PROFITABILITY OF RICE CULTIVATION IN THE SELECTED AREAS OF TANGAIL DISTRICT IN BANGLADESH

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CERTIFICATE

This is to certify that the thesis entitled '**PROFITABILITY OF RICE CULTIVATION IN THE SELECTED AREAS OF TANGAIL DISTRICT IN BANGLADESH**' submitted to the Faculty of Agribusiness Management, Sher-E-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **Master of Science in AGRIBUSINESS AND MARKETING,** embodies the result of a piece of bonafide research work carried out by **Md. Jahiduzzaman Jahid**, Registration Number: **12-05186** 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 duly been acknowledged.

……..

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DEDICATED TO

MY BELOVED PARENTS

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ABSTRACT

The purpose of the study was to identify the major socio-economic characteristics of rice farmers; to assess the profitability of rice production farmers; and to identify problem faced by the farmers in rice production. The study was undertaken purposively in Mirzapur upazila under Tangail district. Validated and well- structured interview schedule (questionnaire) was used to collect data from 95 rice cultivars during 1 s t August, 2019 to 1st September, 2019. The average yields of rice was 10374 kg per hectare for the farmers. The gross returns per hectare was Tk. 186732.00. It was observed that per hectare net return was Tk. 8484.52. Cost and returns were worked out to estimate profitability of rice production. Per hectare total cost, gross return, net return and gross margin were Tk. 178247.48, Tk. 186732.00, Tk. 215931.00 and Tk. 60354.5 respectively. Benefit Cost Ratio was 1.047. Cobb-Douglas production function analysis was carried out for examining the factors affecting the profitability of input use. In most of the cases the coefficients of irrigation, human labor, cost of TSP, cost of manure and cost of pesticide appeared to be significant. The summation of co-efficient of different inputs were greater than one implying that the production functions exhibited increasing returns to scale. The values of the coefficient of multiple determination of rice production was 0.92 which implied that about 92 percent of the total variation in the gross return could be explained by the included explanatory variables of the model. Production function for rice production exhibits increasing returns to scale (2.261). This means that, if all the variables specified in the model were increased by 1 percent, gross return would also increase by 2.261 percent. . The F-value for the rice farmers was 121.726 which were highly significant at 1 percent level. Unavailability of labor was the l[st] problems in the study and poor quality of pesticide was the last problem. To reduce input price was the 1st probable suggestions to overcome problems and available insecticides and pesticides was the last suggestion.

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ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
TPS	True Potato Seed
BARI	Bangladesh Agricultural Research Institute
GDP	Gross Domestic Product
BCR	Benefit Cost Ratio
NGOs	Non-Governmental Organization
BB	Bangladesh Bank
MP	Murate of Potash
HYV	High Yielding Variety
TSP	Triple Super Phosphate
STW	Shallow Tube Well
DTW	Deep Tube-Well
SPSS	Statistical Package for Social Science
LUC	Land Used Cost
TVC	Total Variable Cost
NR	Net Return

CHAPTER I
INTRODUCTION

1.1 Background of the Study

Bangladesh is an agricultural country with the geographical area of 147570 sq kilometers and population of about 160 millions. The population density per km^2 is 1109 people (BBS, 2018). Agriculture is the major dominating sector of the country. Out of total land area of 14.84 million hectares, the net cropped area of the country is 8.29 million hectares and its cropping intensity is 192 per cent (BER 2018). About 80 percent of its population lives in rural areas, where agriculture is the major occupation and 45.1 % (BBS, 2018) labor force are engaged in agriculture. At present the contribution of agriculture to the total GDP (Gross Domestic Product) is 14.10% in which 10.05% comes from crops, 1.19% from forestry, 2.41% from livestock and 3.56% from fisheries (BBS, 2019).In the year (2009-10), Bangladesh earned $687.53 million by exporting agricultural products which is 4.24 percent of total export earnings (BBS, 2010). So agriculture plays vital roles for poverty alleviation and food security by increasing income level of rural population. The population growth rate is 1.36 percent per annum (BBS, 2019) which causes the decreases of farm size in a horrid manner. The extra population is a threat to the total production.

Rice is a major source of subsistence of rural populations in most Asian countries. There are about 4 billion people consuming over 90 percent of the world's rice production. Rice was selected as the subject in the present study because of its prominent position in the national economy of Bangladesh. The share of agriculture to GDP in Bangladesh is about 18.64 percent (BER, 2008-09). About 80 percent of total cultivable land is diverted to rice production (McIntire, 1998). Since 1999-2000, boro rice has contributed to more than half of the total rice production in Bangladesh. From 1980's to 2018's, the production of Boro has increased from 19 to 48 percent while the production of Aus and Aman types being decreased (from 25 to 7 percent and from 56 to 45 percent respectively (Ahmed, 2004)). Currently Boro occupies about 41 percent of total rice area and contributes to some 56 percent share of total rice production in Bangladesh. On the other hand, Aman rice occupies 50 percent of total rice land and contributes to some 38 percent of total production and

while Aus rice taking about 9 percent of total rice area, contributing by 6 percent to rice production (Dev et al., 2009).

A rate of per hectare of low technical efficiency in the production of Modern Variety (MV) rice was observed in Bangladesh (Sharif and Dar, 1996). Given the importance of rice production, yet it is surprising that there have been only a few studies carried out on the efficiency of rice production in Bangladesh. Have farmers promoted their production efficiently along with the progress in available technologies? How have the policies undertaken by governments impacted rice production and a farmer's technical efficiency? These are some of the questions the present study partly sought to answer. Efficiency measures are important because of their vital role in productivity promotion. The efficiency of rice production has been of longstanding interest to the economists and policymakers in Asia, because of the strong relationship between rice production and food security in the region (Richard et al., 2007). A number of studies have examined the productive efficiency in its domain of agricultural production (Travers and Ma, 1994; Fan et al., 1994; Wang et al., 1996a, 1996b; Xu and Jeffrey, 1998; Fan, 1999; Tian and Wan, 2000). Some impacts of the advanced techniques in rice production efficiency in developing countries have been touched upon (Bordey, 2004; Chengappa et al., 2003; and Khuda, 2005). In this context Stochastic Frontier approach has found its wide acceptance within the agricultural economics context (Battese and Coelli, 1992, 1995). Some literature have focused on the Stochastic Frontier model with distributional assumptions by which efficiency effects can be separated from stochastic elements in the model and for this reason a distributional assumption has to be made (Bauer, 1990). Stochastic Frontier analysis employs a composed error model in which inefficiencies are assumed to follow an asymmetric distribution, usually the half-normal, while random errors are assumed to follow a symmetric distribution, usually the standard normal (Aigner et al., 1977).

Table 1.1 Bangladesh: Boro, Aus and Aman Rice Area and Production Estimates

Variety	MY 2016/17		MY 2017/18		MY 2018/19	
	(Estimate)		(Estimate)		(Forecast)	
	Area	Production	Area	Production	Area	Production
	1,000 HA	1,000 MT	1,000 HA	1,000 MT	1,000 HA	1,000 MT
Boro	4,750	18,890	4,472	17,800	4,800	19,100
Aus	1,098	2,338	1,100	2,350	1,120	2,400
Aman	5,900	13,350	5,700	12,500	5,850	13,200
Total	11,748	34,578	11,272	32,650	11,770	34,700

Source: BBS, 2019

1.1.1 Area, Production and yield of Rice in Bangladesh

Rice is grown throughout the country except in the southeastern hilly areas. The agro climatic conditions of the country are suitable for growing rice year-round. Bangladesh ranks fourth among the rice producing countries in the world after China, India and Indonesia (FAO, 2017). Bangladesh agriculture is dominated by production of rice. There are three rice growing seasons in Bangladesh and these are Aus, Aman and Boro season. Aus are generally cultivated in July-August, Aman in December-January and Boro in March-May cropping season. About 75.0% of the total cropped area is devoted to rice cultivation. There are three rice crops grown in Bangladesh, namely Aus, Aman and Boro. Present statuses of different rice are discussed under the following headings.

1.1.2 Area of Aus crop

Total area under Aus crop has been estimated at 1.0 million hectares in year 2015-2016 as compared to 1.05 million hectare in last year which is 2.6% lower than that of last year. The total area of this year and the last year of Aus by variety are as follows (Table 1.2).

Table 1.2. Estimates of total area by type of Aus crop

Variety	2014-2015		2015-2016		Changes over previous year (%)
	Area		Area		
	(in acres)	(in hectares)	(in acres)	(in hectares)	
Local Aus	5,69,378	2,30,415	5,23,605	2,11,891	(-) 8.04
HYV Aus	20,13,925	8,14,991	19,91,898	8,06,078	(-) 1.09
Total Aus	25,83,303	10,45,406	25,15,503	10,17,969	(-) 2.62

Source: BBS, 2018

1.1.3 Yield rate of Aus crop

Average yield rate of 2015-2016 has been estimated at 2.3 metric tons per hectare which is 0.9% higher as compared to that of last year. Estimates of yield rates by varieties and combined average yield rate of all varieties are as follows (Table 1.3).

Table 1.3. Estimates of yield rates by type of Aus crop

Variety	2014-2015		2015-2016		Changes over previous year (%)
	Area		Area		
	(in acres)	(in hectares)	(in acres)	(in hectares)	
Local Aus	13.8	1.3	14.2	1.3	(+)2.99
HYV Aus	27.07	2.5	27.0	2.5	(-) 0.08
Total Aus	24.14	2.2	24.3	2.3	(+) 0.94

Source: BBS, 2018

1.1.4 Production of Aus crop

Total Aus production (husked) of 2015-2016 has been estimated at 2.2 million metric tons as compared to 2.3 million metric tons in last year which is 1.69% lower. Estimates of production by varieties and combined total of Aus is as follows (Table 1.4).

Table 1.4. Estimates of production by type of Aus crop

Variety	2014-2015	2015-2016	Changes over previous year (%)
	Production (M. Ton)	Production (M. Ton)	
Local Aus	2,93,191	2,77,647	(-) 5.30
HYV Aus	20,34,899	20,10,995	(-) 1.17
Total Aus	23,28,090	22,88,642	(-) 1.69

Source: BBS, 2018

1.1.5 Area of Aman crop

Total area under Aman crop has been estimated 1, 38, 14,290 acres in the year 2015-2016 compared to 1, 36, 65, 217 acres in the year of 2014-2015. The harvested area of last year was increased by 1.09% this year. Comparative area estimates are shown below (Table 1.5):

Table 1.5. Estimates of total area by type of Aman crop

Variety	2014-2015		2015-2016		Changes over previous year (%)
	Area		Area		
	(in acres)	(in hectares)	(in acres)	(in hectares)	
Broadcast Aman	8,09,645	3,27,646	8,13,209	3,29,088	(+) 0.44%
Local Transplant Aman	28,69,352	11,61,164	27,46,745	11,11,547	(-) 4.27%
HYV Aman	99,86,220	40,41,204	1,02,54,336	41,49,705	(+) 2.68%
Total Aman	1,36,65,217	55,30,014	1,38,14,290	55,90,340	(+) 1.09%

Source: BBS, 2018

1.1.6 Production of Aman crop

Total Aman production of Financial Year 2015-16 has been estimated 2.412 metric tons compared to 2.385 metric tons of Financial Year 2014-15 which is 1.13% higher. Comparative estimates of Aman production are shown below (Table 1.6).

Table 1.6. Estimates of production by type of Aman (husked) crop

Variety	2014-2015		2015-2016		Changes over previous year (%)
	Area		Area		
	(in acres)	(in hectares)	(in acres)	(in hectares)	
Broadcast Aman	12.72	1.173	12.92	1.192	(+)1.62%
Local Transplant Aman	17.91	1.652	18.06	1.665	(+)0.79
HYV Aman	29.21	2.694	29.36	2.709	(+)0.56%
Total Aman	25.86	2.385	26.15	2.412	(+) 1.13%

Source: BBS, 2018

1.1.7 Production of Aman crop

Total Aman production of Financial Year 2015-16 has been estimated 1,34,83,437 metric tons compared to 1,31,90,163 metric tons of Financial Year 2014-15 which is 2.2% higher. Comparative estimates of Aman production are shown below (Table 1.7).

Table 1.7. Estimates of production by type of Aman (husked) crop

Variety	2014-2015	2015-2016	Changes over previous year (%)
	Production (M. Ton)	Production (M. Ton)	
Broadcast Aman	3,84,411	3,92,331	(+) 2.06%
Local Transplant Aman	19,17,882	18,51168	(-) 3.48%
HYV Aman	1,08,87,870	1,12,39,943	(+) 3.23%
Total Aman	1,31,90,163	1,34,83,437	(+) 2.22%

Source: BBS, 2018

1.1.8 Area of Boro crop

Total area under Boro crop has been estimated 1,17,93,512 acres (47,72,576 hectares) in the year of 2015-2016 as compared to 1,19,60,673 acres (48,40,222 hectares) of the

previous year. The harvested area has decreased by 1.4% in the year of 2015-2016year. Comparative area estimates are shown below (Table 1.8).

Table 1.8. Estimates of total area by type of Boro crop

Variety	2014-2015		2015-2016		Changes over previous year (%)
	Area		Area		
	(in acres)	(in hectares)	(in acres)	(in hectares)	
Local Boro	1,29,905	52,570	1,16,883	47,300	(-)10.02%
HYV Boro	1,01,05,669	40,89,542	99,91,968	40,43,531	(-)1.13%
Hybrid Boro	17,25,099	6,98,110	16,84,661	6,81,745	(-)2.34%
Total Boro	1,19,60,673	48,40,222	1,17,93,512	47,72,576	(-)1.40%

Source: BBS, 2018

1.1.9 Yield rate area of Boro crop

Average yield rate of Boro in Financial Year 2015-16 has been estimated 3.968 metric tons husked rice per hectare which was 3.965 metric tons per hectare in 2014-15. Comparison of estimated yield rates of Boro is shown below (Table 1.9).

Table 1.9. Estimates of yield rate by type of Boro crop

Variety	2014-2015		2015-2016		Changes over previous year (%)
	Area		Area		
	(in acres)	(in hectares)	(in acres)	(in hectares)	
Local Boro	20.36	1.878	20.48	1.889	(+)0.59%
HYV Boro	41.84	3.859	41.85	3.86	(+)0.03%
Hybrid Boro	51.42	4.743	51.51	4.751	(+)0.17%
Total Boro	42.99	3.965	43.02	3.968	(+)0.08%

Source: BBS, 2018

1.1.10 Production area of Boro crop

Total Boro production of Financial Year 2015-16 has been estimated at 1,89,37,581 metric tons compared to 1,91,92,164 metric tons of Financial Year 2014-15 which is 1.33% lower. Comparative estimates of Boro production are shown below (Table 1.10).

Table 1.10. Estimates of production by type of Boro (Husked) crop

Variety	2014-2015	2015-2016	Changes over previous year (%)
	Production (M. Ton)	Production (M. Ton)	
Local Boro	98,729	89,341	(-)9.51
HYV Boro	1,57,82,543	1,56,09,325	(-)1.10%
Hybrid Boro	33,10,892	32,38,915	(-)2.17%
Total Boro	1,91,92,164	1,89,37,581	(-)1.33%

Source: BBS, 2018

1.1.11 Year wise Growth Rate of Rice Production in Bangladesh

Table 1.11 showed that total rice production in Bangladesh 2006-07 was 2,73,18,000 ton and growth rate was 2.97 and total production 2016-17 was 3,42,01,500 and growth rate was 2.45. Production increased from 2005-2006 to 2014-2015 years 76,71,200 ton. Growth rate decreasing year to year but production increases. In 2015-16 growth rate was positive but growth rate negative in 2016-17.

Table 1.11. Year wise growth rate of rice production (ton) in Bangladesh

Year	Production	Growth rate
2005-06	2,65,30,300	5.46
2006-07	2,73,18,000	2.97
2007-08	2,89,31,000	5.9
2008-09	3,13,17,000	8.25
2009-10	3,19,75,000	2.1
2010-11	3,35,40,320	4.9
2011-12	3,39,14,000	1.11
2012-13	3,38,33,000	-0.24
2013-14	3,43,56,300	1.55
2014-15	3,48,61,200	1.47
2015-16	3,50,60,500	0.57
2016-17	3,42,01,500	-2.45

Source: BBS, 2018

1.2 Significance of the Study

Agriculture is the single leading producing sector of the economy and it contributes about 14.10% to the total Gross Domestic Product (GDP) of Bangladesh. Agriculture is the main income source of most of the people who are living in rural areas. The total export value of agricultural product is 7.01% of total export of Bangladesh (Bangladesh Economic Review, 2019). The general price levels of other food and non-food commodities are related to rice price. Income of farmers and their food security depends on rice price, so changes in price of rice are highly sensitive to the lower and middle classes of consumers those who live below or on the poverty level. Rice price fluctuates and changes throughout the year due to various reasons. From the beginning of production process, there are a large number of value adding steps associated with rice production and marketing. The marketing of rice and also its bi-products i.e. broken rice, husk, bran etc. increases due to adding values at each steps of its marketing.

1.3 Justification of the Study

Paddy is the most important cereal crop in terms of area of production contribution to the national income and national economic development substantial area is devoted to paddy production and millions of farmers have been growing paddy in this country. Despite the fact that paddy is cultivated extensively in Bangladesh, per hectare yield is much lower in comparison with that of other paddy growing countries of the world. In order to meet this deficit, yield per unit area of paddy should be increased. The number of landless laborers, disguised and unemployed population is increasing gradually. Therefore, it is necessary to produce food grain to meet food requirements for the increased population.

Bangladesh is the ninth most populous country in the world. The Government of Bangladesh has given too much emphasis on paddy production. Then every year Bangladesh imports rice. In 2016 Bangladesh has imported 50 tons of rice. Bangladesh soil is suitable for producing rice. In the past a few studies have been made on the profitability of paddy/rice in Bangladesh. But there is no exclusive study on the profitability of rice particularly in the Tangail district. As such it was felt that a study on the rice in the area

Tangail district would be of much importance. This is obviously due to the fact that development basically means larger size productive activities in the economy. But we cannot have more of production unless the goods produced are actually sold out and selling depends on the proper marketing conditions. Besides, the results also would serve as a reference for researchers to embark upon similar or related work in other parts of the country. Some arguments supporting the importance of this study are presented below:

- Firstly, the study helps to know about the socio economic condition of the farmers.
- Secondly, it is very much important to know about production of paddy in the study area and analysis of production cost and margins of the farmers. It helps to identify the different cost items, the share of different cost items to total marketing cost.

- Fourthly, it is important to know the marketing costs and marketing margins of intermediaries. It helps to identify the different cost items, the share of different cost items to total marketing cost. Also, it helps to identify who are the most bearer of marketing cost, the level of marketing margin and net margin of market functionaries. Since all of these costs and margins indeed influence the market participants in participating in the markets. So this study will give some shed in this line.

- Finally, problems of farmers and solutions and recommendations are important for government officials, non-government organizations and policy makers to formulate effective marketing policy for efficient rice production and marketing. This study will help in this regard.

The study would provide useful information to the producers, traders, consumers, future researcher and planners of this rice. This study has been conducted on profitability analysis which has important policy implications for farmer, and the policy makers in Bangladesh.

1.4 Objectives of the study

The broad objective of the study is the Profitability of rice in Tangail districts in Bangladesh. The specific objectives of the study are as follows:

- ✓ To identify the major socio-economic characteristics of rice farmers;
- ✓ To assess the profitability of rice production farmers;
- ✓ To estimate the contribution of key inputs to the production processes of rice production;
- ✓ To identify problem faced by the farmers in rice production.

1.5 Limitation of the study

During the period of data collection the following problems were encountered by the author:

i. Most of the respondents were not well educated. They had no previous idea about such a study. They were suspicious about the researcher and therefore did not cooperate and it was therefore difficult to explain the purpose of this research to convince them. At last the respondents were convinced.

ii. Most of the farmers were fearful of imposition of taxes. Their anxiety was that the researcher might use the information against their interest.

iii. The respondents (farmers and intermediaries) did not keep records of their farming business and business activities; they had difficulty in recalling information. It was an added problem co the researcher to collect the reliable data because most of the fanners provided information from their memory.

iv. Sometimes the producer-respondents were not available at their home because they remained busy with their outside work. This is whysome times more than two visits were required to get information from them. So, the author had to give extra effort and time to collect the information

v. The respondents always had a tendency not to provide correct data relating to the size of their holding, income and expenditure received from different activities. Because most of the respondents in the study area thought that the investigator was a government officer. They initially hesitated to answer the question relating to their income and expenditure. The respondents thought that new taxes would be imposed on them if correct information was provided. When they understood then they gave relevant data.

vi. Farmers provided data in local units of measures in response to questions which created complexity in analyzing the data. vii. There was a time limitation so all data and other necessary information was collected within the shortest possible time.

1.6 Organization of the Study

The study has been organized into 8 chapters. Chapter 1 indicates the introduction of the research along with the objectives and justification. In chapter 2 review of literature is presented and methodology is described in chapter 3. Socio-economic characteristics of the rice farmers described in chapter 4, Profitability of rice cultivation are presented in chapter 5, factors affecting of rice cultivation are presented in chapter 6, problems and solutions of farmers are presented are presented in chapter 7 and finally chapter 8 are presented the summary of the major findings of the study and concluding remarks.

CHAPTER II
REVIEW OF LITERATURE

The main purpose of this chapter is to review some related studies in connection with the present study. Although a lot of studies have been done on costs and returns of rice production in Bangladesh, only a few studies have so far conducted related to economic analysis of rice production under different area. This study highlights only a few of the studies, which are considered recent and very relevant for this research. Again, some of these studies may not entirely relevant to the present study, but their findings, methodology of analysis and suggestions have a great influence on the present study and all of these study have been conducted on Bangladesh, so it have great influence on the present study. Therefore, some of the literatures related to the present study are briefly discussed below:

Majumder et al. (2009) investigated the productivity & Resource use efficiency of Boro rice production in Bhola district under different tenure conditions. They showed the difference in the efficiency & productivity among owner, cash tenant & crop share tenant. The total samples in the study were 90 & random sampling technique was used for this study. They found that total gross costs for producing Boro rice was highest in owner farms& lowest in crop share tenants farm because owner operator used more hired labor in compare to other groups. However the cash tenant farmers were more efficient than crop share tenant farmers because crop share tenant used poor resource and they are unable to invest modern farm inputs. They also mentioned that in Bangladesh the predominant tenancy arrangement share cropping is an inefficient form of tenure arrangement in compare to cash tenancy.

Sarker et al. (2010) conducted a study on comparative economic analysis of borrower & non borrower Boro rice farmers in some selected sites of Mymensingh district. They selected one hundred samples from four villages under Trishall upazila. This study has been conducted to examine the differences in input use, costs & returns of the borrower & non borrower rice farmers. They were found that borrower farmers used more inputs &attained more returns through higher yield than their counterparts. The yields of rice per

hector were 5260.80 kg & 422177.34 kg for the borrower and non-borrower farmers respectively. They also found that borrower farmer's net return and gross return are higher than non-borrower farmers.

Wadud et al. (2011) conducted a study on Profit Efficiency and Farm Characteristics Evidence from the Rice Farmers in Bangladesh. They examine profit efficiency of rice farmers in some selected district of Bangladesh. From the study they found that estimated profit frontier revealed negative elasticity of price of fertilizers and positive elasticity of wage rates, price of seeds and area of land cultivated. The mean profit efficiency was 69%.

Zaman (2002) showed a comparative analysis of resource productivity and adoption of modern technology under owner and tenant farms in a selected area of Dinajpur District. It was found that total cash expenses as well as total gross cost for producing HYV Boro rice were the highest in owner farms and the lowest in tenant farms. Owner operators used more hired labor where tenant operators used more family labor. The maximum return over total cost per hectare was obtained by owner operators and minimum by tenant operators and owner operators were more efficient than tenant operators. It was also found that the degree of adequacy level in the application of modern farm inputs were higher in owner farms than in tenant farms.

Rahman, et al. (2002) studied the technical efficiencies obtained by owner-operated farming and share cropping using Cobb-Douglass Stochastic production function. Mean technical efficiencies obtained by owner operators for Boro, Aus and Aman rice crops were 86 per cent, 93 per cent and 80 per cent respectively whereas mean technical efficiencies obtained by share croppers for Boro, and Aman rice respectively 73 percent and 72 percent. The study reveals that owner-operators were technically more efficient than share croppers in the production of all rice crops. To reduce the difference of technical efficiencies between owner operator and share cropper a perfect share leasing system is inevitable.

Barman (2004) attempted to assess the impact of rice-prawn gher farming on land tenure system in southwest Bangladesh. Findings of the study showed that the land tenure systems

were changed after the introduction of rice–prawn gher farming system from traditional sharecropping system to fixed rent. Natural risks, calamities and uncertain yield of prawn were the main factors that enforced the land tenure system to change from sharecropping to fixed rent. The amount of rent paid was usually determined by several factors including the location of the land, size and quality of gher farm and the relationship between the landlord and the tenant.

Iqbal (2005) conducted a study on Cost Requirements for Cultivation of Boro Rice (Oriza Sativa) Under Different Farming System at four villages in Mymensingh district of Bangladesh. He considered 25 farmers and 57 plots for this study .After interviewing farmers on specially designed & pre-tested questionnaire, he found that input cost per hectare varied from Tk.14877 to 18145 and output varied from Tk.25101 to 31647,respectively under different farmers categories. The benefit cost ratio found in landless, marginal, small, medium & large categories of farmers were 1.87, 1.4, 1.83 and 1.64 respectively. The average total input & output costs per hectare in DA,PT and mixed farming method were Tk.16855,15750,16924,and Tk.26525,29400,27434 respectively.

Rahman et al. (2007) conducted a study on measuring the costs of production, based on sizes of farm operation on rice farmers in Jessore district of Bangladesh study .The objectives of the study were to measure the differences in the cost of production of Boro rice farmers on the basis of land. They included three types of rice farmers in this, small, medium &large. They found that although there were no significant differences in the quantity of inputs used for all categories of farmers, the unit cost of some inputs significantly varied between small-large medium-large, thus affecting the cost of production. The reason is that most of the small medium farmers purchased inputs on credit, spending comparatively more than cash &they paid higher interest on borrowed money. They showed that for that reason rice production increased regardless of the land operation size but small &medium farmers still have a serious problem especially the increasing cost involved in the production.

Akanda et al. (2008) conducted a study on Problem of Share crop Tenancy System in Rice Farming in Sherpur district of Bangladesh. The 1984 Land Reform Act in Bangladesh fixed land rent for sharecropping tenants at 33% of harvest yield without input sharing and at 50% with 50% of input sharing. This positively influenced expansion of HYV rice farming. However, the returns for tenants fell over time because of a gradual increase in input prices and wages. This research analyzed the present distribution of returns in the dominant rice farming area in Bangladesh. There was semi feudalism in the tenancy market with landowners earning more from sharecropping than they could from cash renting. Land-rich farmers often cultivated only a small part of their cultivable land and rented out most of it. The existing economic structure did not fairly balance the returns between tenants and landowners. This study suggested the need to reset the land rent at 20% of harvest yield without input sharing and at 40% with input sharing, to protect land-poor tenants.

Nasrin et al. (2011) conducted a study on Land Tenure System and Agricultural Productivity in a Selected Area of Bangladesh. They examine relative efficiency of farming under tenancy systems in some selected areas of Mymensingh district. They were found that share tenant farmers earned significantly lower net return (Tk. 19,252.18) than the cash tenant farmers (Tk. 22,815.89) from Boro rice production and Boro rice production was profitable from the viewpoint of both tenant operators. They also showed that all the explanatory variables (key production inputs) included in the Cobb- Douglas revenue type production function model were important for explaining the variations in gross returns under both tenancy arrangements.

Chowdhury et al,. (2013) investigated the Efficiency of Rice Farms during Boro Period in Bangladesh: An Econometric Approach .They was focusing to achieve the target by improving the efficiency of the farmers. Modern econometric tools, like Stochastic Frontier Approach (SFA) were used for measuring the efficiencies of the farmers. Empirical results of this study shows that average technical, allocative and economic efficiency of the farmers during Boro period were 86 per cent, 75 per cent and 64 per cent respectively.

Jabbar (1977) examined the relative productive efficiency of different tenure classes in the selected areas of Bangladesh. He analyzed the performance of four tenure classes namely part operators, owner operators, owner-cum-tenants and tenants. He found that of the four tenure classes owner operators were the most efficient. For the relative inefficiency of other tenure classes including share-croppers, he implied that the existing pattern of resource ownership and property relations were improper for obtaining higher level of efficiency.

Talukder (1980) investigated the relative efficiency of the alternative forms of land tenure in irrigated Boro rice production. He found that owner tenant farms obtained the highest yield, gross and net return per acre while yield of crop, gross and net return per acre were the lowest for the pure tenant farms. He also stated that tenant's labor had no price to the landlords similarly landowner's land had no price to the tenants. As a result in the case of owner-cum-tenant farms farmers obtained significantly higher yield on own land than on rented in land.

Bhuiyan (1987) conducted a survey at some selected villages of Trishal Upazila in Mymensingh for studying the effects of different farm sizes under different tenurial arrangements on production efficiency. He found that the medium farms (0.75 to 2.0 ha) achieved the highest efficiency followed by small farms (below 0.75 ha) and large farms (above 2.0 ha). He also found that production efficiency was higher on owned land than on rented in land.

Hossain (1989) reported about Green Revolution in Bangladesh and observed that in Bangladesh small farmers and tenants had adopted the modern technology at least as much as have large farmers and owner cultivators. The average cost of working capital must be also higher for the small farmers. He also observed that the variation in the prices of agricultural inputs would thus put a negative pressure on income distribution, which might out weight the effect of the inverse relationship between farm size and adoption rates.

Islam et al. (1990) examined the impact of tenancy on inputs used and their productivity. They found that the majority of pure tenant farmers reported that 50 percent of the cost of inputs like seeds ,fertilizers, insecticides but none for bullock, irrigation and labor were shared by the land owners, while the majority of the owner cum-sharecroppers reported that no cost of inputs were share by the land lords. The pure owner farmers used fertilizer at higher rate followed by owner-cum share croppers and pure tenant farmers .Finally, it was observed that overall productivity in pure tenant farms were a bit higher as compared to that of pure owner farms.

Rahman, et al. (1993) investigated input use efficiency and productivity of different sizes of farms producing HYV Boro in some selected areas of Brahmanbaria district. Returns to scale and farmers capability of producing at the least cost level were statistically tested. Farm size and productivity relationships were found to be positive. Boro production characterized by increasing returns to scale only for the medium farms. Few inputs were used in Boro production at the least cost combined level. Adequate extension services including application of right quantity of inputs at right time were suggested to achieve efficiency in input use and improving level of profitability.

Panda (1996) conducted a study on agricultural tenancy and resource use efficiency. For his analysis he selected two types of villages, Modern Developed Village and Less Developed Village. He found three types of tenurial categories such as the owner operators, owner-cum-tenant operators and tenant operators, from selected villages. The study showed a wide difference in cropping pattern as well as crop yield across village categories. Owner-cum-tenant operators were placed in a better position compared to owner operators and pure tenants. The study finally indicated limited impact of land-ownership on resource use and crop productivity.

From the summary of the above studies it is clear that few of the previous studies conducted in Bangladesh focused on share tenancy, but no studies were accomplished in this study area. A number of researchers explained their opinions on their own viewpoint. It should be noted here that such a study like profitability of rice production is a new and important

study and no systematic research has yet been carried out in this manner. As a result, no exact literature on similar study could be found. The present study is designed to measure the profitability of rice production in the selected areas of Tangail district in Bangladesh.

CHAPTER III
RESEARCH METHODOLOGY

This chapter deals with the tools and techniques used for collecting the necessary information of this study. It also addresses the methodology through which the collected data were categorized and analyzed in order to achieve the objective of the study. The design of research involved in the present study has been described in this chapter.

3.1 Selection of the Study Area

The area where the selected varieties of rice has been grown successful was considered as the study area. The area in which a business survey is to be carried out depends on the particular purpose of the survey and the possible cooperation from the farmer. Tangail district was purposively selected for the study because of the fact that it is one of the leading rice producing areas of Bangladesh.

The researcher had an easy access to this area, on the other hand, the following considerations were kept in mind for selecting Tangail district as a study area.

a. There were a large number of rice growers in that particular area.
b. About 85 percent of the total farmers of the selected area were involved in rice production.
c. The locality has easy accessibility and communication facilities.
d. It is less prone to natural calamities.
e. No related study was conducted in the past.

3.2 Sampling Techniques and Data Collection Procedure

There are different types of sampling techniques depending on the nature of population, objectives of the study and degree of precision desired. Data collection procedures are the activities involved in collecting the desired data from the sample. The desired data can be collected through the interview schedule, questionnaire and direct observation. The following sampling techniques and data collection procedures were followed for the present study.

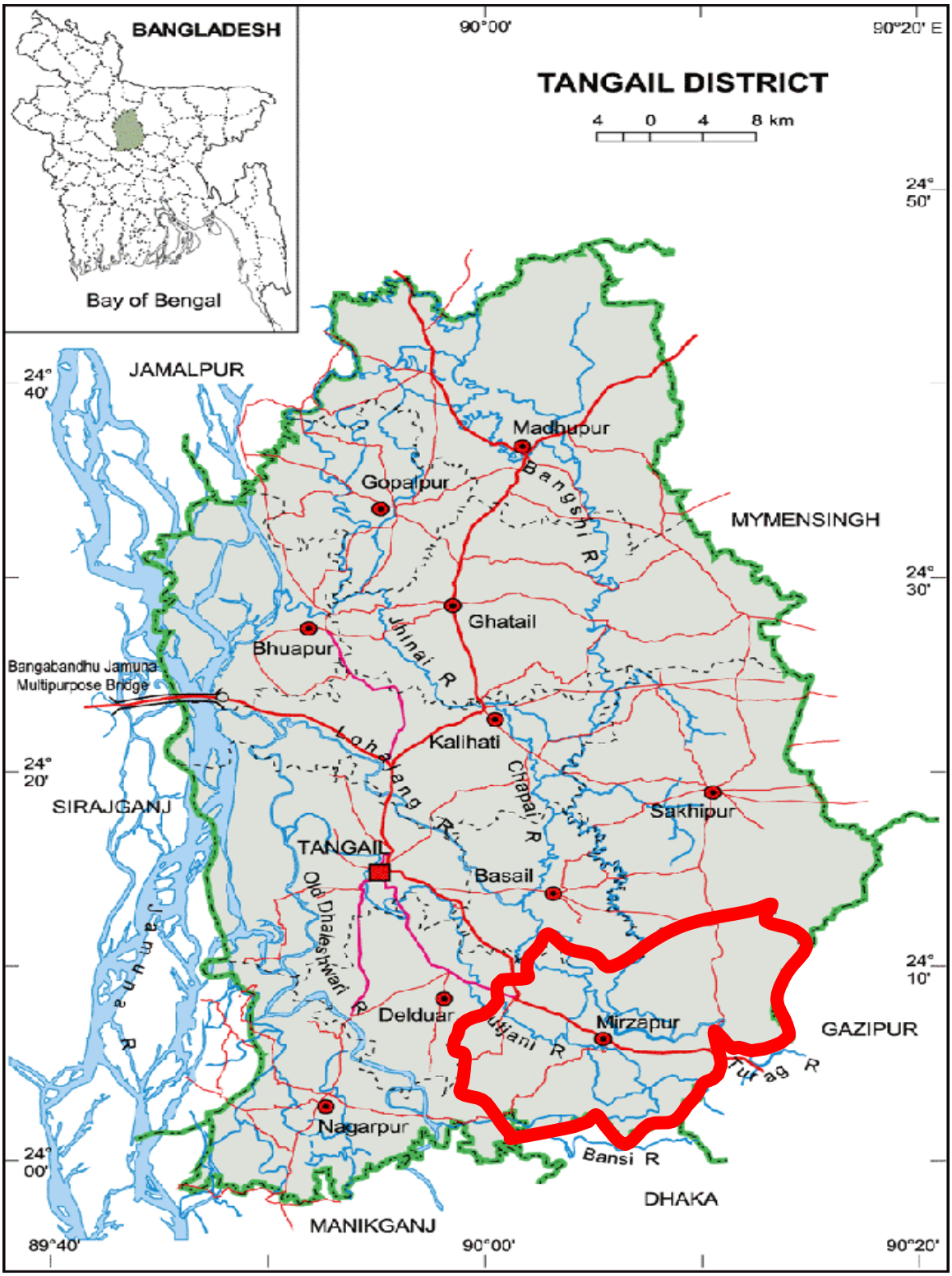

Figure 3.1: Map of Tangail district showing Mirzapur Upazila

3.3 Sampling technique

All the rice growers in Tangail district were not possible to include in this study because of the paucity of resources and time constraint. A reasonable sample survey, which would represent the population, was required in order to meet up the purpose of the study. Simple random sampling technique was adopted in this study. After purposively selecting Tangail district, Mirzapur upazila was selected randomly from 12 upazilas. Subsequently, five villages from two union namely, Ajgana and Bashtoil were also selected randomly. From each of the two union's five villages namely, Chiteswary, Polashtoli and Mojidpur from Ajgana union and Kakrajan and Mamutpur from Bashtoil union selected randomly as a locale of the study. Therefore, a list of rice producers were constructed with the help of village leaders and field level extension personnel. After preparing the sampling frame ninety five farmers were selected randomly for primary data collection.

Table 3.1 Distribution of selected sample households in the study areas

Upazila	Unions	Villages	Sample size
Mirzapur	Ajgana union	chiteswary	19
		polashtoli	19
		mojidpur	19
	Bashtoil union	kakrajan	19
		mamutpur	19
Total			**95**

3.4 Preparation of the interview schedule

In conformity with the objectives of the study, a preliminary interview schedule was designed in an effort to collect the data from the farmers. It was then pre-tested to verify the relevance of the questions and the nature of responses of the farmers. After pre testing of the questionnaire necessary modifications were made in consultation with the relevant experts.

The interview schedule contained the following items:

i. Socioeconomic characteristics of the growers,

ii. Cost and return of rice cultivation.

iii. Agronomic practices operated in the rice plot,

iv. Problems and constraints faced by the growers,

v. Suggestion with respect to the problems faced by the rice farmers.

3. 5 Study and survey period

The data were collected through survey during the entire T. Aman rice growing season precisely from August, 2019 to September, 2019.

3.6 Method of data collection

For the present study, data were collected through personal interviewing of the rice growers. Interviews were mainly conducted at the leisure of the farmers with a view to keeping them undisturbed and securing accurate information. Before going to administer the interview, the respondents were made clear about the purpose and objectives of the study. It was explained to the farmers that the study was purely academic. Each time when every interview was completed, the interview schedule was thoroughly checked and properly recorded. If there were such items, which were overlooked or contradictory, they were amended accordingly to suit the purpose. In addition to survey, observation method was also applied to collect information by the researcher. It is better to mention that some items were recorded initially in local units and finally convened those into standard units while processing data.

3.7 Problems faced by the researcher in data collection

There were some problems faced by the researcher during the period of data collection. The problems which are enlisted below:

1. Although most of the farmers in the study area were literate, they did not have adequate knowledge on the value of a research study and it was therefore, really difficult to convince them as to the utility of this research.
2. The farmers were afraid of imposition of taxes and because of that they always tried to avoid providing authentic information relating to the actual size of holding and annual income.

3. The farmers were not available at their home because they often remained busy dealing with farm activities in the field, thus sometimes; two or three visits were made for a single interview which was really very time consuming and costly as well.
4. Sometimes it was observed that the farmers would try to reply quickly to the questions in order to get rid of researcher somehow or anything like this.
5. The researcher had to depend solely on the memory of the farmers for collecting data because they did not care to keep any written records for their farm business.

3.8 Profitability Analysis

The primary and ultimate goal of a farm is profit maximization. Some of the other goals are attaining a particular output level or business size; reserving a certain amount of time for leisure activities; business growth; business survival; and maintaining a stable income over time (Kay, 1981). As most farms try to receive maximum profit in a perfectly competitive market situation, conditions responsible for maximum profit were given emphasis in the present study. Profit or net return is the difference between total revenue (gross return) i.e. total value product (TVP) and the total factor cost (TFC). Total factor costs included all kinds of variable and fixed costs concerned with the production process. A farm will not know its maximum profit unless the TVP is compared with TFC. Farmers' profit was also shown by gross margin (GM) analysis, where only variable costs were deducted from total revenue.

The TVP was the value of output and was given by

$$TVP= py= p*TPP=g(y)* f(x_1) = g[f(x_1)]* f(x_1)$$

Where,

p is the unit price of output; y is the quantity of output and x1 stands for ith input. On the other hand, total factor cost (TFC) of a product includes all kinds of variable and F fixed cost items involved in the production process; and was given by

Total factor cost. TFC=rx_1 +b=h(x_1)*x_1 +h

Where,
r is the factor price, which in general is a function of the quantity of the factor used i.e. r=h(xl)] and b is the fixed costs.

Given the definition of total value product (TVP) and total factor cost, the profit equation can be define as follows:
Profit, 7t = TVP-TFC
K =£[/(*,)]*/(*,) - [Kx,)* X ' + b]or,

The analytical procedure involves the arrangements of the collected data in systematic ways, costing of the input used, quantifying the effect of inputs on yield, etc.

The following analytical procedures were followed in the present study.

3.8.1 Processing and tabulation of data

The collected data were subsequently compiled, coded, edited, summarized and scrutinized carefully. The computer packages MS EXCEL, SPSS were used for the data entry, aggregation and analysis.

3.8.2 Measurement of cost items

For any profitability' analysis the costs incurred upon various inputs need to be analyzed. There are two types of cost i.e. variable and fixed cost. The variable costs are those which vary directly with the level of production. The fixed costs are those, which are to be borne even when no production is carried out. The costs were calculated on the basis of prices prevailed in the study area during the period of study. The cost items were specified as follows:

3.8.2.1 Cost of labor inputs

Any exertion of mind or body undergone partly or wholly with a view to some good other than the pleasure derived directly from it is called labor. So the cost, which was incurred

upon any exertion of body or mind by both human and animal labor in rice production was considered.

3.8.2.2 Cost of material inputs

All inputs cost other than labor input costs were the material input cost for rice cultivation. The material inputs cost for rice cultivation were specified as shown below.

i) Cost of seed

In the study area most of the rice growers used home supplied seeds/ seedlings rather than from the market. The cost of home supplied seeds/seedlings was usually charged at the average market price. The costs of purchased seeds/ seedlings were calculated according to the payment made.

ii) Cost of manure

The rice growers used different types of manure namely cow dung, farm yard manure (FYM), compost etc. The cost of manure was calculated on the basis of actual price paid by the growers.

iii) Cost of fertilizers

The rice growers applied different types of fertilizer, namely urea, triple super phosphate (TSP), Muriate of potash (MOP), Gypsum and Zinc. The cost of fertilizers was calculated on the basis of actual price paid by the growers.

iv) Cost of insecticides

The farmers used different insecticides in producing rice. The costs of insecticides were computed on the basis of actual cost incurred per hectare of land in producing rice.

v) Land use cost

Value of the land was found to be different for different plots, depending on the location. Fertility and topography of the soil. Cost of land can be computed in different ways. The following three ways are mostly used.

i) The rental value

ii) Interest on value of land, and

iii) Opportunity cost from the best alternative use.

Land was estimated for the cropping period at the rental value in the study area. For rice production, the cropping period considered was four months.

vi) Interest on operating capital

Interest on operating capital was computed taking into account all costs incurred upon the production of different crops.

Hence interest was charged at the rate of 10 percent per annum and was estimated for 6 month period. The following formula was adopted:

$$\text{Interest on operating capital} = \frac{(\text{Operating capital x interest rate x time considered})}{2}$$

3.9 Analytical technique for efficiency estimation

Cobb-Douglas production function is the most widely used form for fitting agricultural production data, because of its mathematical properties, ease of interpretation and computational simplicity (Heady and Dillon, 1969). It is a homogeneous function that provides a scale factor enabling one to measure the return to scale and to interpret the elasticity coefficients with relative ease. It is also relatively easy to estimate because in logarithmic form it is linear and parsimonious (Beattie and Taylor, 1985). Thus Cobb Douglas specification provides an adequate representation of the agricultural production technology.

3.9.1 Specification of the Cobb-Douglas Production Function

The input-output relationships in rice production were analyzed with the help of Cobb-Douglas production function approach. To determine the contribution of the most important variables in the production process of rice production, the following specification of the model was used.

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} e^{ui}$$

The Cobb-Douglas production function was transformed into following logarithmic form so that it could be solved by ordinary least squares (OLS) method.

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_{8+} b_9 \ln X_9 + U_i$$

Where,

Y= Gross income from year round rice cultivation (Tk/ha);

X_1= Cost of land preparation (Tk/ha);

X_2= Cost of seed (Tk/ha);

X_3= Cost of irrigation (Tk/ha);

X_4= Cost of human labor (Tk/ha);

X_5= Cost of urea (Tk/ha);

X_6= Cost of TSP (Tk/ha);

X_7= Cost of MoP (Tk/ha);

X_8= Cost of irrigation (Tk/ha);

X_9= Cost of pesticide (Tk/ha);

a= Intercept;

b_1…..b_6= Coefficient of the respective variable;

U_i= Error Term;

i= 1, 2,…….6.

3.10 Profitability Analysis

Cost and return analysis is the most common method of determining and comparing the profitability of different farm household. In the present study, the profitability of rice production is calculated by the following way.

3.10.1 Calculation of Gross Return

Per hectare gross return was calculated by multiplying the total amount of product and by-product by their respective per unit prices.

Gross Return= Quantity of the product ∗ Average price of the product + Value of by-product.

3.10.2 Calculation of Gross Margin

Gross margin is defined as the difference between gross return and variable costs. Generally, farmers want maximum return over variable cost of production. The argument for using the gross margin analysis is that the farmers are interested to get returns over variable cost. Gross margin was calculated on TVC basis. Per hectare gross margin was obtained by subtracting variable costs from gross return. That is, Gross margin = Gross return – Variable cost.

3.10.3 Calculation of Net Return

Net return or profit was calculated by deducting the total production cost from the total return or gross return. That is,

Net return = Total return – Total production cost.

The following conventional profit equation was applied to examine farmer's profitability level of the rice production farms in the study areas.

$$\text{Net profit, } \pi = \Sigma P_m Q_m + \Sigma P_f Q_f - \Sigma (P_{xi} X_i) - TFC.$$

Where, π = Net profit/Net return from rice production (Tk/ha);

P_m = Per unit price of rice (Tk/kg);

Q_m = Total quantity of the rice production (kg/ha);

P_f = Per unit price of other relevant (Tk/kg);

Q_f = Total quantity of other relevant thing (kg/ha);

P_{xi} = Per unit price of i-th inputs (Tk);

X_i = Quantity of the i-th inputs (kg/ha);

TFC = Total fixed cost (Tk) and

i = 1, 2, 3,. ....., n (number of inputs).

3.10.4 Undiscounted Benefit Cost Ratio (BCR)

Average return to each taka spent on production is an important criterion for measuring profitability. Undiscounted BCR was estimated as the ratio of total return to total cost per hectare.

$$BCR = \frac{\text{Total Return}}{\text{Total Cost}}$$

CHAPTER IV
SOCIO-DEMOGRAPHIC PROFILE OF RICE PRODUCING FARMERS

4.1 Introduction

This chapter deals with the socioeconomic characteristics of the farmers. Socioeconomic characteristics of the farmers are important in profitability of rice cultivation. People differ from one another in many respects. Behavior of an individual is largely determined by his/her characteristics. There are numerous interrelated and constituent attributes that characterize an individual and profoundly influence development of his/her behavior and personality. It was, therefore, assumed that enterprise combination, consumption pattern, purchase pattern and employment patterns of different farm household would be influenced by their various characteristics.

Table 4.1 Characteristics profile of the respondents

Characteristics (with measuring unit)	Range		Mean	SD
	Minimum	Maximum		
Age (years)	2	66	39.36	10.10
Level of education (schooling years)	0	18	7.66	5.57
Family size (total member)	2	9	4.28	1.35
Farm size (hectare)	0.24	5.00	1.41	.94
Experience (years)	2	50	31.84	11.62
Annual family income (‘000’BDT)	20	500	156.37	114.33
Agricultural training (Number of days)	0	11	3.51	3.39
Extension contact (Score)	10	25	17.98	3.11
Credit received (‘000’BDT)	0	190.00	34.25	44.37
Rice cultivation land (ha)	0.16	4.49	1.03	.891

Source: Field Survey, 2019

4.1.1 Age

Age of the respondents varied from 20 to 66 years, the average being 39.36 years with the standard deviation of 10.10. According to their age, the respondents were classified into three categories as “young aged”, “middle aged” and “old aged”. The distribution of the farmers according to their age is shown in Table 4.2.

Table 4.2 Distribution of the farmers according to their age

Categories	Basis of categorization (year)	Respondents	
		Numbers	Percent
Young aged	20-35	37	40.0
Middle aged	36-50	46	47.4
Old aged	Above 50	12	12.6
Total		**95**	**100**

Source: Field Survey, 2019

Data represented in Table 4.2 indicate that the middle aged farmer comprised the highest proportion (47.4 percent) followed by young aged category (40.0 percent) and the lowest proportion were made by the old aged category (12.6 percent). Data also indicates that the young to middle aged respondents constitute almost 87.4 percent of total respondents.

4.1.2 Level of Education

Education level of the respondents ranged from 0-18 in accordance with year of schooling. The average education score of the respondents was 7.66 with a standard deviation of 5.57. On the basis of their level of education, the farmers were classified into five categories as shown in Table 4.3.

Table 4.3 Distribution of the farmers according to their level of education

Categories	Basis of Categorization (schooling years)	Respondents	
		Number	Percent
Illiterate	0	4	4.2
Can sign only	0.5	21	22.1
Primary	1-5	14	14.8
Secondary	6-10	40	42.1
Above secondary	Above 10	16	16.8
Total		**95**	**100**

Source: Field Survey, 2019

Data shown in the Table 4.3 indicates that respondent secondary level of education constitute the highest proportion (42.1 percent) followed by can only sign category (22.1 percent). On the other hand, the lowest proportion (4.2 percent) in illiterate followed by primary education category (14.8 percent) and above secondary (16.8 percent).

4.1.3 Family Size

Family size of the respondents ranged from 2 to 9 members with the mean of 4.28 and standard deviation of 1.35. On the basis of their farm size, the farmers were classified into three categories as shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their family size

Categories	Basis of categorization (member)	Respondents	
		Number	Percent
Small family	2 –3	27	28.4
Medium family	4–6	64	67.4
Large family	Above 6	4	4.2
Total		**95**	**100**

Source: Field Survey, 2019

Data presented in the Table 4.4 demonstrated that highest proportion (67.4 percent) of the farmers had medium family size compared to 28.4 percent having small family size and only 4.2 percent farmers had large family size. The findings indicated that overwhelming majority (95.8 percent) of the farmers had small to medium family size.

4.1.4 Farm Size

Farm size of the respondents ranged from 0.24 hectare to 5.00 hectares with the mean of 1.41 and standard deviation of 0.94 On the basis of their farm size, the farmers were classified into three categories followed by DAE (1999) as shown in Table 4.5.

Table 4.5 Distribution of the farmers according to their farm size

Categories	Basis of categorization (ha)	Respondents	
		Number	Percent
Small farm	0.24 – 1.0	43	45.3
Medium farm	1.01 – 3.0	45	47.3
Large farm	Above 3	7	7.4
Total		**95**	**100**

Source: Field Survey, 2019

Data presented in the Table 4.5 demonstrated that highest proportion (47.3 percent) of the farmers had medium farm compared to 45.3 percent having small farm and only 7.4 percent farmers had large farm. The findings indicated that overwhelming majority (92.6 percent) of the farmers had small to medium farm size.

4.1.5 Experience in rice cultivation

Computed scores of the farmers about experience in rice production ranged from 2 to 50 years with a mean of 31.84 and standard deviation of 11.62. On the basis of farming experience, the respondents were classified into three categories as follows in Table 4.6.

Table 4.6 Distribution of the farmers according to their farming experience

Categories (year)	Basis of categorization (Years)	Respondents	
		Number	Percent
Low experience	2-20	14	14.7
Medium experience	21-42	67	70.4
High experience	Above 42	14	14.7
Total		**95**	**100**

Source: Field Survey, 2019

Data contained in Table 4.6 showing that 70.4 percent of the farmers had medium experience in rice cultivation, whereas 14.7 percent had low experience in rice cultivation and 14.7 percent had high farming experience in rice cultivation. Farming experience is helpful to increase knowledge, improve skill and change attitude of the farmers. It also builds confidence of the farmers for making appropriate decisions at the time of need.

4.1.6 Annual family income

Annual family income of the respondents ranged from 20 to 500 thousand taka. The mean was 156.37 thousand taka and standard deviation was 114.33. On the basis of annual family income, the respondents were categorized into three groups as shown in Table 4.7.

Table 4.7 Distribution of the farmer according to their annual family income

Categories	Basis of categorization ('000' BDT)	Respondents	
		Number	Percent
Low income	20-42	14	14.7
Medium income	43-270	64	67.4
High income	Above 270	17	17.9
Total		**95**	**100**

Source: Field Survey, 2019

Data shown in Table 4.7 presented that the highest proportion (67.4 percent) of the respondents had medium family income while 14.7 and 17.9 percent of the respondents had low and high annual family income respectively.

4.1.7 Training on rice cultivation

The score of training exposure of the farmers ranged from 0-11 days. The mean was 3.51 days and standard deviation was 3.39 On the basis of training, the respondents were categorized into four groups as shown in Table 4.8.

Table 4.8 Distribution of the farmer according to their training on rice cultivation

Categories	Basis of categorization (Days)	Respondents	
		Number	Percent
No training	0	36	37.9
Low training	1-4	22	23.2
Medium training	5-8	28	29.4
High training	Above 8	4	3.8
Total		**95**	**100**

Source: Field Survey, 2019

Data presented in the Table 4.8 showed that about (37.9 percent) of the farmers had no training received on rice cultivation; while only 3.8 percent of the farmers had high training received on rice cultivation. Where, 29.4% farmers had medium training received on rice cultivation and 23.2% of the farmers had low training received on rice cultivation.

4.1.8 Extension contact

The observed extension contact scores of vegetable grower ranged from 10 to 25 with the mean and standard deviation were 17.98 and 3.11 respectively. According to this score, the extension contact were classified into three categories: “low extension contact” (10-14), “medium extension contact” (15-20) and “high extension contact” (above 20). The distribution of the farmers according to their extension contact is shown in Table 4.9

Table 4.9 Distribution of the farmers according to their extension contact

Categories	Basis of categorization (Score)	Respondents	
		Number	Percent
Low extension contact	10-14	7	7.4
Medium extension contact	15-20	67	70.5
High extension contact	Above 20	21	22.1
Total		**95**	**100**

Source: Field Survey, 2019

Data presented in the Table 4.9 showed that a proportion of 70.5 percent of the farmer had medium extension contact compared to 22.1 percent of them having high extension contact and 7.4 percent of the farmer had high extension contact. Thus, overwhelming majority (92.6 percent) of the farmer had medium to high extension contact. Extension contact is a very effective and powerful source of receiving information about various new and modern technologies. The status of no or having low and medium contacts might have significant impacts on use of best management practices.

4.1.9 Credit received

Credit received by the farmers varied from 10 to 190 thousands Taka with an average of 34.25 and standard deviation of 44.37. Based on their credit received, the farmers were classified into three categories namely low credit received (up to 38.82), medium credit received (38.83 to 68.68) and high credit received (above 68.68). The distribution of the farmers according to their time credit received is presented in Table 4.10.

Table 4.10 Classification of the respondents according to their credit received

Categories	Basis of categorization ('000' tk.)	Respondents	
		Number	Percent
No credit received	0	49	51.6
Low credit received	20-63	27	28.4
Medium credit received	64– 126	16	15.8
High credit received	Above 126	4	4.2
Total		**95**	**100**

Source: Field Survey, 2019

Data presented in Table 4.10 indicates that majority (51.6 percent) of the respondents had no credit received, 28.4 percent of the respondents had low credit received, 15.8 percent of the farmers had medium credit received and only 4.2 percent of the farmers had high credit received in rice production.

4.1.10 Rice cultivation land

Farm size of the respondents ranged from 0.19 hectare to 4.49 hectares with the mean of 1.03 and standard deviation of 0.89. On the basis of their farm size, the farmers were classified into four categories followed by DAE (1999) as shown in Table 4.11.

Table 4.11 Distribution of the farmers according to their land under rice cultivation

Categories	Basis of categorization (ha)	Respondents	
		Number	Percent
Marginal farm	0.16-0.2	2	2.1
Small farm	0.21 – 1.0	63	66.3
Medium farm	1.01 – 3.0	24	25.3
Large farm	Above 3	6	6.3
Total		**104**	**100**

Source: Field Survey, 2019

Data presented in the Table 4.11 demonstrated that highest proportion (66.3 percent) of the farmers had small farm compared to 25.3 percent having medium farm and only 2.1 and 6.3 percent farmers had marginal and large farm. The findings indicated that overwhelming majority (91.6 percent) of the farmers had small to medium farm size.

CHAPTER V

PROFITABILITY OF RICE PRODUCTION

5.1 Introduction

The main purpose of this chapter is to assess the costs, returns and profitability of growing rice. Profitability is a major criterion to make decision for producing any crop at farm level. It can be measured based on net return, gross margin and ratio of return to total cost. The costs of all items were calculated to identify the total cost of production. The returns from the crops have been estimated based on the value of main products and by-products.

5.2 Profitability of Rice Production

5.2.1 Variable Costs

5.2.1.1 Cost of Land Preparation

Land preparation is the most important components in the production process. Land preparation included ploughing, laddering and other activities needed to make the soil suitable for onion cultivation. For land preparation in rice production, no. of tiller was required 2 with Tk. 2037.75 per ha. Thus, the average land preparation cost of rice production was found to be Tk. 4075.5 per hectare, which was 2.29 percent of total cost (Table 5.1).

5.2.1.2 Cost of Human Labour

Human labour cost is one of the major cost components in the production process. It is one of the most important and largely used inputs for producing rice. It is generally required for different operations such as land preparation, sowing, weeding, fertilizer and insecticides application, irrigation, harvesting and carrying, threshing, cleaning, drying, storing etc. The quantity of human labour used in rice production was found to be about 175 man-days per hectare and average price of human labour was Tk. 450 per man-day. Therefore, the total cost of human labour was found to be Tk. 78750 representing 44.18 percent of total cost (Table 5.1).

5.2.1.3 Cost of Seed

Cost of seed varied widely depending on its quality and availability. Per hectare total cost of seed for rice production were estimated to be Tk. 4440, which constituted 2.49 percent of the total cost (Table 5.1).

5.2.1.4 Cost of Urea

In the study area, farmers used different types of fertilizers. On an average, farmers used urea 296 kg per hectare. Per hectare cost of urea was Tk. 6216, which represents 3.48 percent of the total cost (Table 5.1).

5.2.1.5 Cost of TSP

Among the different kinds of fertilizers used, the rate of application of TSP (165 kg) was similar to urea fertilizers. The average cost of TSP was Tk. 5115 which representing 2.87 percent of the total cost (Table 5.1).

5.2.1.6 Cost of MoP

The application of MoP per hectare (75 kg) was found lower than other fertilizers. Per hectare cost of MoP was Tk. 1350, which represents 0.76 percent of the total cost (Table 5.1).

Table 5.1: Per hectare cost of rice production

Items of Cost	Quantity (kg/ha)	Rate (Tk./Kg)	Cost (Tk./ha)	% of Total Cost
Land preparation (X_1)			4075.5	2.29
Seed (X_2)	74	60	4440	2.49
Irrigation (X_3)			11115	6.24
Human labor (X_4)	175	450	78750	44.18
Urea (X_5)	296	21	6216	3.48
TSP (X_6)	165	31	5115	2.87
MoP (X_7)	75	18	1350	0.76
Manure (X_8)	1500	2.5	3750	2.1
Pesticide (X_9)			5187	2.91
A. Total Operating Cost (TOC)			119998.5	67.32
Interest on operating capital @ of 10% for months			6378.98	3.58
B. Total Variable Cost (TVC)			**126377.5**	**70.9**
Rental value of land			51870	29.10
C. Total Fixed Cost (TFC)			**51870**	**29.10**
D. Total cost (B+C)			**178247.48**	**100**

Source: Field Survey, 2019

Note: Quantity and rate for land preparation are expressed in no. of tiller per hectare and Tk. per tiller units, respectively. Quantity and rate of human labour are expressed in man-days per hectare and Tk. per man-days units, respectively.

5.2.1.7 Cost of Pesticides

Farmers used different kinds of insecticides to keep their crop free from pests and diseases. The average cost of insecticides for rice production was found to be Tk. 5187 which was 2.91 percent of the total cost (Table 5.1).

5.2.1.8 Cost of Irrigation

Cost of irrigation is one of the most important costs for rice production. Production of rice largely depends on irrigation. Right doses application of irrigation water help to increase bulb diameter, number of cloves, and number of leaves and plant height. As a result yield per hectare is being increased. The average cost of irrigation was found to be Tk. 11115.00 per hectare, which represents 6.24 percent of the total cost (Table 5.1).

5.2.1.9 Interest on Operating Capital

It may be noted that the interest on operating capital was calculated by taking in to account all the operating costs incurred during the production period of rice. Interest on operating capital for rice production was estimated at Tk. 6378.98 per hectare, which represents 3.58 percent of the total cost (Table 5.1).

5.2.1.10 Total Variable Cost

Cost Therefore, from the above different cost items it was clear that the total variable cost of rice production was Tk. 126377.5 per hectare, which was 70.9 percent of the total cost (Table 5.1).

5.2.2 Fixed Cost

5.2.2.1 Rental Value of Land

Rental value of land was calculated on the basis of opportunity cost of the use of land per hectare for the cropping period of three months. Cash rental value of land has been used as cost of land use. On the basis of the data collected from the onion farmers the land use cost was found to be Tk. 51870 per hectare, and it was 29.10 percent of the total cost (Table 5.1).

5.2.3 Total Cost (TC) of Rice Production

Total cost was calculated by adding all the cost of variable and fixed inputs. In the present study per hectare total cost of producing rice was found to be Tk. 178247.48 (Table 5.1).

5.2.4 Return of Rice Production

5.2.4.1 Gross Return

Return per hectare of rice cultivation is shown in table 5.2. Per hectare gross return was calculated by multiplying the total amount of product with respective per unit price. It is evident from table that the average yield of rice per hectare was 10374.00 kg and the average price of rice was Tk. 18.00. Therefore, the gross return was found to be Tk. 186732.00 per hectare (Table 5.2).

5.2.4.2 Gross Margin

Gross margin is the gross return over variable cost. Gross margin was calculated by deducting the total variable cost from the gross return. On the basis of the data, gross margin was found to be Tk. 60354.5 per hectare (Table 5.2).

5.2.4.3 Net Return

Net return or profit was calculated by deducting the total production cost from the gross return. On the basis of the data the net return was estimated as Tk. 8484.52 per hectare (Table 5.2).

Table 5.2: Per hectare cost and return of rice production

Sl. No.	Items	Amount (Tk. hectare)
A.	Gross return (GR)	186732.00
B.	Total variable costs (TVC)	126377.5
C.	Total costs (TVC+TFC)	178247.48
D.	Net return (GR-TC)	8484.52
E.	Gross margin (GR-TVC)	60354.5
F.	Benefit-cost ratio (BCR) = GR/TC	1.047

Source: Field Survey, 2019

5.2.5 Benefit Cost Ratio (Undiscounted)

Benefit Cost Ratio (BCR) is a relative measure, which is used to compare benefit per unit of cost. Benefit Cost Ratio (BCR) was found to be 1.047 which implies that one taka investment in onion production generated Tk. 1.047 (Table 5.2). From the above calculation it was found that rice cultivation is profitable in Bangladesh.

5.3 Concluding Remarks

From the above discussion it is easy to understand about the different cost items and their application doses of farmers, yields and returns per hectare of rice cultivation. Rice production is a labour intensive enterprise. It is most essential to use modern inputs such as seeds, fertilizers, human labour, power tiller, pesticides and irrigation efficiently. Timely and efficient use of these inputs are the most important to increase production and profitability. On the basis of above discussions it could cautiously be concluded here that cultivation of rice is a profitable. Cultivation of rice would help farmers to increase their income earnings.

CHAPTER VI
FACTOR AFFECTING PROFITABILITY OF RICE CULTIVATION

6.1 Introduction

An attempt has been made this chapter to identify and measure the effects of the major variables on rice production. Cobb-Douglas production function was chosen to estimate the contribution of key variables on the production process of rice production. The estimated values of the model are presented in Table 6.1.

6.2 Functional analysis for measuring production efficiency

Production function is a relation or a mathematical function specifying the maximum output that can be produced with given inputs for a given level of technology. Keeping in mind the objectives of the study and considering the effect of explanatory variables on output of rice production, nine explanatory variables were chosen to estimate the quantitative effect of inputs on output.

Management factor was not included in the model because specification and measurement of management factor is almost impossible particularly in the present study, where a farm operator is both a labor and manager. Other independent variables like water quality, soil condition, time etc. which might have affected production of farm enterprises, were excluded from the model on the basis of some preliminary estimation. A brief description is presented here about the explanatory variables included in the model.

6.3 Estimated values of the production function analysis

6.3.1 F-value was used to measure the goodness of fit for different types of inputs.

6.3.2 The coefficient of multiple determinations (R^2) indicates the total variations of output explained by the independent variables included in the model.

6.3.3 Coefficients having sufficient degrees of freedom were tested for significance level at 1 percent and 5 percent levels of significant.

6.3.4 Stage of production was estimated by returns to scale which was the summation of all the production elasticity of various inputs.

The estimated coefficients and related statistics of the Cobb-Douglas production function for rice production are shown in Table 6.1.

Land preparation cost (X_1)

The regression coefficients of land preparation cost was insignificant for rice cultivation (Table 6.1). Co-efficient of land preparation cost (X_1) was 1.019. The result of the analysis indicated that, keeping other factors constant 1 percent increase in additional expenditure on land preparation would increase the yield of rice by 1.019 percent.

Seed cost (X_2)

The regression coefficients of seed was -1.341 (not significant), which implied that, holding other factors constant, 1 percent increase in the amount of seed would decrease the yield of rice by 1.341percent (Table 6.1).

Irrigation cost (X_3)

The magnitudes of the coefficients of irrigation cost was positive and significant for rice production (Table 6.1). The result of the analysis indicated that, keeping other factors constant, 1 percent increase in additional expenditure on irrigation would increase the yield of rice by 0.436 percent.

Human labour cost (X_4)

The regression coefficients of Human labour (X_4) was positive and significant at 1 percent level of significance. The regression coefficients of human labour (X_4) was 0.301, which implied that, other factors remaining the same, if expenditure on human labour was increased by 1 percent then the yield of rice would be increased by 0.301percent (Table 6.1).

Urea cost (X_5)

The regression coefficients of urea (X_5) was insignificant for rice production (Table 6.1). The regression coefficients of urea (X_5) was 0.202, which implied that, other factors

remaining the same, if amount of urea was increased by 1 percent then the yield of rice would be increased by 0.202 percent.

TSP cost (X_6)

The regression coefficient of TSP cost (X_6) of rice production was positive and significant at 1 percent level of significance, which implied that if the expenditure on TSP was increased by 1 percent then the yield of rice would be increased by 0.576 percent, other factors remaining constant (Table 6.1).

MoP cost (X_7)

The regression coefficients of MoP (X_7) was insignificant for rice production (Table 6.1). The regression coefficients of MoP (X_7) was 0.082, which implied that, other factors remaining the same, if amount of MoP was increased by 1 percent then the yield of rice would be increased by 0.082 percent.

Table 6.1 Estimated Values of Coefficients and Related Statistics of Cobb- Douglas Production Function

Explanatory variables	Coefficient	Standard error	p- value
Intercept	1.349	0.449	0.004
Cost of land preparation (X_1)	1.019	0.284	.504 ^{NS}
Cost of seed (X_2)	-1.341	0.427	.304 ^{NS}
Cost of irrigation (X_3)	0.436	0.098	.000***
Cost of human labor (X_4)	0.301	0.082	.000***
Cost of urea (X_5)	0.202	0.178	.296 ^{NS}
Cost of TSP (X_6)	0.576	0.163	.003***
Cost of MoP (X_7)	0.082	0.116	.421 ^{NS}
Cost of manure (X_8)	0.385	0.190	.036*
Cost of pesticide (X_9)	0.601	0.111	.000***
R^2	0.928		
Adjusted R^2	0. 920		
Return to scale	2.261		
F-value	121.762***		

Source: Field Survey, 2019

Note: ** Significant at 1 percent level; * Significant at 5 percent level and NS: Not Significant

Manure cost (X_8)

The regression coefficient of manure cost (X_8) of rice production was positive and significant at 5 percent level of significance, which implied that if the expenditure on manure was increased by 1 percent then the yield of rice would be increased by 0.385 percent, other factors remaining constant (Table 6.1).

Cost of Insecticide (X_9)

The regression coefficient of insecticides cost (X_9) of rice production was positive and significant at 1 percent level of significance, which implied that if the expenditure on insecticides was increased by 1 percent then the yield of rice would be increased by 0.601 percent, other factors remaining constant (Table 6.1).

Coefficient of multiple determinations (R^2)

The values of the coefficient of multiple determination of rice production was found to be 0.928 Which implied that about 92 percent of the total variation in the gross return could be explained by the included explanatory variables of the model. So we can say the goodness of fit of this regression model is better since R^2 indicates the goodness of fit of the regression model (Table 6.1).

Adjusted R^2

Here the term adjusted means adjusted for the degrees of freedom. The adjusted R^2 for rice production was found to be 0.920 which indicated that about 92 percent of the variations of the output were explained by the explanatory variables included in the model (Table 6.1).

Returns to scale in riceproduction

The summation of all the production coefficients of rice production is equal to 2.261. This means that production function for shrimp farming exhibits increasing returns to scale. This means that, if all the variables specified in the model were increased by 1 percent, gross return would also be increased by 2.261 percent (Table 6.1).

F-value

The F-statistic was computed to denote the overall goodness of fit of any fitted model. The F-value for the rice production was estimated at 121.762 which were highly significant at 1 percent level. It means that the explanatory variables included in the model were important for explaining the variation in gross return of rice production (Table 6.1).

CHAPTER VII
PROBLEM AND SUGGESTIONS

7.1 Problem faced by the farmers in rice production

Problems faced by the farmers in producing rice Bangladesh has an economy mainly dependent on agriculture. But this agricultural sector is negligible still now. Various problems are associated with this sector. Experience has shown that farmers in Bangladesh seldom get the required quantity of seeds, adequate fund, fertilizers, pesticides, technical support and finally the remunerative price of their produces. They are economically not very capable of investing the required fund for producing crops due to their low capital base and scarcity of cash fund. Fanners generally complain of receiving insufficient support from government agencies. In this chapter an attempt is made to identify some major problems of rice production Relative problems and constraints of rice production. The sample farmers were asked to stale whether they faced any problems with regard to rice production. It was observed that most of the fanners were facing some important problems in growing rice. It may be noted that the problems confronted by the individual farmers were not identical. Some problems were in fact more severe than others. However those problems and constraints which the farmers emphasized upon are shown in Table 7.1 and described below:

- **Unavailability of labor**

In the study area, most of the farmers could not get labor in time. So they had to depend on own. Very often they faced labor crisis. Even they had to pay illogically very high price. In the study area, unavailability of labor was the most severe problem among the farmers (Table 7.1).

Table 7.1 Problems and constraints of rice production

Problem	Obtained scores (out of 285)	Rank order
Unavailability of labor	256	1st
Lack of adequate fund	110	6th
High rate of input price	234	2nd
Lack of fertilizer in time	129	5th
Need quality seed	90	7th
Lack of government attention	201	3rd
More infestation of diseases and pest	135	4th

Source: Field Survey 2019

- **Lack of adequate fund**

In the study area, most of the farmers reported that they did not have adequate amount of operating capital. Most of them failed to receive the institutional credit. As a result, financial inability and pressing need for cash money force them to borrow money from non- institutional sources and they have to pay high interest rate. In the study area, lack of adequate fund was the 6th most severe problem (Table 7.1).

- **High rate of input price**

Different kind of inputs such as seed, fertilizer, pesticides and insecticides. Petrol & Diesel were used to produce rice. But sorry to say that most of the farmers had to pay high market price than the reasonable. In the study area, high rate of input price was the 2nd severe problem among the farmers (Table 7.1).

- **Lack of fertilizer in time**

Fertilizer is the most important input for producing rice. They usually use urea. TSP, Zypsum and M.P. for the better production farmers had to use fertilizer several times in their field. Fertilizer crisis is a common subject in the production period in our country. Some traders made artificial crisis to make sure higher price of fertilizers. In the study area, it was the fifth problem (Table 7.1).

- **Need quality seed**

Different type of insect and pest arc affected of rice and causes low production. To avoid these losses farmers had to use different kind of pesticides to control insect and pest. But in the production period, the quality insecticides and pesticides are not available and the price of insecticides and pesticides is high. The farmers faced this problem every year (Table 7.1).

- **Lack of government attention**

During the investigation, most of the farmers complained that they did not get enough support from the government. Only large farmers were benefited from the government institution. Input price should be reduced, proper training should be provided to the farmers. In the study area, lack of government attention was the 3rd problems among the farmers (Table 7.1).

- **More infestation of diseases and pest**

For rice production diseases and pest infestation was the one of the severe problems. Farmers said that 10% yield losses due to the diseases and pest infestation when higher in the study area (Table 7.1).

7.2 Suggestions given by the farmers to overcome the problems in producing rice

From the study we observed that various problems were associated with rice production. In the study area, the farmers were given freedom to give their suggestion for overcoming the existing problems related to the rice production. They suggested various measures. These suggestions are discussed below.

Table 7.2 Suggestions to overcome the problems

Solutions to overcome problem	Mean	Rank
Reduce labor price	4.56	7th
Credit facilities	8.45	3rd
To reduce input price	9.79	1st
Available fertilizer	5.57	5th
Need availability of quality seed	7.68	4th
Government attention	9.56	2nd
Available insecticides and pesticides	5.12	6th

Source: Field Survey 2019

- **To reduce labor price**

According to sample farmers, high rate of labor cost in another problem. So, the price of labor should be cheaper which the 7th ranked suggestion of farmers.

- **Credit facilities**

Although, lack of quality seed was the first problem of the sample farmers, they strongly suggested about the credit facility which was the 3rd ranked suggestions of the farmers, because, most of the farmers in the study area were poor and they have no fund to cultivate rice.

- **To reduce input price**

According to sample farmers, high rate of input cost in another problem. So, the price of input should be cheaper which the 1st ranked suggestion of farmers was through input subsidy government can reduce input price.

- **Available fertilizer**

The farmers claimed that sometimes the fertilizer dealers used to create artificial fertilizer crisis to get higher price. In such situation the fanners used to face fertilizer crisis. To get optimum production of rice farmers have to give proper fertilizer to field. So government should take steps to ensure proper fertilizer distribution by the government agencies and it was 5th suggestion in rank order to overcome this problem.

- **Need availability of quality seed**

Quality seed ensure expected production. In the study area farmers faced quality seed crisis in the sowing period. About 52% farmers sought for easy availability of seed through government regulations. Most of the farmers suggested for it because they could not collect quality seed from the dealer and they had to collect poor seed from the local market. So quality seed have to provide to farmers thorough different Channels.

- **Government attention**

In the study area most of the farmers complained that government gave low attention in agriculture. So government should give proper attention to develop agriculture**.**

- **Available insecticides and pesticides**

For rice production insecticides and pesticides arc essential to control pest and insect attract. Quality insecticides and pesticides are not available in market during production period.

CHAPTER VIII
SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

8.1 Introduction

This chapter discusses the summary, conclusion and policy recommendations of the study. These chapter summaries on Introduction (Chapter 1), Review of literature (Chapter 2), Methodology (Chapter 3), Socio-economic characteristics (Chapter 4), Cost and returns (Chapter 5), Factor affecting profitability of rice production (Chapter 6), Problem faced by the farmers of rice production (Chapter 7), Finally Chapter 8 presents summary, conclusion and policy recommendations of the study.

8.2 Summary and conclusions

Bangladesh is predominantly an agricultural country. Agricultural development is still synonyms with the economic development. At present agricultural sector are largely dominated by the rice production. Rice is the staple food of Bangladesh and basically rice cultivation is the major source of livelihood of the people of Bangladesh. On the basis of seasonal classification, three types of rice are grown in Bangladesh namely – Aus, Aman and Boro. HYV Boro rice covered the largest portion of the total rice production of the country. The population growth rate is 1.36 percent per annum (BBS 2018) which causes the decreases of farm size in a horrid manner. The area under study was a rice growing area. An attempt has been made in this study to examine the profitability of rice producing farms farmers. The overall objective of the study will be measure profitability of rice producing farms and also identify the socioeconomic characteristics of the farmers in the study area. The following are the specific objectives:

i. To identify the major socio-economic characteristics of rice farmers;
ii. To assess the profitability of rice production farmers;
iii. To estimate the contribution of key inputs to the production processes of rice production;
iv. To identify problem faced by the farmers in rice production.

All the rice growers in Tangail district were not possible to include in this study because of the paucity of resources and time constraint. A reasonable sample survey, which would represent the population, was required in order to meet up the purpose of the study. Simple random sampling technique was adopted in this study. After purposively selecting Tangail district, Mirzapur upazila was selected randomly from 12 upazilas. Subsequently, five villages from two union namely, Ajgana and Bashtoil were also selected randomly. From each of the two unions five villages namely, Chiteswary, Polashtoli and Mojidpur from Ajgana union and Kakrajan and Mamutpur from Bashtoil union selected randomly as a locale of the study.Therefore, a list of rice producers were constructed with the help of village leaders and field level extension personnel.

It was observed from the socioeconomic characteristics that the highest number of farmers (47.4 percent) belonged to middle age group 36-50 years. On the other hand, the lowest number of farmer were (12.6 percent) belonged to the age group of above 50 year. This information implies that the major portion of all categories of farmers fell into age group 36-50 years. Out of 95 sample farmers, 14.8 percent farmers had primary education, 4.2 percent farmers had illiterate, 22.1 percent farmers had can only sign categories, 42.1 percent farmers had completed their secondary level education and 16.8 percent farmers had completed their above secondary education. Average family size of farmers was 4.28. So farmers had a medium family size highest about 67.4%. It appears that the number of working members (between 4 to 6 members) for farm families was relatively higher than family members in other groups. The data revealed that 47.3 % of the farmers had medium farm size whereas about 66.3 % of the farmers had small land under rice cultivation. Data contained in Table 4.6 showing that 70.4 percent of the farmers had medium experience in rice cultivation, whereas 14.7 percent had short experience in rice cultivation and 14.4 percent had long farming experience in rice cultivation. Data shown in Table 4.7 presented that the highest proportion (67.4 percent) of the respondents had medium family income while 14.7 and 17.9 percent of the respondents had low and high annual family income respectively. Data presented in the Table 4.8 showed that about (37.9 percent) of the farmers had no training received on rice cultivation; while only 3.8 percent of the farmers had high training received on rice cultivation. Where, 29.4% farmers had medium training

received on rice cultivation and 23.2% of the farmers had low training received on rice cultivation. Data showed that a proportion of 70.5 percent of the farmer had medium extension contact compared to 22.1 percent of them having high extension contact and 7.4 percent of the farmer had high contact. Data presented in Table 4.10 indicates that majority (51.6 percent) of the respondents had no credit received, 28.4 percent of the respondents had low credit received, 15.8 percent of the farmers had medium credit received and only 4.2 percent had high credit received in rice production.

The results of profitability analysis of rice it was found that per hectare costs of seed of rice was Tk 4440. Again per hectare animal labor and power tiller cost costs for producing rice was Tk. 4075.5. The per hectare human labor costs was Tk 78750 for the farmers which comprised 44.18 percent of their respective total costs of production. Human labor shared major portion of the total cost in each farmers and the dependency on hired labor was greater in farmers than others cost. Per hectare chemical fertilizer cost were Tk 6216, Tk 5115 and Tk 1350 for urea, TSP and MoP, respectively. Per hectare costs of irrigation cost was Tk 11115 for the farmers and cost of pesticides per hectare was Tk 5187 for farmers. Interests on operating capital per hectare was Tk. 6378.98 in Table 6.1 reveals that interest on operating capital for rice production. The land use cost per hectare was Tk.51870 for the farmers.

The average yields of rice was 10374 kg per hectare for the farmers. The gross returns per hectare was Tk 186732.00. It was observed that per hectare net return was Tk. 8484.52. Cost and returns were worked out to estimate profitability of rice production. Per hectare total cost, gross return, net return and gross margin were Tk. 178247.48, Tk. 186732.00, Tk. 8484.52 and Tk. 60354.5respectively. Benefit Cost Ratio was 1.047.

Cobb-Douglas production function analysis was carried out for examining the factors affecting the profitability of input use. In most of the cases the coefficients of irrigation, human labor, cost of TSP, cost of manure and cost of pesticide appeared to be significant. The summation of co-efficient of different inputs were greater than one implying that the production functions exhibited increasing returns to scale. The values of the coefficient of multiple determination of rice production was 0.92 which implied that about 92 percent of the

total variation in the gross return could be explained by the included explanatory variables of the model. Production function for rice production exhibits increasing returns to scale (2.261). This means that, if all the variables specified in the model were increased by 1 percent, gross return would also increase by 2.261 percent. . The F-value for the rice farmers was 121.726 which were highly significant at 1 percent level. Unavailability of labor was the l^{st} problems in the study area followed by high rate of input price, lack of adequate fund, lack of fertilizer in time, poor quality of pesticide, lack of government attention and more infestation of diseases and pests. Credit facilities was the 1st probable suggestions to overcome problems followed by to reduce input price, need quality seed, available fertilizer, available insecticides and pesticides and government attention.

8.3 Policy Recommendations

Based on the findings of the present research, the following recommendations are put forward.

On the basis of the salient findings of the study, certain broad implications that can be derived for policy makers and extension personnel to design suitable development strategy for increasing the rice production in the study area are indicated here:

- ✓ For increasing production of rice necessary inputs particularly HYV seeds. Fertilizers, insecticides and pesticides etc. should be made available to the farmers just before the growing period.

- ✓ To reduce the cost of seed it will be necessary to produce sufficient quality seeds locally and make them available to the farmers in time at a reasonable price.

- ✓ The farmers, who were more experienced and contacted frequently with extension workers, were more efficient. So, experience and frequency of extension contact should be increased to help skill development.

- ✓ Domestic consumption of rice requires to be raised from the present state. A well-coordinated move towards popularization of intake of rice as a major substitute of cereals is yet to be made. Massive publicity of diversified uses of potato products should be made through mass media.

- ✓ Good quality seed and low price of input should be ensured for increasing rice production because rice producers achieved only 70 % of their potential yield.

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DEPARTMENT OF AGRIBUSINESS AND MARKETING
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An Interview Schedule for the Study Entitled

PROFITABILITY OF RICE CULTIVATION IN THE SELECTED AREAS OF TANGAIL DISTRICT IN BANGLADESH

Name of the respondent:.....Serial No.

Village: …….……. Contact No. ……

Union: …… Upazila: …….

(Please provide the following information. Your information will be kept confidential and will be used for research purpose only)

1. Age
How old are you? _____ Years.

2. Level of education
Please mention your level of education.

a) I can't read and write ☐
b) I can sign only ☐
c) I have passed..... class.

3. Family size
Please mention the number of your family member
a) Male……...
b) Female……. Total…….

4. Farm Size
Please mention the area of your land possession

Sl. No.	**Use of land**	**Land possession**	
		Local unit	**Hectare**
1.	Homestead area (A)		
2.	Own land own cultivation (B)		
3.	Land taken from others on *Borga* system(C)		
4.	Land given to others on *Borga* system (D)		
5.	Land taken from others on lease (E)		
Total=A+B+1\2(C+D)+E			

5. Experience in rice cultivation
How many years you are engaged with rice cultivation?
Ans: ..... (years).

6. Rice cultivation area .....hectare.

7. Annual family income
Mention your annual family income from the following sources

Income sources			Income in '000' Tk.
A.	***Agricultural sources***		
1)	Crop		
2)	Livestock		
3)	Poultry		
4)	Fisheries		
B.	***Non-Agricultural sources***		
i)	Business		
ii)	Job		
iii)	Laborer		
iv)	Others		
Total Income			

8. Agricultural training exposure
Please mention about your training exposure on agriculture

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

9. Agricultural extension media contact
Please indicate the extent of contact in following sources

SL. NO.	Name of information sources	Extent of contact				
		Regularly (4)	Frequently (3)	Occasionally (2)	Rarely (1)	Not at all (0)
1.	Contact/model farmers					

2.	Agricultural input (seed / fertilizer / pesticide / equipment) dealers					
3.	SAAO					
4.	NGO Worker					
5.	Upazila level agricultural organization					
6.	Agricultural program through electronic media (radio/TV)					
7.	Agricultural features in printing media (Daily Newspaper, leaflet, booklet, magazine etc.)					
	Total					

10. Credit received

Did you receive any credit from any sources? ----------Yes / No

If yes, please mention the sources of receiving credit and the amount of credit received

SL. NO.	Sources of credit	**Amount of credit (Tk.)**
1	NGOs	
2	Banks	
3	Money lenders	
4	Friends	
5	Neighbors	
6	Relatives	
7	Others	

11. Profitability of rice cultivation:

Please mention following information:

a. Total cost per ha

Sl No	Item of cost	Quantity Kg/ha	Price Tk/kg	Total cost Tk/ha
1.	Land Preparation			
2.	Seed			
3.	Irrigation			
4.	Fertilizer			
5.	Urea			
	TSP			
	MoP			
	ZnSO4			
	Gypsum			
	Manures			
6.	Pesticide			
7.	Labour cost			
	Total			

b. Total return per ha

Sl. No.	Sources of return	Amount of Production kg/ha	Price Tk/Kg	Total return Tk/ha
1.				

$$\text{Profitability} = \frac{\text{Total Return}}{\text{Total Cost}}$$

12. Problem in rice cultivation

1……

2……

3……

4……

13. Suggestions

1……

2…….

3……

Thank you for your co-operation.

Date……..…

_____

Signature of interviewer