was measured based on their response to participate any training program organized by the local agricultural extension office and the duration of the training they attended. Those who was attended any training program was given score 1 otherwise 0.

Farm size

Farm size of a farmer referred to the total area of land on which his/her family carried out the farming operation, the area being in terms of full benefit to the family. The term refers to the cultivated area either owned by the farmer or cultivated on sharecropping, lease or taking from other including homestead area and measured using the following formula (Rashid, 2014):

EFS = A +0.5(B + C) + D

Where, FS = Farm size,

A = Own land under own cultivation,

B = Land taken from others as borga

C = Land given to other as borga,

D = Land taken from others on lease,

The data was first recorded in terms of local measurement unit i.e. shotok.

Based on their total farm size, the farmers were classified into five categories according to DAE (Department of Agricultural Extension) as follow:

Category	Area (Hectare)
Landless	≤ 0.020
Marginal Farmer	0.021 to 0.20
Small Farmer	0.21 to 1.00
Medium Farmer	1.01 to 3
Large Farmer	> 3

Women participation

Women participation in rice production was measured based on their women family member worked in filed Those who has women participation and others were given score 1 otherwise 0.

Farming experience

Farming experience of rice cultivators was determined by the total number of years involved in farming activities. A score of one (1) was assigned for each year farming experiences of his own in this sector.

Credit received

Credit received was determined by the farmers response towards credit facility. Those who received credit and others were give score 1 otherwise 0.

Organization participation

Organization participation was determined by the farmers membership and/or participation in any social/agricultural organization participation. Those who involved in any organization and others were give score 1 otherwise 0.

Advised received

Advised received was determined by the farmers guidance about farm mechanization from others family members, friends or any other persons. Those who received farm mechanization advised were given score 1 otherwise 0.

Table 3.1: Explanatory variables used in the models

Variable	**Notation**	**Description**
Age (years)	X_1	Age of the farmer
Education (years)	X_2	Total number of years the farmer attended school
Farm size (ha.)	X_3	Total amount of cultivable land by the farmers
Experience (years)	X_4	Total number of years involved in rice cultivation by the farmer
Women participation (yes/no)	X_5	One if the farmer allow women, otherwise zero
Advice received (yes/no)	X_6	One if the farmer received advice, otherwise zero
Credit received (yes/no)	X_7	One if the farmer received credit, otherwise zero
Organization participation (yes/no)	X_8	One if the farmer participated in different organization, otherwise zero
Extension contact (yes/no)	X_9	One if the farmer had extension contact, otherwise zero
Training (yes/no)	X_{10}	One if the farmer received training, otherwise zero

3.8 Theoretical and empirical framework

Coherent adoption analysis needs to view technology adoption within a conceptual framework that treats potential adopters as agents who make decisions in their own best interest. Adoption of agricultural technology and input use are the outcomes of optimization by heterogeneous agents (Foster and Rosenzweig, 2010; Janvry *et al*, 2010). This optimization takes place in the presence of constraint budget, information, credit access, and the availability of both the technology and other inputs. Thus, households are assumed to maximize their utility function subject to these constraints (Asfaw *et al*, 2012). The difference between the utility from adopting farm mechanization (U_iA) and the utility from not adopting farm mechanization (U_iN) may be denoted as U_i^*, such that a utility maximizing farm household, *i*, will choose to adopt new technology if the utility gained from adopting is greater than the utility from not adopting ($U_i^* = U_iA - U_iN > 0$). Since these utilities are unobservable, they can be expressed as a function of observable elements in the latent variable model as shown in Equation 1. By following Feleke and Zegeye (2006), Janvry et al (2010), Asfaw *et al.* (2012), and Kohansal and Firoozzare (2013), the adoption decision can be modeled in a random utility framework as follows:

$$Ui^* = Xi'\gamma + u_i \quad \text{..... (1)}$$

$$\text{with } U_i = \begin{cases} 1 & \text{if } U_i^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

where, U_i^* is the latent variable which represents the probability of the household's decision to adopt farm mechanization, and takes the value '1' if the farmer adopts farm mechanization, '0' otherwise. The term X_i' represents explanatory variables explaining the adoption decision, γ is a vector of parameters to be estimated, and u_i is the error term assumed to be independent and normally distributes as $u_i \sim N(0, 1)$.

We employed a logit model (STATA 14.2) to determine the probability of adopting farm mechanization using farm-level data. The logit model is the most suitable tool to determine the probability of whether or not to choose adoption, particularly at the plot-level data analysis (Gauchan *et al.*, 2012). We, further, are interested in assessing the influence of each of the independent variables on the decision of the farm household to adopt farm mechanization. For that, we estimated the marginal effect of independent variables in the logit model which can be obtained by differentiating the first and second order conditions as follows (Greene, 2012):

$\partial E[U_i^*|X_i] / \partial X_i = \Phi(X_i'\gamma)\,\gamma$

Based on the above mentioned theoretical model and previous study experiences (Gao *et al*, 1995; Yen and Jones, 1997; Newman *et al*, 2003; Feleke and Zegeye, 2006; Langyintuo and Mungoma, 2008; Janvry *et al.*, 2010; Asfaw *et al*, 2012; Gauchan *et al*, 2012; Noltze *et al.*, 2012; Kohansal and Firoozzare, 2013), we selected our explanatory variables and specified a logit model as follows:

$$\text{Log } [P/1\text{-}P] = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + e_i$$

Where,

P = Probability of Outcome

β_0 = Intercept

β_1 to β_{10} = Co-efficient of Age, Education, Farm size, Experience, Women participation, Advice received, Credit received, Organization participation, Extension contact and Training

X_1 to X_{10} = Age, Education, Farm size, Experience, Women participation, Advice received, Credit received, Organization participation, Extension contact and Training

e_i = Random Error

3.9 Null hypothesis

The null hypothesis is a characteristic arithmetic theory suggesting that no statistical relationship and significance exists in a set of given, single, observed variables between two sets of observed data and measured phenomena. The null hypothesis presented below was established to explore the contribution of the selected characteristics on adoption of Farm Mechanization technologies. Hence, in order to conduct tests, the earlier research hypothesis was converted into null form as follows:

“There is no contribution of the selected characteristics (age, education, farm size, experience, women participation, advice received, credit received, organization participation, extension contact and training) of farmers on adoption of Farm Mechanization technologies in rice farming.

3.10 Percentage formula

Problems faced by the rice farmers in adoption of farm mechanization were shown in percentage which was calculated by using following formula:

$$P = \frac{F}{N} X\ 100$$

Here, P = Percentage

F = Frequency/sample of the respondent

N = Total number of respondents

Ranking of problems are done based on their majority which is expressed in percentage.

CHAPTER 4
SOCIO ECONOMIC PROFILE OF THE FARMERS

This Chapter presents a conclusive and extensive explanation of the scientific research study's conclusions. This Chapter is divided into three subsections. The first segment examined socio-economic characteristics of the respondents. The second portion discussed the factors affecting adoption of farm mechanization. Finally, the final segment explored the problems faced by the farmers in farm mechanization.

4.1 Descriptive statistics

As table 4.1 shows, the adopters (44.98 years of age) on average were younger than the non-adopter (55.53 years of age), the adopters (7.44 years of schooling) on average were more educated than the non-adopters (5.51 years of schooling), the adopters (0.18 hectare of land) on average have less amount of land than the non-adopters (0.22 hectare of land), the adopters (20.63 years of experience) on average have less years of experience than non-adopters (27.53). About 78 percent of the adopters had extension contact time to time, compared to only 3 percent of the non-adopter farmers had extension contact. About 78 percent of the adopters had received training, compared to only 8 percent of the non-adopter farmers had received training.

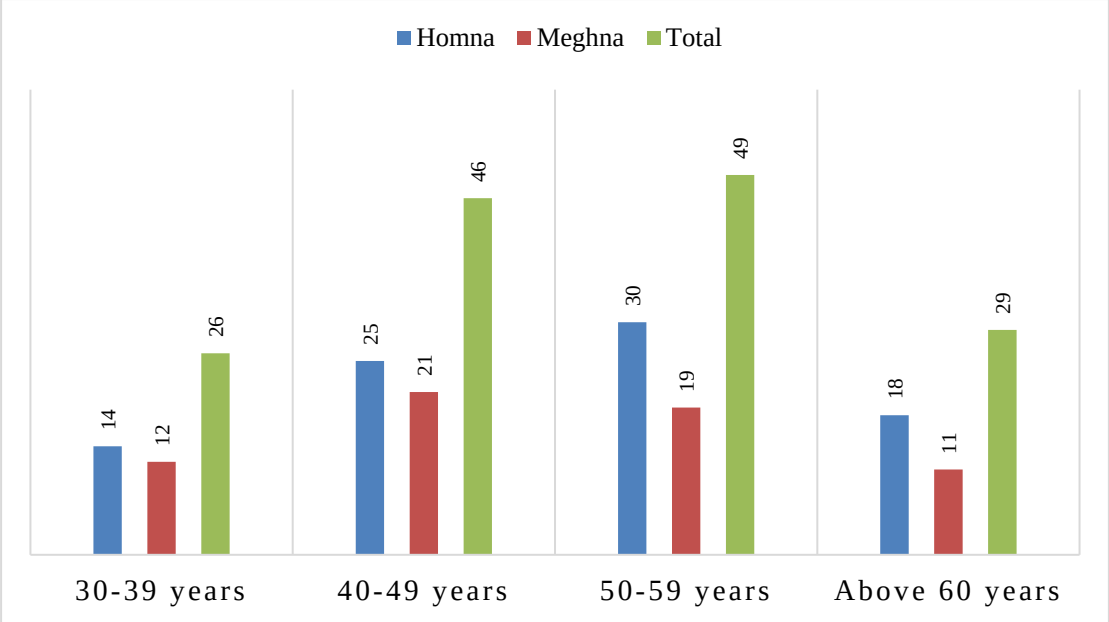
Table 4.1: Descriptive statistics of the variables

Variables	**Adopters (n=90)**		**Non-adopters (n=60)**	
	Mean	Std.	Mean	Std.
Age (years)	44.98	9.21	55.53	6.73
Education (years)	7.44	2.05	5.51	2.70
Farm size (ha.)	0.18	.04	0.22	0.03
Experience (years)	20.63	7.69	27.53	7.67
Women participation (yes/no)	0.77	0.42	0.12	0.32
Advice received (yes/no)	0.77	0.42	0.15	0.36
Credit received (yes/no)	0.73	0.44	0.17	0.38
Organization participation (yes/no)	0.78	0.42	0.20	0.40
Extension contact (yes/no)	0.78	0.42	0.03	0.18
Training (yes/no)	0.78	0.42	0.08	0.28

4.2 Socio economic profile of the farmers

4.2.1 Age

87 and 63 samples were obtained from two upazilas named Homna and Meghna, respectively, to represent the overall population. In Homna upazila, 16 percent of sample populations were 30-39 years old, 29 percent were 40-49 years old, 34 percent were 50-59 years old and 21 percent were over 60 years old. In Meghna upazila, 19 percent of sample populations were 30-39 years old, 33 percent were 40-49 years old, 30 percent were 50-59 years old and 18 percent were over 60 years old. And the total 17 percent were 30-39 years old, 31 percent were 40-49 years old 33 percent were 50-59 years old and 19 percent were over 60 years old in the research region. So, the majority of individuals were between the ages of 50 and 59 years.

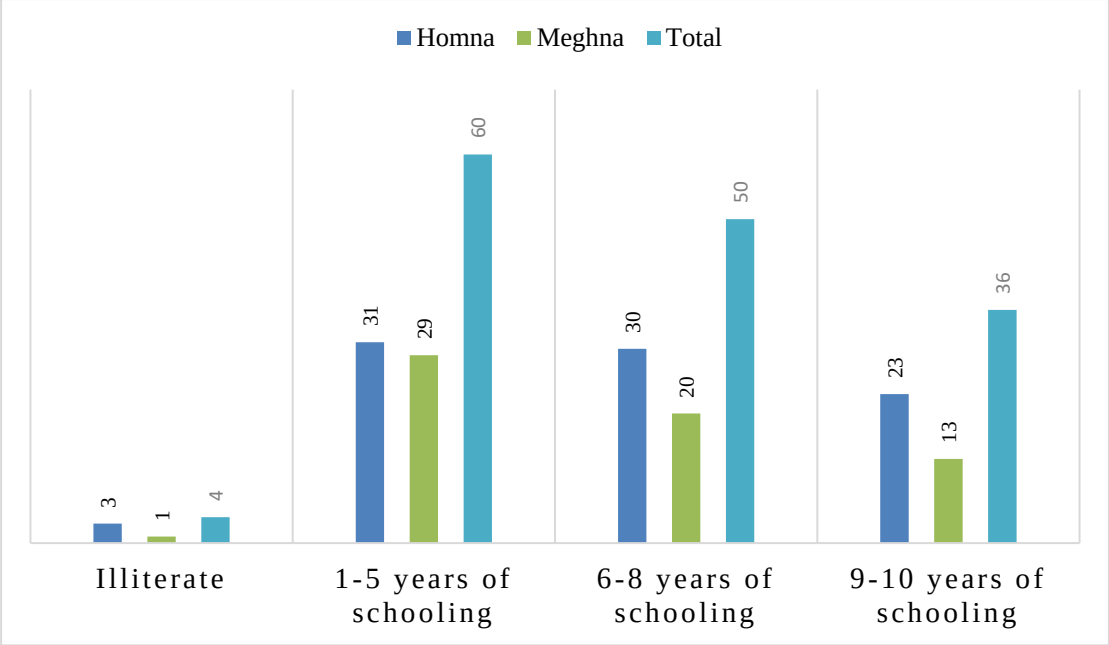


Source: Field Study, 2021

Fig 4.1: Age of the respondent by Study Area (No. of Farmer)

4.2.2 Education

According to Figure 4.2, 3 percent of persons have no education/illiterate, 36 percent have a 1-5 years of schooling, 35 percent have a 6-8 years of schooling and 26 percent have a 9-10 years of schooling in Homna upazila. Around 2 percent of persons have no education/illiterate, 46 percent have a 1-5 years of schooling, 32 percent have a 6-8 years of schooling and 20 percent have a 9-10 years of schooling in Meghna upazila. And altogether, we can observe from this data that roughly 3 percent of persons have no education/illiterate, 40 percent have a 1-5 years of schooling, 33 percent have a 6-8 years of schooling and 24 percent have a 9-10 years of schooling in the study region. Finally, the bulk of farmers in each upazila have a 1-5 years of education.



Source: Field Study, 2021

Figure 4.2: Education Level of the Farmer by Study Area (No. of farmer)

4.2.3 Farm size

According to the data in table 4.2, a significant number (78.89 percent) of respondents were marginal farmer compared to 21.11 percent who were small farmer and there were no landless, medium and larger farmer in case of adopter category. A significant number (76.67 percent) of respondents were small farmer compared to 23.33 percent who were marginal farmer and there were no landless, medium and larger farmer in case of non-adopter category.

Table 4.2: Distribution of the respondents according to their farm size

Categories	Adopter		Non Adopter	
	No. of farmers	Percentage	No. of farmers	Percentage
Landless (≤ 0.02 ha)	0	0.00	0	0.00
Marginal Farmer (0.021 to 0.20 ha.)	71	78.89	14	23.33
Small Farmer (0.21 to 1.00 ha.)	19	21.11	46	76.67
Medium Farmer (1.01 to 3.00 ha)	0	0.00	0	63.34
Large Farmer (> 3.00 ha.)	0	0.00	0	0.00
Total	90	100.00	60	100.00

Source: Field Study 2021

4.2.4 Farming experience

Agricultural experience is critical for farm production, since experienced farmers can execute farm tasks more efficiently. Farmers with more expertise in agricultural operations are often correlated with greater technical efficiency. Farmers' technical inefficiencies are strongly tied to their agricultural experience.

Table 4.3: Distribution of the respondents according to their farming experience

Categories	Adopter		Non Adopter	
	No. of farmers	Percentage	No. of farmers	Percentage
Low Experience level (up to 10 years)	13	14.44	02	3.33
Medium Experience Level (11 to 25 years)	54	60	20	33.33
High Experience Level (Above 25 years)	23	25.56	38	63.34
Total	90	100.00	60	100.00

Source: Field Study 2021

According to the data in table 4.3, a significant number (60 percent) of respondents had a “medium experience level," compared to 14.44 percent who had a "low experience level" and just 25.56 percent who had a "high experience level" in case of adopter category. A significant number (63.34 percent) of respondents had a “high experience level," compared to 3.33 percent who had a "low experience level" and just 33.33 percent who had a "medium experience level" in case of non-adopter category.

4.2.5 Annual family income

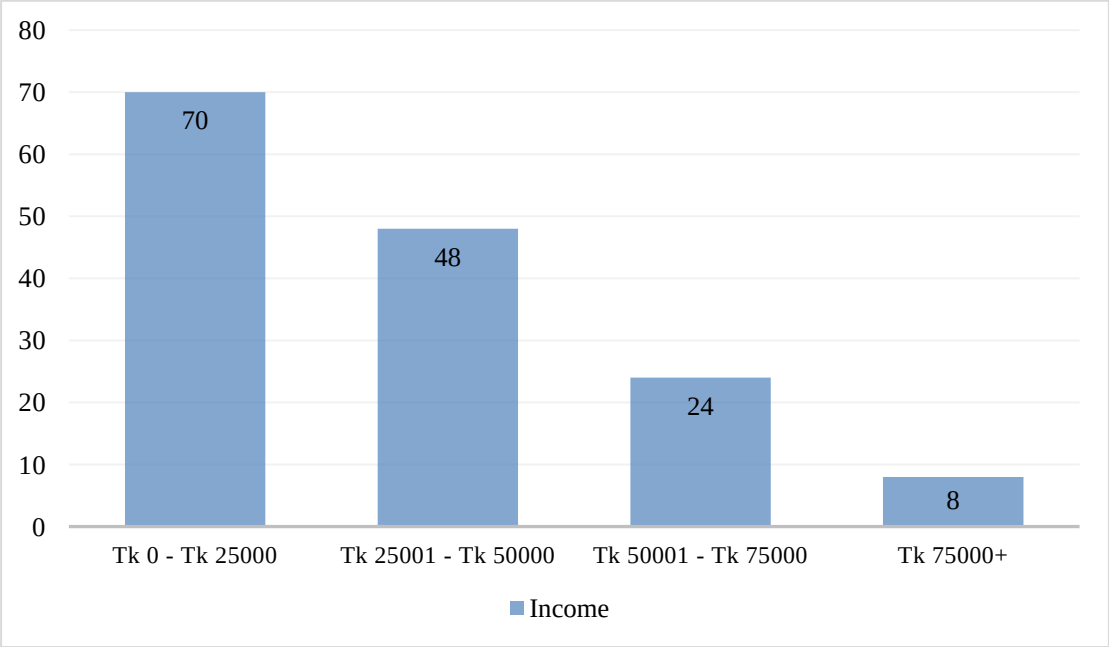
Rice farming is the sample's primary farming income sources. The majority of framers earn their living through agriculture. Crop cultivation was the primary source of income for these individuals, with an average annual revenue from farming is Tk. 22214.77 (Table 4.3).

Table 4.4: Annual family income

Sector	Average annual Income
Farming	22214.77
Non-Farming	12684.56
Total	34899.33

Source: Field Study, 2021

Non-agricultural activities included day labor, auto and truck driving, domestic labor, small business, overseas remittance, and services. Tk. 12684.56 was reported to be the annual average revenue from non-agriculture sources. The overall yearly average income was determined to be Tk 34899.33 (Table 4.3)



Source: Field Study, 2021

Figure 4.3: Farmer Category according to average annual income

4.2.6 Farm machinery training

Only 12 percent of responding farmers in Meghna Upazila got training in agricultural farm mechanization, compared to 44 percent in Homna upazila (Table 4.5). And altogether 31 percent of the respondents got training when 69 percent were not. These training sessions heightened their understanding of correct machine handling, the use of agricultural farm mechanization instruments, the administration of new farm machineries, among other things. BARD, Cumilla and DAE supplied the bulk of the teaching on agricultural mechanization.

Table 4.5: Farm Machinery Training of the respondent by Study Area

Training Received	Homna Upazila		Meghna Upazila		Overall	
	No.	%	No.	%	No.	%
Yes	38	43.68	8	12.70	46	30.67
No	49	56.32	55	87.30	104	69.33
Total	87	100	63	100	150	100

Source: Field survey, 2021

4.2.7 Membership of any social/agricultural organization

In Homna upazila, merely 14 percent of farmers were found to be members of different social and/or agricultural groups, whereas in Meghna upazila, 35 percent farmers were found to be members of various social and/or agricultural organizations (Table 4.6). And altogether 23 percent of the respondents had membership of different social and/or agricultural groups when 77 percent were not.

Table 4.6: Membership in any social/agricultural organization of the respondent by Study Area

Membership	Homna Upazila		Meghna Upazila		Overall	
	No.	%	No.	%	No.	%
Yes	12	13.79	22	34.92	34	22.67
No	75	86.21	41	65.08	116	77.33
Total	87	100	63	100	150	100

Source: Field Study, 2021

4.2.8 Extension contact

In Homna upazila, merely 39 percent of farmers were found to have extension contact, whereas in Meghna upazila, 60 percent farmers were found to have extension contact (Table 4.7). And altogether 48 percent of the respondents had extension contact when 52 percent were not.

Table 4.7: Extension contact of the respondent by study area

Extension contact	Homna Upazila		Meghna Upazila		Overall	
	No.	%	No.	%	No.	%
Yes	34	39.08	38	60.32	72	48.00
No	53	60.92	25	39.68	78	52.00
Total	87	100.00	63	100.00	150	100.00

Source: Field Study, 2021

4.2.9 Credit received

In Homna upazila, merely 45 percent of farmers were found to receive credit, whereas in Meghna upazila, 59 percent farmers were found to receive credit (Table 4.8). And altogether 51 percent of the respondents had received credit when 49 percent were not.

Table 4.8: Credit received by the respondent in study area

Credit received	Homna Upazila		Meghna Upazila		Overall	
	No.	%	No.	%	No.	%
Yes	39	44.83	37	58.73	76	50.67
No	48	55.17	26	41.27	74	49.33
Total	87	100.00	63	100.00	150	100.00

Source: Field Study, 2021

4.2.10 Advice received

In Homna upazila, merely 48 percent of farmers were found to be receiving advice from different organization, whereas in Meghna upazila, 57 percent farmers were found to be receiving advice (Table 4.9). And altogether 52 percent of the respondents had received advice from different organization when 48 percent were not.

Table 4.9: Advice received by the respondent in study area

Advice Received	Homna Upazila		Meghna Upazila		Overall	
	No.	%	No.	%	No.	%
Yes	42	48.28	36	57.14	78	52.00
No	45	51.72	27	42.86	72	48.00
Total	87	100.00	63	100.00	150	100.00

Source: Field Study, 2021

4.2.11 Women participation

In Homna upazila, merely 65 percent of farmers were found to allow women members in rice field, whereas in Meghna upazila, 68 percent farmers were found to allow women members in rice field (Table 4.10). And altogether 67 percent of the respondents had allowed women members in rice field from when 33 percent were not.

Table 4.10: Women participation percentage by study area

Women participation	Homna Upazila		Meghna Upazila		Overall	
	No.	%	No.	%	No.	%
Yes	57	65.52	43	68.25	100	66.67
No	30	34.48	20	31.75	50	33.33
Total	87	100.00	63	100.00	150	100.00

Source: Field Study, 2021

CHAPTER 5
FACTORS AFFECTING ADOPTION OF FARM MECHANIZATION IN RICE CULTIVATION

Age, education, farm size, experience, women participation, advised received, credit received, organization participation, extension contact and training are the major inputs used in adoption of farm mechanization in rice cultivation in study area. These inputs were used as explanatory factors in the adoption of farm mechanization in rice cultivation to help explain the findings.

5.1 Interpretation of binary logistic regression

Binary logistic regression analysis was performed to estimate the factors affecting the adoption of farm mechanization for rice cultivation from the independent variables, as shown in Table 5.1.

Table 5.1: Binary logistic regression coefficients of contributing factors related to the adoption of farm mechanization for rice cultivation

Independent Variable	Coefficient (t value)	P value (Coefficient)	Marginal effect	P value (Marginal Effect)
Age	0.047 (0.85)	0.396	0.0414	0.389
Education	0.233* (1.74)	0.081	0.0206*	0.068
Farm size	-0.013 (-1.29)	0.197	-0.001	0.186
Experience	-0.042 (-0.95)	0.342	-0.004	0.339
Women participation	0.514 (0.60)	0.55	0.045	0.547
Advice Received	0.443 (0.60)	0.551	0.0390	0.550
Credit Received	0.244 (0.32)	0.75	0.0214	0.750
Organization participation	0.533 (0.77)	0.44	0.0470	0.438
Extension Contact	2.88*** (3.00)	0.009	0.2532***	0.001
Training	2.1*** (2.94)	0.003	0.1849***	0.001
Pseudo R^2	0.578			
Chi-squared	115.642***			

N.B.: *** and * indicates 1 and 5 percent level of significance

Table 5.1 shows that extension contact and training were the most important determinants (significant at the 1 percent level of significance), as well as education level of the farmer (significant at the 10 percent level of significance) also important factors related to the adoption of farm mechanization for rice cultivation.

Amin (2015) also showed in his study at Jhalokathi district in Bangladesh that a significant contribution of training exposure on adoption of modern technologies by the rice cultivators.

The marginal effect of training was 0.1849. This means respondents who took training had 18.49 percent higher probability of adoption of farm mechanization for rice cultivation than their counterparts. As the farmers get training about ideas and operation of farm mechanization, they get comparatively rational to adopt farm mechanization which leads them to be skillful about rice farming and get the optimum harvest.

The coefficient of extension contact was also statistically significant at 1 percent level (see Table 5.1). The marginal effect was 0.2532. This means respondents whose fields were visited by extension officers had 25.32 percent higher probability of adoption of farm mechanization for rice cultivation than who did not receive this service. Unlike this study, Hossain (2004) revealed significant and positive relationship between extension media contact and the adoption of modem Boro rice cultivation practices. Through field visits by the Upazila Extension Officers, the farmers get the latest updates about new cost-effective machineries to work with which help them to decide to adopt farm mechanization.

The coefficient of education level was statistically significant at 10 percent level (see Table 5.1). The marginal effect was 0.0206. This means if education level increases by 1 percent then farmers' probability to adopt farm mechanization will be increased by 0.02 percent.

The results of Sumon (2013) also collide with this study showing significant positive relationship of education with the adoption of improved farm practices. That is, higher the education higher the adoption.

The coefficient of age (0.047) was positive but not significant. Hence, the age of the respondent had no significant relationship with their adoption of farm mechanization for rice cultivation as the mechanization is now available to different people of different ages. (see Table 5.1).

The coefficient of women participation (0.514) was positive but not significant. As the women had less facility to skill development and less labor power to operate and adopt heavy machineries, it has not shown any significant relationship. (see Table 5.1).

The coefficient of advice received (0.443) was positive but not significant. Hence, the advice received from other farmers had no significant relationship with their adoption of farm mechanization. (see Table 5.1).

The coefficient of credit received (0.244) was positive but not significant. The credit taking facility was not enough helpful to inspire the farmers to adopt mechanization. (see Table 5.1).

The coefficient of organization participation (0.533) was positive but not significant. the organization at which they participated was unable to increase the adoption tendency among the rice farmers. (see Table 5.1).

The coefficient of farm size (-0.013) was negative but not significant. Hence, the size of the farm had no significant relationship with their adoption of farm mechanization for rice cultivation (see Table 5.1).

The coefficient of experience (-0.042) were negative but not significant. The experienced were mainly old farmers who were not always interested in investing in adoption of farm mechanization (see Table 5.1).

The analysis suggests that the respective authority should consider the education, extension contact and training for increasing the adoption of farm mechanization for rice cultivation.

The Pseudo R^2 (0.578) of the variation in the respondents showed the probability of adoption of farm mechanization for rice cultivation can be attributed 57.8 percent to their respondents' education, extension contact and training, each predictor may explain some of the variance in respondents' adoption farm mechanization for rice cultivation simply by chance. Besides, the chi^2 (115.642) is highly significant at 1 percent level (Table 5.1). These findings indicate that, the model is valid and more likely it is we'll reject the null hypothesis and conclude the variables are associated with each other.

CHAPTER 6

PROBLEM FACED BY FARMERS IN FARM MECHANIZATION

The purpose of this Chapter is to determine the magnitude of the issues faced by rice farmers. Farmers had several difficulties in adoption of farm mechanization in case of cultivating rice. The issues were social and cultural in nature, as well as financial and technological in nature. This chapter will discuss some of the socioeconomic issues and limits associated with adoption of farm mechanization. Farmers challenges and limits were identified based on their perspectives These problems were first counted in response of the number of respondents. Then the counts were transformed into percentage. Hereafter, the problem that obtained the greatest percentage was ranked number 1. And the other problems were ranked accordingly on the basis of greater percentage of respondents facing these problems, constraints (Table 6.1).

6.1 Fragmented lands

It has been revealed that many farmers cultivate just approximately 1.0 hectare land using conventional way. Further, the complete holding of land is not placed in one spot, rather, it is found in divided plots in different places. This prohibits power driven tilling, planting and harvesting machinery to work at best efficiency. Even two wheel tractors, reapers and combines encounter great difficulty from repeated turnings on such fragmented fields. Almost 80 percent of rice farmers classified this as a serious concern (Table 6.1).

6.2 Poor buying capacity of farmers

The rural people are usually impoverished and scarcely can afford a pricey equipment individually. Certain moneyed farmers having a significant number of agricultural fields hold some pricey machinery like, tractors, power tillers, power tiller driven seeders, combines etc. They utilize these devices on their own fields and also run them on hiring basis in others' properties and make a large return. But, the number of such farmers is very limited. Almost 66.67 percent of rice farmers classified this as a serious concern (Table 6.1).

6.3 Lack of quality machines

Due priority was not given to agricultural farm mechanization until the beginning of the century. Earlier, just a few manufacturers came forward to create rudimentary manually driven machines like weeder, thresher, winnower etc. With the expanding requirements for foods, the decision makers acquired the awareness that Bangladesh agriculture would have no other choice but to embrace mechanical production to feed her ever growing population. This helped create several agricultural manufacturing workshops in the nation. Many tiny workshops are making sub-standard equipment generating unfavorable influence among the farmers. These tiny workshop operators, in general, do not employ jigs and fixtures and make distinct standard machines. They obtain the prototype from the designers/researchers and multiply them. While copying these machines, they do not employ precise quality materials and specs therefore producing poor quality equipment. Almost 60 percent of rice farmers classified this as a serious concern (Table 6.1).

Table 6.1: Problems faced by farmers in farm mechanization

Types of Problem	No. of Farmers	Percentage	Rank
Fragmented Lands	120	80.00	1st
Poor buying capacity of farmers	100	66.67	2nd
Lack of quality machines	90	60.00	3rd
Lack of Knowledge and skill of users, artisans and traders	50	33.33	4th

Source: Field Study 2021

6.4 Lack of knowledge and skill of users, artisans and traders

The machine users, craftsmen and dealers are mainly illiterate and don't have substantial knowledge and expertise regarding machine operation, repair and maintenance. The producers do not give 'after sale service' to the consumers. From field experience it has been established that machines are left without operation for small and readily repairable defects. Almost 33.33 percent of rice farmers classified this as a serious concern (Table 6.1).

CHAPTER 7
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary

The early rise of agricultural mechanization in Bangladesh was assisted by an emphasis on small-scale technology suited to its socio-economic setting. The second phase of expansion was associated with imported equipment paired with local manufacturing of sparer parts. The current and third phase of agricultural mechanization in Bangladesh is a result of numerous governmental and private activities promoted by the 'National Agricultural Mechanization Policy' adopted in 2020.

As a growing nation, Bangladesh's recent accomplishments are credited to the continued expansion in its agricultural industry. Despite impressive performance measures, agricultural production in the nation is still quite low. The scientific community believes that farm mechanization might encourage the future expansion of agricultural sector by assuring the timeliness of operation and decreasing the related expenses. This is especially necessary in order to limit the severe consequences of climate change of which Bangladesh is a frontline victim. At times like COVID-19 pandemic, the importance of agriculture mechanization has been realized by many. Since the outbreak started, combining harvesters were implemented at haste in various regions of the country in order to rescue millions of hectares of mature paddy grains from the immediate danger of early flood. Similar activities in other fields of agriculture i.e., transplanting, spraying and precision agriculture might also boost the total agricultural production in the nation. It is thus crucial that the strength and limitations of agricultural mechanization in Bangladesh be examined in light of major recent advancements. In this light, we also analyzed the possibilities of how agricultural mechanization may benefit the Bangladesh economy during times like COVID-19 epidemic, and also during other natural catastrophes.

The sampling frame for the present study were selected purposively as to select the area where the farm machinery was used. On the basis of higher concentration of farm machinery used, two upzillas namely Homna and Meghna in Cumilla district was selected. A sample size of 150 is generally regarded as the minimum requirement for larger population that will yield a sufficient level of certainty for decision-making. In

this case, who were using and not using farm machinery in their rice field in the selected areas were selected as samples. Data for the present study have collected during the period of January to February 2021. Primary data were collected from primary farmers. Selected respondents were interviewed personally with the help of pre-tested questionnaires. The collected data were checked and verified for the sake of consistency and completeness. Editing and coding were done before putting the data in computer. All the collected data were summarized and scrutinized carefully to eliminate all possible errors. Data entry was made in computer and analysis was done using the concerned software Microsoft Excel and STATA.

According to the socio-economic profile study, the majority of individuals were between the ages of 40 and 49 years. the bulk of farmers in each upazila have a 1-5 years of education. The average household size in the study region is 5.30. A significant number (78.89 percent) of respondents were marginal farmer compared to 21.11 percent who were small in case of adopter category. A significant number (76.67 percent) of respondents were small farmer compared to 23.33 percent who were marginal farmer in case of non-adopter category. Average annual revenue from farming is Tk. 22214. 77.. Tk. 12684.56 was reported to be the annual average revenue from non-agriculture sources. The overall yearly average income was determined to be Tk 34899.33. Altogether 31 percent of the respondents got training when 69 percent were not. About 23 percent of the respondents had membership of different social and/or agricultural groups when 77 percent were not. A significant number (60 percent) of respondents had a medium experience level compared to 14.44 percent who had a low experience level and just 25.56 percent who had a high experience level in case of adopter category. A significant number (63.34 percent) of respondents had a high experience level compared to 3.33 percent who had a low experience level and just 33.33 percent who had a medium experience level in case of non-adopter category. On an average, about 48 percent of the respondents had extension contact when 52 percent were not. About 51 percent of the respondents had received credit when 49 percent were not. Around 52 percent of the respondents had received advice from different organization when 48 percent were not. About 67 percent of the respondents had allowed women members in rice field from when 33 percent were not.

Education level of the farmer, extension contact, and training had positive significant towards the adoption of farm mechanization in rice farming. Determinants like age, farm size, experience, women participation, advice received, credit received and organization participation had no impact in the adoption of farm mechanization for rice farming.

Farmers faced some problems in farm mechanization. fragmented lands, poor buying capacity of farmers, lack of quality machines, tariff difference on machines and spare parts, high price of imported machinery, lack of knowledge and skill of users, artisans and traders. Government should take necessary steps to solve these problems.

7.2 Conclusions

Farm mechanization may enhance output of higher-value items while removing the drudgery associated with agricultural production driven by human labor. Thus, there is little question that the application of farm power to suitable tools, implements, and machines, together referred to as "farm mechanization," is a critical agricultural input in Bangladesh, with the potential to improve the lives and economics of millions of rural communities. Additionally, agricultural mechanization in its broadest sense has the potential to significantly contribute to the global sustainable development of food systems by increasing the efficiency, effectiveness, and environmental friendliness of post-harvest, processing, and marketing activities and functions. Farm automation resulted in an increase in inputs due to increased average cropping intensity and area, as well as greater farm labor productivity. Farm mechanization enhanced agricultural productivity and profitability due to the greater efficiency of operations, the higher quality of labor performed, and the more effective use of inputs. Farm mechanization has a modest effect on on-farm human work, but has a significant effect on off-farm labor.

Despite these advancements and limits, physical labor continues to be the biggest input cost in the country's rice production, since it is required for transportation, weeding, harvesting, threshing, and drying, among other operations. Farmers and rural businesses are attempting to further automate some of these tasks in order to minimize production costs and operating time. To support this process of mechanization and to gain a better

understanding of the impact on the livelihoods of rural poor such as marginal farmers, agricultural laborers, and rural artisans, highly coordinated research and extension among government, non-governmental organizations, and private agricultural machinery manufacturers are required. Additionally, to provide an equivalent level of equipment and safety precautions across the Asia-Pacific area, testing and standardization stations should have standardized testing facilities.

7.3 Recommendations

Bangladesh's national agricultural mechanization policy recognizes that mechanized agriculture is the way of the future for Bangladesh agriculture. The government has identified agricultural mechanization as a key instrument for achieving the sustainable development goals (SDGs). These initiatives must be enhanced in the future to ensure that automated farming becomes a viable entrepreneurial model in the future. In light of the trend toward automation, the following actions should be implemented to guarantee the sustainability of future agricultural practices:

a) Young people should be involved in the process of mechanization and get them enrolled in different training programs to increase their knowledge and skill.
b) Farm machineries should be made available at a very reasonable price at the doorstep of the rice cultivators which will widen the range of adoption.
c) Extension service should be made wider to reach every farmer to make them well updated about machineries and technologies.
d) More and more educated persons should be engaged in the farming activities.
e) Identification of farmer-appropriate equipment and continuation of maximum subsidy in the distribution of agricultural machinery to a certain level.

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APPENDIX - I

Questionnaire of

Factors affecting adoption of farm mechanization in rice farming in some selected areas of Bangladesh

Serial No:

1. Farmer's Personal Information

Name: .....

Village: ..... Upazila: ….....

Sex: …..... (M/F)

2. Socio-Economic Profile of the Farmer

i. Age: …..... years

ii. Main Occupation: …..... Secondary Occupation: …..... (1= Agriculture, 2= Business, 3=Job, 4= Daily Labor, 5= Rickshaw Puller, 6= Others)

iii. Education level of the respondent (Years): ……

iv. Education level of the respondent's spouse (Years): …….

v. Number of working members in family: …….

vi. Total number of family members: ……

vii. Do you allow women members to work in the rice field? Yes/ No

viii. Are you a member of any social/agricultural organization? Yes / No
If yes, how many organizations? .....

ix. Does Extension officer visit your field? Yes / No
If yes, how many times in a year? .....

x. Distance of the Extension office from your field .....kilometers

xi. Distance of local market from your house ……. kilometers

xii. Did you attend any training regarding rice production? Yes / No
If yes, for how many days? …….

xiii. Do you have farmers field school/IPM club in your village? Yes/No

xiv. Do you receive any credit for rice cultivation? Yes/ No

If Yes, please mention the source of credit: …….

Please mention the total amount of credit: ……Taka

Please mention the duration of credit: ……..Year

xv. Total cultivable land: …… (shotok)

xvi. Total rice producing area: ……. Shotok

xvii. Do you have rented in land? Yes / No

xviii. Do you have rented out land? Yes / No

xix. Total rice production (kg): …….

xx. How many years you have been involved in Rice production? ……. Years

xxi. How many months in last year you consume from your own production? …….

xxii. Sources of yearly income:

i. Farming income (Taka): …….

ii. Non-Farming Income (Taka): …….

iii. Total Annual Income from Rice Production = …… Taka

3. Types of farm machineries you use in the rice field:

No.	Type	Yes	No
01	Power tiller		
02	Rice Harvesting Machine		
03	Thresher		
04	Tractors		
05	shallow tube well		
06	Deep tube well		
07	Power sprayers		
08	Rice transplanter		
09	Combined harvester		
10	Others small machineries		

4. Information on Rice cultivation:

a) Do you discuss with neighbor farmers about using Farm mechanization? Yes / No

b) Do you discuss with neighbor farmers about rice cultivation? Yes / No

c) Do you have any service provider in your village/upazila? Yes/ No

d) Is there any facility in the nearest place to have spare parts for farm machineries? (Yes/No)

e) Do you think adoption of farm mechanization reduces labor cost? Yes / No

f) Did you receive any training for operating these machineries properly? (Yes/ No)

g) Do you use non-chemical measure to control rice insect-pest? Yes / No

If Yes, please mention the measures

No.	Type	Yes	No
01	Hand sweep of insects		
02	Light traps		
03	Collection and destroy of insects by hand		
04	Perching		
05	Neem cake		
06	Use of pheromone traps		
07			
08			

h) Do you allow women to participate in pest management practices? Yes/ No

i) Did you receive advise on pest management training from pesticide dealers? Yes / No

j) Who take decision regarding use of farm machinery? Man/ Women/ Both

k) Who take decision regarding use of pest management practices? Man /Women / Both

5. How many labours you need in a season for rice cultivation? ……number

6. What is the total cost of labour in your farm for rice cultivation? ……Taka

7. What is the total cost of pesticides for rice cultivation? ……Taka

8. What is the total cost of non-chemical measures of pest control for rice cultivation? ……..……Taka

9**.** Problems regarding farm mechanization

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10**.** Recommendation by the farmers:

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Date: ..... Correspondent Sign:
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