UTILIZATION OF AGRICULTURAL MACHINERIES BY THE FARMERS OF SAGHATTA UPAZILLA UNDER GAIBANDHA DISTRICT

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December, 2020

UTILIZATION OF AGRICULTURAL MACHINERIES BY THE FARMERS OF SAGHATTA UPAZILLA UNDER GAIBANDHA DISTRICT

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A thesis
Submitted to the Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University, Dhaka
In Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE (MS)
IN
AGRICULTURAL EXTENSION

SEMESTER: July-December, 2020

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CERTIFICATE

This is to certify that the thesis entitled **"UTILIZATION OF AGRICULTURAL MACHINERIES BY THE FARMERS OF SAGHATTA UPAZILLA UNDER GAIBANDHA DISTRICT"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **Master of Science in Agricultural Extension**, embodies the result of a piece of bona fide research work carried out by **MD. Waliul Islam**, Registration No. **18-09199** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

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DEDICATED
TO
MY BELOVED
PARENTS

ACKNOWLEDGEMENS

All praises are due to almighty the merciful Allah, who enabled the researcher to complete the study successfully. Guidance, help and co-operation have been received from several persons or authority during the tenure of the study; the author is immensely grateful to all ofthem.

The author with a sense of respect, expresses his heart felt gratitude to his Supervisor Professor Dr. Md. Sekender Ali, Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka for his untiring and painstaking guidance, innovative suggestions, continuous supervision, timely instructions and inspirations throughout the tenure of research work.

Heartfelt gratitude and profound respect to his Co-supervisor ProfessorDr. Md.Rafiquel Islam, Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka for his constructive criticism, valuable suggestions and co-operation throughout the study period. The author also expresses his profound respect and sincere gratitude to all other teachers of Department of Agricultural Extension & Information System, Sher-e-Bangla Agricultural University, Dhaka for their co-operation and suggestions.

The author is grateful to Upazilla Agriculture Officer and Agriculture Extension Officer and SAAOs of Saghatta and Ghuridaho Union of Saghatta upazilas under Gaibandha district for rendering co-operation during the field work. Special thanks are due to farmers, who were the respondents of the study area and gave their valuable time for interview during collection of data.

The author takes the opportunity to express his indebtedness and profound respect to his reverend father Md. Abdur Rashid Akanda, mother Most. Jakiya Sultana and other relatives for their blessings, sacrifices, financial support and encouragement for higher study without which it can never be forgotten.

Finally, author expresses his gratefulness to Razeul Islam Razu for his valuable inspiration, encouragement and cooperation for this researchwork.

The Author

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UTILIZATION OF AGRICULTURAL MACHINERIES BY THE FARMERS OF SAGHATTA UPAZILLA UNDER GAIBANDHA DISTRICT

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Abstract

The main purpose of this study was to determine the extent of utilization of agricultural machineries by the farmers and to explore the relationship of each of the selected characteristics of the farmers with their utilization of agricultural machinery. The selected characteristics were age, education**,** farm working area**,** annual family income, extension contact, possession agricultural implements and satisfaction on agricultural implements. Data were gathered from 107 farmers of four villages namely Sathalia, Jugipara, Jadur Tair and Mothor para of Saghatta upazila under Gaibandha district by using personal interview schedule during the period from 24th October to 16th November, 2020. The Findings revealed that 86.9 percent of the farmers had medium use of farm implements as compared to 13.1 percent of them having low utilization of the same. Pearson's Product Moment coefficient of correlation (r) show that farm working area, annual family income, extension contact, possession of agril. implements and satisfaction of agril. implements had significant positive relationship with their utilization of farm implements while rest of the variables show non significant relationship with their use of farm implements. Constraints faced Index (CFI) in using of farm implements, indicated that "high cost of agril. machineries" ranked the 1st problem followed by "weather related issues".

Key words: utilization, agricultural machineries, constrained faced

CHAPTER I

INTRODUCTION

1.1 Background of the Study

Mechanization is a process through which agricultural activities can be improved and optimum crop production can be achieved. Tools, implements and powered machinery, are essential and major inputs to agriculture. The term "Farm Mechanization" is generally used as an overall description of the application of these inputs in crop cultivation. Different mechanical inputs currently practiced in different farming activities in Bangladesh. The cropping intensity and production of food crops has recently been increased significantly due to adoption of mechanized tillage, irrigation, and spraying operations (Sarker, 2000). Bangladesh agriculture is currently faced with range of challenges like ageing farmers, feminization of agriculture, farm labor shortage, shrinking land, degradation of natural resources, soaring prices, and vulnerability to climate change. In the face of these challenges, we need knowledge intensive green revolution that combines advances in science and agricultural engineering with the unique traditional knowledge to make agriculture more environmentally resilient (ESCAP, 2016).

Agriculture of Bangladesh is characterized by overwhelmingly small holdings due to higher population density and nearly 80 per cent of its population residing in the rural areas coupled with unabated land fragmentation due to the inheritance laws of the country (Rahman et. al., 2011).According to preliminary estimate of BBS, in FY2017-18, food grains production stood at around 413.25 lakh metric tons (MT). In the same fiscal year, the total internal procurement of food grains was 16.7 lakh MT against the target of 17.3 lakh MT. In addition, an amount of Tk.20400 crore was targeted to be disbursed as agricultural credit against that Tk.21393 crore was disbursed till June 2018, which was 104.87 percent of the target (Anon, 2018d). Rice based cropping pattern shows dominancy in Bangladesh for the highest demand of rice as staple food and suitable condition for rice production (Shirazy et. al., 2016). In Bangladesh, rice is grown in 80% of the total cropped area (Kabir et. al., 2016). Rice (Oryza sativa L.) is grown in three distinct seasons- namely boro (Dec-April), aus (April-July) and a man (Aug-Nov).The country produced 36.278 million metric ton of cleaned rice in 28.075 million hectares of land (Anon, 2018b).Rice is the staple food of about 150 million people of Bangladesh. It provides nearly 48% of rural employment, about two-third of total calorie supply and about one-half of the total protein intakes of an average person in the country. Rice sector contributes one-half of the agricultural GDP and one-sixth of the national income

in Bangladesh (Anon, 2018c). The yearly per-capita rice consumption is decreasing from 180 kg in 1977 (Ahmad and Hassan, 1983) to 148 kg in 2015. The population will reach 215.4 million in 2050 and the demand of cleaned rice would be 44.6 million ton (Kabir et. al., 2016). This decreasing consumption is replaced by wheat, which is the second most important cereal crop, grown in winter season in Bangladesh with an area and production of 0.867 million hectares of land and 1.098 million metric ton respectively (Anon, 2018b). The land area is decreasing at the rate of 80,000 hectare annually due to construction of road, house and industry (Anon, 2009). The farmers have to grow more food within the limited land resources to meet the growing demand. The country aims at increasing productivity in order to achieve food for raising demand and establish social security of this growing population (Anon, 2015a). The agricultural labor force followed decreasing trend (48.3 % in 2002-03 and 40.6 % in 2016- 17) due to shifting low productivity to high productivity sector (Anon, 2018a).

As a result, the availability of agricultural labor force become very scarce and cost of crop cultivation increase with the hike in the wages of labor leading to reduce profits to the farmers. Unavailability of laborers during cultivation period compelled the farmers to delay in harvesting which results in yield loss; sometimes incurred total loss of field crops due to natural disaster. It also hampers the land preparation and sowing operations for the next crop. To keep economical consistency over the shifting of manpower from agriculture to service and industry, it requires filling up the labor gap in agricultural operations by mechanical interventions (Islam et. al., 2016a). There is a substantial contribution of mechanization in agricultural operations that made it possible to release agricultural laborers to get into other high income professions (i.e. business or service). Total factor productivity growth in the agriculture sector of Bangladesh from 1948 to 2008 was largely due to technological progress (Rahman & Salim, 2013).Mechanization reduces the drudgery of farm labor, relaxes peak-season labor constraints, reduces costs of production, and can save crucial resources (Biggs & Justice, 2015; Rahman et. al., 2011). Low mechanization levels also can make farming unattractive to the youth and disproportionately affect women farmers (Baudron et. al., 2015).

Application of farm mechanization will adversely affect the labor requirement, which will adversely affect the exiting unemployment situation. However, at the same time it is argued that the application of mechanization will boost up the overall productivity and production with the lowest cost of production (Aurangzeb et. al., 2007).With the introduction of

medium-scale mechanization the nature of using cultivation power has changed significantly and it appeared that the use of farm machineries has increased rapidly.

1.2 Statement of the Problem

Farm mechanization is the main plank of modern agriculture. Many developed countries revolutionized by using farm mechanization, which resulted in tremendous production and productivity gains. However, the conditions under which it was introduced in those countries differ greatly from Bangladesh context. Two of the most important conditions were the shortage of labour and large sizeof farm. But as the pressure of population on land is increasing steadily, the solution lies in mechanizing agriculture, which would realize the goal of achieving targeted food gains production in Bangladesh.

In many developing countries up to 80 percent of farm power is provided by human beings. In most developed countries human beings are used less and less as a source of power and more for machine operation and control (http://agricoop.nic.in/). At present Bangladesh is a middle income country, to reach in row of developed country there is no better option rather than shift its manpower from agriculture sector to industry and service sector. To fulfillment of our desire to become developed country our present government set "Vision 2021" as following as in Table 1.1.

Table 1.1. Sector wise manpower contribution at present and targeted vision 2021

Sector	Present contribution (Percent)	Targeted contribution in Vision 2021 (Percent)
Agriculture	40.6	30.0
Industry	20.4	25.0
Service	39.0	45.0

Source: Bangladesh Economic Review, 2019

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 and insufficient awareness building activities, tariff difference on machines and spare parts, financial and institutional constraints. Therefore, the researcher has undertaken the study entitled "Utilization of Agricultural Machineries by the Farmers of Saghatta Upazilla under Gaibandha District" In order to make the study manageable, the following research questions were taken into considerations:

- What was the extent of utilization of agricultural machineries by the farmers?

- What were the selected characteristics of the farmers that influence their utilization of agricultural mechanization?
- Is there any relationship of the farmers' selected characteristics with their utilization of agricultural machinery?
- Is there any problems faced by the farmers for agricultural mechanization?

1.3 Objectives of the Study

Considering the importance of agricultural mechanization, the following objectives were taken in order to give proper direction in the study:

- To determine the extent of utilization of agricultural machineries by the farmers in the study area;
- To assess and describe some selected characteristics of the farmers;
- To explore the relationship of each of the selected characteristics of the farmers with their utilization of agricultural machinery; and
- To find out the constraints faced by the farmers for using agricultural machineries.

1.4 Justification and Scope of the Study

The country is, at present, about to achieve self-sufficiency in cereal production. This is due to irrigation development and partial mechanization in other agricultural operations. But to meet up the food requirements of the ever growing population of the country in 2015, an additional 5 million tons of food grain need to be produced from the continuously decreasing agricultural lands. To achieve this target, there is no other better option than to increase production per unit of land as well as cropping intensity. Thus, to increase production and cropping intensity, the most important gain will be the faster development of agricultural mechanization as well as variety development. Replacing the traditional inefficient agricultural tools, efficient mechanized cultivation must be introduced and extended. The good news is that the government has already attributed due importance to agricultural mechanization in the National Agricultural Policy (MOA, 2013). In the Policy (Draft 5) it is included that "The Government will encourage production and manufacturing of agricultural machinery adaptive to our socio-economic context. Manufacturing workshops and industries engaged in agricultural mechanization activities will be provided with appropriate support." Government and non-government organizations are currently putting effort and allocating resources for increasing uses of agricultural machinery and also encouraging both rural and

urban people to adopt and practice agricultural machinery. So, evaluation of knowledge, attitude and utilization of the concerned farmers is necessary for the further development of agricultural mechanization in Bangladesh.

Considering the above fact, the researcher felt a necessity to undertake a study to determine the utilization of agricultural machineries by the farmers of Gaibandha District.

1.5 Assumptions of the Study

An assumption is the supposition that an apparent or principle is true in the light of the available evidence (Goode and Hatt, 1952). An assumption is taken as a fact or belief to be true without proof. The researcher had the following assumptions in mind while undertaking this study:

- The respondents had the capacity to response the questions furnished in the interview schedule.
- The responses furnished by the respondents were reliable. They express the truth while passing their opinions and providing information.
- The sample size was representative to the whole population of the study area.
- The items, questions and scale of measurement of the variables were reasonably authentic to represent the actual condition of the respondents.
- The data collected by the researcher were free from bias.
- The researcher was capable to adjust with the social and cultural environment of the study area

1.6 Limitation of the Study

Considering the time, money and other resources available to the researcher and to make the study meaningful, it became necessary to impose certain limitations as noted below:

- The research was conducted to a confined area of Saghatta upazilla under Gaibandha district.
- The characteristics of the respondents farmers in the study area were many and varied but only 7 characteristics were selected for examining their relationship with their utilization of agricultural mechanization.
- Data were collected from the selected farmers furnished by them from their memory during interview.

- For some cases, the researcher faced unexpected interference from the over interested side-talkers while collecting data from the target populations. However, the researcher tried to overcome the problem as far as possible with sufficient tact and skill.

1.7 Definition of the Related Terms

In this section, the terms which have been frequently used throughout the thesis are defined and interpreted below:

Age: Age of a farmer referred to the span of his/her life in years from his/her birth to the time of interview.

Education: Education referred to the ability of the respondents to read and write or having formal education received up to a certain level from educational institute at the time of interview. It was measured on the basis of classes a farmer has passed from a formal educational institution.

Farm working area: Farm working area referred to the cultivated area either owned by the farmer or obtained from others on borga system, the area being estimated in terms of full benefit and half benefit to the farmer respectively. The self-cultivated owned land and cultivated area taken as lease or mortgage from others was recognized as full benefit. In this study farm size was measured in hectare.

Annual family income: The term annual family income referred to the total amount of money earned by the earning members of a farm family from agriculture, livestock, fisheries and other accessible sources (business, service, daily labor etc.) during a year. It was expressed Thousand in Taka.

Extension contact: Agricultural extension contact referred to an individual exposure to different information sources and personalities relate to agriculture for dissemination of new technologies.

Possession of Agril. Implements: Possession is the state of having something or something that is owned. So,possession of agril. implements (Such as Tractor, Power tiller, etc.) means agril. implements are normally owned by the individuals, respondents.

Satisfaction of Agril. Implements: Satisfaction meansfulfilment of one's wishes, expectations, or needs, or the pleasure derived from this.Satisfaction of agril. implements means fulfilment of one's wishes, expectations, or needs derived from agril. implements.

Use of farm implements: Use of farm implements means these types of equipment are used for various purpose for farming activities of small / large farms.

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.

Utilization of agricultural mechanization: It refers to the level of utilization by the farmers in various aspects of agricultural mechanization such as land preparation, threshing, plant protection (spraying), milling, transporting, irrigation, fertilizer application, harvesting etc.

Problem faced: Problem faced in practicing agricultural mechanization meant any difficult situation which require some actions to minimize. The term problem faced referred to different problem faced by the farmers during practicing agricultural machinery.

CHAPTER II

REVIEW OF LITERATURE

Review of literature provides the clear and concise direction of the researcher for conducting the experiment. With aim to get clear and concise direction this chapter deals with the review of past research works that relates to this investigation directly or indirectly. The reviews are conveniently presented based on the major objectives of the study. This study was mainly concerned with farmers‟ utilization of agricultural machineries by the farmers and the contribution of the selected characteristics of the farmers to their agricultural machineries. Despite frantic search, the researcher found only a few literatures related to this study. The researcher came across with some subject matter specialist opinions and has tried his best to collect necessary information through searching relevant studies, thesis, journal, articles, periodicals, bulletins, leaflets, websites etc. However, a brief review of the available literature has been incorporated in the light of the objectives of this study under the following heads:

2.1 Concept of utilization

2.2 Concept of agricultural mechanization

2.3 Agricultural mechanization in Bangladesh

2.4 Relationship between selected characteristics of the respondents and their utilization of agricultural machineries

2.5 Research gap of the study

2.6 Conceptual framework of the study

2.1 Concept of utilization

According to Oxford dictionary “Utilization is the actual use of an idea, belief, or method as opposed to theories relating to it.” Machinery utilization as the actual use of machinery compared to the potential capacity. In agricultural engineering literature, utilization is often referred to as physical operating time on the field compared to total workable hours (Enache & Stampfer, 2015).

2.2 Concept of agricultural mechanization

Concept of agricultural mechanization agricultural mechanization is the application of technology into the field of agriculture in order to improve agricultural output, as well as deliberate conscious departure from the peasant and subsistence agriculture into a Commercial Agriculture. Farm mechanization encompasses in its widest sense hand- tool technology, draught animal technology and mechanical power technology (Maharjan and

Cheltri, 2006). Farm mechanization is the process of development and introduction of mechanized assistance of all forms and at any level of technological sophistication in agricultural production in order to reduce human drudgery, improve timeliness and efficiency of various farm operations, bring more land under 12 cultivation, preserve the quality of produce, improve living condition and markedly advance the economic growth of the rural sector (Akande, 2009).Farm mechanization is the application of engineering and technology in agricultural operations to do a job a better way to improve productivity. This includes development, application and management of all mechanical aids for field production, water control, material handling, storing and processing (Vinay et. al., 2010). Agricultural mechanization includes three main power sources: human, animal, and mechanical. The manufacture, distribution, repair, maintenance, management and utilization of agricultural tools, implements and machines is covered under this discipline with regard to how to supply mechanization inputs to farmers in an efficient and effective manner (Zangeneh and Banaeian, 2014).

There have been some studies conducted on the impacts of mechanization on overall livelihood of the rural population (Anon, 1973; Gill, 1984; Miah et. al., 2002). These studies indicated that the increased use of small scale mechanization and to some extent, mechanization seriously affected the income of small farmers and landless labourers while contributing little to the overall productivity of farming system. Besides, a number of studies (Roy and Blase, 1978; Duft 1986; Agarwal, 1981;Aurangzeb et. al.,2007) were conducted outside the country regarding this issue.

Khalequzzaman and Karim (2007) studied agricultural mechanization and its impact on rural environment. (Aurangzeb et. al., 2007) found with the introduction of smallscale mechanization the nature of using cultivation power has changed significantly and it appeared that the use of power tiller for tillage has increased rapidly.

2.3 Agricultural Mechanization in Bangladesh

Mechanization may be defined as the process of injecting power and machinery between man and materials in a production system (Khalequzzaman and Karim, 2007). Agricultural mechanization is an art and scientific application of agricultural machinery, tool and implement for increasing farm production and cropping intensity. The irrigation policy in Bangladesh in the 20th century originally focused on large-scale canal systems and Deep Tube Wells (DTW) (Biggs & Justice, 2015). Agricultural mechanization in Bangladesh there by started with DTW for irrigation (Pingali, 2007). Irrigation system development and a

cooperative-model were associated with the government promotion of four-wheel tractors (4 wt) since 1960s. However, small land holding coupled with further fragmentation of land impeded the wide-scale adoption of 4 wt (Hossainet. al.,2007). After independence, irrigation policy in Bangladesh increasingly focused on the use of shallow tube wells (STWs) and less energy requiring Low Lift Pumps (LLPs) for irrigation (Biggs & Justice, 2015).Several institutional models were under taken to promote small-scale mechanization. Consequently, by mid 70sthe number of LLPs in Bangladesh reached 35,000 units (Anon, 2012w). Since the 1960s locally manufactured mechanical threshers are extensively used as economical options to overcome labor shortages. In1960, a pedal thresher was reproduced in Bangladesh by Comilla Cooperative Karkhana using the Japanese model (Anon, 2012w). At present, almost each district in Bangladesh has a local thresher manufacturer. In some districts such as Jessore and Khulna, there are more than 100 thresher manufacturers (Anon, 2012w).

Before 1988, the import of agricultural equipment was restricted. The Standardized Committee of Bangladesh was responsible for controlling the quality of imported machinery including agricultural equipment and only a list of standardized machines required for agricultural operations could be imported. In 1988, the Ershad Government started liberalizing markets, lowered the tariffs on machine imports, and dissolved the Standardized Committee. This policy change resulted in an import surge of low-cost small engines and engine powered machinery such as power tillers (two-wheel tractors, 2WTs),diesel pumps and other equipment into Bangladesh, primarily from China (Gisselquistet. al., 2002; Kienzle et. al.,2013; Mottaleb et. al., 2016; Pingali, 2007). After the trade liberalization in 1988, cost of these machines especially power tillers and minor irrigation pumps fell by 50% resulting in increases of 400% in sales of diesel engines and more than 1000% in power tillers compared to sales three years before the liberalization (Gisselquist et. al., 2002). At present, 80% land is prepared by power tiller and 18% by tractor or 2 WTs and/or 4WTs (Islam, 2018 and Kienzle et. al., 2013).

However, mechanization of other agricultural field operations is still very low in Bangladesh and thus, adoption of other agricultural equipment such as bed makers, seeders, weeders, harvesters and winnowers is not common (Islam, 2009). Due to the prevailing small landholdings, many farmers who own agricultural machines opt for hiring out these machines in addition to operating ton their own land (Biggs & Justice, 2015; Kienzle et. al., 2013). This, on the one hand, optimizes the use of machines and on the other hand, increases farmers‟ access to these machines. Through custom hiring services, even the poor can afford

to mechanize farming (Alamet. al., 2004). This has been reported across South Asia and for different implements – including 4 wt drawn zero-till seed drills(Erenstein& Farooq, 2009), laser-land leveling (Aryal et. al., 2015) and2wt (Mottaleb et. al., 2017). Hence the existence of rental markets can facilitate rapid adoption of lumpy technology and make technology accessible to even poor and marginal farmers who otherwise could not invest in or access it. Bangladesh agriculture is now one of the most mechanized agricultural economies in south Asia (Baudron et. al., 2015; Islam, 2009).

Bangladesh has the globes highest per-capita level of rice consumption at 172.6 kg / person in a year (Anon, 2015e). The government of Bangladesh (GoB) has tended to encourage mechanization as an avenue to increase rice production and move towards rice self-sufficiency. To facilitate this process, the GoB voluntarily reduced import restrictions and tariffs on select machineries, while also supplying subsidy to help purchasers offset fixed costs. The GoB first introduced irrigation pumps and tractors in the 1960s (Ahmed, 2001). Four wheel tractors were initially promoted, which are arguably scale-inappropriate in Bangladesh given the small average farm size at around 0.53 hectares, which is often divided into multiple fields (Hossain et. al., 2007), making demand aggregation for tillage services among farmers, and between-field and -farm transport of tractor equipment problematic. The GoB also first introduced centralized irrigation facilities by establishing deep tube wells (DTWs) and supplying low-lift irrigation pumps (LLPs) to farmers on a rental basis from the Bangladesh Agricultural Development Corporation (BADC). The GoB also supplied fuel at 75% subsidized rate to pump owners through BADC until the 1970s (Hossain, 2009). By 1978, BADC had rented out and managed a total of 9,000 DTWs and 35,000 LLPs (Anon, 2012x). Irrigation and land preparation management under nearly complete government control however presented large logistical and financial burdens. Eight years after independence, Bangladesh undertook liberalization policies, and as a result, the government gradually opted out of state-led support of mechanization and began the privatization of irrigation, with additional efforts to open markets for land preparation equipment (Gisselquist et. al., 2002). BADC initiated sales to liquidate DTWs and LLPs to farmer' cooperatives and also to individual farmers, many of whom became service providers (Hossain, 2009). Privatization, however, only gained full momentum when a number of tariff and non-tariff barriers on the import of irrigation and diesel engines and tractors were eliminated, actions that were linked to disaster response management by the Bangladeshi government. During

this period, the GoB's Standardized Committee was responsible for controlling the quality of imported machinery, including

Transplanting, weeding, harvesting and threshing operations are considered as four major labor intensive operations in rice cultivation in Bangladesh condition. Mechanized cultivation substantially reduces the labor force than manual operation. Traditional method is incapable whereas adoption of mechanization is a way to meet such conditions with a burden of large investment. Emphasis should be given to mechanize these operations in order to reduce the labor requirement in rice cultivation. To increase crop security, faster transplanting and harvesting operation are ways that could only be established by mechanical intervention. Mechanization transform the labor intensive works to power intensive works and reduce the human drudgery. It has been proven that mechanization maximize the production, reduce the cost of cultivation and post harvest loss and made agriculture profitable (Islam, 2018).

Mechanization of farming is considered as one of the top ten engineering accomplishments in the 20th century (Tiwari et. al., 2017b). Farm mechanization has been well-received world over as one of the important elements of modernizing agriculture. The level and appropriate choice of farm mechanization has direct beneficial effects on land and labour productivity, efficient use of farm inputs, increased farm income and the quality of life of farmers. Farm machines also ensure timeliness of farm operations and increase work output per unit time. Suitability to small farms; simple design and technology; versatility for use in different farm operations; affordability in terms of cost and most importantly, the provision of support services are the basic requirement for the expansion of farm mechanization. One of the feasible options to increase crop production in the region is to follow intensive method of cultivation and this could be achieved only by mechanization. The global threats of food deficit also forecast to produce 40% more grain by 2020, most of which would have to come from yield increases and reduced losses through appropriate mechanization. Farm mechanization has the potential to meet the contemporary

2.4 Relationship between selected characteristics of the respondents and their use of agricultural machineries

2.4.1 Age and use of agricultural machineries

These personal factors can affect the innovativeness of an individual and thus contribute to determining the rate at which farmers' will adopt new technology (Adesina and Zinnah, 1992; Deressa *et al.,* 2009; Spence, 1994). Older farmers may be less interested because they

have less need for extra income.(Rahman, 2018) reported in his study that age of the farmers had non-significant negative relationship with their practice of Agricultural Mechanization.

2.4.2 Education and use of agricultural machineries

Rahman (2018) reported in his study that educational qualification of the farmers had significant positive relationship with their practice of agricultural mechanization.

2.4.3 Farm working area and use of agricultural machineries

Rahman (2018) reported in his study that farm size of the farmers had significant positive relationship with their practice of agricultural mechanization.

2.4.4 Annual family income and use of agricultural machineries

Rahman (2018) reported in his study that Annual family income of the farmers had significant positive relationship with their practice of agricultural mechanization.

2.4.5 Extension contact and use of agricultural machineries

Islam (2018) reported that the extension contact of the farmers had significant positive relationship with their practice of Practice of agricultural mechanization.

2.4.6 Possession of agricultural implements and use of agricultural machineries

Possession of the implements is the paternity or Ownership of an implements for farming activities. If a person possess implements (like Tractor, Power tiller, etc.), he / she will be able to perform framing operation easily through use it. No findings were noticed directly on this aspect to the researcher at the time of reviewing literature.

2.4.7 Satisfaction of agricultural equipment and use of agricultural machineries

Farmers are the direct beneficiaries of compensation funds. The higher the farmers' satisfaction with the current facilities of agricultural incentives and facilities, the more active the farmers' cultivated land protection behavior will be. The elements that constitute the economic compensation mode of cultivated land protection are similar to the components of a machine, such that the defect of any component will affect the operation of the machine to varying degrees (Cai & Yu, 2018). No findings were noticed on this aspect to the researcher at the time of reviewing literature.

2.5 Research Gap

According to the review of literature of the present study the researcher has established the following research gaps:

- Very few researches have been conducted on farmers' use of agricultural mechanization. So the researcher carried out the study to find the utilization of agricultural machineries and to explore the relationship between each of selected characteristics of the farmers with their use of agricultural mechanization.
- Farmers' level of problem faced in using agricultural machinery using has been identified in very few research. Therefore, the researcher carried out to this research crosscheck the level of problem faced by the farmers in using agricultural machinery.

2.6 Conceptual framework of the study

In scientific research, selection and measurement of variables constitute an important task. Studies on individual, group and society revealed that acceptance of modern technologies is conditional upon many factors. Some of these are social, personal, economical and situational factors and the behavior of farmers are influenced by these characteristics. The hypothesis of a research while constructed properly consist at least two important elements i.e.: a predicted variable and an experimental variable. An experimental variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. Variables together are the causes and the phenomenon is effect and thus, there is cause effect relationship everywhere in the universe for a specific events or issues.

Utilization of agricultural machineries by the farmers in the selected area of Gaibandha district was the predicted variable and eight selected characteristics of the farmers were considered as the experimental variables under the study. Utilization of agricultural machineries may be affected through interacting forces of many experimental variables. It is not possible to deal with all of the experimental variables in a single study. It was therefore, necessary to limit the experimental variables, which include age, education, farm working area, annual family income, extension contact, possession of agril. implementsnad satisfaction on agril. implements. Considering the above-mentioned situation and discussion, a conceptual framework has been developed for this study, which is diagrammatically presented in Figure 2.1.

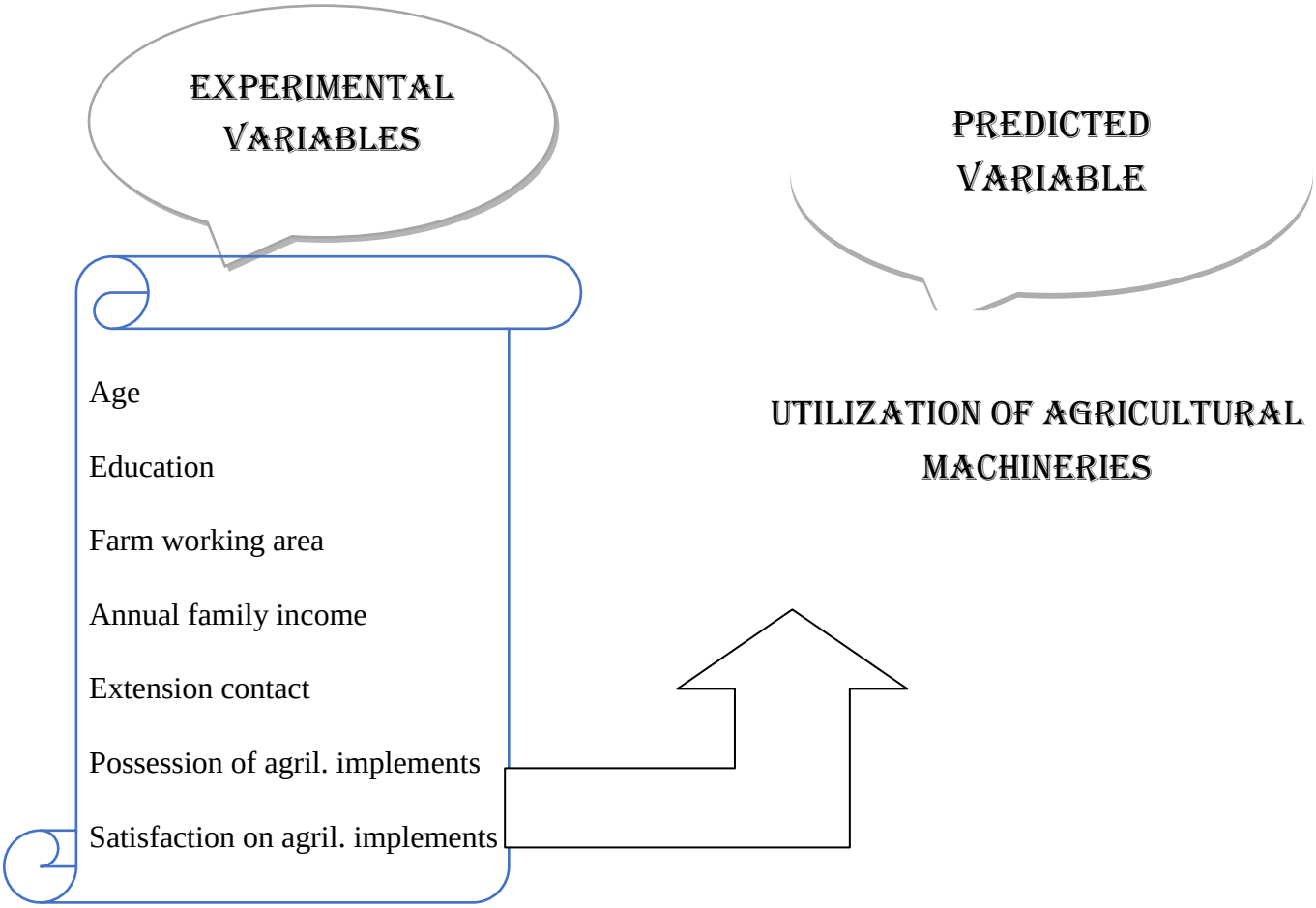

Figure 2.1 Conceptual framework of the study

CHAPTER III

MATERIALS AND METHODS

In conducting a research study, methodological issue is one of the prime considerations for yielding of valid and reliable findings. Appropriate methodology enables the researcher to collect valid and reliable information and to analyze the information properly in order to arrive at correct conclusions. However, the methods and operational procedures followed in conducting this study has been described in the subsequent sections of this chapter.

3.1 Locale of the Study

The study was conducted at Saghatta and Ghuridaho unions of Saghatta upazila under Gaibandha district. Out of four unions of the upazilla, Saghatta and Ghuridaho union were purposively selected because of higher use of agricultural mechanization. Thereafter, four villages namely,Sathalia, Jugipara, Jadur Tair and Mothor para were selected randomly from 17 villages of these unions. A map of Gaibandha district showing Saghatta upazila and a map of Saghatta upazila showing the study area have been shown in Fig 3.1 and 3.2 respectively.

3.2 Population and Sample of the Study

Four separate lists of farmers of the selected four villages were prepared by the researcher himself with the help of the respective Sub-Assistant Agriculture Officer (SAAO) andUpazila Agriculture Office (UAO), Saghatta. There were 301 farmers who have been using agricultural machineries in the selected villages which constituted the population of the study.

By using the sample size calculator developed by Creative Research System(Ardon. 2013)by taking 99% confidence level and 10 as confidence level, the sample size was determined as 107 for this study. Separate sample sizes of each of the villages were determined proportionately. Sample was drawn from the population by using proportionate random sampling method.

A reserve list of 11 farmers was also prepared by using 10 percent of the sample size so that the respondent of this list could be used for interview if the respondents included in the original sample were not available at the time of conduction of interview. The distribution of the population, sample and number of respondent in the reserve list are given in Table 3.1.

Figure 3.1 Map of Gaibandha district showing Saghatta upazila

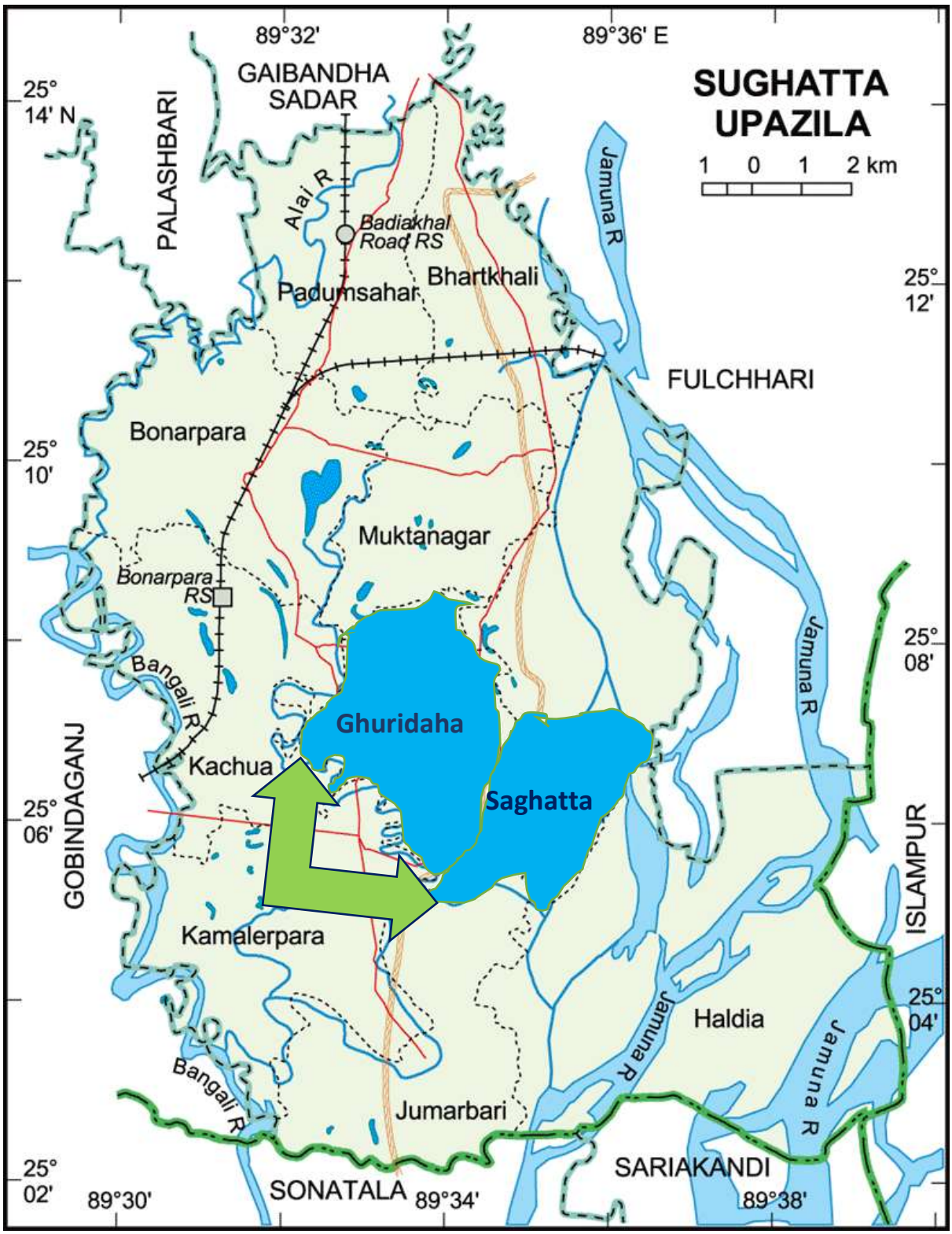

Figure 3.2 Map of Saghatta upazila showing the study area (Saghatta and Ghuridaho Union)

Table 3.1 Distribution of the population and sample of the respondents with reserve list

Name of Unions	Name of villages	Population (No. of total farmers)	Sample Size	Reserve list
Saghatta	Sathalia	76	27	3
	Jugipara	70	25	3
Ghuridaho	Jadurtair	87	31	3
	Mothor para	68	24	2
Total		301	107	11

3.3 Instrument for Data Collection

In a social research, preparation of an interview schedule for collection of information with very careful consideration is necessary. Keeping this fact in mind the researcher prepared an interview schedule carefully for collecting data from the respondents. Objectives of the study were kept in view while preparing the interview schedule.

The initially prepared interview schedule was pre-tested among 10 respondents of the study area. The pretest was helpful to find out gaps and to locate faulty questions and statements. Alterations and adjustments were made in the schedule on the basis of experience of the pretest. English version of the interview schedule is shown in appendix-A.

3.4 Collection of Data

The researcher collected data from the sample farmers with the help of a pretested interview schedule. Before starting collection of data, the researchers met with the local SAAOs of the respective blocks in order to explain the objectives of the study and requested them to provide necessary help and cooperation in collection of data. The local leaders of the area were also approached to render essential help. As a result of all these a good working atmosphere was created in the study area which was very helpful for collection of data by the researcher.

Before going to the respondents for interview they were informed earlier, so that they would be available in their respective area. The interviews were held individually in the house or farms of the respective respondent. The researcher established adequate rapport so that the respondents did not feel hesitant to provide actual information. Whenever any respondent faced difficulty in understanding a particular question, the researcher took care to explain the same clearly. No serious constraints were faced by the researcher in collecting data. Data were collected during October to November 2020.

3.5 Variables of the study

Utilization of Agricultural mechanization by the farmers were the main focus of this study and it was considered as the predicted variable.

For selection of experimental variables the researcher went through the past related literatures as far as possible. He discussed with the researchers, experts in the relevant fields and research fellows in agricultural and related disciplines. He also carefully noticed the various characteristics of the farmers of the study. Availability of time, money and other resources were also kept in view in selecting the variables. Characteristics of the farmers like age, education, farm working area, annual family income, extension contact, possession of agril. implements and satisfaction on agril. equipment were selected as the experimental variables.

3.6 Measurement of Variables

In order to conduct the study in accordance with the objectives, it was necessary to measure the selected variables. This section contains procedures for measurement of both experimental as well as predicted variables of the study. The procedures followed in measuring the variables are presented below:

3.6.1 Measurement of experimental variables

It was pertinent to follow a methodological procedure for measuring the selected variables in order to conduct the study in accordance with the objectives already formulated. The procedures for measuring the experimental variables are described below:

3.6.1.1 Age

Age of a respondent was measured in terms of years from birth to the time of interview which was found on the basis of response. A score of one (1) was assigned for each year of age. Question regarding this variable appears in item no. 1 in the interview schedule (Shown in Appendix-A).

3.6.1.2 Education

Education was measured in terms of one's year of schooling. One score was given for passing each year in an educational institution. For example, if the respondent passed the S.S.C. examination, his education score was given as 10, if passed the final examination of class Seven (VII), his education scores was given as 7. If the respondent did not know how to read and write, his education score was given as '0' (zero). A score of 0.5 (half) was given to that respondent who could sign his/her name only. Question regarding this variable appears in the item no. 2 in the interview schedule (Appendix-A).

3.6.1.3 Farm working area

Farm working area of a respondent referred to his total area of land in terms of ownership and benefit obtained from the land. It was measured in hectares using the following formula as developed by Karim and Mahboob (1974) with some modification:

FWA= a + b + ½c

Where,

FWA= Farm working area (in hectare)

a = Own land under own cultivation

b = Land taken from others on lease

c = Share cropped area

3.6.1.4 Annual family income

Annual family income referred to the total earnings of a respondent and the members of his family from agricultural and non-agricultural sources (business, services, daily labour etc.) during the previous year. It was measured by the total earning of all the members of the family. Annual family income was expressed in '000' taka (Shown in Appendix-A).

3.6.1.5 Extension contact

The extension contact of a respondent was measured in terms of his extent of contact with eight selected extension media. A scale was developed arranging the weights for '0', '1', '2', '3' and '4' for the responses of'never', 'rarely', 'occasionally', 'frequently' and 'regularly' contact with these media respectively. Extension contact score of the respondents could range from 0 to 32, while '0' indicating no extension contact and '32' indicating highest extension contact (Appendix-A).

3.6.1.6 Possession of agril. implements

Agril. implements are normally owned by individuals, government, group of individuals, etc. Ownership of the agril. implements is the paternity or possession of a implements for agricultural farming activities. Possession here means the act of owning. Possession of agril. implements was measured on the basis of their spent for agricultural implements. Possession of agril. implements was calculated in '000' taka (Appendix-A).

3.6.1.7 Satisfaction on agril. implements

Satisfaction means fulfillment of one's wishes or expectations. Customer satisfaction is defined as a measurement that determines how happy customers are with a

products satisfaction, services, and capabilities. A scale was developed arranging the weights for '0', '1', '2' and '3' for the responses for not at 'all satisfied', 'moderate satisfied', 'low satisfied' and 'high satisfied' in case of performance of Agril. Implements (Shown in Appendix-A).

3.6.1.8 Constraints faced in using agricultural machineries

There are many constraints in using agricultural machineries but eleven major constraints were selected for the research after consultation with the supervisor and relevant experts. The respondents were asked to respond to four alternative responses as 'not at all', 'low', 'medium' and 'high problem' for each of eleven selected constraints. Scores were assigned to those alternative responses as '0', '1', '2' and '3' respectively.

Attempts were made to compare the constraints by using Constraints Faced Index (CFI) with the following formula:

$$CFI = C_h \times 3 + C_m \times 2 + C_l \times 1 + C_0 \times 0$$

Where, CFI= Constraint Faced Index

C_h= No. of farmers faced high constraints

C_m = No. of farmers faced medium constraints

C_l= No. of farmers faced low constraints

C_0 = No. of farmers faced no constraints

Thus, the possible CFI of the constraint items could range from 0 – 321, where '0' indicating no constraints and '321' indicating very high constraints. To compare the severity of the constraints, rank order was made by the descending order of the CFI.

3.6.2 Measurement of predicted variable

3.6.2.1 Utilization of agricultural machineries

A good number of machineries are being used now- a -days by the farmer for their agricultural production. Based on pre-test experience and through consultation with relevant experts, 13 machineries for farm mechanization were considering for this study. The respondents were asked to indicate their extent of use of these 13machinerieswith four alternative responses as full, moderate, low and not at all use and weights were assigned to the alternative responses as 3, 2, 1 and 0 respectively. Use of farm machinery score of the respondents were computed by summing up all the scores obtained by them from all the 13 items. Thus the possible range of use of agricultural mechanization score was 0-39, while 0 indicated no use and 39 indicated highest use of agricultural machineries.

3.7 Statement of the Hypotheses

As defined by Goode and Hatt (1952) a hypothesis is "a proposition which can be put to test to determine its validity. It may seem contrary to, or in accord with common sense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test."

3.7.1 Research hypotheses

In the light of the objectives of the study and variables selected, the following research hypotheses were formulated to test them in. The research hypotheses were stated in positive form, the hypotheses were as follows:

"Each of seven selected characteristics of the farmers have significant relationship with their utilization of agricultural machineries."

3.7.2 Null hypotheses

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

"Each of the seven selected characteristics of the farmers have nosignificant relationship with their utilization of agricultural machineries."

3.8 Data Processing

3.8.1 Editing

The collected raw data were examined thoroughly to detect errors and omissions. As a matter of fact the researcher made a careful scrutiny of the completed interview schedule to make sure that necessary data were entered as complete as possible and well arranged to facilitate coding and tabulation. Very minor mistakes were detected by doing this, which were corrected promptly.

3.8.2 Coding and tabulation

Having consulted with the research supervisor and co-supervisor, the investigator prepared a detailed coding plan. In case of qualitative data, suitable scoring techniques were followed by putting proper weight age against each of the traits to transform the data into quantitative forms. These were then tabulated in accordance with the objective of the study.

3.8.3 Categorization of data

Following coding operation, the collected raw data as well as the respondents were classified into various categories to facilitate the description of variables. These categories were developed for each of the variables by considering the nature of distribution of the data and

extensive literature review. The procedures for categorization have been discussed while describing the variables under consideration in Chapter IV.

3.9 Statistical Analysis

Data collected from the respondents were analyzed and interpreted in accordance with the objectives of the study. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Science) computer program, version 20.The statistical measures such as range, mean, standard deviation, percentage, rank order were used for describing variables. Tables were also used in presenting data for clarity of understanding. Pearson Product Moment correlation was run to determine the relationship between each of the selected characteristics of the farmers with their utilization of agricultural machineries. Five percent (0.05) level of probability was used as the basis for rejection of a null hypothesis throughout the study. Co-efficient values significant at 0.05 level is indicated by one asterisk (*) and that at 0.01 level by two asterisks (**). For determining severity of theconstraints, rank order was made based on the descending order of the Constraints Faced Index (CFI).

CHAPTER IV

FINDINGS AND DISCUSSION

The findings of the study and interpretations of the results have been presented in this Chapter. These are presented in seven sections according to the objectives of the study. The **first** section deals with utilization of agricultural machineries by the farmers, while the **second** section deals with the selected characteristics of the farmers. In the **third** section relationship between the Selected Characteristics of the farmers' and their use of agricultural machineries have been discussed. The **final** section deals with the constraints faced by the farmers for using agricultural machineries. However, for convenience of the discussions, the findings are systematically presented in the following sections.

4.1 Utilization of Agricultural Machineries

The observed score of utilization of agricultural machineries of the farmers ranged from 10 to 22 against a possible range of 0 to 39. The average score of the farmers was 15.65 with a standard deviation 2.544. The respondent farmers were classified into three categories on the basis of their utilization of agricultural machineries scores and distribution of the two categories namely 'low' and 'medium' use of farm implements of the farmers are shown in Table 4.1.

Table 4.1 Distribution of the farmers according to their utilization of agricultural machineries

Category (Score)	Observed	Farmers		Mean	SD
		Number	Percent		
Low (≤13)	10-22	14	13.1	($\bar{x}$)	(σ)
Medium (Above 13)		93	86.9	15.65	2.544
Total		107	100		

Results show that the highest proportion (86.9 %) of the respondent farmers had medium use of farm implements as compared to 13.1 percent of them having low use of farm implements. Majority farmers of the study area had medium utilization of agricultural machineries, The results here show that middle farmers have the highest percentage of total users, followed by low users and there is no maximum number of users. There are many factors and obstacles involved in increasing the level of mechanization. Lack of experienced and skilled manpower at all stages of production of agricultural machinery, poor quality of repair and maintenance and after-sales service, lack of skilled and experienced manpower related to design, reverse engineering and production process, lack of state-of-the-art equipment at

manufacturing stage Competitive marketing is a major obstacle. The level of use of agricultural machinery and the required mechanization in an area depends on the socio-economic status of the people in that area, environmental factors, availability of agricultural labor and technical equipment. In addition to sustainable mechanization, government strategies to ensure sustainable crop production, research capacity building, effective linkages between different GEOs and NGOs, regional-based feasibility assessments, priority ranking and subsidies on improved and quality agricultural machinery, as well as agricultural machinery development capacity building, Infrastructure reform, after-sales service and supply of quality spare parts at all stages and ensuring necessary materials are required. Rahman (2010) found almost similar findings.

4.2 Selected Characteristics of the Respondent Farmers

Seven characteristics of the farmers were selected to find out the relationships with their utilization of agricultural machineries. The selected characteristics included their age, education, farm working area, annual family income, extension contact, possession of agril. implements and satisfaction on agril. equipment. These characteristics of the respondent farmers are described in this section.

Findings contained in the Table 4.2 reveal the salient features of the characteristics of the respondent farmers in order to have an overall picture of these characteristics at a glance. However, for ready reference, separate tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics in this chapter.

Table 4.2 The salient features of the selected characteristics of the respondent farmers

Categories	Measuring unit	Range		Mean	S.D
		Possible	Observed		
Age	Years	Unknown	30-63	46.02	7.65
Education of farmer	Schooling years	Unknown	0.0-17	7.88	5.55
Farm working area	Hectare	Unknown	0.04-1.4	0.288	0.2326
Annual family income	‘000’BDT	Unknown	90-470	213.60	73.988
Extension contact	Score	0-32	5-16	9.13	2.54
Possession of agril. implements	BDT	Unknown	34-500	137.57	78.02
Satisfaction on agril. equipments	Score	0 - 39	13-23	19.10	1.97

4.2.1 Age

Age of the respondents varied from 30 to 63 years, the average being 46.02 years with the standard deviation of 7.65. Regarding age, the respondent farmers were classified into three

categories according to Ministry of Youth and Sports, Bangladesh, 2008, such as "young aged" (up to 35), "middle aged" (36- 50) and "old aged" (above 50 years). The distribution of the farmers according to their age is shown in Table 4.3.

Table 4.3 Distribution of the farmers according to their age

Category	Number of Farmers	%
Young Aged (up to 35 years)	8	7.5
Middle Aged (36 to 50 years)	73	68.2
Old Aged (Above 51 years)	26	24.3
Total	**107**	**100.0**

Results shown in Table 4.3 reveal that the middle-aged farmers comprised the highest proportion (68.2%) followed by old aged category (24.3%) and the lowest proportion were made by the young aged category (7.50%). Data also indicated that the middle and old aged category constitute 92.5 percent of total farmers. The middle and old aged farmers were generally more possessed farm implements than the young.

It may be due to young to middle aged people are generally receptive to new ideas and things. They are more innovative than old aged people. They have a favorable attitude towards trying new ideas. It means that farm mechanization in the study area is being managed by young to middle aged farmers.

4.2.2 Education of farmer

The level of educational scores of the farmers ranged from 0 to 17 with a mean and standard deviation of 7.88 and 5.55, respectively. Based on the educational scores, the farmers were classified into five categories. The distributions of farmers according to their level of education are presented in Table 4.4.

Table 4.4 Distribution of the farmers according to their level of education

Category(Years)	Observed	Farmers	
		Number	Percent
Can't read and sign (0)	0-17	4	3.7
Can sign only (0.5)		27	25.2
Primary education (1-5)		7.5	7.5
Secondary education (6-10)		35	32.7
Above secondary (>10)		33	30.8
Total		107	100.0

Table 4.4 shows that respondent farmers under secondary education category constituted the highest proportion (32.7%) followed by above secondary education (30.8%). On the other

hand, the lowest 3.7 percent in can't read and sign category followed by primary category (7.5%) and 25.2 percent respondents were in can sign only category. Education broadens the horizon of outlook of farmers and expands their capability to analyze any situation related to utilization of modern technologies. An educated farmer is likely to be more responsive to the modern facts, ideas, and information of modern farm technologies. To adjust with the same, they would be progressive minded to adopt modern technologies related to farm mechanization as well as involve with modern cultural farm activities.

4.2.3 Farm working area

Farm working area of the respondents ranged from .04 hectare to 1.40 hectares with the mean of 0.288 and standard deviation of 0.2325. On the basis of their farm working area, the respondent farmers were classified into three categories as shown in Table 4.4.

Table 4.5 Distribution of the farmers according to their effective land possession

Category (Hectare)	Observed	Farmers	
		Number	Percent
Land less (≤ 0.20)	0.04-1.40	49	45.8
Small (0.21 – 1.00)		55	51.4
Medium (Above 1.00)		3	2.8
Total		107	100.0

The data in the Table 4.5revealed that more than half of the respondent framers (51.4%) had small farm while 2.8 percent had medium farm, and 45.8 percent had of the farmers land less. The findings again revealed that most (97.2 %) of the respondents had land low to small farm size. This small farm size or fragmented land is one of the major problems for farm mechanization. The average farm size of the farmers of the study area (0.28 hectare) was less than that of national average (0.60 ha) of Bangladesh (BBS, 2008)

4.2.4 Annual family income

The score of annual family income of the farmers ranged from 90 to 470 with a mean and standard deviation of 213.60 and 73.99, respectively. On the basis of annual family income, the farmers were classified into three categories namely 'low', 'medium' and 'high' annual family income. The distribution of the farmers according to their annual family income is presented in Table 4.6.

Table 4.6 Distribution of the farmers according to their annual family income

Category ('000 BDT')	Observed	Farmers	
		Number	Percent
Low income (≤ 150)	90-470	19	17.8
Medium income (151-300)		78	72.9
High income (Above 300)		10	9.3
Total		107	100.0

The data is presented in table 4.6indicate that the majority (72.9%) of the farmers had medium income compared to 17.8 percent had low family income and 9.3 percent had high family income. As well as mean annual income of the study area was higher than the national average of $1909 USD. Its indicating that agricultural mechanization is usually practiced by the farmers having comparatively higher economic condition.

4.2.5 Extension contact

The observed score of extension contact of the farmers ranged from 5 to 16 against the possible range of 0 to 28. The average score of the farmers was 9.13 with the standard deviation of 2.54. The farmers were classified into three categories on the basis of theirextension contact scores and distribution of the three categories namely 'low', 'medium' and 'high' extension contact of the farmers are shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their extension contact

Category (Score)	Observed	Farmers	
		Number	Percent
Low contact (≤ 10)	5-16	80	74.8
Medium contact (Above 10)		27	25.2
Total		107	100.0

Data presented in table 4.7 showed that majority proportion (74.8 percent) of the farmers had low extension contact compared to 25.2 percent of them had medium media contact.

From this table, it might be concluded that majority of the farmers had low extension contact. The finding was interesting but logical because in general the farmers in the rural areas of Bangladesh are less cosmopolite in nature and less exposed to different information sources. Finding revealed that 74.8 percent of the farmers had low extension contact which demands for strengthening and improving the communication strategy. Extension contact pertains to ones contact with multifarious sources of farming knowledge and information. This results in cognitive change of the users with an eventual change in behavior and also in skill. They receive information from their neighbors, relatives etc.

4.2.6 Possession of agril. implements

The observed score of possession of agril. implements of the farmers ranged were 34 to 500. The average score of the farmers was 137.57 with a standard deviation 78.02. The farmers were classified into three categories on the basis of their possession of agril. implements scores and distribution of the three categories namely 'low', 'medium' and 'high' possession of agril. implements of the farmers are shown in Table 4.8.

Table 4.8 Distribution of the respondent farmers according to their possession of agril. implements

Category (Score)	Observed	Farmers	
		Number	Percent
Low {≤ 59 (< Mean – SD)}	34 -500	15	14.0
Medium {59 – 215 (Mean ± SD)}		80	75.0
High { Above 215 (> Mean +SD)}		12	11.0
Total		107	100.0

Information showed that the highest proportion (75.0%) of the farmers had medium possession of agril. implements as compared to 14.0 percent of them having low possession of agril. implements and 11.0 percent fell in high possession of agril. implements.

From this table, it might be concluded that majority of the farmers had medium possession of agril. implements. It could be concluded that possession of Agril. implements of the study area were available to the farmers. The findings was interesting but logical because in general the farmers in the rural areas of Bangladesh are less cosmopolite in nature and less exposed to different information sources. As well as mean annual income of locale was higher than the national average of $1932 USD. So, higher annual income of farmers facilitated towards more possession of farm implements.

4.2.7 Satisfaction on agril. equipment

The observed score of satisfaction on Agril. Equipment of the farmers ranged from 13 to 23 against a possible range of 0 to 39. The average score of the farmers was 19.10 with a standard deviation 1.97. The farmers were classified into three categories on the basis of their satisfaction on agril. equipment scores and distribution of the two categories namely 'low' and 'medium' satisfaction on agril. equipments of the farmers.

Table 4.9 Distribution of the farmers according to their satisfaction on Agril. Equipment

Category (Score)	Observed	Farmers	
		Number	Percent
Low (≤ 13)	13 - 23	2	1.9
Medium (Above 13)		105	98.1
Total		107	100.0

Information showed that the highest proportion (98.1%) of the farmers had medium satisfaction on agril. equipment as compared to 1.9 percent of them having low satisfaction on agril. equipment.

From this table, it might be concluded that majority of the farmers had medium satisfaction on agril. equipment. The finding was interesting but logical because in general the farmers in the rural areas of Bangladesh are faced moderate barrier for farm implements handling as well as maintenance.

4.3 Relationship between Selected Characteristics of the respondents Farmers and Their Utilization of Agricultural Machineries

To explore the relationships between the selected characteristics of farmers with their utilization of agricultural machineries, Pearson Product Moment correlation was run. From this correlation test, it was found that farm working area, annual family income, extension contact, possession of agril. implements and satisfaction of agril. implements had significant positive relationship with their use of farm implements. Beside these five characteristics, rest two characteristics of the farmers (age and level of education) had no significant relationship with their use of farm implements. (Table 4.14). Intercorrelation among all the variables may be seen in Appendix-B.

Table 4.10 Co-efficient of correlation showing relationship between selected characteristics of the farmers and their utilization of agricultural machineries

Predicted variable	Experimental variable	Computed value " r "
Utilization of agricultural machineries	Age	-0.042^{NS}
	Education	0.098^{NS}
	Farm working area	0.355**
	Annual family income	0.269**
	Extension contact	0.200*
	Possession of agril. implements	0.286**
	Satisfaction of agril. implements	0.479**

^{NS}Not significant, *Significant at 0.05 level & ** Significant at 0.01 level of probability

4.3 Relationship between selected characteristics of the farmers and their utilization of agricultural machineries

4.3.1 Age and utilization of agricultural machineries

The relationship between age of the farmers and their use of farm implements was examined by testing the following null hypothesis:

"There is no relationship between age of the farmers and their use of farm implements."

Co-efficient of correlation between the concerned variables was found to be 'r' = -0.042 as shown in Table 4.17. This led to the following observations regarding the relationship between the two variables under consideration:

- The relationship showed a negative trend.
- The computed value of 'r' (-0.042) was smaller than the table value with 105 degrees of freedom at 0.05 level of probability.
- The concerned null hypothesis was accepted.
- The co-efficient of correlation between the concerned variable was non-significant at 0.05 level of probability.

Thus, the age of the farmers had negative non-significant relationship with their utilization of agricultural machineries. Rahman (2018) observed the similar findings in his studies.

4.3.2 Level of education and utilization of agricultural machineries

The relationship between education level of the farmers and their use of farm implements was examined by testing the following null hypothesis:

"There is no relationship between education level of the farmers and their use of farm implements."

Co-efficient of correlation between the concerned variables was found to be 'r' = 0.098 as shown in Table 4.17. This led to the following observations regarding the relationship between the two variables under consideration:

- The relationship showed a positive trend.
- The computed value of 'r' (0.098) was smaller than the table value with 105 degrees of freedom at 0.05 level of probability.
- The concerned null hypothesis was accepted.
- The co-efficient of correlation between the concerned variable was non-significant at 0.05 level of probability.

Thus, the level of education of the farmers had positive non-significant relationship with their utilization of agricultural machineries.

4.3.3 Farm working area and utilization of agricultural machineries

The relationship between farm working area of the farmers and their utilization of agricultural machineries was examined by testing the following null hypothesis:

"There is no relationship between farm working area of the farmers and their utilization of agricultural machineries."

Co-efficient of correlation between the concerned variables was found to be 'r' = 0.355 as shown in Table 4.17. This led to the following observations regarding the relationship between the two variables under consideration:

- The relationship showed a positive trend.
- The computed value of 'r' (0.355) was greater than the table value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The co-efficient of correlation between the concerned variable was significant at 0.01 level of probability.

Thus, the farm working area of the farmers had positive significant relationship with their utilization of agricultural machineries. Rahman (2018) observed the similar findings in his studies.

4.3.4 Annual family income and utilization of agricultural machineries

The relationship between annual family income of the farmers and their utilization of agricultural machineries was examined by testing the following null hypothesis:

"There is no relationship between farm annual family income of the farmers and their utilization of agricultural machineries."

Co-efficient of correlation between the concerned variables was found to be 'r' = 0.269 as shown in Table 4.17. This led to the following observations regarding the relationship between the two variables under consideration:

- The relationship showed a positive trend.
- The computed value of 'r' (0.269) was greater than the table value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The co-efficient of correlation between the concerned variable was significant at 0.01 level of probability.

Thus, the annual family income of the farmers had positive significant relationship with their utilization of agricultural machineries. Rahman (2018) observed the similar findings in his studies.

4.3.5 Extension contact and utilization of agricultural machineries

The relationship between extension contact of the farmers and their utilization of agricultural machineries was examined by testing the following null hypothesis:

"There is no relationship between extension contact of the farmers and their utilization of agricultural machineries."

Co-efficient of correlation between the concerned variables was found to be 'r' = 0.269 as shown in Table 4.17. This led to the following observations regarding the relationship between the two variables under consideration:

- The relationship showed a positive trend.
- The computed value of 'r' (0.200) was greater than the table value with 105 degrees of freedom at 0.05 level of probability.
- The concerned null hypothesis was rejected.
- The co-efficient of correlation between the concerned variable was significant at 0.05 level of probability.

Thus, the annual family income of the farmers had positive significant relationship with their utilization of agricultural machineries. Rahman (2018) observed the similar findings in his studies.

4.3.6 Possession of agril. implements and utilization of agricultural machineries

The relationship between possessions of agril. implements of the farmers and their utilization of agricultural machineries was examined by testing the following null hypothesis:

"There is no relationship between possessions of agril. implements of the farmers and their utilization of agricultural machineries."

Co-efficient of correlation between the concerned variables was found to be 'r' = 0.286 as shown in Table 4.17. This led to the following observations regarding the relationship between the two variables under consideration:

- The relationship showed a positive trend.

- The computed value of 'r' (0.286) was greater than the table value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The co-efficient of correlation between the concerned variable was significant at 0.01 level of probability.

Thus, the possession of agril. implements of the farmers had positive significant relationship with their utilization of agricultural machineries. Rahman (2018) observed the similar findings in his studies.

4.3.7 Satisfaction on Agril. equipments and utilization of agricultural machineries

The relationship between satisfactions on agril. equipment of the farmers and their utilization of agricultural machineries was examined by testing the following null hypothesis:

"There is no relationship between satisfactions on agril. equipment of the farmers and their utilization of agricultural machineries."

Co-efficient of correlation between the concerned variables was found to be 'r' = 0.479 as shown in Table 4.17. This led to the following observations regarding the relationship between the two variables under consideration:

- The relationship showed a positive trend.
- The computed value of 'r' (0.479) was greater than the table value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The co-efficient of correlation between the concerned variable was significant at 0.01 level of probability.

Thus, the satisfactions on agril. equipment of the farmers had positive significant relationship with their utilization of agricultural machineries. Rahman (2018) observed the similar findings in his studies.

4.4 Constraints facedin using agricultural machineries

The extent of constraints faced by the farmers using agricultural machineries in terms of Constraints Faced Index (CFI) along with their rank order based on the CFI values have been presented in table 4.11. Findings furnished in the Table 4.1 indicate that the constraints which ranked first was "High cost of agril. Machineries" ranked first followed by "high price of diesel, lubricants oil etc.", "and Inadequate govt. assistance". Rank order of other constraints may be seen in Table 4.11.

Table 4.11Constrained faced Index (CFI) with Rank Order

SL. NO	Items of constraints	CFI	Rank order
1	High cost of agril. machineries	303	1
2	Not useable in small farm land	75	10
3	Maintenance cost high in case of repairing	135	8
4	Unsuitable for cultivating all type crops	138	7
5	Limited scope of modernization the agril. equipments	130	9
6	High price of diesel, lubricants oil etc.	208	2
7	Weather related issues (operating wet, muddy etc.) cases the hamper of spoiled machinery equipment	53	11
8	Unavailable of skilled person for repairing / operating or lack training can result in abused machine/ operating or lack training can result in abused machinery & costly breakdown	146	5
9	Inadequate govt. assistance	204	3
10	Lack of available of agril. machinery / equipment	149	4
11	Lack of information on agril. equipment	145	6

By the following table the ranking order of constrained faced to the respondent farmers first of all is ‘high cost of agril. machineries’ following second order is ‘not useable in small farm land’and following the third order is ‘maintenance cost high in case of repairing’ and others also the different kinds of canstrained faced in different order of rankings.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Findings

Findings different aspects of the study are summarized below:

5.1.1 Utilization of agricultural machineries:

Majority (86.9%) of the farmers had medium use of farm implements, while 13.1 percent farmers had low use of agricultural mechanization.

5.1.2 Selected characteristics of the farmers

Age: The highest proportions (68.2%) of the respondents were in the middle aged category compared to 24.3 percent old and 7.5 percent young aged category.

Educational of farmer: A large proportion (32.7%) of the respondents fell under the category of "secondary education" compared to 3.7 percent "illiterate", 25.2 percent having "can sign only", 7.5 percent having "primary education", 30.8 percent having "higher secondary and above higher secondary education".

Farm working area: More than half of the respondent (71.7%) had small farm, 26.4 percent had medium farm, and 1.9 percent had large farm. The average farm size of the farmers of the study area (0.78 hectares) was higher than that of national average (0.60 ha) of Bangladesh (BBS, 2008).

Annual family income: The majority (72.9%) of the farmers had medium income compared to 17.8 percent low income and 9.3 percent had high income.

Extension contact: A proportion of 74.8 percent of the farmers had low extension media contact compared to 25.2 percent of them having medium media contact.

Possession of agril. implements: The majority (75.0%) of the farmers had medium possession of agril. implements compared to 14.0 percent low possession of agril. implements and 11.0 percent had high possession of agril. implements.

Satisfaction on agril. equipment: The majority (98.1%) of the farmers had medium satisfaction on Agril. Equipment compared to 1.9 percent low Satisfaction on agril. equipment.

5.1.3 Result of Hypothesis Testing

Out of seven selected characteristics of the farmers, farm working area, annual family income, extension contact, possession of agril. implements and satisfaction of agril. implements had significant positive relationship with their use of farm implements. Beside these five characteristics, rest two characteristics of the farmers (age and level of education) had no significant relationship with their use of farm implements of the farmers.

5.2 Constrained Faced by the Farmers

For indexing the Constrained, rank order of the eleven dimensions of selected constrains faced during to use of agricultural machineries of farmers was made by the descending order of constraints faced index (CFI). As per constrained faced index (CFI),high cost of agril. Machineries positioned the 1st and weather related issues (operating wet, muddy etc.) cases the hamper of spoiled machinery equipment was in the last position.

5.3 Conclusions

The findings and relevant facts of research work prompted the researcher to draw following conclusions.

- Majority (86.9%) of therespondent farmers had mediumutilization of agricultural machineries. Therefore, it may concluded that the utilization behavior of the farmers in respect of utilization of agricultural machineriespresents a promising picture, but there is further scope for increasing the extent of using ofutilization of agricultural machineries
- Satisfactions on agril. equipment of the respondent farmers had significant positive relationship with theutilization of agricultural machineries. Therefore, it was concluded that any arrangement made to increase the satisfactions level would ultimately increase theutilization of agricultural machineries.
- Extension media contact of therespondent farmers had a significant positive relationship with theutilization of agricultural machineries. Through extension media contact an individual farmer became facilitating of the information on the various aspect of farm implements. The above facts lead to conclude that necessary arrangements should be made to increase the extension media contact of farmers which would ultimately increase theutilization of agricultural machineries.
- Possession of agril. implements of the respondent farmers had positive significant relationship with theirutilization of agricultural machineries. Therefore, it was concluded

that any financial incentives may offer to increase the ownership level would ultimately increase the use of farm implements.

- Annual family income of therespondent farmers had positive significant relationship with theirutilization of agricultural machineries. The above facts lead to the conclusion that necessary helpful tusk need to run to develop their financial conditionwhich would ultimately develop theutilization of agricultural machineries.
- Farm working area of the farmers had positive significant relationship with their use of farm implements. It is difficult to adopt farm mechanization in small area so, medium to large area were always easy forusing of agricultural machineries.

5.4 Recommendations

5.4.1 Recommendations for policy implications

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

- A large number of farmers (97.20%) had less to smalleffective land possession and had a positive significant relationship with utilization of agricultural machineries. This finding needs to be interpreted with cautions. Farmers were asked about their farm working area where they used agricultural machineries. Most of farmers were under less to small farm working area. However, farm working area should be improved to enhance the effective use agricultural machineries.
- Annual family income also had a positive significant relationship with their utilization of agricultural machineries. Majority of the farmers (82.2%) belonged to medium to high income. Government organizations like Krishi Bank and non-government organization like BRAC, Grammen Bank, etc should provide easy conditioned loan facilities and various income generating training. So that there buying capacity for agril. implements should be enhanced.
- Extension contact had a significant positive relationship with their utilization of agricultural machineries. It may be recommended that agricultural extension agencies especially the DAE and relevant NGOs should critically review their extension programs and make sound provisions so that the farmers understand the benefits of use of machineries. The DAE and other non-governmental organizations should strengthen their extension.
- Possession of agril. implementshad a significant positive relationship with their utilization of agricultural machineries. Majority (75.0%) of the respondents had medium utilization

of agricultural machineries. Therefore it may be concluded that the utilization of agricultural machineries would not be possible to improve a significant extent unless the concerned authorities(DAE, BADC, BARI, BRRI and different NGOs) take proper steps to improve farmers' buying capacity of agricultural machineries.

- It is recommended that extension organizations and other support services should be conscientious of to facilitate annual family income of farmers through different income generating activities. So, concerned extension organizations and other sponsor services must settle training and arrange discussion as well as some meetings so that farmers can change their decision to adopt modern agricultural mechanization to a higher degree.
- It was observed that higher (98.1%) number of the farmers had medium satisfactions on utilization of agricultural machineries. Therefore, it may be recommended that utilization of agricultural machineries would not be possible to improve a significant extent unless the concerned authorities take massive demonstration programs, training programs, field trips etc. should be implemented to bring about considerable changes in the farmers' satisfactions level.

5.4.2 Recommendations for further study

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

- It is recommended that similar studies should be conducted in other areas of Bangladesh.
- It is recommended that further study should be conducted with other characteristics of the farmers with their utilization.
- Studies need to be undertaken to ascertain the principles and procedures for installation, patronization of nursing association in rural areas of Bangladesh.
- It is therefore suggested that future studies should be included more reliable measurement of concerned variable.
- The study was based on the farmers' utilization of agricultural mechanization. Further studies may be conducted in respect of utilization of specific modernagricultural mechanization.
- Similar studies can be conducted in other areas of the country where farm mechanization practiced largely which will be helpful for effective policy implementation.

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APPENDICES

Appendix - A

(English version of the interview schedule)

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University, Dhaka-1207

An Interview schedule for a research study entitled:

"UTILIZATION OF AGRICULTURAL MACHINERIES BY THE FARMERS OF SAGHATTA UPAZILLA UNDER GAIBANDHA DISTRICT"

Serial no…… Name of respondent……
Village…….. Union…… Thana …….
District ……. Mobile No:

(Please provide the following information. Give tick (√) marks if necessary. Your information will be kept confidential and will be used research purpose only.)

1. Age.
Please mention your age .....year

2. Education of farmer: Please mention your educational status.

a. I don't know how to read and write ()
b. I can sign only ( )
c. I have studied up to class…….

3. Farm working area: Please mention your farm area.

Sl. No.	Particulars	Local Unit (Hectare)
1	Own land	
2	Taking lease	
3	Share cropped area	
Total		

4. Annual family income: Please mention your annual family income.

Sl. No.	Source of Income	Amount (Tk)/year
1	Agriculture	
2	Fisheries	
3	Livestock	
4	Forestry	
5	Business	
6	Service	
7	Others	
Total		

5. Extension contact:
Please mention the extent of your contact with the following extension media.

Sl. No.	Sources (of information)	Extent of contact				
		Regularly	**Often**	**Occasionally**	**Rarely**	**Never**
1	Model farmers	>5 times or more/ month ( )	4-5 times /month ( )	2-3 times/ month ( )	Once/ month ( )	Never ( )
2	Input dealers	>5 times or more/ month ( )	4-5 times /month ( )	2-3 times/ month ( )	Once/ month ( )	Never ( )
3	NGO workers	3 times or more/ month ( )	1-2 times /2 month ( )	1-2 times/3 month ( )	Once/ Quarter ( )	Never ( )
4	Sub-Assistant Agricultural Officer (SAAO)	2 or more times/ month ( )	1-2 times /2 month ( )	1-2 times/3 month ( )	Once/ Quarter ( )	Never ( )
5	Upazilla level Agricultural Officers/AEO	>5 times or more /year ( )	4-5 times/ year ( )	2-3 times/ year ( )	Once/ year ( )	Never ( )
6	Mass media (Television program/Radio)	>5 times or more/ month ( )	4-5 times /month ( )	2-3 times/ month ( )	Once / month ( )	Never ( )
7	Farm Publications (e.g.Krishikatha, poster, leaflet)	>5 times/ year ( )	4-5 times/ year ( )	2-3 times/ year ( )	Once/ year ( )	Never ( )

6. Possession of agril. implements: Please mention your possession of farming agril. implements.

Sl. No.	Implements	Value ('000' Tk)
1	Tractor	
2	Power tiller	
3	Fertilizer drill	
4	Power weeder	
5	Sprayer	
6	Irrigation machine/ Electric motor	
7	Seed cum fertilizer drill	
8	Seed drill machine	
9	Leveler	
10	Combine harvester	
11	Power thresher	
12	Peddle thresher	
13	Grain winnower	

7. Satisfaction on agril. equipment: Please mention your level of satisfaction of using the following agril. implements.

Sl. No.	Implements	Extent of satisfaction			
		High	Moderate	Low	No
1	Tractor				
2	Power tiller				
3	Fertilizer drill				
4	Power weeder				
5	Sprayer				
6	Irrigation machine/ Electric motor				
7	Seed cum fertilizer drill				
8	Seed drill machine				
9	Leveler				
10	Combine harvester				
11	Power thresher				
12	Peddle thresher				

13	Grain winnower				

8. Constrained faced by the farmer:
What are the problems do you face during to use agricultural machineries?

Sl. No.	Problems	Extent of problems			
		High	Medium	Low	Not at all
1	High cost of agril. machineries				
2	Not useable in small farm land				
3	Maintenance cost high in case of repairing				
4	Unsuitable for cultivating all type crops				
5	Limited scope of modernization the Agril. Equipment's				
6	High price of diesel, lubricant oil etc.				
7	Weather related issues (operating wet, muddy etc.) causes the hamper of spoiled machinery equipment				
8	Unavailable of skilled person for repairing/operating or lack training can result in abused machinery & costly breakdown				
9	Inadequate govt. assistance				
10	Lack of availability of agril machineries/equipment				
11	Lack of information on agril. equipment				

9. Use of farm implements: Please mention the use of followingAgril. Implements.

Sl. No.	Implements	Extent of use			
		Full	Moderate	Low	No
1	Tractor				
2	Power tiller				
3	Fertilizer drill				
4	Power weeder				
5	Sprayer				
6	Irrigation machine/ Electric motor				
7	Seed cum fertilizer drill				

8	Seed drill machine				
9	Leveler				
10	Combine harvester				
11	Power thresher				
12	Peddle thresher				
13	Grain winnower				

(Thank you for nice co-operation)

……
Signature of the Interviewer
Date:…….

Appendix – B

Correlation matrix among the variables

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	Y
X_1	___							-0.042^{NS}
X_2		___						0.098^{NS}
X_3			___					0.355^{**}
X_4				___				0.269^{**}
X_5					___			0.200^{*}
X_6						___		0.268^{**}
X_7							___	0.479^{**}
Y	-0.042^{NS}	0.098^{NS}	0.355^{**}	0.269^{**}	0.200^{*}	0.268^{**}	0.479^{**}	___

^{NS}Not significant, *Significant at 0.05 level & **Significant at 0.01 level of Regression

Where,
X_1 = Age
X_2 = Education of farmer
X_3 = Farm working area
X_4 = Annual family income
X_5 = Extension contact
X_6 = Possession of agril. implements
X_7 = Satisfaction on agril. equipment utilization of agricultural machineries

Y =