

# USE OF AGRICULTURAL MACHINERIES BY THE FARMERS

**Nazia Azrumir Prima**



**DEPARTMENT OF  
AGRICULTURAL EXTENSION & INFORMATION SYSTEM  
SHER-E-BANGLA AGRICULTURAL UNIVERSITY  
DHAKA-1207**

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**USE OF AGRICULTURAL MACHINERIES BY THE FARMERS**  
**BY**

**Nazia Azrumir Prima**

**REG. NO. 19-10217**

[nazia.prima@gmail.com](mailto:nazia.prima@gmail.com)

Mobile: 01712185869

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**Approved by:**

---

**Prof. Dr. Mohammad Zamshed Alam**

Supervisor

Dept. of Agricultural Extension and  
Information System

Sher-e-Bangla Agricultural University,  
Dhaka-1207

---

**Prof. Md. Mahbubul Alam, PhD**

Co-Supervisor

Dept. of Agricultural Extension and  
Information System

Sher-e-Bangla Agricultural University,  
Dhaka-1207

---

**Prof. Dr. Mohammad Zamshed Alam**

Chairman

Dept. of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University, Dhaka-1207

**Department of Agricultural Extension and Information System**  
**Sher-e-Bangla Agricultural University**

**Sher-e-Bangla Nagar, Dhaka-1207**



**CERTIFICATE**

This is to certify that the thesis entitled **“USE OF AGRICULTURAL MACHINERIES BY THE FARMERS”** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka in partial fulfilment of the requirements for the degree of **Master of Science (MS) in Agricultural Extension and Information System**, embodies the result of a piece of research work conducted by **Nazia Azrumir Prima, Registration No. 19-10217** under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this study has been fully acknowledgement by her.

Dated: December, 2021

Dhaka, Bangladesh

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Prof. Dr. Mohammad Zamshed Alam  
Supervisor  
Dept. of Agricultural Extension and  
Information System

**“Dedicated to My  
Respected Parents”**

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## **ABBREVIATION**

BARI	Bangladesh Agricultural Research Institute
BBS	Bangladesh Bureau of Statistics
GDP	Gross Domestic Product
DAE	Department of Agricultural Extension
FAO	Food and Agriculture Organization of the United Nations
GoB	Government of Bangladesh
MoA	Ministry of Agriculture
NGO	Non-Governmental Organization
SAAO	Sub Assistant Agriculture Officer
SAU	Sher-e-Bangla Agricultural University
SPSS	Statistical Package for Social Sciences

# USE OF AGRICULTURAL MACHINERIES BY THE FARMERS

## ABSTRACT

**Nazia Azrumir Prima**

Farm mechanization plays an important role in food production in Bangladesh. Today, increased mechanization makes it easier to meet the demand for food production which emphasized the importance of using agricultural machineries by the farmers for their farm operations. Therefore, the objectives of this study were (i) to describe the selected characteristics of the farmers; (ii) to determine the extent of use of agricultural machineries by the farmers; and (iii) to determine the contribution of the selected characteristics of the farmers to their use of agricultural machineries. The study was conducted in four randomly selected villages of Kurigram sadar upazila under Kurigram district. A structured interview schedule was used to collect data from 104 randomly selected respondents during 10 July to 10 August, 2021. Descriptive statistics and multiple regression were used for the analysis. Descriptive statistics showed that most of the farmers (89.7 percent) had medium use of agricultural machineries while only 7.7 percent had low and 2.6 percent had high use of agricultural machineries for their farming operations. Multiple regression analysis revealed that the farmers' level of education, farm size, exposure to agricultural extension media contact and benefit of using machineries had positive and significant contribution to their use of agricultural machineries. However, age, annual family income, farming experience, organizational participation and knowledge on agricultural machineries had no significant contribution to their use of agricultural machineries. It can be concluded that higher level of education, farm size, agricultural extension media contact and benefit of using machineries would encourage farmers towards use of agricultural machineries. Therefore, policymakers should emphasize particularly on those identified factors in order to promote mechanized agriculture.

# CHAPTER 1

## INTRODUCTION

### 1.1 General Background

Mechanization is a process by which agricultural practices can be improved and optimal agricultural production can be achieved. Mechanical inputs are currently being used in various agricultural operations. In Bangladesh, pumps are used for irrigation, power tiller and tractor, disc plow, disc harrow subsoiler for tillage, weeders for weeding, sprayers for spraying pesticides, and threshers for threshing crops. Farming intensity and food crop yields have recently increased significantly due to the adoption of mechanized tillage, irrigation and spraying practices (Sarker, 2000).

Agricultural mechanization is a system that uses more machines and technologies to reduce the use of human and animal power in agricultural production, preservation and processing more efficiently and quickly. Mechanization saves materials, time, labor and money. At the same time, it increases farming efficiency, intensity and productivity of farming and improves crop quality, leading to profitable agriculture and creating job opportunities. Agricultural mechanization reduces the difficulty and increases the safety and comfort of the working environment. It improves yield, crop intensity and production. It increases the income of agricultural workers, which in turn improves social equality and the general standard of living. If farm machineries are used properly, it will conserve and rationally use natural resources and reduce production costs. It enables faster agricultural operations, produces higher quality agricultural products, and more.

Bangladesh is predominately an agricultural country. To feed her 150 million people from 8.2 million hectares of cultivable land is a tough task. Every year almost 0.20 million people are being added to the total population whereas the estimated annual shrinkage of agricultural land is about 0.08 million hectares due to various non-agricultural activities like constructions of houses, offices, roads, mills, factories etc.

Within the framework of the Agricultural Mechanization Program of the Department of Agriculture Extension (DAE), research institutes have made efforts to popularize agricultural machines. This has created great interest among farmers in the use of

agricultural machinery in their fields. The government, NGOs and development-related organizations have taken initiatives to establish local service delivery groups to promote agricultural machinery. Through the training of small farm machinery traders, machine services increase in agricultural production at a lower cost. As a result, agricultural productivity in the country increases and both farmers and service provider's benefit.

The economic development of Bangladesh has been achieved at the expense of rural-to-urban labor migration over the past three decades. Unskilled agricultural workers are employed in the garment industry as the demand for low-cost unskilled labor has increased. This has created a shortage of agricultural laborers in rural areas. Deficiencies are very evident during peak transplanting and harvesting periods when meeting seasonal deadlines is critical. The next phase of agricultural mechanization in Bangladesh is expected to take place in these two areas. However, tilling, weeding and crop protection techniques must also be mechanized in the coming days (Rahman et al., 2021).

In Bangladesh, agricultural machinery is used for social development for of the higher demands of agriculture. It increases the efficiency of agricultural production, reduces the cost of agricultural production, and improves product quality and safety. The use of agricultural machinery is the only way to improve Bangladesh's agricultural development and improve Bangladesh's agricultural competitiveness in the world. Research shows that mechanization of tillage, irrigation, crop protection (spraying) and threshing is making progress. However, the mechanization of planting, harvesting and drying is still inadequate. Farmers are interested in using machines in the above activities due to lack of farm labor during peak season. So, there is no other alternative of farm mechanization. However, the government should be subsidies for machines, and machines for farmers (Rahman, 2018).

## **1.2 Background of Farm Mechanization in Bangladesh**

The Government of East Pakistan imported power tillers and power pumps in the late 1960s as a part of “Green Revolution” activities. The Government of Bangladesh also allowed continued import of farm machinery after independence to help mechanize farming activities. The Government of Bangladesh abolished standardization requirements of imported machinery in 1988 and made the market open for the import

of agricultural machines (especially power tillers and pumps) at a nominal tariff following a devastating flood that caused the loss of a large population of draught animal.

However, decreasing number of draught animals, shortening of turn-around time for land preparation and harvesting, shortage of labor at peak periods, and increasing demand for irrigation for the dry season are creating demands for appropriate farm machinery in pre-and postharvest operations. Mechanization in agriculture is reducing demand for labor and creating alternating livelihood opportunities for displaced labor and thus contributing to the non-farm economy in the rural areas through operating machinery, trading, fabricating agro-tools and spares, service providing, etc.

National Agricultural Policy of 1999 emphasized meeting the deficit of animal draught power through the import of machines and raw materials needed for local fabrication with tax relief, providing credit to both users and traders, and encouraging the formation of user groups/cooperatives for owning or custom hiring of agricultural machinery to help mechanization. But this was not yet fully implemented (Hossen, 2019).

### **1.3 The Future Outlook of Agricultural Mechanization**

Bangladesh is an agricultural country and a significant share of its GDP comes from agriculture, which is very important for our economy. With limited mechanical use in crops and other sub-disciplines, agricultural production increased. The National Agricultural Mechanization Policy of Bangladesh recognized that mechanized agriculture is the future of Bangladeshi agriculture. To achieve the Sustainable Development Goals (SDGs), agricultural mechanization has been adopted by the government as one of the development tools. These efforts need to be strengthened in the future for mechanized agriculture to emerge as a startup model in the future. The steps should be taken to ensure the sustainability of farming practices in the future. More importantly, farmers get realize that in order to save time and operating costs and make agriculture profitable there is no better choice than mechanized farming. It creates hope about better mechanization in the coming years. Now, well planning and have positive intentions by higher authorities is necessary. However, Bangladesh hopes to go further develop industries with modern mechanization technology (Rahman, 2021).

#### **1.4 Statement of the Problem**

A systematic evaluation study on use of agricultural machineries by the farmers has not been undertaken till now. Also, very little information is available on knowledge and actual utilization of farm implements and machinery by the farmers in such areas of Bangladesh. All the farmers may not have sufficient knowledge about improved machineries and may not be used the improved machineries at the same time and at the same rate. Mechanization in the country is always associated with some inherent drawbacks like, fragmented lands, poor buying capacity of farmers, lack of quality machines for farm operation, inadequate knowledge of the users about machines, tariff difference on machines and spare parts, financial and institutional constraints. Therefore, the researcher has undertaken the study titled “use of agricultural machineries by the farmers”.

#### **1.5 The Research Questions of the Study:**

In order to guide the research work, the following research questions were formulated in this study.

- i. What are the socio-economics factors that farmer towards use of agricultural machineries?
- ii. To what extent farmers use agricultural machineries for their farming activities?
- iii. What are the contributions of farmers’ selected socio-economic factors to their use of agricultural machineries for their farming activities?

#### **1.6 Objectives of the Study**

The specific objectives of the study:

- i. To identify and describe the selected characteristics of the farmers;
- ii. To determine the extent of use of agricultural machineries by the farmers; and
- iii. To determine the contribution of the selected characteristics of the farmers to their use of agricultural machineries.

#### **1.7 Limitations of the Study**

The study was undertaken to understand the extent of use of mechanization in agriculture by the farmers. The respondents were selected randomly from the study

area. To make the study meaningful, the following limitations were taken into consideration:

- Among 476 upazilas of Bangladesh only one, Kurigram sadar upazila under Kurigram district has been selected as the study area.
- The study was limited to the two unions and four villages of Kurigram sadar upazila.
- In trying to accomplish the goals indexed above, the researcher depended on data provided through the respondents.

### **1.8 Assumptions**

An assumption is a supposition that an apparent fact or principle is true in the light of the available evidence (Goode and Hatt,1952). The following assumptions were kept in mind by the researcher when conducting the study:

- The respondents selected for this study were competent enough to give suitable answers to the questions included in the interview schedule.
- Respondents' views and opinions were representative views and opinions of all farmers in that area.
- The researcher had adapted well to the socio-cultural environment of the study area. Therefore, the data collected from the respondents were free from biased.
- Answers provided by respondents were reliable and they expressed the truth about their belief and opinions.

### **1.9 Definition of the Terms**

For clarity, some terms used throughout the study are defined as follows:

#### **Age**

Age of the respondent was defined as the period of time in years from his birth to the time of interview. It was obtained by asking direct question.

#### **Level of education**

Education was the production of desirable change in human behavior which is change in knowledge, skill and attitude of an individual through reading, writing and observation of activities. In this study the level of education was measured on the basis of grades passed by an individual in formal school.



**Farm size**

The farm size is the cultivated area either owned by respondent's family or obtained on barga / lease in term of full benefits.

**Annual family income**

Annual family income refers to the actual amount of annual income of a respondent and his family earned from agricultural activities and other socially acceptable regular means, such as agricultural crops, fisheries, livestock, service, business, labour, and remittance etc. during a year. It was expressed in 1000 Taka = 1 Taka.

**Organizational participation**

Organizational participation of a farmer refers to his taking part in different organizations as different post bearer.

**Agricultural extension media contact**

Agricultural extension media contact refers to direct contact with various sources of information and individuals' involvement in agriculture to spread new technologies.

**Farming experience**

It means the experience that one obtains directly from agricultural activities. The agricultural experience of the demand grower is measured by the number of years he has engaged in agricultural activities.

**Knowledge on agricultural machineries**

It is the basic level of farmers' understanding of various agricultural machinery and the basic understanding of using different types of machineries. Regarding aspects of knowledge, knowledge emerges when an individual is exposed to the existence of technologies and gains some understanding of how they work.

**Benefit of using machineries**

Benefit of using machinery refers to the improvement and benefit that respondents are getting from using different types of agricultural machinery in farming activities.

**Agricultural machinery**

Agricultural machinery is machinery used in farming or other agriculture. There are many types of such equipment, from hand tools and power tools to tractors and the

countless kinds of farm implements that they tow or operate. Diverse arrays of equipment are used in both organic and nonorganic farming. Especially since the advent of mechanized agriculture, agricultural machinery is an indispensable part of how the world is fed.

### **Farmers**

The persons who were involved in farming activities are called farmers. They participated in different farm and community level activities like crops, livestock, fisheries, other farming activities etc. In this study crop growers were treated as farmers.

### **Respondent**

People who are randomly selected are considered representative of the population known as respondents. These are the people from which a social researcher usually gathers most of the data needed for his or her research. In this study, the respondents were village farmers.

## **CHAPTER 2**

### **REVIEW OF LITERATURE**

In this Chapter, reviews of the related literature to the study are presented. The researcher intensively searched Internet, available books, journals, and printed materials from different sources of home and abroad. The literatures have been organized into following three sections to set the context of the study:

First section: Theoretical Concept of Farm Mechanization

Second section: Review of Literature Related to Selected Characteristics of the Farmers and Their Use of Agricultural Machinery

Third section: The Conceptual Framework of the Study

#### **2.1 Farm Mechanization**

Agricultural mechanization is the process of driving energy between man and materials (Khalequzzaman et al., 2007) in a farm production system powered by engine or motorized equipment's (Negrete, 2019). It simplifies and reduces heavy work, compensates for labor shortages, enhances productivity, and may contribute to the mitigation of climate-related threats (Negrete, 2018).

Mechanization is an operative process through which improved agricultural activities and optimum crop production can be achieved. Currently, the mechanical inputs were used in different farming activities in Bangladesh like as pump, power tiller, subsoiler, weeder, sprayer, combine harvester and thresher for sustainable crop production. The cropping intensity and production of crops have recently been increased significantly due to the adoption of mechanized tillage, irrigation, and spraying practices (Rahman, 2018).

Mechanization is an important tool for profitable and competitive agriculture. The need for mechanization increases rapidly as traction decreases. Without mechanization, it would not be possible to maintain many farming patterns, requiring rapid tillage, planting, weeding, harvesting, processing, etc. (MoA, 2009).

Agricultural mechanization was an important factor in promoting higher production of farms and thus increasing the profitability of agricultural operations (Ghosh, 2010).

Smart farming involved integrating modern technologies into traditional farming methods to improve farming efficiency and produce high quality agricultural products. Interest in smart farming technology is growing to maximize agricultural production and minimize environmental pollution (Sung, 2018).

Mechanization had a positive effect leading to increased productivity and profitability. The results got from the DEA approach imply that farms with a higher degree of mechanization were technically more efficient than other farmers, even though both groups of farmers were technically less efficient (Vortia, 2019).

Mechanized agriculture was given higher productivity and output. Researcher did a study where they concluded that tractor farms gave high yields of wheat, rice and sugarcane. Total yield per hectare was higher in mechanized farming than in non-mechanized farming. Traditional farming techniques and farming methods had changed remarkable with breakthroughs in science and technology. It analyzed a wide range of factors affecting agricultural mechanization of different region, including the overall level of economic development, rural labor migration, land use, agricultural production, food demand, machinery industry, trade and production and testing capacity (Soni, 2010). Many small workshops were manufacturing sub-standard machinery creating adverse impact among the farmers. These small workshop owners, in general, did not use jigs and fixtures and produce different standard machines. They got the prototype from the designers / researchers and multiply them. While copying these machines, they did not use exact quality materials and specifications thus producing low quality machines. This kind of situation, unfortunately, not only happened in Bangladesh, but also in some other countries. Most small and medium metal shops reverse engineer and manufacture spare parts for farm machinery. In addition, 15 medium and large manufacturers of machinery were developed in the country. These manufacturers were engaged in the production of agricultural machinery (Farouk et al., 2007).

## **2.2 Agricultural Mechanization in Bangladesh**

Bangladesh is a country with the highest population density and the highest per capita rice consumption (172.6 kg person 1 year<sup>1</sup>; FAOSTAT, 2015), the Government of Bangladesh had encouraged agricultural intensification and mechanization as an

opportunity to increase production and move towards rice self-sufficiency (Mainuddin et al., 2015).

In Bangladesh, importance was not given to farm mechanization until the beginning of this century, and only a few manufacturers were established to fabricate simple, manually-operated machinery like weeders, threshers, winnowers, etc. With the growing needs for food, the decision-makers realized that Bangladesh agriculture will had no other alternative than to adopt mechanized cultivation to feed her ever growing population. This helped the growth of some agricultural manufacturing workshops in the country. Presently, more than 40,000 small and medium-sized local metal working workshops had grown up to manufacture agricultural machinery all over the country (Farouk et al., 2007).

Irrigation pumps were first introduced by GOB in the 1960s. Their supply was then supported by the private sector after the GOB liberalized the machinery market and relaxed import duties between 1988 and 1995 (Hossain, 2009).

The Government of Bangladesh also initially promoted mechanized tillage with four-wheel tractors, which was said to be unsuitable in size given the average Bangladeshi farm size of about 0.53 hectares, often divided into several fields. Such dispersion makes it difficult to aggregate demand for tillage services between farmers and transport between fields and farms with larger tractors. GOB also introduced centralized irrigation facilities for the first time by setting up deep tube wells and providing low surface water lifting pumps to farmers on lease basis from Development Corporation (Hossain et al., 2007).

Water-saving irrigation technology was expected to be applied in the coming days and solar irrigation systems would be allowed to gradually replace 1.6 million diesel pumps nationwide. This means less carbon emissions from the irrigation sector, reducing production costs and reducing the burden on the national economy because diesel fuel was heavily subsidized by the government (Rahman et al., 2021).

Bangladesh had made significant progress in the production of cereals (rice, wheat and maize) and to some extent vegetables (tomatoes, cauliflower, cabbage, eggplant, beans, etc.) application of agricultural mechanization. In many parts of Rajbari, Faridpur, Magura, Rajshahi and Dinajpur districts, farmers make extensive use of tillage and seeding machines. Agricultural engineers from Bangladesh Agricultural

Research Institute (BARI) had made the improvement to the ordinary two-wheeled tractor. Almost 100 percent of the corn peeling was done using corn peeling machines developed by BARI. Before the development of corn huskers, maize cultivation was very limited due to corn husk problems and low market demand. However, after BARI developed the machine, maize planting area increased rapidly across Bangladesh and demand also increased rapidly. In the past, corn husking was a big problem for farmers.

BARI had also developed a seeder cum seeder bed. The machine was located behind the electric tiller. It could form furrows in both plowed and untied soil the normal and conservation tillage method, this machine could be used to create beds and sow seeds. For planting corn, wheat and vegetable seeds in flower beds, the machine could be used quite well. In some areas of Rajshahi and Dinajpur district, this machine was used. Another success development of BARI's Urea Super Granule (USG). The government had firmly insisted on USG application development to save application time and labor cost for USG application in rice farming. In addition, BRRI had developed wheat-thresher thresher, open-drum thresher, wetland weeder and thresher. These machines were used in many parts of the country. BRRI popularized these machines in other parts of the country through the Agricultural Machinery Extension Project (Islam, 2011).

In recent years, the level of agricultural mechanization had increased start moving faster in Bangladesh. But the overall sound level progress was relatively weak versus full mechanization Nation. However, other mechanization agriculture activities were very low in Bangladesh; such as bed makers, seeders, weeders, harvesters and harvesters (Islam, 2018).

The application of mechanization in the agricultural sector of Bangladesh was increasing but unbalanced. The whole country had prioritized the mechanization of irrigation water pumping. About 55 percent of the total cultivated area was irrigated, mainly by pumps. The second priority was the mechanization of energy-intensive tillage operations digger machine. About 80 percent of all tillage was done by tillers and tractors. Cultivators use for tillage was higher than tractors because the average area was quite small. In addition, rapid development of mechanization had been observed in threshing operations (Roy and Singh, 2008).

DAE had also implemented a 5-year project called “Improving agricultural production through agricultural mechanization project phase II” funded by GoB for the period 2013-2018 across the country. Under this project, the subsidy amount had been increased to 50 percent so that farmers could easily buy all kinds of agricultural machinery, especially seeding machines, transplanters, harvesters, mini combine harvesters and threshers (Islam, 2018).

### **2.3 The Impact of Agricultural Mechanization on Agriculture**

In the Asia-Pacific region, the promotion of agricultural mechanization had led to a changes in the agricultural sector. Many types of small and medium agricultural machines had been widely produced and used in that region. Agricultural mechanization was increasingly important in agricultural production in Vietnam Asia-Pacific region. It reduces difficulty and increases safety and comfort in work environment; It improved yield, crop intensity and production. It increased agricultural workers' income, then improves social equality and the general standard of living. So exactly used, it conserve and uses natural resources rationally and reduced production costs. It enableing faster agricultural operations, effectively copes with climate change, produces higher quality agricultural products, and more. Therefore, it was necessary to use modern equipment in agriculture and modern science and technology for regenerative agriculture. The region necessarily had to accelerate the development of agricultural mechanization (Soni, 2010).

### **2.4 Use of Agricultural Mechineries**

Use of technology had a decision that fully utilized innovation as the best course of action available (Ray, 1991). Or, popularly known as adoption had been defined as “the integration of an innovation into the normal agricultural practice of farmers over an extended period of time”.

Machinery utilization as the actual use of machinery compared to the potential capacity. In particular, we focus on the number of machinery and working hours on the same scale and the same condition comparison by organization types. In agricultural engineering literature, utilization is often referred to as physical operating time on the field compared to total workable hours (Enache, 2015). According to Oxford dictionary “Utilization is the actual use of an idea, belief, or method as opposed to theories relating to it.”

In different countries, and sometimes even in the same country, different terms were used for what was really the same kind of enterprise or organization to enable farmers to share machinery, or had work from them. Therefore in term multifarm use or use of agricultural machineries were used to cover all the various ways of employing field farm machineries such a way that capital outlay or running costs may be reduced by using the machineries on more than one farm (Lonnemark, 1967).

## **2.5 Farmers' Selected Characteristics and their Contribution to Use of Agricultural Machineries**

### **2.5.1 Age and use of agricultural machineries**

Khan (2020) conducted a study and found in his research that age had a non-significant contribution with use of agricultural machineries.

Rahaman (2020) conducted a study and found in his research that age had a non-significant impact on using agricultural machineries.

Sabi *et al.* (2014) revealed that age of the farmers showed a positive and significant contribution with their technological gap and adoption.

Sharma (2010) found that there was a positive and non significant contribution between age and adoption of chilli technology by the farmers.

Joseph (2007) found that an average farmer with an average age of 44 years and with the other farmers' characteristics would almost certainly (99.00 percent) adopt an EFTE. He also reported that regression coefficient for age was positive and statistically significant at the one percent level. The positive and significant contribution of age, suggests that adoption of IFTE was higher among older farmers than younger ones.

Hossain (1999) conducted a study on determine farmers' perceptions of the impact of agrochemicals on the environment. He found that farmers' age had no contribution to their use of fertilizer applicator in their farming.

### **2.5.2 Level of education and use of agricultural machineries**

Khan (2020) conducted a study and found that education had a significant contribution with use of agricultural machineries.



Owolabi (2019) showed that farmer's education play an important role in the realization of farming mechanization among farmers use of agricultural machineries.

Pullaila (2018) reported that educational background (formal human capital formation) was not found to significantly affect the use of agricultural machinery.

Sanam (2016) found that education had a significant contribution with respondents' use of farm machinery.

Islam (2003) conducted a study on "The Use of Organic Fertilizers". He found that there was contribution of farmers' education and use of different fertilizer applicator in their farming.

Dulle and Aina (1999) observed that education influences the ability to access information, understand and use of new agricultural innovation and practices.

### **2.5.3 Farm size and use of agricultural machineries**

Khan (2020) conducted a study and found that farm size had a non-significant relationship with use of agricultural machineries.

Ani (2018) found that in his studies the larger farm size reduce negative perceptions about implant use of agricultural machineries (transplanter and combine harvesters).

Deininger (2018) showed that farm size and yield per unit of land had positive impact on machine utilization.

Keijiro (2016) found that unless new policy measures were taken to expand farm size, Asia as a whole risks losing its comparative advantage in using agricultural machinery and becoming a grain importer in the future. He showed in his studies that farm size had a significant contribution on using agricultural machineries.

Islam (2011) conducted a research where large farmers had purchased high-speed tillers and rotary seeders, using them commercially with other farmers. From field visits to Raj Bari and Dinajpur, it is known that farmers who purchase agricultural machinery had switched to commercial using machinery.

Ghosh (2010) found that farm size had significant contribution on using agricultural machinery.

Soni (2010) found that in Bangladesh and in Nepal with a small land, which had prevented farmers from adopting large machines. Short suitable machinery to carry

out various agricultural activities had left farmers with no choice but to continued traditional farming techniques.

Elizabeth (1998) in his study observed that farm size of the farmers had a positive contribution in the use of farm technology.

#### **2.5.4 Annual family income and use of agricultural machineries**

Hassan (2021) found that higher incomes would be an enabling factor that would be needed for many low- and middle-income countries for their use of agricultural machineries.

Khan (2020) conducted a study and found that annual family income had a non-significant contribution with use of agricultural machineries.

Aryal (2019) found that enabling development of small-scale machinery and custom hiring services, and enhancing farmers' income had a significant positive contribution in use of agricultural machinery.

Engene (2018) Stated that there was a positive contribution between annual income and use of agricultural machineries.

Amare (2016) observed in his studies that total income higher on mechanized farms than on non-mechanized farms. Farmer's higher income had positive contribution in using agricultural machinery.

Lambert & Bayda (2015) found in his researched that income or capital was positively associated with the use of machinery. Those who were financially solvent, they were more found of using machinery.

Aurangozeb (2002) conducted a study on adoption of targeted homestead farming technologies by the rural women in RDRS. He found that there was a positively significant annual income of the respondent and their adoption of integrated homestead farming technologies.

#### **2.5.5 Organizational participation and use of agricultural machineries**

Sanam (2016) findings of the study indicated that social participation had no significant contribution on respondents' use of agricultural machineries.

King (2008) showed that strength of the community to adapt and react to external influences on the system to sudden market changes such as prices or consumer preferences for use agricultural machineries.

Richardson (1999) found that in developing countries research, consultation, collaboration with the stakeholders had a positive contribution in using agricultural machinery by mapping communication and information sharing.

### **2.5.6 Farming experience and use of agricultural machineries**

Pullaila (2018) found that farmer those were the longer the agricultural experience had the negative perceptions about the use of agricultural machineries.

Sanam (2016) founded that farm experience had negatively significant influence on adoption of improved farm practices and use of agricultural machineries.

### **2.5.7 Extension media contact and use of agricultural machineries**

Rahman (2021) reported that appropriate repair and maintenance facilities for rice transplanter should be established in each area through extension services for the more use of agricultural machineries.

Khan (2020) conducted a study and found that extension contact had a significant contribution with use of agricultural machineries.

Ani (2018) found that agricultural extension services play an important role in reducing negative perceptions of farmers towards use of agricultural machineries and thus facilitate farming mechanization in response to the rapid development of agriculture labor wages.

Pullaila (2018) showed that the extension media service acts as the important role in reducing the negative perception of farmers about use of agricultural machinery (transplanter and combine harvester) thus facilitate the mechanization of agriculture to cope with the rapidly rising wages of agricultural workers.

Kher et al. (1991) reported that mass media participation was positively and significantly associated with the use of agricultural machineries.

Hossain (2004) founded that exposure to agricultural extension had a significant positive effect on their adoption of modern boro rice farming methods and use of different machineries in the field.

### 2.5.8 Knowledge and use of agricultural machineries

Khan (2020) found that there was a positive contribution of farmers' knowledge on agricultural machinery and use of machinery in farming activities.

Adetimehin (2018) showed that the farmer knowledge positively contributed the use of agricultural machinery about 85.5 percent of farmers used agricultural machineries.

Habanyati (2017) found that lack of adequate knowledge in machinery (16 percent) and opportunity to reduce use of agricultural machinery among smallholder farmers.

### 2.5.9 Benefit of using machinery and use of agricultural machineries

Ghosh (2010) showed that the proportion of small farmers and marginal farmers in the agricultural scenario prevented from exploiting the full benefits of modern agricultural tools. So, there was a significant contribution of benefit of using machinery and use of agricultural machinery.

## 2.6 The Conceptual Framework of the Study

In scientific research, a conceptual framework is the selection and measurement of variables. A properly formulated research hypothesis contains one "dependent variable" and one "independent variable". This study involves with farmers' characteristics.

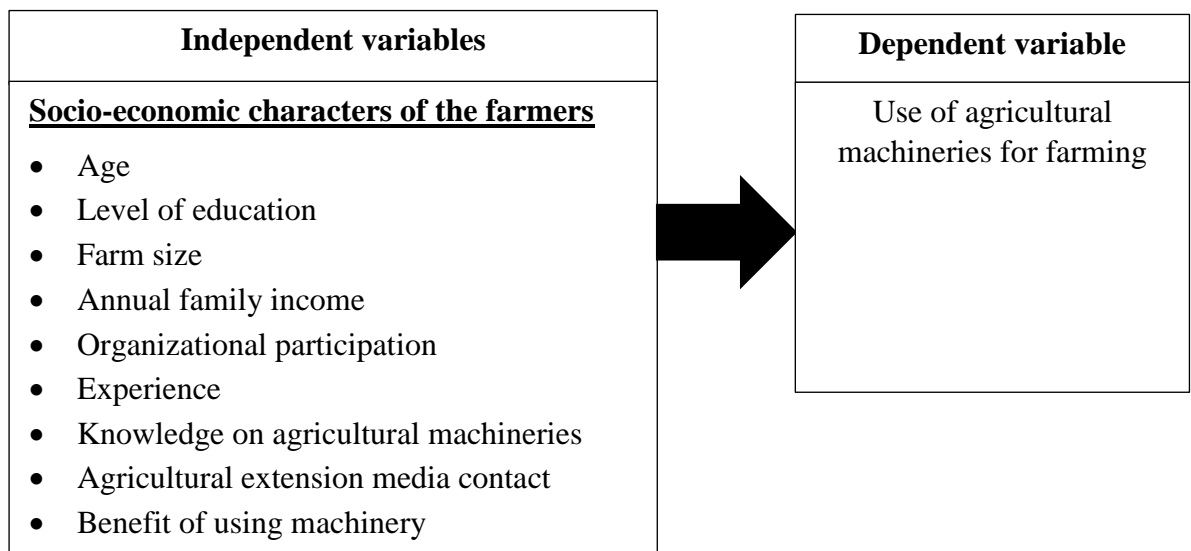


Fig 2.1 : The Conceptual Framework of the Study

## CHAPTER 3

### METHODOLOGY

The methodology allows the researcher to collect valid information. It is impossible to carry out research work without a suitable methodology and it is very difficult to approach the goal scientifically. A sequential description of the methodologies applied in the conduct of this research is presented in this chapter. This chapter is divided into three parts. The first section describes an overview of the study design. Second part describes the measurement of variables and the third section describes the methods applied in the data analysis.

#### 3.1 Design of the Study

The design of the study is a descriptive survey study. In other words, the study is designed to describe the agricultural machinery used by the farmers of Kurigram Sadar upazila and their enabling factors for the use of agricultural machinery. It is also designed to describe the contribution of selected characteristics. Data was collected through an interview with selected respondents. Independent variables include age, education level, farm size, annual family income, organizational participation, farming experience, agricultural extension media contact, knowledge on agricultural machineries, and benefit of using machineries in farming. The dependent variable was the use of agricultural machineries. Figure 3.1 show the map of the study area.

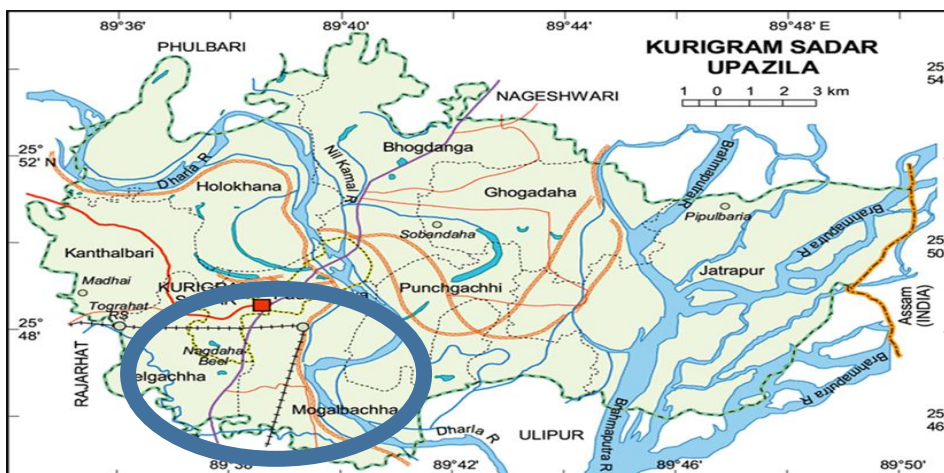


Figure 3.1 A map of Kurigram sadar upazila

### 3.2 Population and Sample

The study was conducted in Kurigram sadar upazila under Kurigram district. In kurigram sadar upazila there are eight union. For the study two unions were selected randomly out of 8 unions. Finally, four villages were randomly selected from two selected unions consisting of two villages from each union. These four villages of kurigram sadar upazila was the locale of the study. Separate lists of farmers of the study villages were prepared by the researcher with the help of Sub-Assistant Agriculture Officer (SAAO) of Kurigram sadar upazila agriculture Office. Table 3.1 shows the distribution of the population, sample for the study. An online sample determination application ([www.surveysystem.com](http://www.surveysystem.com)) was used in order to determine the sample size at 9% error term with 95% confidence interval. An appropriate sample reserve list was determined to avoid the uncertainty related to the availability of sample during data collection.

Table 3.1 Distribution of the Population, Sample and Reserve Sample for the Study

SI	Union	Village	Population	Sample	Reserved
1	Belgacha	Palashbari	480	49	5
2		Kalemouza	250	26	2
3	Kathalbari	Raipur	150	15	2
4		Cherengee	149	14	1
		<b>Total</b>	<b>1029</b>	<b>104</b>	<b>10</b>

### 3.3 Data Collection Instrument

Keeping in mind the objectives of the study, an interview schedule was carefully designed to collect relevant data. The program had both closed and open questions. Simple and direct questions had been included in the program. Appropriate scale was used to identify the adoption of agricultural machine by the farmer Kurigram sadar upazila in Kurigram district. Pre-testing allows the researcher to test the relevance of various questions and statements of the schedule. In addition to removing invalid questions and statements, additions and changes were made based on expert feedback and previous results. A final version of the interview schedule was then prepared and printed to collect data from respondents (Appendix A).

### 3.4 Variables of the Study

A variable is a characteristics that can take on different values in successive individual case. A research paper usually contains at least two important variables,

namely the dependent variable and the independent variable. However, it is difficult to address all factors in a single study. By taking relevant literature available, discussing it with teachers, experts, and researchers in the relevant field, and considering the time and resources available to the researcher, variables were selected. The use of agricultural machinery was considered as the dependent variable of the study. The researcher selected nine respondents' characteristics as independent variables. Characteristics included age, level of education, farm size, annual income, organizational participation, farming experience, knowledge, agricultural extension media contact, knowledge on agricultural machineries and benefits of using machinery in farming.

### **3.5 Measurement of Variables**

To convey the study in accordance with the objectives, it is necessary to measure the selected variables. This selection includes the procedure for measuring the dependent and independent variables of the study. The following procedures for measuring variables are presented below.

#### **3.5.1 Measurement of the independent variables**

The study intended to identify enabling factors that might drive farmers toward mechanized agriculture. The selected socio-economic characteristics of the farmers were identified as enabling factors expected to influence their farm mechanizing decision positively. Considering the scope and budget of the study, nine enabling factors as the form of independent variables were chosen for the study. The measurement procedures for the selected variables were as follows:

##### **Age**

The age of the respondents was calculated based on the total time from their birth to the time of interview. It is obtained by asking a direct question and is measured in years. Since rural Bangladeshis do not keep a record of their date of birth, age is sometimes based on arbitrary estimates. A score of one (1) was assigned for each year age.

##### **Level of education**

Educational achievement was measured based on years of schooling and grades were assigned to a school year. If a respondent passes the final class V test, their

educational score was considered to be 5. If the respondent passed from Madrasa then that also had to be counted. For the respondents who were illiterate and did not attend formal school, the educational score was considered as zero (0). Respondents who only know how to sign receive 0.5 points. Respondents' educational scores were determined from their responses to item number 2 of the interview schedules.

### **Farm size**

Data obtained by item number 4 of the interview schedule was the basis for determining the land ownership rights of the respondent's family. It was measured based on the actual area of land that he and his family own and were cultivating. Land ownership was measured in hectares according to the following formula:

$$\text{Total farm size} = A + B + C + \frac{1}{2}(C + D) + E$$

#### **Where,**

A = Homestead land.

B = Own land under cultivation.

C = Land taken from other as borga.

D = Land given from other as borga.

E = Land taken from other as lease.

### **Annual family income**

A respondent's income was calculated in thousands of Taka based on his family's total annual income from agriculture and other sources. Data obtained by item number 5 of the interview grids was used to determine the annual household income of the respondents. Method of determining income from agriculture and other sources such as services, business, etc. was determined by asking a direct question. The annual income of all family members from farming and other sources was added together to calculate the actual annual household income of the respondents. Score 1 (one) was given for an income of one thousand Taka.

### **Organizational participation**

Respondents' organizational involvement was measured by scoring on organizational involvement based on the nature and duration of their involvement in the five organizations selected up to the time of the interview. Organizational participation



scores were assessed for each respondent based on their membership in the organizations. The following scale was used to calculate the organization's participation score, the scores are 0, 1, 2 and 3, respectively. The nature of participation is to No participation, Ordinary member, Executive committee member and Executive committee officer.

### **Farming experience**

Farming experience was measured on engaged in farming practices. The number of experiences is counted as the numbers of years he/she involved with farming activities. The allocation of one (1) farm experience point was determined by each year of work experience that respondents have, either on their own or their parents' farm.

### **Agricultural extension media contact**

Extension exposure was essentially the exposure of farmers to thirteen selected extension vehicles. Respondents were asked to mention the nature of their exposure to 13 selected media with five alternative responses such as "regularly", "often", "occasionally", "rarely" " and "never". Scores were assigned to these answers as 4, 3, 2, 1 and 0 respectively. The value could range 0-52 where 0 indicates no extension media contact and 52 indicates the highest extension media contact. The item presented in the section 8 of the interview schedule.

### **Knowledge on agricultural machineries**

Respondent were asked some open indeed questions related to agricultural machinery and uses of machinery in different purpose. Total marks were 20 on this section and it indicated in section 9 of the interview schedule. These questions were obtained after extensive consultation with relevant experts by reviewing existing literature and research websites. Each statement has a total weight of 2 (two). For the correct answer, the respondent receives full points. If the respondent did not give an answer, they had been received a zero and partial answer had also been counted.

### **Benefit of using machinery in farming**

The benefit of using machinery in farming was classified into three categories. Technical benefit, financial benefit and others benefit. Respondents were asked to mention the nature of their exposure to eleven selected statements with five

alternative responses such as strongly agree, agree, and neither agree nor disagree, disagree, strongly disagree. Scores were assigned to these answers as 1, 2, 3, 4, and 5. Therefore, the possible score of this variable could range 11- 55, where 11 indicates the lowest benefit and 55 indicates the highest benefit received by the farmers through agricultural mechanization. Section number 10 of the interview grid was used to determine the benefit of using machineries in farming.

### **3.5.2 Measurement of the dependent variable**

The use of agricultural machineries by the farmers was the dependent variable in this work. It was measured by using five point rating scale. The respondents were asked to indicate their use of machineries in ten different stages of farming activities.

The method of assigning points to the five alternatives in each statement is as follows

<b>Extent of use</b>	<b>Scores assigned</b>
Regularly	4
Often	3
Occasionally	2
Rarely	1
Never	0

The extent of use scores of a respondent was measured by adding all the machineries as shown in item no 11 of the interview schedule. The possible range of this variable 0-120.

### **3.6 Collection of Data**

Data were collected through a process of interviewing 104 farmers selected by the researcher herself. The previously prepared interview schedule was used for data collection. Interviews are usually conducted with respondents in their homes and fields. At the beginning of the interview with the respondent, the researcher paid great attention to establishing a relationship with the respondent so that he did not hesitate to provide the desired information. The investigator clearly explained the purpose of the study to the respondents. The researcher explains/reviews the problem to respondents who did not understand the question or do not recall previous activities. The researcher encountered some problems during data collection, but she received

excellent cooperation from the respondents in the interview. Agricultural Extension Officer Kurigram sadar upazila along with his staff enthusiastically assisted the enumerators in data collection. Data were collected from July 10, 2021 to August 10, 2021.

### **3.7 Hypothesis of the Study**

Hypotheses are always in the form of declarative sentences and they are related to each other, generally or specifically from one variable to another. In a broad sense, assumptions were divided into two categories research hypothesis and null hypothesis:

#### **3.7.1 Research hypothesis**

Based on the review of the literature and development of conceptual framework, the following research hypothesis was formulated:

The null hypothesis was developed in this study to explore the contribution between dependent and independent variables. Each of the nine selected characteristics as independent variables (age, education, annual family income, organizational participation, farming experience, organizational participation, agricultural extension media contact, knowledge on agricultural machineries, benefit of using machinery in farming) and one dependent variable use of agricultural machineries”.

However, when a researcher tries to perform statistical tests, then it became necessary to formulate null hypothesis.

#### **3.7.2 Null hypothesis**

A null hypothesis stated that there was no contribution between the concerned variables. If a null hypothesis was rejected on the basis of the test, then it was concluded that there was a contribution of concerned variables. The following null hypothesis was formulated to explore the contribution of the selected characteristics in empowering the farmers through use of machineries. 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, annual family income, organizational participation, farming experience, agricultural extension media contact, knowledge on agricultural machineries and benefit of using machinery in farming) on use of agricultural machineries.

### **3.8 Data Analysis Procedure**

Data analyzing procedure was conducted into 3 steps. Firstly, collected data were compiled, categorized and Statistical analysis according to the objectives of the study. The SPSS (Statistical Package for Social Sciences) was used to perform the data analysis.

#### **3.8.1 Compilation of data**

After the conclusion of the field investigation, data from all interview schedules were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. During this process, all responses from the interview program were provided with numerical coded values. Local units were converted into standard units and qualitative data was converted into quantitative data by assigning appropriate scores as needed.

#### **3.8.2 Categorization of data**

To describe the different characteristics and used of agricultural machinery, respondents were classified into several categories. These categories were developed into narration the nature of the data distribution, frequent understanding, social systems, and observable scoring systems. The procedure for classifying data for different variables will be discussed in detail when describing these variables in Chapter 4.

#### **3.8.3 Statistical analysis**

Analysis was performed using the SPSS (Statistical Package for Social Sciences) computer package. Descriptive analyzes such as range, number, percentages, mean, and standard deviation were used where possible. Multiple regressions analysis was computed for the estimation. Throughout the study, a probability level of at least five percent (0.05) was used as the basis for rejecting the null hypothesis.

#### **3.8.4 Analytical Model**

The specified regression model is used in the study to investigate the use of agricultural machineries was as follows:

The model is explicitly specified as follows;

$$Y_i = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + e$$

Where:

$Y_i$  = use of agricultural machineries,

$x_1$  = age,

$x_2$  = education,

$x_3$  = farm size,

$x_4$  = annual family income,

$x_5$  = organizational participation,

$x_6$  = farming experience,

$x_7$  = knowledge on agricultural machinery,

$x_8$  = agricultural extension media contact

$x_9$  = Benefit of using machinery

On the other hand,  $b_1, \dots, b_9$  are regression coefficients of the corresponding independent variables, and “e” is random error, which is normally and independently distributed with zero (0) mean and constant variance.

## CHAPTER 4

### RESULTS AND DISCUSSION

The results or the findings of this study and its explanation have been presented here in this chapter. According to the objectives of the study, collected data were surveyed, analyzed, tabulated and statistically treated which were obtained from the respondents. These are presented in two sections according to the objectives of the study. In the first section, independent variables (selected characteristics of the farmers) had been discussed. The second section deals with the contribution of independent variable and dependent variable (using agricultural machinery).

#### 4.1 Respondents Characteristics and Descriptive Statistics

This section discusses some of the characteristics of farmers that were thought to be related to the use of agricultural machinery in farming. Different farmers had different characteristics determined by their behavior. Nine enabling variables such as age, education, farm size, annual family income, organizational participation, farming experience, knowledge on agricultural machinery, agricultural extension media contact, benefit of using agricultural machinery and one dependent variable, i.e., use of agricultural machinery were considered for this study were presented in Table 4.1.

**Table 4.1 The Respondents' Characteristics & Descriptive Statistics**

<b>Descriptive Statistics (N=104)</b>					
<b>Characteristics</b>	<b>Measuring unit</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>S.D</b>
Age	Year	29	75	52.65	10.62
Education	Year of schooling	0.5	16.0	6.48	4.44
Farm size	Hac	0.07	1.21	0.36	0.29
Annual family income	000 Tk	36	600	234.77	181.87
Organizational participation	Score	0	8	2.66	1.46
Farming experience	Score	3	45	20.61	11.24
Knowledge on agricultural machinery	Score	11	20	16.34	3.18
Agricultural extension media contact	Score	23	42	32.09	3.50
Benefit of using machinery	Score	36	53	47.42	8.24
Use of agricultural machineries	Score	33	87	64.76	20.64

#### 4.1.1 Age

Age of the respondent farmers ranged from 29 to 75 years old. The mean age was 52.65 years with a standard deviation of 10.62 years. Based on their age, farmers were classified into three categories according to the Ministry of Youth and Sports, Bangladesh (2008), such as 'young' (up to 35 years old), 'middle-aged' (36-50) and 'old aged' (above 50). The distribution of farmers by age was presented in Table 4.2.

**Table 4.2 Distribution of the farmers according to their age**

Categories	N=104		Mean	S.D
	Number	Percent		
Young aged ( up to 35 years)	9	8.7	52.65	10.62
Middle aged (36 -50)	36	34.6		
Old aged (Above 50)	59	56.7		
Total	104	100		

Table 4.2 revealed that the highest proportions (56.7%) of the respondents were old aged, while 34.6% and 8.7% belonged to the middle-aged and young aged groups. Data also indicate that the middle to old aged respondents constitute almost 91.3 percent of total respondents. This means that cultivation in the study area is being managed by comparatively older farmers.

#### 4.1.2 Level of education

The respondents' educational achievement scores ranged from 0 to 16 with a mean of 6.48 and a standard deviation of 4.44. Based on their scores, the farmers are classified into four categories as shown in Table4.3.

**Table 4.3 Distribution of farmers according to their education**

Categories	Number	Percent	Mean	S.D
Illiterate ( up to .5)	5	4.8	6.48	4.44
Primary level (1-5)	44	42.3		
Secondary level (6-10)	33	31.7		
Above secondary level (>10)	22	21.2		
Total	104	100		

Educational qualification of the respondents' had been categorized as done by Sadekuzzaman (2007). Table 4.3 shows that the majorities (42.3%) of the farmers were primary of level education while 31.7% of the farmers were secondary level of education, 21.2% were above secondary level of education and only 4.8% were illiterate. Education develops the mental and psychological capacity of the average person to understand, decide and apply new practices and ideas. Therefore, education is expected to be one of the enabling factors determining the level of farmers' use of agricultural machineries. The findings thus, indicate that the current literacy rate in the study area is higher than that of the national average of 73.9 percent (BBS, 2020). Ahmmed (2016) and Hasan (2015) found almost similar findings.

#### 4.1.3 Farm size

The farm size of farmers in the study area ranges from 0.07 to 1.21 ha with an average of 0.36 ha and standard deviation of 0.29. According to the Department of Agricultural Extension (1999) farm size were classified into five categories as shown in Table 4.4.

**Table 4.4 Distribution of farmers according to their farm size**

Categories	Number	Percent	Mean	S.D
Landless (<.20)	22	21.2	0.36	0.29
Marginal (.21-.50)	43	41.3		
Small (<1 ha)	32	30.8		
Medium (1- 3ha)	7	6.7		
Large (>3.0 ha)	0	0		
Total	104	100.0		

Table 4.4 show that the highest proportion of the respondents belonged to 41.3% to marginal, 30.8% small, 21.2% landless compared to 6.7% had medium farms. The findings indicated that 93.3% of the farmers had below 1 hector farm size. The findings indicated that overwhelming majority (72.1 percent) of the farmers had marginal to small farm size. In Bangladesh most of the farmers live on below a subsistence level. This in one of the vital reasons for not accepting improved



agricultural machineries in their farm as well as having lower skill on agricultural practices. Khan (2020) found almost similar findings.

#### 4.1.4 Annual family income

The respondents' annual income scores ranged from 36 to 600 (thousands) with a mean of 231.49 and a standard deviation of 179.56. Based on annual family income, respondents were classified into three categories (Mean $\pm$  .5 SD) as shown in Table 4.5.

**Table 4.5 Distribution of farmers according to their annual income**

Categories	Number	Percent	Mean	S.D
Low income ( up to 142)	45	43.3	231.49	179.56
Medium income (142-320)	34	32.7		
High income ( above 320)	25	24.0		
Total	104	100.0		

Table 4.5 presented that 43.3% of respondents had low income, while 32.7% had medium income and 24% had high income. A farmer's total annual family income is an important indicator of how much he can invest in his farming. Farmers' higher annual incomes allow them to invest more in farms. On the other hand low income farmers often invest less in their farms. The respondents in the study area were not only engaged in agriculture but also earn from other sources, such as services, businesses, etc. Higher income increases farmers' exposure protection to using agricultural machinery. Low-income farmers often invest less. Ahmmmed (2016) found almost similar findings.

#### 4.1.5 Organizational participation

The respondents' organizational participation scores ranged from 0 to 8 with a mean of 2.66 and standard deviation 1.46. They were categorized in three categories (Mean $\pm$  .5 SD) based on their participation as shown in Table 4.6.

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

Categories	Number	Percent	Mean	S.D
Less participation (< 2)	36	34.6	2.66	1.46
Medium participation (2-5)	45	43.3		
High participation (> 5)	23	22.1		
Total	104	100.0		

Table 4.6 indicated that 43.3% had medium participation, 34.6% had less participation, and 22.1% had high organizational participation. Thus, overwhelming majority (77.9 percent) of farmers had low to medium organizational participation. Bhuiyan (2008) found almost similar findings. Organizational participation is a very effective and powerful source of receiving information about various new and modern technologies. The status of no or having low and medium organizational participation might have significant impacts on use of agricultural machineries.

#### **4.1.6 Farming experience**

The respondents' experience indicated their work experience in agriculture which scored rang was 3 to 45 years, where average farming experience 20.61 and standard deviation 11.24. Based on their farming experience they were categorized into three different categories (Mean± .5 SD) as shown in Table 4.7.

**Table 4.7 Distribution of the farmers according to their farming experience**

Categories	Number	Percent	Mean	S.D
Low experience (up to 15)	25	24.0	20.61	11.24
Medium experience (16-26)	48	46.2		
High experience (above 26)	31	29.8		
Total	104	100.0		

Data presented in the Table 4.7 indicated that 46.2% of the farmers had medium farming experience, while 29.8% of the farmers had high farming experience and 24% of the farmers had low farming experience. Overall, 76 percent had medium and high experience. Thus, overwhelming majority (76.0 percent) of the farmers had medium to high farming experience. Sadekuzzaman (2007) found almost similar findings.

#### **4.1.7 Agricultural extension media contact**

The respondents' agricultural extension media contact ranged observed 23 to 42, mean was 32.09 and the standard deviation was 3.50. Based on their extension contact respondents were classified into three categories (Mean± SD) as shown in Table 4.8.

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

<b>Categories</b>	<b>Number</b>	<b>Percent</b>	<b>Mean</b>	<b>S.D</b>
Low extension contact (up to 28)	15	14.4	32.09	3.50
Medium extension contact (29-36)	73	70.2		
High extension contact (>36)	16	15.4		
Total	104	100.0		

Similar result was observed Sadekuzzaman (2007) and Poddar (2015) where highest respondents were medium extension contact. Table 4.8 show that 70.2% farmers had medium extension media contact, 15.4% had high extension media contact and 14.4% had low extension media contact. Agricultural extension media contact was a very effective and powerful source for getting information and sharing knowledge about the problems and prospect of various new and modern agricultural machineries with others.

#### **4.1.8 Knowledge on agricultural machineries**

The respondents' knowledge on agricultural machinery score ranged from 11 to 20 with an average of 16.34 and the standard deviation was 3.18. Based on their knowledge scores (Mean± .5SD), respondents were classified into three categories as shown in Table 4.9.

**Table 4.9 Distribution of the farmers according to their knowledge on agricultural machineries**

Categories	Number	Percent	Mean	S.D
Low Knowledge (up to 14)	16	15.4	16.34	3.18
Medium knowledge (15-18)	63	60.6		
High knowledge (above 18)	25	24		
Total	104	100		

Result show that 60.6% farmers were moderately knowledgeable about farm machineries use, 24% had high and 15.4% had low knowledge on machinery. The ranged observed 11 to 20. Findings again revealed that almost all (76.0 percent) of the farmers had medium to high knowledge on agricultural machineries. In order to get maximum production and crop yield, farmers must have adequate knowledge and skills in various aspects of using machinery in farming. Khan (2020) found almost similar findings.

#### **4.1.9 Benefit of using machinery in farming**

The observed benefit of using machineries mean was 47.42 and standard deviation 4.12. According to their using scores ranged observed 36 to 55. They were categorized (Mean $\pm$  .5SD) in three categories based on their scores were shown in Table 4.10.

**Table 4.10 Distribution of the farmers according to benefit of using agricultural machinery in farming**

Categories	Number	Percent	Mean	S.D
Low Benefit (<43)	5	4.8	47.42	8.24
Medium Benefit (43-52)	88	84.6		
High Benefit (>52)	11	10.6		
Total	104	100.0		

Data presented in the Table 4.10 indicated that the majority 84.6 percent of the farmers had medium benefited by using machinery in farming, 10.6% of the farmers had high benefited by using machinery in farming and 4.8% of the farmers had low benefited by using machinery in farming. Overall, 95.2 percent of the farmers had medium and high benefit of using agricultural machineries.

#### 4.2 Use of agricultural machineries

As mentioned earlier (Chapter 3), the use of agricultural machineries were considered as the dependent variable of this study. The mean and standard deviation were 64.76 and 20.64 respectively. Based on score the use of agricultural machineries were classified into three categories, as data shown in Table 4.11.

**Table 4.11 Distribution of farmers according to use of agricultural machineries**

Categories	Number of farmers	Percent	Mean	S.D
Low use (upto 40)	8	7.7	64.76	20.64
Medium use (40-80)	95	89.7		
High use (> 80)	2	2.6		
Total	104	100.0		

Table 4.11 indicated that most of the farmers (89.7%) had moderately used while 7.7% had low use and 2.6% had high use of agricultural machinery. Among the farmers, majority of them (97.0 percent) of the farmers had low to medium use of agricultural machineries. Therefore, there is an ample scope to improve agriculture machineries use status by the farmer in the respected study region. Farouk *et al.* (2015) found almost similar findings.

#### 4.3 Contribution of the Selected Characteristics of the Respondents to Their Use of Agricultural Machineries

This section discusses the contribution of nine selected characteristics of farmers with their use of agricultural machineries (dependent variable). Characteristic included age, education, farm size, annual family income, organizational participation, farming experience, agricultural extension media contact, knowledge on agricultural machineries, benefit of using machinery in farming were the independent variables. In

order to estimate the use of agricultural machineries in farming activities, the multiple regression analysis was used which is shown in Table 4.12.

**Table 4.12 Multiple regression co-efficient showing contribution to the selected characteristics of the farmers to their use of agricultural machineries.**

Dependent variable	Independent variables	Un Std. B	Coefficient Std. Error	$\beta$	t	Sig.	R <sup>2</sup>	Adj. R <sup>2</sup>	F
Use of Agricultural Machineries	Age	.000	.000	0.037	.531	0.597	0.715	0.688	26.216
	Level of education	.001	.001	0.176	2.236	0.028*			
	Farm size	.024	.011	0.214	2.101	0.038*			
	Annual family income	.003	.000	0.017	.139	0.889			
	Organizational participation	.003	.002	0.174	1.882	0.063			
	Farming experience	.000	.000	0.071	.783	0.436			
	Agricultural Extension Media contact	.012	.005	0.180	2.111	0.037*			
	Knowledge on agricultural machineries	.001	.001	0.044	.620	0.537			
	Benefit of using machineries	.020	.009	0.237	2.303	0.023*			

(\* Significant at 0.05 level of probability)

The results presented in Table 4.12 shows that among the nine variables the respondents' level of education, farm size, agricultural extension media contact and benefit of using machinery made significant positive contributions to the use of agricultural machineries. However, age, annual family income, organizational

participation, farming experience, knowledge on agricultural machinery showed such no contribution. Among these, benefit of using machinery was the most significant .023 (significant at the 5% level of significance). The variables altogether contribute 68% of the variance of the use of agricultural machineries. However, each predictor may explain some of the variance in respondents their use of agricultural machineries simply by chance. The adjusted R<sup>2</sup> value penalizes the addition of extraneous predictors in the model, but value 0.688 is still show that variance is farmers their use of agricultural machineries can be attributed to the predictor variables rather than by chance (Table 4.12). In summary, the models suggest that the respective authority should be considers the responds' education, farm size, agricultural extension media contact and benefit of using machinery and in this connection some predictive importance has been discussed below:

#### **4.3.1 Contribution on benefit of using machineries to farmers' use of agricultural machineries**

From multiple regression, it is concluded that the contribution between farmer's benefit and use of agricultural machinery tests the following null hypothesis; "There is no contribution of the benefit of using machineries on the use of agricultural machinery in farming."

The p value of the assumed variable is .023. The following observations have been made based on the value of the relevant variable in the study under consideration.

- a) The contribution of benefit of using machineries at the significance level is 5%. Here,  $p < .05$ .
- b) The concerned null hypothesis was rejected.

The  $\beta$ -value of benefit of using machinery was .237. So, it can be stated that benefit of using machineries increased by one unit, farmers' use of agricultural machineries. Based on the findings it can be said that farmers who were benefited by the use of machinery they had positive impact on the use of agricultural machinery. When farmers are benefited themselves by using machineries they are found of more machines and also inspired their neighbors to use different machines.

#### **4.3.2 Contribution of farm size to farmers' use of agricultural machineries**

From multiple regression, it was concluded that the contribution of farm size and use of agricultural machinery tests the following null hypothesis; "There is no contribution of farm size on the use of agricultural machinery in farming."

The p value of the assumed variable was .038. The following observations had been made based on the value of the relevant variable in the study under consideration.

- a) The contribution of farm size at the significance level is 5%. Here,  $p < 0.05$ .
- b) The concerned null hypothesis was rejected.

The  $\beta$ -value of farm size was .214 .so, it can be said that farmers' who had more farm increased by one unit, farmers' use of agricultural machineries increased by .214. Based on the above findings it can be said that farmers who hold a large amount of land use more agricultural machinery in farming. Hong (2020) found similar result and developed a theoretical framework that distinguishes exogenous from endogenous factors in farmer characteristics such as farm size and use of agricultural machinery and found positive contribution of farm size on the use of agricultural machinery.

#### **4.3.3 Contribution of agricultural extension media contact to farmers' use of agricultural machineries**

From multiple regression, it was concluded that the contribution of agricultural extension media contact and the use of agricultural machinery tests the following null hypothesis; "There is no contribution of agriculture extension media contact on the use of agricultural machinery in farming."

The p value of the assumed variable is .037. The following observations had been made based on the value of the relevant variable in the study under consideration.

- a) The contribution of agricultural extension media contact at the significance level is 5%. Here,  $p < 0.05$ .
- b) The concerned null hypothesis was rejected.

The  $\beta$ -value of agricultural extension media contact was .180. So, it can be stated that extension media contact increased by one unit farmers' use of agricultural machineries increased by .180. Based on the above findings, it can be said that farmers who had more exposed to agriculture extension media contact, they are used more agricultural machinery. Similar result also found by Siphesihle (2020) and



Rahaman (2020). Due to agricultural extension media contact farmers are getting to know about new machines and become interested in using machineries. Even if they faced any problems on using machinery agriculture extension officer or block supervisor can help them. Agricultural extension media contact has positive contribution on using more machineries in farming.

#### **4.3.4 Contribution of level of education to farmers' use of agricultural machineries**

From multiple regression, it was concluded that the contribution between farmer's level of education and use of agricultural machinery tests the following null hypothesis; "There is no contribution of education on the use of agricultural machinery in farming."

The p value of the affected variable was .028. The following observations had been made based on the value of the relevant variable in the study under consideration.

- a) The contribution of level of education system at the significance level is 5%. Here,  $p < 0.05$ .
- b) The concerned null hypothesis was rejected.

The  $\beta$ -value of the level of education of farmers was .176. So, it can be stated that as farmers' education increased by one unit farmers' use of agricultural machineries increased by .176. Based on the above findings, it can be said that educated farmers had a positive influence on the use of agricultural machinery in farming. So, higher education has high significantly contributed to the farmers' use of agricultural machinery. Education enhances knowledge and helps farmers to gather more knowledge on using machinery which ultimately helps farmers to reduce their problems in using machines.

## **CHAPTER 5**

### **SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS**

This Chapter deals with the summary of findings, conclusions and recommendations of this study. In this Chapter, the summary of this study is presented.

#### **5.1 Summary of the Findings**

##### **5.1.1 Selected characteristics of the farmers**

Data were collected randomly from selected 104 farmers of four villages of two union of sadar upazila under Kurigram district by using a presented interview schedule. Appropriate scales were developed in order to measure the variables. Descriptive statistics such as mean, standard deviation, range and percentage were used to describe the variables.

##### **Age**

The farmers were classified into three categories. The highest proportions (56.7 percent) were old, while one-third of them (34.6 percent) were middle aged and 8.7 percent were young aged.

##### **Level of education**

The majority of farmers (42.3 percentage) had primary level education while 31.7 percent of farmers had secondary level of education, 21.2 percent had above secondary level and 4.8 percent illiterate/can sign only.

##### **Farm size**

The highest proportion of farm size was (41.3 percent) marginal, 30.8 percent small, and 21.2 percent landless and 6.7 percent had medium farm size.

##### **Annual family income**

The majority of farmers had (43.3 percent) of low income, while 32.7 percent had middle income and 24 percent had high income.

##### **Organizational participation**

The majority of farmers (43.3 percent) had medium participation, 34.6 percent had less participation and 22.1 percent had high organizational participation.

### **Farming experience**

The majority of farmers had (46.2 percent) medium farming experience, 29.8 percent had high experience and 24 percent had low farming experience.

### **Knowledge on agricultural machinery**

The majority of farmers (60.6 percent) had medium knowledge, 24 percent had high knowledge, and 15.4 percent had low knowledge respectively.

### **Agricultural extension media contact**

The majority of farmers (70.2 percent) had medium extension media contact and almost equal proportions of the farmer (15.4 & 14.4 percent) had high and low extension media contact, respectively.

### **Benefit of using machinery**

The majority farmers (84.6 percent) were moderately benefited whereas one-tenth of the respondents (10.6 percent) were highly benefited from using mechanized farming. However, less than 5 percent of the farmers experienced low benefit.

### **Use of agricultural machineries**

The majority of farmers (91.3 percent) had medium use while less than one-tenth of the respondent (7.7 percent) had low and only 1 percent had high use of agricultural machineries. Overall, the statuses of the farm mechanization of the study area were moderately satisfactory.

#### **5.1.2 Contribution of the selected characteristics of the respondents to their use of agricultural machinery**

In multiple regressions test nine null hypotheses were developed and tested to explore the contribution of these nine enabling socio-economic factors that influence farmers to use agricultural machinery. In test revealed that level of education, farm size, agricultural extension media contact and benefit of using machinery had positive contribution to their use of agricultural machinery, while age, annual family income, Knowledge and farming experience had no contribution to their use of agricultural machineries. Higher education had high significantly contributed to the farmers' use of agricultural machinery. Farmers who had a large amount of land use more

agricultural machinery in farming. Farmers who were benefited by the use of machinery they had significant contribution on the use of agricultural machineries.

## **5.2 Conclusions**

The conclusions drawn based on the results of this study and their logical interpretation based on other relevant factors were given below:

- ✓ Among the farmers, the majority 89.7 percent of the respondents had medium use of agricultural machineries. Therefore, it may be concluded that there is scope to increase the extant of use of agricultural machineries by the farmers.
- ✓ Education contributed to farmers' use of agricultural machinery. Therefore, it can be concluded that farmers who were more educated had more use of agricultural machinery than a farmer with a lower level of education.
- ✓ Farm size had positively significant on the use of agricultural machinery. It is expected that farmers having large farm will benefit more from mechanized farming since it may reduce their operational costs and address labor shortage problems at peak times.
- ✓ Extension media contact significantly positively contributed to the use of agricultural machineries. Therefore, it can be concluded that higher farmer exposure to extension media contact increases farmers' awareness and interest in the use of agricultural machinery.
- ✓ Farmers' benefit of using agricultural machinery had a positive contribution on their use of agricultural machineries. This means that the more farmers benefit from machineries, the greater they will use agricultural machineries.

## **5.3 Recommendations**

### **5.3.1 Recommendations for policy formulation**

- i. Farmers' overall use of agricultural machineries was found medium. However, the benefit of using machinery was found to positively contribute to their use of agricultural machinery. Therefore, it is important to encourage farmers and introduce policies in favor of farm mechanization so that farmers can easily benefit from it.
- ii. Extension media contact enhances farmers' diverse knowledge and enables them to cope with different problems while using machinery. So, extension

media contact should be increased in the study area with regard to farm mechanization.

- iii. Concerned ministries, particularly the Ministry of Agriculture and Ministry of Commerce, should introduce subsidies, credit and insurance facilities for small farmers in favor of farm mechanization.

### **5.3.2 Recommendations for further study**

- i. The study was conducted in four unions of Sadar upazila under Kurigram district. The results of this study need to be verified by similar studies in other parts of the country.
- ii. This survey explored the contribution of nine characteristics of farmers to their use of agricultural machineries. Further research can be conducted by taking other characteristics to observe the contribution of those factors to their use of agricultural machinery.

## REFERENCES

- Adetimehin, O., Okunlola, J. & Owolabi, K. 2018. Utilization of Agricultural Information and Knowledge for Improved Production by Rice farmers in Ondo State, NiGeria. *Journal of Rural Social Science*. **33**(1):76-100.
- Ahmmed, Uddin, A.T.M. and Farouk, S.M. 2016. Research on agricultural Machinery in Bangladesh. *Journal of Agricultural Mechanization in Asia, Africa and Latin America (AMA)*. **47**(2):18-39.
- Ani, P., Eka, R.A. & Akira, I. 2018. Factors affecting paddy farmers' perception of utilizing agricultural machines in Indonesia. *Journal of Agricultural Extension and Rural Development*. **10**(8): 150-157.
- Aryal, P.J., Rahut, B.D. & Maharjan S. 2019. Understanding Factors Associated with Agricultural Mechanization: A Bangladesh case. *World Development perspectives*. **13**(2):1-9.
- Aurangozeb, M.K. 2002. Adoption of Integrated Homestead Farming Technologies by the Rural Women in RDRS, *MS (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- BBS. 2020. Statistical Yearbook of Bangladesh (19th Ed.), Dhaka: Ministry of Planning, GoB.
- BBS. 2021. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics, Statistical Division, Ministry of Planning, Government of People's Republic of Bangladesh, Dhaka.
- Bhuiyan, M.R.K. 2008. Attitude of farmers towards organic cultivation of HYV of Rice. M.S. Thesis, Department of Agricultural Extension and Information System, Sher-E-Bangla Agricultural University, Dhaka.
- Deininger, K., Jin, S. & Liu, Y. 2018. Can labor market imperfections explain changes in the inverse farm size-productivity relationship? : Longitudinal evidence from rural India. *International Food Policy Research Institute*. **94**(2): 239-258.
- Dulle, F.W. and Aina, L.O. 1999. The information Needs of Small Scale Dairy Farmers in Tanzania. *International Association of Agricultural Information Specialists (IAALD) Quarterly Bulletin*. **44**(3-4): 173-176.

- Elizabeth, Z. & Dunn, G. 1998. Land Tenure, Farm Size, and Rural market Participation in Developing Countries Tunisian Olive Sector. *The University of Chicaco press journals*. **46**(4): 25.
- Enache, A. and Stampfer, K. 2015. Machine utilization rates, energy requirements and greenhouse gas emissions of forest road construction and maintenance in Romanian mountain forests. *Journal of Green Engineering*, **4**(4), 325–350.
- Engene, S., Cunningham, L. & Greene, R. 2018. Limitation of Static Economic Theory in Farm Management Analysis. *Journal of Farm Economics*. **32**(2): 1120-1124.
- Farouk, M.O., Ziauddin, A.T.M. and Ahmed, S. 2015. Agricultural mechanization policies and strategies for employment generation and poverty alleviation in rural areas of Bangladesh. Proceedings of the National Workshop on Strengthening Agricultural Mechanization: Policies and Implementation Strategies in Bangladesh. Bangladesh Agricultural Research Council, Framgate, Dhaka, Bangladesh.
- Farouk, S., Ahmed, S. & Ziauddin, 2007. Agricultural Mechanization Policies and Strategies for Employment Generation and Poverty Alleviation in Rural Areas of Bangladesh. Framgate, Dhaka, Bangladesh: Proceedings of the National Workshop on Strengthening Agricultural Mechanization: Policies and Implementation Strategies in Bangladesh.
- Federica, C., Michele, R., Margherita, M.C., & Eugenio, C. 2018. Part-Time Farmers and Accidents with agricultural Machinery:a Moderated Mediated Model on the Role Played by Frequency of Use and Unused Belifes. *Journal of Occupational Health*. **60**(1): 80-84.
- Ghosh, B.K. 2010. Determinants of Farm Mechanization in Modern Agriculture: A Case Study of Burdwan District of West Bengal. *International Journal of Agricultural Research*. **5**(12): 1107-1115.
- Goode, W. J. and Hatt, P. K. 1952. *Methods in Social Research*. Megraw-Hill Book.
- GOB. (Government of Bangladesh), 2015. Bangladesh Economic Review 2014. Master Plan for Agricultural Development, Finance Division, Ministry of Finance, Dhaka.
- Habanyati, & Estone, J. 2017. Factors Contributing to Disadoption of Conservation Agriculture among Smallholder Farmers in Petauk, Zambia. *M.S. Thesis*,

- Department of Science in Environment and Natural Resources Management.  
The University of Zambia, Zambia.
- Hasan, M. 2015. Adoption of modern practices in rice cultivation by the farmers of madhukhali upazilla under Faridpur district. Sher-E-Bangla Agricultural University, Dhaka, Bangladesh.
- Hassan, A., Guler, Y. & Sarisu, C.H. 2021. Two Enabling Factors for Farmer-Driven pollinator Protection in low-and Middle-Income Countries. *International Journal of Agricultural Sustainability*. **20**(1):54-67.
- Hong, Y. & Nico, H. 2020. Farm Size and Smallholders' Use of Intercropping in Northwest China. *Science Direct*. 99: 1050.
- Hossain, M. A. 2004. Adoption of Selected Modern Boro Rice Cultivation Technology by the Farmer of Homna Upazila in Comilla District. *M. S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh
- Hossain, M. M. 1999. Farmers' Perception of the Effect of Agro-chemicals on Environment. *MS (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- Hossain, M., Lewis, M.L. & Chowdhury, A. 2007. Farm Machinery and Postharvest Process Engineering Division, progress, and poverty: the Bangladesh case.
- Hoque, M.S. 2009. Adoption of improved practices in sugarcane cultivation of some selected areas of Jessore district. M.S. Thesis, Bangladesh Agricultural University, Mymensingh.
- Hossen, M. 2019. Mechanization in Bangladesh: Way of Modernization in Agriculture. *International Journal of Engineering Trends and Technology (IJETT)*. **67**(9):112.
- Islam, A. K. M. S. 2018. Status of rice farming mechanization in Bangladesh. *Journal of Bioscience and Agriculture Research*. **17**(1): 1386-1395.
- Islam, D. S. 2011. Farm Mechanization for sustainable Agriculture in Bangladesh: Problems and Prospects. Joydebpur, Gazipur-1701, Dhaka: BARI.
- Islam. M. A. 2003. Farmers' Adoption of Organic Manures for Maximizing Rice Production. *MS. (Agril. Ext. Edu.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh



- Joseph, G.A. 2007. Analysis of factors influencing adoption of intermediate farm tools and equipment among farmers in the Semi-Arid Zone of Nigeria. *Journal of Applied Sciences*. **7**(6):796-802.
- Keijiro, O., Yanyan, L. & Futoshi, Y. 2016. The Future of Small Farms in Asia. *Development Policy Review*. **34**(3):441-461.
- Khalequzzaman, K. M. and M. A. Karim. 2007. Study of Agricultural Mechanization and Its Impact on Rural Environment, *J. Innov. Dev. Strategy*. **1** (1):37-40.
- Khan, M.D. 2020. Farmers' Knowledge on Agricultural Machineries. *M.S. (AEIS) Thesis*, Department of Agricultural Extension and Information System, Sher-E-Bangla Agricultural University, Dhaka.
- Khan, M.T.A. 2020. Farmers' knowledge on agricultural machineries. *M.S. Thesis*, Department of Agricultural Extension and Information System, Sher-E-Bangla Agricultural University, Dhaka.
- Kher, S.K., Mukku, K.N. and Supe, S.V. 1991. Socio-economic factors contribution to the level of adoption of improved cultural practices of almond. *Maharashtra J. Extn. Edn.* **10**(1): 23-24.
- King, C.A. 2008. Community resilience and contemporary agri-ecological systems:reconnecting people and food, and people with people. *Wiley Online Library*. **25**(1):111-124.
- Lambert, D.K. & Bayda, V.V., 2015. The Impacts of Farm Financial Structure on Production Efficiency. *Journal of Agricultural and Applied Economics*. **37**(1):277-289.
- Lonnemark, H., 1967. Multifarm Use of Agricultural Machinery. *Agricultural Development Paper (p.85)*. Rome, Italy: FAO.
- Mainuddin, M., Kirby, M., 2015. National food security in Bangladesh to 2050. [fao.org/site/345/default.aspx](http://www.fao.org/site/345/default.aspx) (accessed 14.05.15). **7**(3):633-646.
- MoA. National Agricultural Mechanization Policy, 2020, Ministry of Agriculture, Government of the People's Republic of Bangladesh, 2020
- MoA. National Agriculture Policy (Draft-5). Ministry of Agriculture, government of the People's Republic of Bangladesh, Shegun Bagicha, Dhaka, 2009.
- Negrete, J. C. 2018. Research Trends and Perspectives of Mechanization and Agricultural Machinery in Mexico for the 21st century, *Journal of Agriculture and Crop Sciences*.**1**(1):29-38,

- Negrete, J. C. 2019. The Role of Agricultural Mechanization in Food Security, *J. Agri. Res. Adv.* 1 (3):12–15.
- Owolabi, A.O. and Kolawole. 2019. Grass Root Mechanized Farming: The Role of Agricultural Extension Providers. *International Journal of Civil Engineering and Technology.* **10**(2): 176-182.
- Poddar, K. K. 2015. Effects of Climate Change on Rural Farmers Livelihood. *M.S. (Ag. Ext. & Info. Syst) Thesis*, Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka.
- Pullaila, A. & Amrullah, E.R. 2018. Factors affecting paddy farmers' perception of utilizing agricultural machineries in Indonesia. *journal of Agricultural Extension and Rural Development.* **10**(8):150-157.
- Rahaman, M.A. 2020. Perception of the Farmers towards Combine Harvester. *M. S. Thesis*, Department of Agricultural Extension, Hajee Mohammad Danesh Science and Technology University, Dinajpur
- Rahman, M.M., Ali, M.R. & Uddin, M.Z. 2021. Farm Mechanization in Bangladesh: A review of the status, roles, policy and potentials. *Journal of Agriculture and Food Research*, **56**(1):1022.
- Rahman, H. M. 2018. Farmers Perception on Climate Change in Panchagarh District. *M.S. Thesis*, Department of Agricultural Extension, Hajee Mohammad Danesh Science and Technology University, Dinajpur.
- Ray, G.L. 1991. Extension Communication and Management, Calcutta: Nayaproskash
- Richardson, D.D. 1999. The Virtual Research and Extension Communication Network. *Food and Agriculture Organization of United Nations* (p. 23). Guelph, Ontario, Canada: FAO.
- Roy, K.C. and Singh, G. 2008. Agricultural Mechanization in Bangladesh. *Agricultural Mechanization in Asia, Africa and Latin America.* **39**(2):83- 93.
- Sabi, S., Natikar, K.V. and Patil, B.L. 2014. Socio-economic characteristics of farmers in relation to their knowledge and technological gap in wheat cultivation. *Karnataka J. Sci.* **27**(4): 542-544.
- Sadekuzzaman, M. 2007. Adoption of intercropping in sugarcane by the farmers. *M.S. (Ag. Ext. & Info. Syst) Thesis*, Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka.

- Sanam, J. & Kadam, R. 2016. Adoption of Improved Farm Implements Recommended by Vasantao Naik Marathwada Krishi Vidyapeeth. *Indians Journals.com*. **11**(2): 242-246.
- Sarkar, R.I. 2000. Strengthening agricultural mechanization: policies and implementation strategies. Proceedings of the national workshop, BARC, Dhaka.
- Sharma, P.P. 2010. Adoption of chlli technologies by the farmers. Unpublished M.Sc. (Agril.) thesis, Dr. BSKKV, Dapoli, Maharashtra, India.
- Siphesihle, Q. 2020. Factors affecting subsistence farming in rural areas of nayandeni local municipality in the Eastern Cape Province. *South African Journal of Agricultural Extension*. **48**(2): 92-105.
- Soni, P. 2010. Agricultural Mechanization at a Glance Selected Country Studies in Asia on Agricultural Machinery Development. India: ResearchGate.
- Sung, J. 2018. The fourth industrial revolution and precision agriculture. In: Automation in Agriculture: Securing food supplies for future generations. Intechopen: London, UK, 3-15.
- Vortia, P., Nasrin, M., Bipasha, S.K. & Islam, M.M. 2019. Extent of farm mechanization and technical efficiency of rice production in some selected areas of Bangladesh. *Springer Link*. **86**(2):729-742.

**APPENDIX-A**  
**Department of Agricultural Extension and Information System**  
 Sher-e-Bangla Agricultural University, Dhaka-1207

An interview schedule on  
**“USE OF AGRICULTURAL MACHINERIES BY THE FARMERS”**

**Sl. No.:**

**Name of the respondent:** .....

**Village:** ..... **Contact No:** .....

**Union:** ..... **Upazila:** .....

**P.O:** ..... **District:** .....

(Please answer the following questions. Provided information will be kept confidential and will be used only for research purpose)

**1. Age:** Please mention your age? ..... (In years)

**2. Level of Education:** Mention your educational attainment.

- a) Don't know how to read or write
- b) Can sign name only
- c) Passed class.....

**3. Farm size:** Please mention your farm size.

Sl. No.	Types of land	Land area	
		Local unit (Decimal)	Hectare
1	Homestead		
2	Own land under own cultivation		
3	Land taken from other as borga		
4	Land given from other as borga		
5	Land taken from others on lease		
6	Others		

**4. Annual Family Income:** Please state the annual family income from different sources during the last year.

Sl. No.	Sources of income	Amount ('000 Taka)
A. Agricultural sources		
1	Crop	
2	Livestock	
3	Fisheries	
<b>Sub-total (A)</b>		
B. Non-Agricultural Sources		
4	Service/Job	
5	Business	
6	Labour	

7	Remittance	
8	Others	
<b>Sub-total (B)</b>		
<b>Total (A+B)</b>		

**5. Organizational Participation:** Please mention in the nature and duration of your participation in the following organizations.

Sl. No.	Name of organizations	Types of participation			
		No participation	Ordinary member (1 for one year)	Executive committee member (2 for one year)	Executive committee officer (3 for one year)
1	Farmers' Association/ Cooperative				
2	Bazar committee				
3	School committee				
4	Religious committee				
5	Union Parishad				
6	Others (please specify _____)				

**6. Farming Experience:** How long have you been engaged in farming? \_\_\_\_\_ (in years).

**7. Agricultural Extension Media contact:** please indicate the extent of your contact with following extension media.

Sl. No.	Name of media	Nature of communication				
		Regularly (4)	Often (3)	Occasionally (2)	Rarely (1)	Never (0)
<b>A. Individual contact</b>						
1	Friends/ Progressive farmers/ Neighbors	Multiple times a week	Once a week	Once a fortnight	Once a month	
2	Sub-Assistant Agricultural Officer (SAAO)	Once a week	Once a fortnight	Once a month	Once in two months	
3	Agricultural Extension Officers (AEO/UAO)	Multiple times a month	Once a month	Multiple times in two months	Once in two months	
4	NGO workers	Once a week	Once a fortnight	Once a month	Once in two months	
5	Input dealers (e.g., pesticide, fertilizer, irrigation, machineries)	Once a week	Once a fortnight	Once a month	Once in two months	

6	Market actor (e.g., traders, wholesalers, retailers)	Once a week	Once a fortnight	Once a month	Once in two months	
<b>B. Group contact</b>						
7	Participation in group meeting	Multiple times a month	Once a month	Multiple times in three months	Once in three months	
8	Participation in demonstration meeting	Once a month	Once in 2-3 months	Once in 6 months	Once a year	
9	Participation in field day	Once a month	Once in 2-3 months	Once in 6 months	Once a year	
<b>C. Mass Media Contact</b>						
10	Listening Farm radio programme	Multiple times a week	Once a week	Once a fortnight	Once a month	
11	Watching Agricultural program on Television	Multiple times a week	Once a week	Once a fortnight	Once a month	
12	Agri call center (e.g., 16247)	Once a week	Once a fortnight	Once a month	Once in 2-3 months	
13	Social Media (e.g., Facebook, Twitter, YouTube)	Multiple times a week	Once a week	Once a fortnight	Once a month	

**8. Knowledge on agricultural machineries:** Please answer the following questions.

Sl. No.	Questions	Full marks	Obtained marks
1	What do you mean by agricultural mechanization?	2	
2	Mention the name of two farm machinery used for land preparation	2	
3	Mention two types of pumps used for irrigation	2	
4	Mention the name of two machines used for sowing operation	2	
5	Mention the name of two machines used for weeding operation	2	
6	Mention two sprayer names	2	
7	Mention the name of two machines used for harvesting	2	
8	Mention the uses of a power tiller (any two)	2	
9	Mention the uses of a tractor (any two)	2	

10	Mention the name of two machines used for post-harvesting operation	2	
Total		20	

**9. Benefit of using machinery in farming:** Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Statements	Extent of Agreement				
		Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
<b>A. Technical Benefit</b>						
1	Help to save time					
2	Making farming practice easy					
3	Require less labour					
4	Land can be prepared well					
5	Help to produce more yield					
6	Work could be more efficient					
<b>B. Financial Benefit</b>						
7	Comparatively low cost operations than human labour					
8	Reduce post-harvest losses					
9	Generate in income through providing custom service					
10	Getting government subsidy					
<b>C. Others Benefit</b>						
11	Use in disaster time or on emergency					

**10. Use of Agricultural Machineries:** Mention the extent of use of following farm machineries for your farming purposes.

Sl. No.	Name of Machinery	Extent of use				
		Regularly (4)	Often (3)	Occasionally (2)	Rarely (1)	Never (0)
<b>A Land Preparation</b>						
1	Power tiller					
2	Moldboard plow					
3	Tractor drawn cultivator					

4	Chisel plow					
5	Cultivator					
<b>B</b>	<b>Planting Operation</b>					
6	Rice transplanter					
7	Drum seeder					
8	Farrow opener					
<b>C</b>	<b>Irrigation</b>					
9	Low lift pump					
10	Shallow tube-well pump (STW)					
11	Deep Tube-well pump (DTW)					
12	Motorized pump					
13	Manual pump					
<b>D</b>	<b>Inter cultural operation</b>					
14	Japanese rice weeder					
<b>E</b>	<b>Fertilizer Application</b>					
15	USG					
16	Battery operated USG applicator					
17	Nitrogen Applicator					
18	Fertilizer cum seed driller					
<b>F</b>	<b>Herbicide and pesticide</b>					
19	Knapsack Sprayer					
20	Tractor mounted sprayer					
<b>G</b>	<b>Harvesting operation</b>					
21	Combine Harvester					
22	Reaper					
<b>H</b>	<b>Threshing operation</b>					
23	Close drum thresher					
24	Open drum thresher					
<b>I</b>	<b>Drying</b>					
25	Mechanical dryer					
26	Machine operated fan					
27	Sun dry					



<b>J</b>	<b>Transportation</b>					
28	Tractor					
29	Van					
30	Trolley					

(N.B. Regularly = Every time whenever needed, Often = Multiple times whenever needed, Occasionally = Use only when it is available, Rarely = Use once there is no other alternatives, Never=Not use at all)

Thank you for co-operation.

Name of the Interviewer: .....

Contact Number of the Interviewer: .....

Date: .....