



## RESEARCH ARTICLE

# PRESENT STATUS AND PROBLEM CONFRONTATION OF FARM MECHANIZATION IN BANGLADESH

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## ABSTRACT

Mechanization is an important tool for profitable and competitive agriculture. Proper selection and utilization of machinery effortlessly would boost and optimize farm production. The study aimed to quantify the present status and problem confrontation of villages named Shovna, Khornia, and Tipna villages under Dumuria Upazila of Khulna district and Ashurkhai, Brommotor, Bakdokra villages under Saidpur Upazila of Nilphamari about farm mechanization and to explore the relationship between the selected characteristics of the respondents and their problems associated with farm mechanization. A validated and structured interview schedule was used to collect data from 150 farmers' during December 2020. The farmers' of the study area used 25 mechanized implements/ machinery at different stages of cultivation to a different extent. The farmers of the study area highly used sprayers (for controlling insect-pests and diseases) to the highest extent while they used moisture meter at the least extent. Besides those, the respondents used some farm machinery (such as diesel pumps, tractors, and power tillers). About three-fourths (75.33%) of the respondents belonged to the medium machinery use category, whereas about one-fourth (24.67%) of them belonged to the low use category. None of them belonged to the high-use category. The majority (51.3 %) of the respondents belonged to the high problem confrontation category; on the other hand, about two-fifths (38.0%) and one-tenth (10.7%) of them confronted medium and very high problems respectively. Among nine selected characteristics of the farmers' age, family size, and training experience showed a negative significant relationship with their problem confrontation while educational qualification had a significant positive relationship with problem confrontation of the farmers.

## KEYWORDS

Present status; problem confrontation; farm mechanization.

## 1. INTRODUCTION

Bangladesh is an agricultural country. The economy of Bangladesh is mainly dependent on agriculture. Agriculture contributes about 14.23% to the country's GDP (BBS, 2018). Agriculture employs about 50% of Bangladesh's population, with more than 70% of the country's land dedicated to crop production (FAO, 2011). To increase production and cropping intensity, the most important achievement will be the faster development of agricultural mechanization and 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 (Islam and Shirazul, 2009).

Mechanization is an essential tool for profitable and competitive agriculture. The need for mechanization is increasing fast with the decrease of draft power. Without mechanization, it will not be possible to maintain multiple cropping patterns, which need quick land preparation, planting, weeding, harvesting, and processing (Islam and Shirazul, 2009). Agricultural mechanization today has a comprehensive meaning. This broad meaning includes the production, distribution, and utilization of various tools, machinery, and equipment for the development of agricultural land, planting, harvesting, and primary processing (Emami et al., 2018).

Farm mechanization facilitates a 5.22% enhancement in cropping intensity, an increase in productivity to the extent of 12-34%, and seed cum fertilizer drill facilitates a 20.0% saving of seed and a 15-20% saving in fertilizers. It increases 23.50% in gross income and return of the farmers' (Prasad et al., 2009). Farm mechanization saves time and labor, cuts down crop production costs, in the long run, reduces post-harvest losses, and boosts crop output and farm income. However, the level of mechanization of different operations in Bangladesh agriculture differs from operation to operation (Singh and Singh, 2009).

Farm mechanization helps to enhance overall productivity and production with the lowest cost of production. Farm mechanization can help in 15-20% saving in seeds, 15-20% saving in fertilizers, 5-20% increase in cropping intensity, 20-30% saving in time, 20-30% reduction in manual labor, and 10-15% overall increase in farm productivity (Kumar and Sankarakumar, 2012). Mechanization is a multi-dimensional concept and is widely used in agriculture. There is, however, a major difference between the application of mechanization in developed and developing countries. The developing countries tend to design their strategies for food security given the challenges they face in all aspects of their economy, including feeding a growing population, reducing poverty, protecting the environment, managing the effects of climate change, and fighting malnutrition, all of which may further contribute to a reduction in economic growth and political instability (Emami et al., 2018).

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Bangladesh emerged as a middle-income country in 2020 (Rahman et al., 2021). This breakthrough has come at the expense of rural workers' migration to cities over the last three decades. Unskilled farm workers are employed in the ready-made garment industry, where the demand for cheap unskilled workers is skyrocketing. As a result, there is a shortage of agricultural labor in rural areas. The shortage is felt seriously during peak transplant and harvest periods when it is important to meet the seasonal deadlines. The next phase of Bangladesh's agricultural mechanization is expected to take place in these two sectors. However, tillage, weed control, and plant protection technologies will also need to be mechanized in the coming days. Very little and sporadic research had been conducted on farm mechanization in Bangladesh before as reported (Khan, 2020). The researchers were conducting this study to satisfy the mentioned gaps. The findings may improve the condition of mechanization in Bangladesh in the current state and aspects of mechanization through this study.

Analyzing the problems associated with farm mechanization from farmers' perspective in a developing country like Bangladesh, the researchers undertook the study entitled "Present Status and Problem Confrontation of Farm Mechanization in Bangladesh." To make the study manageable, the following research questions were taken into consideration:

- i. What is the present status of farm mechanization in Bangladesh?
- ii. What are the problems confronted by the farmers related to farm mechanization?
- iii. What were the farmers' selected characteristics?
- iv. Is there any relationship between the farmers' selected characteristics and the problems associated with farm mechanization?

## 2. SPECIFIC OBJECTIVES

In these circumstances, the present research has been undertaken with the following objectives:

- i. To depict the present status of farm mechanization.
- ii. To determine the extent of the farmers' problems about farm mechanization.
- iii. To analyze the selected characteristics of the farmers.
- iv. To explore the relationship between the farmers' selected characteristics and the problems associated with farm mechanization.

## 3. METHODOLOGY

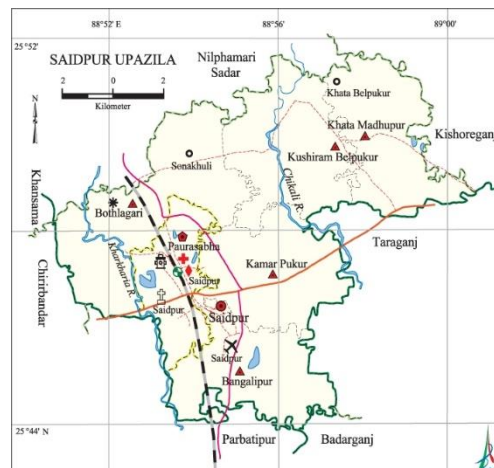
### 3.1 Design and Locale of the Study

The research was conducted following the Descript and Diagnostic Design (Kothari, 2004). It was designed to determine farm mechanization's present status and its problem confrontation. This research was census sampling. Data were collected through interviews with respondents. The study was conducted in Shovna, Khornia, and Tipna villages under Dumuria Upazila of Khulna district and Ashurkhai, Brommottor, Bakdokra villages under Saidpur Upazila of Nilphamari district. The selected areas for the study were best on time and resource availability. A map of Dumuria and Saidpur Upazila of Khulna and Nilphamari, respectively, is shown in Figure 1 and Figure 2.



**Figure 1:** Map of Dumuria upazila under Khulna district showing the study area

(Source: [https://en.banglapedia.org/index.php/Dumuria\\_Upazila](https://en.banglapedia.org/index.php/Dumuria_Upazila))



**Figure 2:** Map of Saidpur upazila under Nilphamari district showing the study area

(Source: [https://en.banglapedia.org/index.php/Saidpur\\_Upazila](https://en.banglapedia.org/index.php/Saidpur_Upazila))

### 3.2 Population and Sampling

The farmers who were exposed to mechanized cultivation were treated as the population of this study. A total of 150 farmers (75 from each of Khulna and Nilphamari) were selected as a sample of this study, followed by an accidental random sampling method (Kothari, 2004).

### 3.3 Instrument, Method and Time of Data Collection

To collect relevant information from respondents, a carefully designed and pretested interview schedule was used. Data were collected from the sampled respondents by the researchers themselves through personal interviews conducted during December 2020.

### 3.4 Data Processing and Analysis

During data processing, an appropriate scoring technique was followed to convert the data into a quantitative form in the case of qualitative data. Local units of measurement were converted into standard units. Indices and scales were considered efficient instruments for data reduction and analysis. All personal characteristics were categorized and arranged in simple tables for interpretation and discussion. Number, frequency, percentage, range, mean, standard deviation, and rank order were used for statistical description. Correlation coefficient "r" was employed to explore the relationship between any two variables. Data were analyzed by using SPSS 20.0.

### 3.5 Determining the Present Status of Farm Mechanization

The present status of farm mechanization was determined in terms of machinery used and ownership. The respondents were directly asked to mention the name of machinery used in different stages of cultivation and their ownership (own/hire).

The use intensity of different machinery/implements was determined by calculating Machinery Use Index (MUI). The MUI was determined by using the following formula.

$$(\%) \text{ MUI} = \frac{\text{Observed MUI Score}}{\text{Highest Possible MUI Score}} \times 100$$

The MUI Score was calculated by using the following formula:

$$\text{MUIS} = (N_{RE} \times 3) + (N_{SO} \times 2) + (N_{RA} \times 1) + (N_{NA} \times 0)$$

Where,

MUIS = Machinery Use Index Score

$N_{RE}$  = No. of the respondent used machinery regularly

$N_{SO}$  = No. of the respondent used machinery sometimes

$N_{RA}$  = No. of the respondent used machinery rarely

$N_{NA}$  = No. of the respondent not at all used the machinery

Ownership: The respondents were directly asked to indicate the ownership of their used machinery as either own or hire.

### 3.6 Measurement of Problem Confrontation

Problem confrontation in farm mechanization was treated as a dependent/focus variable of this study. Twenty problems related to farm machinery were incorporated into the interview schedule. A five-point Likert-type scale in which 0 = not at all, 1 = less severe, 2 = moderately severe, 3 = severe, 4 = highly severe was employed against each of the problems associated with farm machinery. Each of the respondents was asked to indicate the extent/severity of the problems in faced.

To identify the most severe problems(s), a Problem Confrontation Index Score (PCIS) was calculated by using the following formula:

$$\text{PCIS} = N_{HS} \times 4 + N_S \times 3 + N_{MS} \times 2 + N_{LS} \times 1 + N_{NAA} \times 0$$

Where,

PCIS= Problem Confrontation Index Score

$N_{HS}$  = No. of the respondent at highly severe

$N_S$  = No. of the respondent at severe

$N_{MS}$  = No. of the respondent at moderately severe

$N_{LS}$  = No. of the respondent at less severe

$N_{NA}$  = No. of the respondent not at all

As there were 150 respondents, so Problem Constraints Index Score (PCIS) could range 0-450. Based on PCIS, 20 problems were ranked to compare the level of severity by the respondents. The PCIS was converted into a percentage using the following formula:

$$(\%) \text{ Problem Constraints Index} = \frac{\text{Observed PCIS}}{\text{Highest Possible PCIS}} \times 100$$

The problem confrontation score was determined by summing up all the scores obtained by the respondents against all the twenty problems. The problem confrontation score of a respondent could range from '0' to '80'. The respondents were grouped into the following categories based on exposure score, as shown in Table 5.

### 3.7 Measurement of Selected Characteristics of the Respondents

The selected nine characteristics of the respondents were measured following standard procedure and then categorized and arranged in a simple table for interpretation and discussion (Islam et al., 2019; Mondol et al., 2019) (Table 6).

## 4. RESULTS AND DISCUSSION

### 4.1 Present Status of Farm Mechanization

The present status of farm mechanization was observed in terms of use and ownership of machinery.

### 4.2 Uses of machinery

Sl. No.	Machines	Total Users	MUI		Rank
			MUIS	%	
1	Power Tiller	136	279	62	4 <sup>th</sup>
2	Tractor	124	342	76	3 <sup>rd</sup>
3	Moisture Meter	4	4	0.88	21 <sup>st</sup>
4	Transplanter	7	8	1.77	19 <sup>th</sup> =
5	Drum Seeder	11	16	3.55	15 <sup>th</sup> =
6	Seed Sower	5	7	1.55	20 <sup>th</sup>
7	PTO Seeder	8	12	2.66	17 <sup>th</sup>
8	Seed Drill Machine	7	8	1.77	19 <sup>th</sup> =
9	Potato Seed Digger	7	9	2	18 <sup>th</sup>
10	Japanese Rice Weeder	11	15	3.33	16 <sup>th</sup>
11	Electric Pump	84	213	47.33	7 <sup>th</sup>
12	Diesel Pump	145	365	81.11	2 <sup>nd</sup>
13	PTOS	10	16	3.55	15 <sup>th</sup> =
14	Sprayer	150	450	100	1 <sup>st</sup>
15	Combined Harvester	14	27	6	13 <sup>th</sup> =
16	Reaper Binder	14	27	6	13 <sup>rd</sup> =
17	Trolley	90	146	32.44	11 <sup>th</sup>
18	Tractor Driven Trolley	90	157	34.88	10 <sup>th</sup>
19	Paddle Thresher Manually	131	253	56.22	5 <sup>th</sup>
20	Power Thresher (Open Drum)	110	203	45.11	8 <sup>th</sup>
21	Power Thresher (Close Drum)	100	201	44.66	9 <sup>th</sup>
22	Corn Thresher	16	24	5.33	14 <sup>th</sup>
23	Seed Crop Cleaning Machine	10	16	3.55	15 <sup>th</sup> =
24	Power Thresher	43	68	15.11	12 <sup>nd</sup>
25	Cold Storage	116	227	50.44	6 <sup>th</sup>

MUI (Machinery Use Index); MUIS (Machinery Use Index Score)

The farmers of the study area used 37 types of machinery/implements at different stages of cultivation, where 25 were mechanized (Table 1a), and 12 were non-mechanized farm instruments (Table 1b). However, the farmers of the study area introduced mechanized cultivation by using 25 types of machinery to a different extent, among which a sprayer was highly used followed by a diesel pump, tractor, power tiller, and so on. The study's findings are in harmony with the findings of (Rahman et al., 2021).

They found that most of the respondents (95%) used a sprayer. They also reported that 80% of the land was tilled by power tiller while 15% was tilled by the tractor. Irrigation was powered by a diesel pump. The respondents used a moisture meter to a minor extent (0.88%). The findings also indicate that the respondents were conscious about pest control, irrigation, and land preparation but less conscious about the moisture of their produced grains/seeds.

**Table 1b:** Relative position of the traditional machinery based on the Machinery Use Index (MUI)

Sl. No.	Machines	Total Users	MUI		Rank
			MUIS	%	
1.	Spade	150	450	100	1 <sup>st</sup> =
2.	Country Plough	140	243	54	5 <sup>th</sup>
3.	Plastic Mulch Layer	128	294	65.33	4 <sup>th</sup>
4.	Tubewell	147	441	98	2 <sup>nd</sup>
5.	Don/ Seuty	48	81	18	6 <sup>th</sup>
6.	Sickle	150	450	100	1 <sup>st</sup> =
7.	Heading on Foot	150	450	100	1 <sup>st</sup> =
8.	Cow	45	57	12.66	7 <sup>th</sup>
9.	Winnowing Fan/Kula	150	450	100	1 <sup>st</sup> =
10.	Kula	150	450	100	1 <sup>st</sup> =
11.	Sun Drying	150	450	100	1 <sup>st</sup> =
12.	Storehouse (Gola/sack)	147	299	66.44	3 <sup>rd</sup>

MUI (Machinery Use Index); MUIS (Machinery Use Index Score)

#### 4.3 Distribution of the Respondents according to Extent of their Use of Machinery

The farm machinery use score of the respondents varied from 28 to 72

with a mean and standard deviation of 48.11 and 8.14, respectively. The distribution of the respondents according to the machinery use categories is shown in Table 2.

**Table 2:** Distribution of the respondents according to machinery use score

Categories (Use)	Score (Number)	Respondent (N=150)		Range		Mean±Sd
		Number	Percent	Min.	Max.	
Low	Upto43	37	24.67	28	72	48.11 ± 8.14
Medium	44-86	113	75.33			
High	87-129	00	00			
	Total	150	100			

Data presented in Table 2 reveal that about three-fourths (75.33%) of the respondents had medium use, whereas about one-fourth (24.67%) had low use. It means that all respondents fall in the medium to low-use category. The findings of this study are a little bit in harmony with the findings of (Khan, 2020). He found that most of the respondents (86.24%) had a medium to low-use category.

Possession of machinery was divided into two categories:

- Own
- Hire

Data presented in Table 3 show the percentages (grand total, total own, total hire) of 37 machinery/implements (mechanized and non-mechanized).

#### 4.4 Ownership / Possession of Machinery

**Table 3:** Distribution of the respondents according to their possession of machinery

Steps	Instruments	Ownership (N=150)		Total Use
		Owned (%)	Hired (%)	
Land Preparation/Laddering	Spade	150 (100%)	-	150 (100%)
	Country Plough	84 (56%)	56 (37.33%)	140 (93.33%)
	Power Tiller	22 (14.67%)	114 (76%)	136 (90.67%)
	Tractor	13 (8.67%)	111 (74%)	124 (82.67%)
Seed Selection	Moisture Meter	3 (2%)	1 (.67%)	4 (2.67%)
Transplanting	Transplanter	-	7 (4.67%)	7 (4.67%)
Seeding	Drum Seeder	-	11 (7.33%)	11 (7.33%)
	Seed Sower	-	5 (3.33%)	5 (3.33%)
	PTO Seeder	-	8 (5.33%)	8 (5.33%)
	Seed Drill Machine	-	7 (4.67%)	7 (4.67%)
Digging	Potato Seed Digger	3 (2%)	4 (2.67%)	7 (4.67%)
Weeding	Japanease Rice Weeder	2 (1.33%)	9 (6%)	11 (7.33%)

**Table 3 (Cont.):** Distribution of the respondents according to their possession of machinery

Mulch	Plastic Mulch Layer	125 (83.33%)	3 (2%)	128 (85.33%)
Irrigation	Electric Pump	23 (15.33%)	61 (40.67%)	84 (56%)
	Diesel Pump	64 (42.67%)	81 (54%)	145 (96.67%)
	Tubewell	134 (89.33%)	13 (8.67%)	147 (98%)
	Don/ Seuty	48 (32%)	-	48 (32%)
Fertilization	PTOs	9 (6%)	1 (.67%)	10 (6.67%)
Spraying	Sprayer	91 (60.67%)	59 (39.33%)	150 (100%)
Harvesting	Combined Harvester	-	14 (9.33%)	14 (9.33%)
	Sickle	150 (100%)	-	150 (100%)
	Reaper- Binder	-	14 (9.33%)	14 (9.33%)
Transporting	Trolley	5 (3.33%)	85 (56.67%)	90 (60%)
	Tractor Driven Trolley	11 (7.33%)	79 (52.67%)	90 (60%)
	Heading on Foot	94 (62.67%)	56 (37.33%)	150 (100%)
Threshing	Paddle Thresher/ Manually	57 (38%)	74 (49.33%)	131 (87.33%)
	Power Thresher (Open Drum)	32 (21.33%)	78 (52%)	110 (73.33%)
	Power Thresher (Closed Drum)	9 (6%)	91 (60.67%)	100 (66.67%)
	Cow	39 (26%)	6 (4%)	45 (30%)
	Corn Thresher	2 (1.33%)	14 (9.33%)	16 (10.67%)
Winnowing	Winnowing Fan/ Kula	150 (100%)	-	150 (100%)
	Seed Crop Cleaning Machine	1 (.67%)	9 (6%)	10 (6.67%)
Cleaning	Power Thresher	17 (14%)	26 (17.33%)	43 (31.33%)
	Kula	150 (100%)	-	150 (100%)
Drying	Sun Drying	150 (100%)	-	150 (100%)
Storage	Storehouse (Gola/sack)	136 (90.67%)	11 (7.33%)	147 (98%)
	Cold Storage	-	116 (77.33%)	116 (77.33%)

\*Figure in the parenthesis indicate the percentage of the respondents

#### 4.5 Problem Confrontation Related to Farm Mechanization

##### 4.5.1 Problems Faced/Confronted

The respondents of the study area confronted 20 problems to a different

extent. The price of machinery was the most severe problem, while the less severe problem was the stagnant water. Some other major problems were heavy machinery not affordable, lack of capital and loan facilities, and unavailability of some machinery.

**Table 4:** Severity of the selected 20 problems

Sl. No.	Problems	PCI		Rank
		Score	Percent	
1.	High Price of Machinery	543	90.5	1 <sup>st</sup>
2.	Lack of Quality of Locally Made types of equipment	373	62.17	9 <sup>th</sup>
3.	Lack of Technical Knowledge	395	65.83	5 <sup>th</sup>
4.	Lack of Skill for Operation	388	64.67	7 <sup>th</sup>
5.	Lack of Technical Training Exposure	322	53.67	10 <sup>th</sup>
6.	Unavailability of Some Machinery	401	66.83	4 <sup>th</sup>
7.	Fragmentation of Land	259	43.17	15 <sup>th</sup>
8.	Small Land Holding	246	41	16 <sup>th</sup>
9.	Topography of Land	193	32.17	19 <sup>th</sup>
10.	Stagnant Water	184	30.67	20 <sup>th</sup>
11.	Heavy Machinery not affordable (Economic Hardship)	456	76	2 <sup>nd</sup>
12.	Transport Problem/Lack of Road Communication	382	63.67	8 <sup>th</sup>
13.	Lack of Capital and Loan Facilities	403	67.17	3 <sup>rd</sup>
14.	Lack of Govt. Support	312	52	11 <sup>th</sup>
15.	Unavailability/High Price of Energy	389	64.83	6 <sup>th</sup>
16.	High Rate for Renting Machinery	292	48.67	12 <sup>th</sup>
17.	High Maintenance Cost	236	39.33	17 <sup>th</sup>
18.	Lack of Local Workshop for Repairing	282	47	13 <sup>th</sup>
19.	Lack of Local Service Provider	273	45.5	14 <sup>th</sup>
20.	Unavailability of Spare Parts	212	35.33	18 <sup>th</sup>

#### 4.5.2 Extent of Problems Confronted by the Respondent

Problem confrontation of the respondents ranged from 23-69 with a mean of 43.45 and a standard deviation of 9.72. The distribution of the respondents according to their problem confrontations is shown in Table

5. The majority (51.3%) of the respondents belonged to the high problem confrontation category; on the other hand, about two-fifths (38.0%) of them had medium problem confrontation, and one-fifth (10.7%) of them had very high problem confrontation.

**Table 5:** Distribution of the respondents according to their problem confrontation

Categories (Problem Confrontation)	Score (Number)	Respondent (N=150)		Range		Mean±Sd
		Number	Percent	Min.	Max.	
Low	Up to 20	0	0	23	69	43.45 ±9.72
Medium	21-40	57	38.0			
High	41-60	77	51.3			
Very High	61-80	16	10.7			
	Total	150	100			

**Table 6:** Distribution of the respondents according to their selected characteristics

Characteristic	Categories	Score	Respondents		Range		Mean±SD
			Number	Percent	Min.	Max.	
Age (year)	Young	Up to 35	26	17.3	22	73	48.13 ± 11.31
	Middle	36-50	60	40.0			
	Old	>50	64	42.7			
Experience in farming (year)	Low	Up to 10	26	17.3	5	55	23.66 ±10.71
	Medium	11-20	40	26.7			
	High	>20	84	56.0			
Experience in farm mechanization (year)	Low	Up to 10	32	21.3	3	45	19.27±7.81
	Medium	11-20	56	37.3			
	High	>20	62	41.3			
Level of education (year of schooling)	Illiterate	0	6	4	0	17	8.69 ±3.76
	Primary	1-5	30	20			
	Secondary	6-10	80	53.3			
	Higher Secondary	11-12	21	14			
	Above Higher Secondary	>12	13	8.7			
Family size (number)	Small	Up to 4	86	57.3	2	12	4.59 ±1.48
	Medium	5-6	52	34.7			
	Large	=>7	12	8			
Farm size (ha)	Landless	Below 0.02	0	0	0.02	4.50	1.13 ±1.26
	Marginal	0.02-0.2	60	40			
	Small	0.21-1	30	20			
	Medium	1.01-3	30	20			
	Large	>3	30	20			
Annual Income ("000' BDT)	Low	Up to 150	53	35.3	25	2390	292.90 ± 310.24
	Medium	151-200	62	41.3			
	High	>200	35	23.3			
Training exposure (number)	No Training Exposure	0	17	11.3	0	5	1.73 ±1.05
	Low	1-2	107	71.3			
	Medium	3-4	23	15.3			
	High	=>5	3	2			
Extension contact (score)	Low	Up to 12	14	9.3	7	30	19.67 ±5.49
	Medium	13-24	91	60.7			
	High	25-36	45	30			

#### 4.6 Selected Characteristics of the Farmers

The highest (42.7%) of the respondents fell in the old-aged category compared to young-aged (17.3%) and middle-aged (40.0%). Most (82.7%) of the farmers belonged to old to middle-aged categories. Similar results were also reported by Manabika *et al.* (2019), where they found that 40.0%

of respondents were from the old age group of above 50 years of rooftop gardening. The majority (56.0%) were highly experienced compared to 26.7%, and 17.3% were medium and low experience in farming, respectively. This finding is in harmony with the farming related to the age of this study. Most (82.7%) of the respondents had medium to high experience in farming. The highest proportion (41.3%) of the respondents was highly experienced compared to 37.3% and 21.3% were medium and

low experience in farm mechanization, respectively. The findings also indicate that mechanization started the very early stage of this experience in Bangladesh.

The majority (53.3%) of the respondents belonged to the secondary education category compared to primary (20%), higher secondary (14.0%), above higher secondary (8.7%) and illiterate (4.0%) of the farmers' categories respectively. The findings also indicate that very high percentages (96%) of the respondents possessed the level of education, and only a few (4%) were illiterate. Similar results were also reported by where they stated that the highest number of respondents were in the secondary level of education (Mannan and Miah, 2007). The majority (57.3%) of the respondents belonged to the small family, whereas 34.7% and 8.0% of the respondents belonged to the medium-sized families and the large size family, respectively. Similar results were also reported where they found that 55.0% of the respondents had small-sized families (Manabika et al., 2019). The respondents' average family size is higher than the national average (4.50); (BBS, 2016).

It means that the farmers of the study area are not so aware of the population growth rate and planned family. Two-fifths (40.0%) of the farmers possessed a marginal farm. Similar percentages of farmers (20.0%) belonged to small, medium and large farm categories. The average farm size of the study area is higher than the national average (0.04816 ha);(BBS, 2016). About two-fifths (41.3%) of the respondents had medium-income whereas more than one-third (35.3%) and one-fifth (23.3%) had low and high income, respectively. The average per capita income of the respondents of the study area (292.90 BDT) is higher than the national per capita income (219.644 BDT); (The Financial Express, 2021). The majority (71.3%) of the respondents belonged to the low training exposure category. On the other hand, 15.3% of the respondents had medium training exposure, to 2.0% of them had high training exposure. However, 15.3% of the respondents had no training exposure. Most (90.7%) of the respondents had medium to high extension contact, whereas 9.3% of them had low extension contact

#### 4.7 Relationship between the Selected Characteristics of the Farmers and Their Problems Associated with Farm Mechanization

The coefficient of correlation was computed to explore the relationship between the selected characteristics of the farmers and their problems associated with farm machinery. The selected characteristics of the farmers constituted independent variables, and their problems associated with farm machinery constituted the dependent variable of the study. In this section, relationships between the respondents' nine selected characteristics (independent variables) and the dependent variable (their problems associated with farm mechanization) have been described. Pearson's Product Moment Coefficient of Correlation ( $r$ ) was used. Five percent and one percent levels of probability were used. The results of the coefficient of correlation indicating the relationship between the selected characteristics of the respondents and their problems associated with farm mechanization are shown in Table 7.

Table 7: Relationship between the selected characteristics of the respondents and their problems associated with farm mechanization		
Dependent Variable	Characteristics (Independent Variables)	Correlation Coefficient
Problems Associated with Farm Mechanization	1. Age	-0.349**
	2. Farming Experience	-0.118
	3. Farm Mechanization Experience	-0.018
	4. Level of Education	0.224**
	5. Family Size	-0.254**
	6. Farm Size	0.053
	7. Annual Income	-0.084
	8. Training Exposure	-0.190*
	9. Extension Contact	0.155

NS= Non-significant, \*\*Correlation is significant at the 0.01 level (2-tailed), \*Correlation is significant at the 0.05 level (2-tailed), PPCC = Pearson's Product Moment coefficient of correlation.

Among nine selected characteristics, the farmers' age, family size, and Training exposure (5%) showed a significant negative relationship with their problem confrontation. It means that the higher the age, family size,

and training exposure- the lower the problem confrontation. A group researchers found the opposite result regarding age and problem confrontation (Manabika et al., 2019). They found that the age of the respondents had a positive significant relationship with their problem confrontation. Several researchers observed a non-significant relationship; most for researchers found a non-significant relationship between family size and problem confrontation (Hannan et al, 2020; Manabika et al., 2019; Akter et al., 2019).

A group researchers found a similar type of result regarding the training exposure of the respondents (Hannan et al., 2020). They found that training exposure had a negative significant relationship with their problem confrontation. On the other hand, Level of Education had a significant positive relationship with the problem confrontation of the farmers. It means that the higher the Level of Education, the higher the farmers' ability to identify the problem of farm mechanization. However, most of researchers found a non-significant relationship between education and problem confronted (Hannan et al., 2020; Manabika et al., 2019; Akter et al., 2019).

## 5. CONCLUSION

- Although the farmers are still using traditional implements, they have shifted to mechanized cultivation by using mechanized implements to a different extent.
- Two-thirds of the respondents (75.33%) used machinery to a moderate extent. Most of them used their sprayer while power tiller and tractor were used on a hire basis (75%).
- The majority of the respondents (51.3%) were in the high problem confrontation category. The higher price of farm machinery and economic hardship mainly hindered farm mechanization.
- Among nine selected characteristics of the farmers' age, family size, and training experience showed a negative significant relationship with their problem confrontation while level of education had a significant positive relationship with problem confrontation of the farmers.

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