AN ECONOMIC ANALYSIS OF HYV BORO PADDY PRODUCTION UNDER DIFFERENT LAND TENURE SYSTEMS IN SOME SELECTED AREAS OF JHENAIDAH DISTRICT OF BANGLADESH

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CERTIFICATE

This is to certify that the thesis entitled **"AN ECONOMIC ANALYSIS OF HYV BORO PADDY PRODUCTION UNDER DIFFERENT LAND TENURE SYSTEMS IN SOME SELECTED AREAS OF JHENAIDAH DISTRICT OF 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 **AGRICULTURAL ECONOMICS**, embodies the result of a piece of bonafide research work carried out by **LATIFA PERVIN**, Registration number: **07-02408** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

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DEDICATED
TO
MY BELOVED PARENTS

AN ECONOMIC ANALYSIS OF HYV BORO PADDY PRODUCTION UNDER DIFFERENT LAND TENURE SYSTEMS IN SOME SELECTED AREAS OF JHENAIDAH DISTRICT OF BANGLADESH

ABSTRACT

This study was conducted to examine the profitability and resource use efficiency of Boro paddy producing farms under different land tenure systems. In total 90 farmers of which 30 owner, 30 cash tenant and 30 crops share tenant farmers were selected randomly from three villages namely Aruyakandi, Baroipara and Habibpur under Shailkupa Upazila in Jhenaidah district of Bangladesh. Primary data were collected from the farmers by farm survey method.

The study revealed that the socio-economic condition of owner farmers had better than cash and crop share tenant farmers. It was found that HYV Boro paddy production was profitable for both land tenure farmers but there exists a difference in profitability among owner, cash tenant and crop share tenant farmers. Per hectare gross cost of owner, cash tenant, and crop share tenant farmers were respectively Tk 95858, Tk 91793.96 and Tk 78752.77 and per hectare gross returns were Tk 108933.00, Tk 119079.50 and Tk 117368.48, respectively. It was observed that per hectare net return was Tk. 14296.78, 27285.54 and 38615.72 for the owner, cash tenant, and crop share tenant farmers, respectively. This result indicated that crop share tenant farmer earned more profit than the other group of farmers. The undiscounted BCR were 1.14, 1.30, and 1.49 in owner, cash tenant and crop share tenant farmers, respectively. Finally, it was observed that more profit could be earned by reallocating of resources following a series of interrelated reform measures.

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The Author

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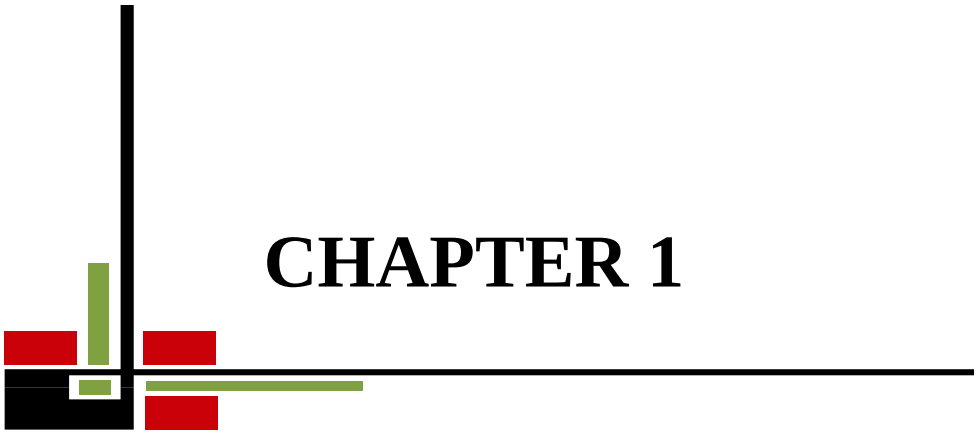
ACRONYMS AND ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
BER	Bangladesh Economic Review
BCR	Benefit-Cost Ratio
GOB	Government of Bangladesh
0C	Degree Celsius
e.g.	exempil gratia (for example)
etal.	et alia (and others)
etc.	et cetera (and others and so forth)
GDP	Gross Domestic Product
GM	Gross Margin
GR	Gross Return
HSC	Higher Secondary Certificate
SSC	Secondary School Certificate
Ha	Hectare
HYV	High Yielding Varieties
Kg	Kilogram
Km2	Kilometer Square
Ln	Natural Logarithm
M.T	Metric Ton
MFC	Marginal Factor Cost
MVP	Marginal Variable Cost
M0P	Murate of Potas
MT	Metric Ton
TSP	Triple Super Phosphate
TVC	Total Variable Cost



CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 The Bangladesh Economy

Bangladesh is an agricultural country with the geographical area of 147570sq kilometers and population of about 149.77 millions. The population density per km2 is 976 people (BBS, 2013). 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 190 per cent (BER 2012). About 80 percent of its population lives in rural areas, where agriculture is the major occupation and 45.6 % (BBS, 2013) labor force are engaged in agriculture. At present the contribution of agriculture to the total GDP (Gross Domestic Product) is 17.21% in which 10.05% comes from crops, 1.19% from forestry, 2.41% from livestock and 3.56% from fisheries (BBS, 2013).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, 2013) which causes the decreases of farm size in a horrid manner. The extra population is a threat to the total production.

Agricultural development is still synonymous with the economic development of Bangladesh. Economic development of the country cannot be achieved unless there is a breakthrough in agriculture sector. At present, agriculture sector is largely dominated by the rice production. Rice, the staple food and major cereal crop of Bangladesh. Basically rice cultivation is the major source of livelihood of the people of Bangladesh A small parcel of land not only acts as a constraint to profitable investment, but also deprives farmers of access to production inputs, formal credit and other institutional services required for improved agricultural practices. As a result, farmers are often forced to cultivate land under different tenure systems. In present farming system of Bangladesh, tenancy systems occupy a considerable percentage of socioeconomic reasons which turn a farmer to be tenant (Khan, 2008).

Land tenure refers to “the possession of rights to the use of land. People hold various kinds of rights in the use of land and are said to be belonging in different tenure classes. Although it is difficult to rank tenure classes according to the degree of rights,

which are held, we generally recognize that the owner operator without debt has the most freedom of action with respect to the use of his inputs. At the other end of this scale of rights in land are found the hired farm labor and share-croppers. Between these two extremes are the share tenants, cash tenants, mortgage-owners, part owners and numerous combinations of these groupings" (Bishop and Toussaint, 1958). In other words, tenure system implies the interrelationship among (1) landlord; (2) tenant; and (3) government or state concerned with regulating the use of land.

There are different types of tenure arrangements in Bangladesh agricultural economy today. These arrangements influence the efficiency with which inputs are used. They also affect the degree of uncertainty encountered in the operation of a farm. The contemporary agricultural land tenure system in Bangladesh is still deeply influenced by the practices of British colonial administrators. However, functioning of the agricultural tenancy market has not been thoroughly explored with respect to Bangladesh. Moreover, to date no land reform or tenancy reform policies have been successfully implemented in Bangladesh. It is important to note those livelihoods strategies among farmers in our country are influenced by the land tenure rules are informal.

Otsuka (2007) stated that household farming or owner cultivation is the optimum form of production organization in agriculture in the context of Asian countries. In contrast, tenant cultivation is widely believed to be inefficient because of the adverse effect of tenure insecurity on long term investments as well as the disincentive effect of output sharing on work effort. Consequently, these inefficiencies affect the agricultural productivity.

One way of approaching this problem of improving agricultural production efficiency is to examine whether the present pattern of ownership and use of resources is efficient or inefficient. In order to examine the impact of land tenure system on HYV Boro productivity, the main emphasis of this study will be given to analyze profitability HYV Boro rice production and also input use efficiency. Production analysis will help in providing information regarding farmers' income generation. Further, input use efficiency will help in providing information regarding farmer can use of inputs efficiently or inefficiently.

1.2 Background Information

1.2.1 Importance of Agriculture Sector

The economy of Bangladesh is substantially agro-based. A satisfactory growth in agriculture is a necessary pre-condition for accelerating overall economic growth. Table 1.1 shows agricultural sector growth rates in GDP of Bangladesh. The share of agriculture in GDP has fallen in recent years but it is still largest economic sector in our country.

Table 1.1 Agricultural Sector Growth Rates of GDP of Bangladesh at current Market Price.

(Growth rate in % per year)

Year	Agriculture	Crop	Forestry	Livestock	Fisheries
2006-07	12.70	13.77	7.06	11.34	8.98
2007-08	14.37	15.46	9.14	12.41	11.29
2008-09	11.50	11.01	8.96	15.55	10.19
2009-10	12.48	12.03	10.43	15.83	11.08
2010-11	12.92	13.14	9.35	13.88	11.45
2011-12	10.71	9.88	10.14	14.88	14.84
2012-13	8.94	7.66	10.20	13.91	15.06

Source: BBS, 2013

1.2 .2 Area and Production of Rice in Bangladesh

Bangladesh was the fourth largest rice producer in the world, but its productivity was low compared with other Asian countries. It is currently the world's sixth-largest producer. High yield varieties of seed, application of fertilizer, and irrigation have increased yields, although these inputs also raise the cost of production and chiefly benefit the richer cultivators. Bangladesh inherited an agricultural sector dominated by rice production. Rice nearly three fourths of the crop land and is dominant source of supply of food and the major source of income and employment that helps finance development activities. Every year nearly adds 1.5 million people (GOB, 2008).In order to meet the demand of food grain for the increasing population and to achieve

self-sufficiency in food grain, the government of Bangladesh has given much emphasis on rice production. Rice and wheat are the main food grain crops and again rice alone meets up about 90% of total demand for food grain. Rice production systems make a vital contribution to the reduction of hunger and poverty in Bangladesh. Total rice production in Bangladesh was 10.32 million tons in the year 1975-76 when the country's population was only 79.90 millions (BBS and DAE, 2007). However, the country is producing 33833thousands metric tons rice in the year of 2012/13, where Boro rice contributed more than 18778 thousands metric tons (BBS, 2013).

From the analysis of the last few years' data we found that its contribution in total rice production follows an increasing trend (Figure 1.1). Table 1.2 represents areas and production of Aus, Aman and Boro. It was showed that the area under cultivation of Aus and Aman decreasing where area under Boro was increased. The highest production of Boro was 17844 metric tons in 2009/10 and lowest production was 3552 metric ton in2007/08.The area under HYV Boro increased by 1.04 times in 2012/13 as compared to 2005/06. Recently, the rate is increasing rapidly due to adoption of high yielding rice varieties, including modern rice cultivation technologies, improvement irrigation facilities and applications of fertilizer and pesticides. But for continuing this production rate there should be proper management practices. Requirement for Boro Rice Production in Bangladesh proper management practices, mainly fertilizer and irrigation application in different growing stages. Therefore, ensuring irrigation and fertilizer in farmer level on scheduled times (application time) are of major concern.

Table 1.2 Area and Production of HYV Aus, Aman and Boro Rice in Bangladesh

(000 acres) (000 m. tons)

Year	AUS		Aman		Boro	
	Area	Prod'n	Area	Prod'n	Area	Prod'n
2005/06	1277	1081	7891	7505	9617	13628
2006/07	1187	996	8245	7867	10166	14709
2007/08	1385	1099	8405	7715	9341	3552
2008/09	1704	1948	9145	9075	2011	12866
2009/10	1600	1316	9323	9403	13366	17844
2010/11	1970	1739	9647	10142	9968	15329
2011/12	2104	1963	9650	10254	10114	15597
2012/13	1949	1821	9822	10437	10082	15752

Source: BBS, 2013

1.2.3 Importance of HYV Rice

Rice, the staple food crop in Bangladesh about 80% of the cultivable lands are occupied by rice. Rice production systems make a vital contribution to the reduction of hunger and poverty in Bangladesh. It grows in three seasons namely; Aus, Aman and Boro. It covers 8.80%, 55.55% and 37.37% (Figure 1.2) of land respectively and total production of rice was estimated to be 33833 metric ton (BBS, 2013).About 100% population of the country depend on rice as their major food. The cultivation of HYV Boro rice shows an increasing trend since few years with rapid intensification of land, Boro has the higher production than other two rice growing seasons (Fig 1.1).

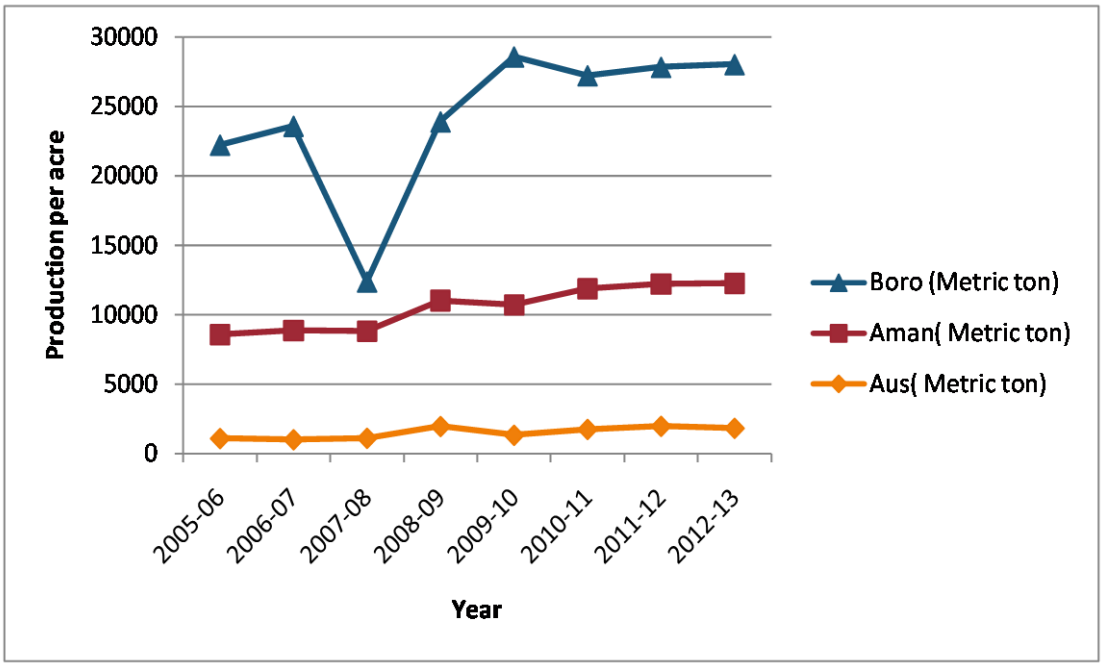


Figure 1.1: Per Acre Production of Different Varieties of HYV Rice

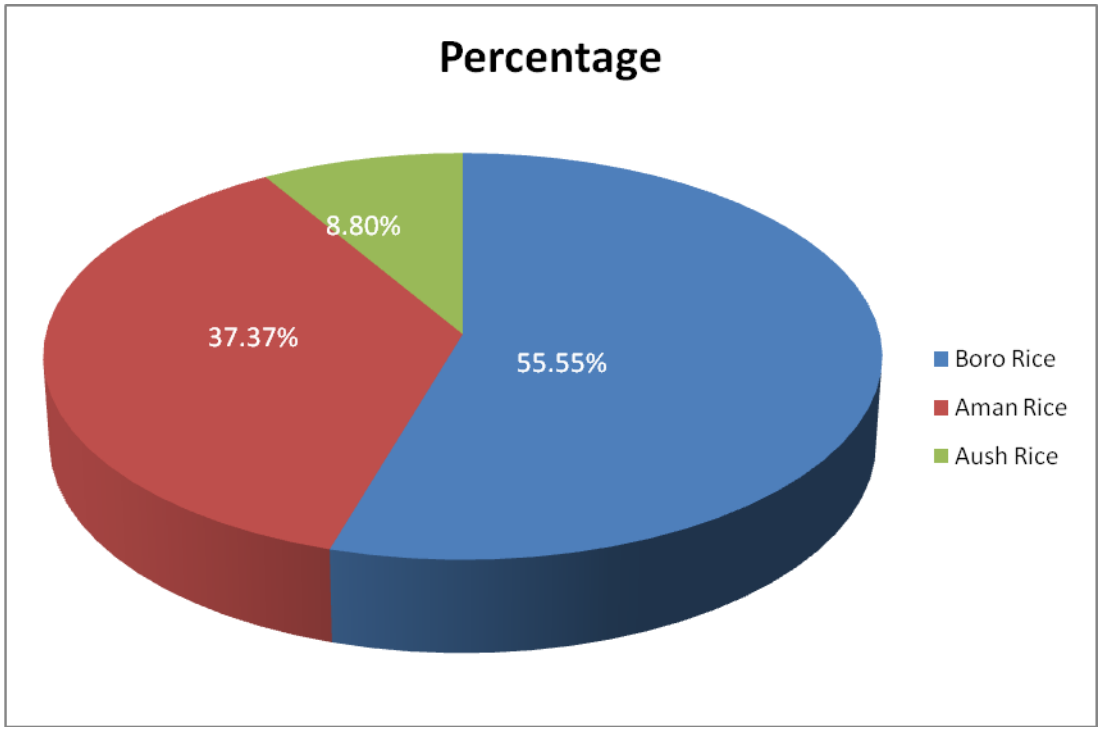


Figure 1.2: Areas under Different Rice Varieties (HYV) Production in Bangladesh.

Recently, the rate is increasing rapidly due to adoption of high yielding rice varieties, including modern rice cultivation technologies, improvement irrigation facilities and applications of fertilizer and pesticides. But for continuing this production rate there should be proper management practices. In Bangladesh proper management practices in different tenure system is needed for higher HYV Boro production. Therefore, considering different tenure system is of major concern.

1.2.4 Concept of Land Tenure System

According to FAO (1993), "land tenure" is originally a legal term that means the right to hold land rather than the simple fact of holding it. The word "tenure" derives from the Latin term for "holding" or possession and its use in this context derives from the English feudal period when, following their conquest of England in 1066 the Normans declared all previous land rights void and replaced them with grants from the new King. As such the concept applied to the terms on which land was held, in particular the rights and duties of the holder.

Land tenure is the relationship, whether legally or customarily defined, among people, as individuals or groups, with respect to land. (For convenience, "land" is used here to include other natural resources such as water and trees.) Land tenure is an institution, i.e., rules invented by societies to regulate behavior. Rules of tenure define how property rights to land are to be allocated within societies. They define how access is granted to rights to use, control, and transfer land, as well as associated responsibilities and restraints. In simple terms, land tenure systems determine who can use what resources for how long, and under what conditions.

Bruce (1993) Tenure is defined as the bundle of rights which a person or community holds in land, or water or other resources. Thus, tenure determines who is allowed to use which resources in which way and at what time.

Bishop and Toussaint (1958) defined land tenure as the possession of rights to the use of land .People hold varying kinds of rights in the use of land are said to belong in different tenure classes. Although it is difficult to rank tenure classes according to the degree of rights which are held, generally owner operators are recognized to have the most freedom with respect to the use of resources.

There are different types of tenure arrangements in Bangladesh agricultural economy today. These arrangements influence the efficiency with which inputs are used. They

also affect the degree of uncertainty encountered in the operation of a farm. Although innumerable breakdowns are possible, most tenure arrangements can be placed in one of the three main classes. (Bishop and Toussaint, 1958), as follows:

a) Owner operators;
b) Owner-cum-tenant operators or part owners; and
c) Tenant operators

a) Owner Operators Owner is a rural household (excluding those households, which own only homestead land) that cultivates its own land either with family labor, hired labor, or a combination of both. Such a household does not rent in land from others. An owner farming can be expressed as one where the land is owned by operator himself and who bears all the costs of production including management and supervision. From this point of view though landlord owns some land, he is simply a party who has the freedom to sell, mortgage, lease or transfer, but does not necessarily operate. Owners as a group generally have more freedom in their production plans than any other tenure class. However, in order to obtain ownership, many owners have had to be satisfied with relatively small farms because of the small amount of capital available to them. Ownership does not always guarantee the most efficient organization of resources (Bishop and Toussaint, 1958).

b) Owner-Cum-Tenant This group includes those farmers who own some land and rent additional land in order to enlarge their farming units. Here the interesting feature is that the function of management and ownership is combined. Due to insufficient land, the farmers of this category rent in more land, besides their own land to utilize their fixed resources and equipment including unutilized family labor. Share cropping system is practiced by this category of farmers merely. It is assumed that the number of these farmers is increasing day by day because of intensive pressure of population and poverty.

c) Tenant Operators A tenants is a rural household who has temporary possession of land in accordance with the terms of a written or oral agreement specifying the amount due in cash or in kind from tenant household to the owner(s) of the land. Such a household does not own any land other than homestead land. Thus tenants are those farmers who rent in all of the land they operate. Share croppers, for example, are tenants who pay a particular type of rent, a share of crop. They do not own much, if

any of the farming equipment (Bishop and Toussaint, 1958). A tenant farm is defined as one which is not owned by the operator and the operator cultivates the land on share-rent basis in cash or kind. . Generally two types of tenant arrangements are practiced in Bangladesh crop share or cash basis.

Cash Tenant Operator: A cash tenant is a rural household who has temporary possession of land in accordance with the terms of a written or oral agreement specifying the amount due in cash to the owner(s) of the land. This tenant group paid lump sum amount money to the land owner for using his land. The cash amount is fixed at the beginning of the year and the farmer invests all the inputs and hired labor, casual hired labor or completely landless agricultural labor.

Crop Share Tenant Operator: This group includes those farmers who use the land of land owner by crop share basis. Land owner provide only land and the tenant provide all other input cost to produce boro rice. After harvesting the land owner and the tenant share the output. These arrangements influence the efficiency with which inputs are used. They also affect the degree of uncertainty encountered in the operation of a farm.

At present most of the tenure arrangements can be placed in owner, cash tenant and crop share tenant categories. In the study area tenure arrangements categorized into owner, cash tenant and crop share tenant.

1.3 Objectives of the Study

Overall Objective:

The overall objective of the study will be measure profitability and resource use efficiency of Boro paddy producing farms under different tenurial system and also identify the socioeconomic characteristics of the farmers in the study area.

Specific Objectives:

- To identify the socio-economic characteristics of tenant farmers;
- To assess the profitability of HYV Boro paddy production farmers and compare profitability under different tenure system;
- To estimate the contribution of key inputs to the production processes of HYV Boro paddy production under different tenure system ;
- To measure resource use efficiency of different land tenure system; and
- To suggest some policy guidelines of land tenure system.

1.4 Justification of the Study

Agriculture plays a vital role through employment generation, poverty alleviation, food security enhance, standard of living by increasing income level of the rural people. About 80 percent of the people of Bangladesh live in the rural areas and they depend on agricultural activity. But population is increasing day by day which causes the decrease of farm size in a horrid manner. Land for the people of Bangladesh is the single most important asset. The majority of households in Bangladesh largely depend on land-based activities for their livelihoods. As almost 65 percent of the total population (and above 80 percent of the rural population) were depend on agriculture. In order to meet the demand of food grain for the increasing population and to achieve self-sufficiency in food grain, the government of Bangladesh has given much emphasis on rice production. Significant compositional changes occurred within rice production. The area under study is rice growing area under different tenurial arrangement and this area Boro rice increased by several times over the past two decades due to diffusion of new technologies such as HYV seeds, fertilizer, irrigation, pesticides, power tiller etc. This has definitely changed the cost structure of rice production.

Land is a limited resource and its distribution as well as tenure structures are viewed as key issues in nation's developmental strategy. Bangladesh has a long history of inequitable access to land. Land tenure systems affect agricultural productivity by influencing the efficient use of inputs and adoption of modern technology. The development of agriculture sector is very much urgent for poverty reduction and sustainable development of the country.

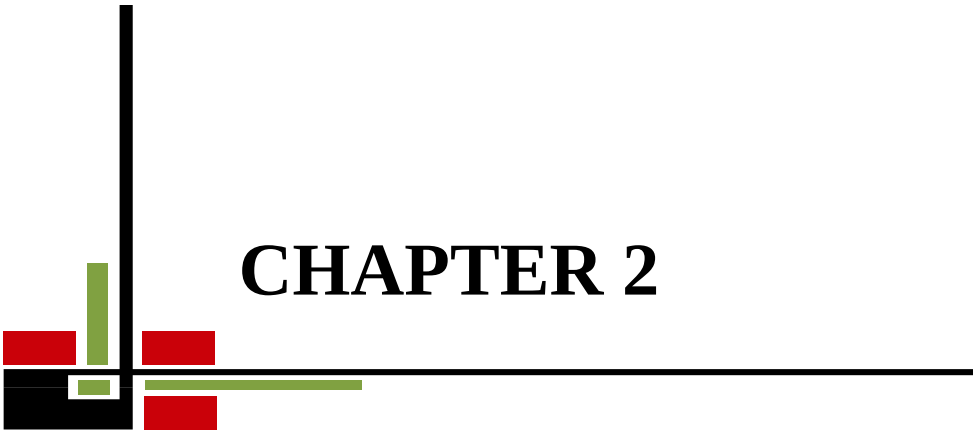
Under such circumstances, compared to past, if rice production under tenurial arrangements is not remunerative for the farmers, they may be disinterested in rice production which has serious implication on the Bangladesh economy as a whole since rice is the main sector in agriculture which still contributes major share in the GDP. To continue rice production in order to meet increasing demand for food grain for the nation whole, farmers' economic incentive for rice production under tenurial systems need to be examined.

So these study attempts to measure profitability and resource use efficiency of Boro rice producing farms under different tenurial system. It also attempts to measure socioeconomic characteristics of the farmers in the study area.

A few field level studies have been conducted on land tenure systems in Bangladesh. The findings of the earlier studies have been very helpful. Moreover, this type of study has not conducted before in my study area. So, further investigations are necessary to help the policy makers in coming to right conclusion, and formulating appropriate policies. Study of such nature will definitely help the policy makers, researchers and Government officials (dealing with food policy) in formulating future strategies for rice production in Bangladesh.

1.5 Organization of the Study

The study has been organized into eight chapters. Chapter 1 describes the introduction of the study along with the objectives and justification. In chapter 2 a review of literature is presented and methodology is described in chapter 3 .description of the study area is included in chapter 4.Chapter 5 represents the socioeconomic characteristics of the tenant farmers. Profitability analysis of Boro paddy is shown in Chapter 6 and Chapter 7 provides Effects and resources use efficiency of inputs used. Finally Chapter 8 presents summary, conclusion and policy recommendations of the study.



CHAPTER 2

REVIEW OF ITERATURE

CHAPTER 2
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 HYV Boro rice production under different land tenure systems. 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:

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-sharecroppers 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.

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 Sharecrop 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.

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.

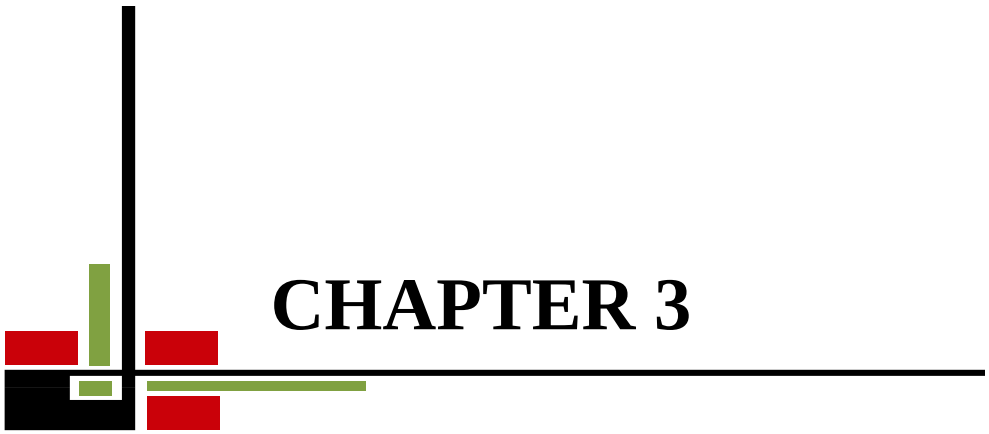
Sarker *et al.* (2010) conducted a study on comparative economic analysis of borrower & non borrower Boro rice farmers in some selected sites of Mymensingh district. They selected one hundred samples from four villages under Trishall upazila. This study has been conducted to examine the differences in 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 5260.80kg &422177.34kg 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%.

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.

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 impact of land tenurial arrangements on HYV Boro paddy production and resource use efficiency on tenurial arrangements 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 and resource use efficiency of HYV Boro paddy production in a less developed area of Bangladesh on the basis of tenancy.



CHAPTER 3

METHODOLOGY

CHAPTER 3
METHODOLOGY

3.1 Introduction

Methodology is a system of broad principles or rules from which specific methods or procedures may be derived to interpret or solve different problems within the scope of a particular discipline .Methodology is not a formula but set of practices.

The study was conducted to measure profitability and resource use efficiency of Boro rice production farmer under different land tenure systems in a selected area of Bangladesh and also to determine socio-economic characteristics of small farmer. Necessary data were collected from the operating farmers of the selected area and analyzed in terms of the objectives set for the study.

This study was based on field level data where primary data were collected from different tenure categories, which produced HYV Boro paddy. There are several methods of collecting this basic information. The data for this study were collected by the survey method. Survey is a research technique in which information is gathered from a sample of people by use of a questionnaire or interview (Zikmond) .The word "survey" refers to a method of study in which an overall picture of a given universe is obtained by systematic collection of all available data on the subject (Efferson, 1963).It is a method of data collection based on communication with a representative sample of individuals. The main reasons why the survey method is preferred to cost:

- Survey through sacrificing a certain details, enables quick investigation of a large number case.
- Survey entails much less cost
- Surveys provide quick, inexpensive, and efficient.

3.2 Selection of Study Area

The selection of the study area is an important step, which largely depends upon objectives set for the study. According to Yang (1962), "the area in which a farm business survey is to be conducted relies on the particular purpose of the survey and possible cooperation from the farmers and other respondents." The aim of the present study is to determine profitability and resource use efficiency of different tenures on

production of HYV Boro rice. For selection of the study area, the researcher visited several villages namely Aruyakandi, Baroipara and Habibpur under Shailkupa Upazila of Jhenidah district. These three villages have similar types of land and soil characteristics and grow mainly irrigated Boro rice in boro season. These areas were selected for some other reasons such as:

- Availability of a large number of small farmers.
- Study of this type was conducted previously in the study area.
- Easy accessibility and good communication facilities in these villages.
- Researcher herself was fairly well known to the local customs and practices and was able to speak the farmers' language. A good cooperation was expected from the respondents.

3.3 Preparation of Survey Schedule and Pre-testing

The survey schedule was designed in accordance with the objectives of the research. Data were collected from the operating farms by survey method through personal interview with the farmers for which necessary schedules were to prepare. Survey schedule was prepared for the study. Information about farmers fixed resources, farm income and detailed information about production of HYV Boro rice such as acreage grown, use of inputs such as labor, seed, manures, fertilizers, water, pesticides including their prices were collected. The schedules were tested prior to implementation and were improved for applicability in the actual field conditions.

3.4 Selection of Sample

The main purpose of sampling is to select a small group which will represent a reasonably true picture of the population. The size of the sample depends on a number of factors like variability in local conditions, degree of precision required, and the types of tabulation desired, the funds, the personnel and the time available for research. However, two factors need to be considered before selecting a sample .First one relates to the sample size which should be large enough to allow for adequate degrees of freedom in the statistical analysis. On the other hand, administration of field research, processing and analysis of data should be manageable within the limitation imposed by physical, human and financial resources (Mannan, 2001).

So, the selection of sample size was one of the crucial aspects for the study. A reasonable size of sample to achieve the objectives of the study was followed in this

study to collect relevant data and information. In total 90 farmers of three categories were selected. Although classification of tenure category is a controversial issue and there can be a variety of tenure categories depending on the criteria used, major tenure categories associated with the HYV Boro paddy production in the selected area were found to be as follows:

i. Owner operators ,those were cultivating all of their own land:
ii. Cash Tenant Operator, those have temporary possession of land in accordance with the terms of a written or oral agreement specifying the amount due in cash to the owner(s) of the land. This tenant group paid lump sum amount money to the land owner for using his land. In this tenancy the tenants uses all inputs and get all of the outputs.
iii. Cash Share Tenant Operator, those farmers who use the land of land owner by crop share basis. Land owner provide only land and the tenant provide all other input cost to produce boro rice.

It was found that most of the farmers of this area are small farmer and they cultivate land excluding household not less than .2ha and not above 1 ha. Considering all these aspects 30 farmers from each tenurial status were selected randomly (Table 3.1).

Table 3.1 Distribution of Sample Farmers According to Tenurial Categories

Tenure Categories	Aruyakandi (Nos.)	Baroipara (Nos.)	Habibpur (Nos.)	Total (Nos.)
Owner	15	8	7	30
Cash Tenant	10	10	10	30
Crop Tenant	12	10	8	30
Total	37	28	25	90

Source: Field Survey, 2014

3.5 Period of Data Collection

Data were collected by the researcher himself through personal interviews with the respondents. Data were collected during the period from July to September, 2014.Prior to final data collection the interview schedule was pre-tested by collecting information from selected samples.

3.6 Data Collection and Accuracy of Data

Generally most of the farmers did not keep their written records on annual, monthly or daily transaction and activities. It was very difficult to collect actual data. Because the information of the farmers was supplied from their memory and the researcher had to rely solely on the memory of the farmers. To overcome this problem, all possible efforts were made by the researcher himself to ensure the collection of reasonably accurate information from the field on recall basis. So, it has not been possible to apply any other method of investigation such as cost or financial accounting which would require detailed and accurate information based on properly kept records and accounts. Survey method has the advantage that it facilitates quick investigation and involves less cost. In order to collect relevant information before taking interview, the whole academic purpose of the study was clearly explained and made clear to the sample respondents. . The researcher himself collected the relevant data from the selected tenant farmers through face to face interview .At the same time of interview, the researcher asked questions systematically and explained whenever felt necessary. Data so collected were checked and verified in the field for accuracy and consistency.

3.7 Analysis of Data

Data collected were classified, tabulated and analyzed in terms of the objectives set for the study. Both tabular and statistical techniques were used to find important relationships among the relevant variables.

Tabular Technique: Tabular technique of analysis is generally used to find out the crude association or difference between two variables. In this study tabular technique was used to illustrate the whole picture of analysis. The sum, gross returns etc. of this technique is based on arithmetic average.

The advantages of tabular analysis are:

- Computation of data involves less work; and
- It illustrates the whole picture of analysis as well as the results of analysis.

Analytical Technique

Profitability Analysis: Seven variables such as cost of seedling, animal labor and power tiller, human labor, fertilizer, manure, irrigation and pesticide in producing

HYV Boro rice will be considered for Profitability analysis as well as Cobb-Douglas production function. Profit function of the following algebraic form will be used in this study,

$$\text{Profit } (\pi) = \sum_{i=1}^{n} (P_{yi}.Y_i) - \sum_{i=1}^{n} (P_{xi}.X_i) - \text{TFC}$$

Where,

Π= Net Return,

P_{yi}= Price per unit of the ith produce

Y_i= Quantity of the ith produce

P_{xi}= Price per unit of the ith inputs

X_i = Quantity of the ith inputs

TFC= Total Fixed Cost.

Multiple Regression Analysis: The general purpose of multiple regression analysis (the term was first used by Pearson, 1908) is to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable. For example, the yield of Boro rice per hectare depends upon quantity of seed, human labor, fertilizer, irrigation water used etc. It enables us to study the individual influence of these variables on yield. The most common form of multiple regression analysis, i.e., Cobb-Douglas revenue type production function has been used in the present research.

Cobb-Douglas Production Function: For determining the effect of variable inputs to the production of HYV Boro paddy in different tenurial arrangements, Cobb-Douglas production function chosed on the basis of best fit and significance result on output. In this model, yield per hectare was considered as the dependent variable. The functional form of the multiple regression equation is as follows:

$$Y= a\, X_1^{b1}\, X_2^{b2}\, X_3^{b3}\, X_4^{b4}\, X_5^{b5}\, X_6^{b6}\, X_7^{b7} + U_i$$

For the purpose of the present empirical exercise, the Cobb-Douglas production function was converted into the following logarithmic (Double log) form:

$$\ln Y= \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + U_i$$

Where,

Y = Per hectare yield of HYV Boro paddy (Tk. /ha)

a = Intercept

X_1 = Quantity of seed in producing HYV Boro paddy (Kg/ha)

X_2 = Cost of animal labor and power tiller (Tk. /ha)

X_3=No. of human labor (man days/ha)

X_4= Quantity of fertilizer in producing HYV Boro paddy (Kg /ha)

X_5= Quantity of manure in producing HYV Boro paddy (Kg/ha)

X_6=Cost of irrigation in producing HYV Boro paddy (Tk. /ha)

X_7= Cost of pesticide in producing HYV Boro paddy (Tk. /ha)

b_1,b_2……b_7=Coefficient of relevant variables.

Ui=Disturbance term

ln=Natural logarithm.

Cobb-Douglas form of production function has the following advantages.

- $\frac{dy}{dxj} = \frac{bj}{xj}$ y [ify = f(xj)]
- Elasticity of Y upon xj can be easily read out from bj.
- In Cobb-Douglas production function, returns to scale can be easily calculated by simply summing up the elasticity of Y with respect to Xj.
- This form of production function explains that agricultural production operates under either constant increasing or decreasing returns to scale.

Production function analysis was done to determine the resource use efficiency and productivity of HYV Boro rice producing small farmers. Cobb-Douglas function was fitted to determine the impact of selected inputs on productivity of HYV Boro rice. Marginal productivity of selected inputs was calculated to ascertain the level of efficiency of individual input use.

Efficiency of Resource Allocation

In order to test the efficiency the ratio of Marginal value product (MVP) to the Marginal Factor Cost (MFC) for each input is computed and tested for its equality to 1.i.e; $\frac{MVPxi}{MFCxi} = 1$

The marginal productivity of a particular resource represents the additional to gross returns in value term caused by an additional one unit of that resource, while other

inputs are held constant. When the marginal physical product (MPP) is multiplied by the product price per unit, the marginal value product (MVP) is obtained. The most reliable, perhaps the most useful estimate of MVP is obtained by taking resources (Xi) as well as gross return(Y) at their geometric means (Dhawan and Bansal, 1977).

In these studies the MPP and the corresponding values of MVP were obtained as follows:

$MPPXi*P_{yi} = MFC$

Where,

MPP Xi*Pyi =MVP But,MPP = bi*(Y/Xi)

So,MVP =bi*(Y/Xi)Pyi

Where,

bi = Regression co-efficient

Y = Mean output

Pyi = Price of output

MFC = Price per unit of input

Thus when Resource use efficiency (RUE) =1, resources are optimally utilized, when RUE < 1, resource are over utilized and when RUE > 1, resource are under -utilized.

3.8 Specifications of Variables

The relative efficiency of alternative forms of tenure was to be ascertained on the basis of different measures of enterprise incomes of the farmers falling into different tenure categories. This required specification and measurement of variables in the form of input used and output received in the production of Boro paddy. Inputs used included human labor, animal power, different materials used and output was yield per hectare of crop and by-product. Different input and output figures were multiplied by the average prices of the tenure groups to get cost and return figures for producing HYV Boro paddy but since no cash payment was made for the home-supplied inputs, the costs of these inputs were stir by using opportunity cost principle

In determining the opportunity cost of an individual input the relevant input price is the value forgone by replacing this input from another enterprise (Bishop and

Toussaint, 1958) in calculating the gross expenses the following components of costs were considered.

3.8.1 Cost of Seed/Seedling

In the study area, farmers used both home supplied and purchased seedling. The cost of purchased seed/seedling was calculated on the basis of actual price paid by the farmers. The cost of home supplied seedling was estimated at the prevailing marketing price. The source of Boro seeds were BRAC, Upazila Krishi office and BADC and local bazar in the study area.

3.8.2 Cost of Animal Power and Power Tiller

Animal power cost for producing HYV Boro rice was calculated by taking account of the actual pair day of animals multiplied by price per pair day. It was difficult to calculate the cost of animal power in the sense that animals are used along with human labor and also in most cases with some implements. Keeping the above considerations in mind, farmers were asked about how many animal pair day per unit of land were used for producing HYV Boro rice. The reasonable rate per animal pair days used was multiplied by cost per pair day to arrive at animal power cost for production HYV Boro rice. The cost of pair day was considered at the prevailing rate in the study area. For quick land preparation particularly for Boro rice the use of power tiller is very important. The payment involves charge for the use of the power tiller and the driver. It was very difficult to separate the cost for power tiller and the driver. The cost of power tiller per cultivation was considered at the rate prevailing in the study area.

3.8.3 Human Labor

Human labor, both family and hired labor, for production of HYV Boro rice included total man-day spent on various operating for producing the crop such as land preparation, sowing/planting of seed weeding, manuring, fertilizering, harvesting, threshing, carrying, etc. One man day consists of 8 hours of work, by an adult man. Child and woman labor was converted into man equivalents by assigning appropriate ratios. This was per formed as follows (Yang, 1965):

1 adult man = 1.5 adult woman 2 children

Total man-day used per unit of land was multiplied by the market wage rate to arrive at human labor cost for producing HYV Boro rice. Thus opportunity cost of unpaid

family labor was considered equal to the market wage rate for calculating human labor cost.

3.8.4 Cost of Fertilizer

Chemical fertilizers which included urea, Triple super phosphate, Potash and Zinc, were charged according to the actual price by the farmers for the respective fertilizer.

3.8.5 Cost of Manure

Most of the farmer used home supplied manures which was mostly cow dung. The price of cow-dung was charged for each farm on the basis of information provided by the farmers.

3.8.6 Cost of Irrigation

In the study area farmers mostly used shallow pump and motor pump for irrigation. The cost of water was charged at fixed rate for the season on the basis of per unit of irrigated land for power pump. Sometimes cost of water was paid by paddy.

3.8.7 Cost of Pesticides

In the study area, Boro rice growers used pesticides, such as, Basudin, Dimecrone, Sumithion, Biter, Furadan, Marshal, Diazinon, etc. The costs of pesticides were computed on the basis of the actual price paid by the farmers.

3.8.8 Interest on Operating Capital

Interest on operating capital was determined on the basis of opportunity cost principle. The operating capital actually represented the average operating cost over the period because all costs were not incurred at the beginning or at any single point of time. The cost was incurred throughout the whole production period; hence at the rate of 10 percent per annum interest on operating capital for six months was computed for boro paddy. Interest on operating capital was calculated by using the following formula (Miah and Hardekar, 1988)

IOC= AIit

Where,

IOC= Interest on operating capital

i= Rate of interest

AI= Total investment / 2

t = Total time period of a cycle

3.8.9 Land Use Costs

In the study area the cost of land was different to plots depending on location, topography and fertility of the plots. It also varies from one season to another, i.e., from kharif to Rabi season. Land use cost was calculated on the basis of opportunity cost of the use of land per hectare for the cropping period of six months. In this study, the cost of land use was considered as cash rental value of land.

3.9 Calculation of Returns

3.9.1 Gross Return

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

3.9.2 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

3.9.3 Net Return

Net return 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 profit equation discussed earlier in this chapter was used to assess the profitability of HYV Boro paddy production farmer.

3.9.4 BCR (Benefit Cost Ratio)

BCR is the ratio of present worth of benefit and present worth of cost. It indicates the benefit of per unit cost at present worth. BCR was calculated by using the following formula-

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

3.10 Problems Encountered in Collecting Data

The researcher had to face the following problems in collecting data from the field:

i. Generally most of the farmers did not keep their written records on annual, monthly or daily transaction and activities. It was very difficult to collect actual data. Because the information of the farmers was supplied from their memory and the researcher had to rely solely on the memory;

ii. Most of the respondent were illiterate which caused another problem to data collection to the researcher;

iii. Sometimes respondent could not answer to questions accurately and to the point;

iv. The farmers were afraid of imposition of taxes and they always tried to avoid providing true information relating to the actual size of holding and income;

v. The farmers usually remain busy with field work. So, the researcher had to visit some of them even at the field and researcher sometimes had to pay more than two visits to meet the farmer which was very time consuming;

vi. Most of the tenant farmers do not want to give proper or accurate information about input used in their rented in land.

CHAPTER 4

DESCRIPTION OF THE STUDY AREA

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4.1 Introduction

For any research study it is necessary to know the physical feature of the study area because it provide overall scenario of agriculture. It provides topography, soil condition climate, temperature and rainfall, occupation of the villagers, communication and marketing facilities and cropping patterns of the study area. The aim of this chapter is to present a brief description of the study area and to provide an outline of its current agricultural status.

4.2 Physical Feature of the Study Area

4.2.1 Location

Jhenaidah was upgraded into a full fledged zilla in 1984. Before its birth as zilla it was a sub-division of greater Jessore district. There is hearsay that in the long past the area become prominent for collection of "Jhinuk" from the river Nabagonga & burning (Meaning "Daha" in Bangali) them for the production of Calcium. The Zilla might have derived is name as Jhenaidah from the above words. The zilla is bordered on the north by kushtia and Rajbari Zilla, on the east by Magura zilla, on the south by Jessore Zilla & on the west by Chudanga & partly by India (Fig 4.1). The Zilla stands between 23^0.13' & 23^0.46' north latitude & between 88^0.42' & 89^0.23' longitudes. In size it is 1964.77 sq.km of which 33.80 sq. Km is reveries. It holds 1.73% of the total area of the zilla. In respect of area, the zilla shows 5^{th} among the 10 zilla of the Khulna Division and 34^{th} position among the 64 zilla of the country. The areas selected for the study were Aruyakandi, Habibpur and Baroipara villages of Shailkupa Upazila in Jhenaidah district. Shailkupa Upazila is bounded by Khoksa and Kumarkhali Upazila on the north, Jhenidah Sadar and Harinakunda Upazila on the south, Pangsha and Srepur (Magura) Upazila on the east, Kushtia Sadar and Harinakunda Upazila on the west (Fig4.2).The total area of Shailkupa Upazila is 373.42 sq. km.

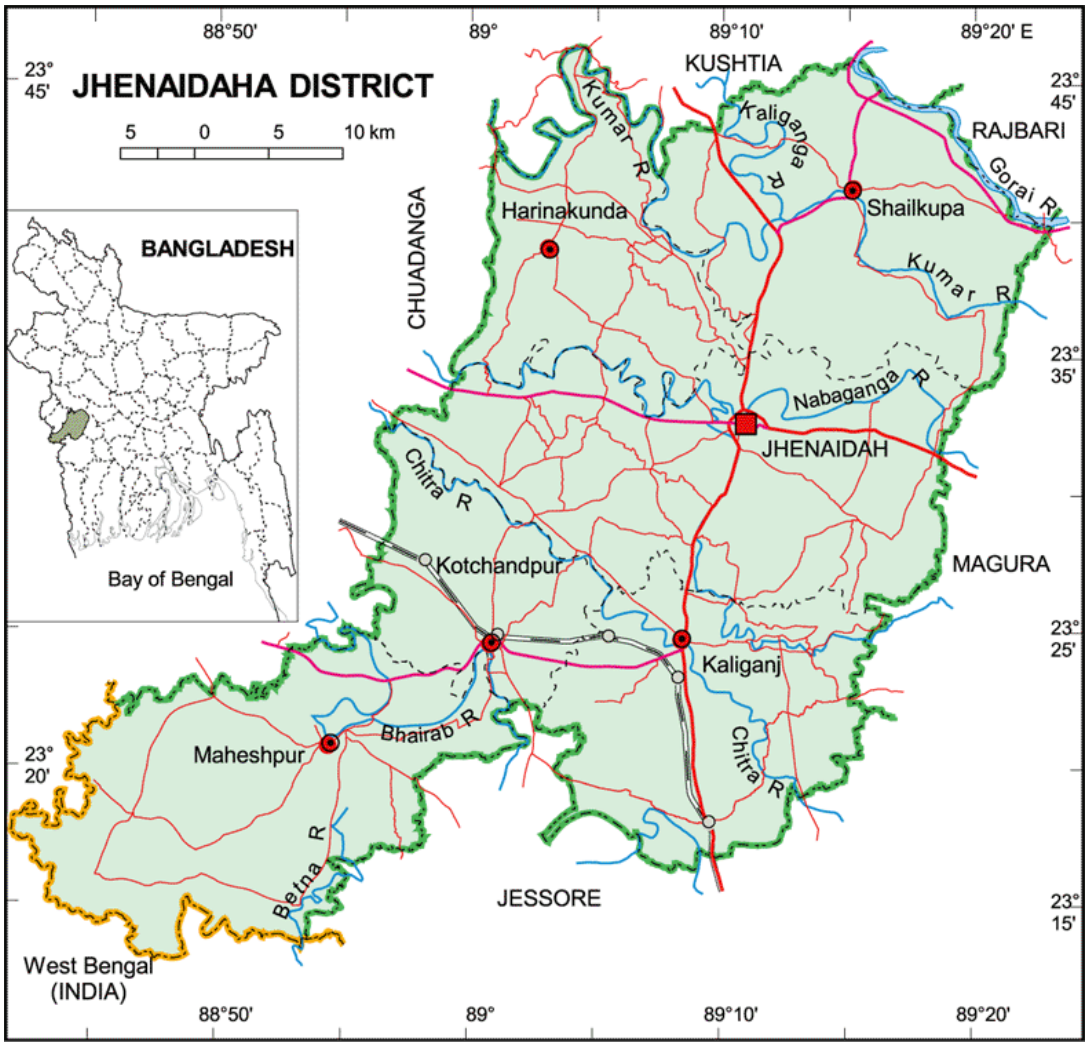

Figure 4.1: Geo-Code of Jhenaidah District

Source: Adapted from wikipedia.com

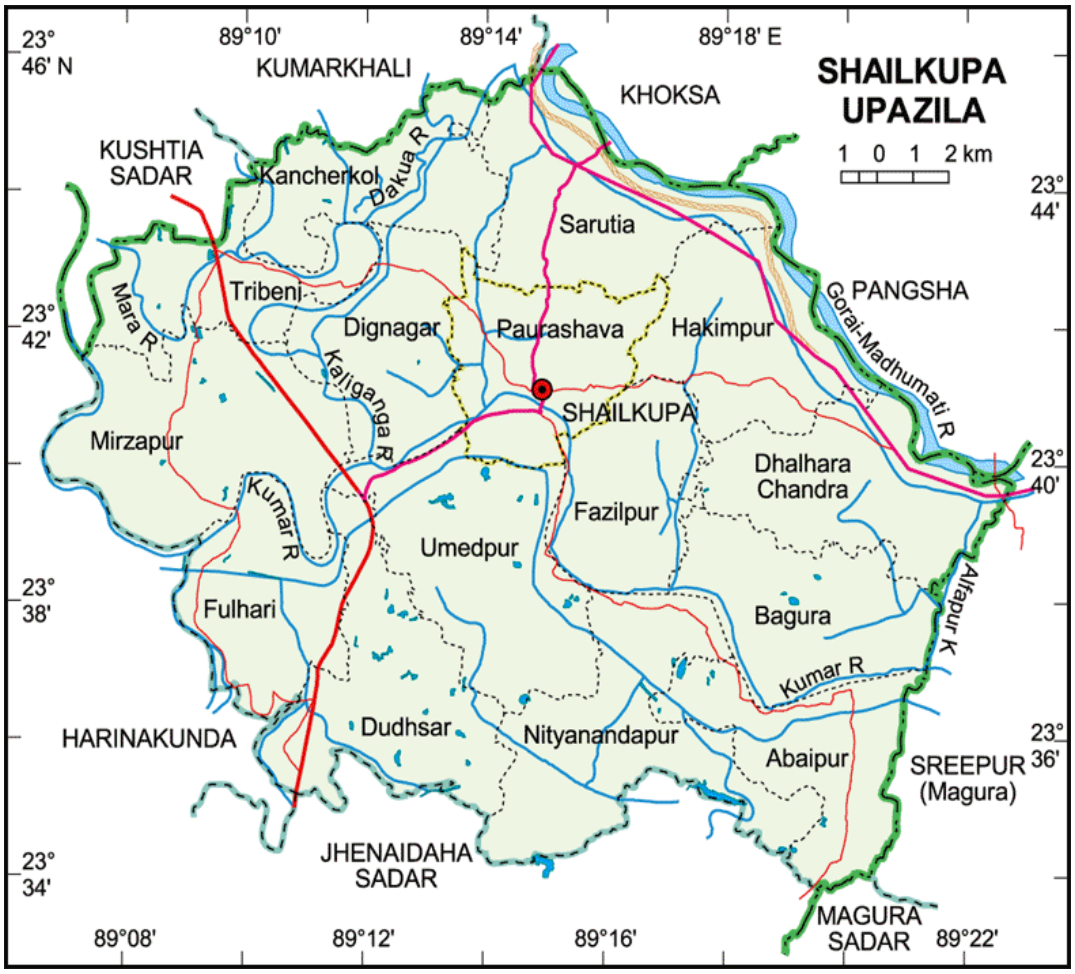

Figure 4.2: Geo-Code of Shailkupa Upajila

Source: Adapted from wikipedia.com

4.2.2 Soil Condition

The soil of the zilla is mainly categorized into two types,

1) Silty clay loam of the old Ganges meander flood plain and

2) Silty clay loam of the mixed young & old Ganges meander flood plain. Loamy soil in both categories are permeable & well structured small saline or alkali patches occur on ridges in the southern part of the zilla. Along the river valleys, the Silty clay loam of the mixed young and old Ganges mender flood plain is suitable for the cultivation of Rabi corps, Aus and vegetables.

4.2.3 Climate, Temperature and Rainfall

The climate of the zilla is characterized generally with a tropical monsoon which experiences comparatively high temperature and Considerable humidity. The summer steps in mid April and continues till mid June which bears a very hot weather. The maximum & minimum average Temperatures usually vary between 37.1^0C to 11.2^0C Rainy Season Sets in mid June & Continues till August. Maximum rainfall in generally experienced during the month of July and August. The average annual rainfall in the zilla as recoded 1467 mm. (BBS, 2011)

Table 4.1 Monthly Temperatures, Humidity and Rainfall of Jhenaidah District for 2011

Name of Months	Maximum Temperature (^{0}C)	Minimum Temperature (^{0}C)	Average humidity (%)	Rainfall (mm)
January	11.2	12.8	82	000
February	13.1	15.8	76	007
March	20.8	18.7	75	034
April	23.3	24.5	71	000
May	24.2	25.4	70	185
June	25.7	26.5	81	241
July	26.0	26	86	277
August	26.1	25.7	83	418
September	25.3	25.6	85	094
October	22.3	22.0	82	002
November	16.9	17.5	81	000
December	14.6	11.1	88	000

Source: BBS, 2011

4.2.4 Area, Population and Household

According to the population & housing census 2011 total number of households of the Jhenaidah Zilla was at about 422 thousand and the population was 1771304 which was 1.05 percent of total population of the country. The density of population is 900 per sq. km. The percentages of Male & Female population were 51% and 49% respectively. Shailkupa Upazila of Jhenidah district occupies an area of 373.42 sq.km out of total population35271 and the density of population is 968 per sq. km. Male constitute are 51.43 percent and females 48.57 percent. The literacy rate of Shailkupa upazila is 54.1(Table-4.2).

Table 4.2 Area, Population and Literacy Rate of Shailkupa Upazila

Name of the Upazila	Area in (Sq.Km)	Population	Total Cultivated Land	Fallow Land	Cropping Intensity	Male	Female	Literacy Rate (%)
Shailkupa	373.42	35271	29730.06	15288.45	165	51.43	48.57	54.1

Source :(Population & Housing Census, BBS, 2011)

Table-4.3 shows that total household in Jhenaidah district were 108924 and the study area of Shailkupa upazilla were 83348.The number of union and mouza of Jhenaidah and Shailkupa upazilla were 17, 14 and 268,181 respectively.

Table 4.3 Household, Union/Ward & Mauza of Jhenidah zilla

Name of Upazila	**Area in (Sq. Km)**	**No. of Union**	**No. of Mouza**	**No. of Households**
Jhenaidah	1964.77	17	268	108924
Shailkupa	373.42	14	181	83348

Source :(Population & Housing Census, BBS, 2011)

4.2.5 Transportation, Communication and Marketing Facilities

Transport, commutation and marketing facilities are the main agricultural infrastructure, which play an important role in agricultural development of a particular region. Communication of the study villages with Jhenaidah district and Shailkupa Upazila headquarters is facilitated by pucca 180 km, semi pucca 100 km, mud road

6000km, water ways 22 nautical miles. The village is easily accessible by rickshaws, votvoti, bi-cycles, motor- cycles, motor cars, vangari, etc. Therefore the marketing facilities of these village areas are reasonably developed. The local markets are situated within a short distance from the village. There are two bazaars and two hats outside the village. The growers often sell their products directly to the markets and transport system was reasonably developed so local farmers can easily sell their products at district market. The rich farm sells different crops from their houses or from farms.

4.3 Occupation of the People

In Shailkupa Upazila 80 percent of the households depend on agriculture as the main source of household income and other sources of household income are non agricultural labor, business and employment in government and non-government agencies. Main occupations include agriculture 48.14 percent, agriculture labor 23.17 percent, wage labor 2.67 percent, commerce 11.26 percent, service 4.41 percent, transport 2.1 percent, others 8.35 percent.

4.4 Agricultural Land ownership, Crops and Cropping Pattern

In Shailkupa Upazila total cultivable land is 29730.06 hectares, of which fallow land is15288.45 hectares. Among the peasants, 39 percent are medium, 28 percent are large, 23percent are small and 10 percent are landless. Cultivable land per head is 0.10 hectare and cultivable land under irrigation 53.12%. In the study area, rice is the principal crop which is grown in three traditional seasons namely, Aus, Aman, and Boro. Among of these transplants Aman and Boro are the most important rice crops. Besides, the other winter crops namely, jute, wheat, mustard, pulses and vegetables like Brinjal, cucumber, bottle gourd, bean, tomato, lalshak, spinach, cabbage, cauliflower, etc. are also grown in the village. However, major fruits such as mango, jackfruit, litchi, banana, guava, coconut, and papaya are also grown in home-yards of the study area. Boro paddy was the most important crops of the village. It covers more than 60 percent of total land area during the Boro season. Transplanted Aman covered about 70 percent of the study area in Aman season but yield (t/ha) of Boro rice is 1.66 and Aman is 1.36 which is less than Boro. Jute is grown on under medium high land and it’s got priority in this study area after rice. The farmers usually grow two or three crops in a year. The cropping intensity was thus 199 percent in 2008. Mustard, wheat

and vegetables were grown in the medium high land. Boro was grown between Januarys to mid May. Aus grown between mid May to August and Aman was grown between Septembers to December.

4.5 Use of Modern Technology

Modern technology namely shallow tube well, irrigation, modern varieties of seeds, fertilizer, insecticides are widely used in the study area. STWs and electric motors are mainly used for watering HYV Boro rice fields in the Study area.

4.6 Farm Size

Based on the total cultivated land farm size were divided in three categories included small farm, medium farm and large farm. Under Small farm cultivable land excluding household is not less than .2 ha and not above 1 ha was considered. Area under 1.0-3.0 hectares considered as medium farm and household above 3.0 hectare considered as large farm.

CHAPTER 5

SOCIO-ECONOMIC CHARACTERISTICS OF THE SAMPLE FARMERS

CHAPTER 5
SOCIOECONOMIC CHARACTERISTICS OF THE SAMPLE FARMERS

5.1 Introduction

Social scientists use socio economic characteristics as an umbrella term to cover a wide variety of interested social and economic factors .Socio factors refers to any number of demographic and social conditions such as the age structure, racial compositions ratio, maritual status etc. Economic refers to the economic condition such as income, employment rate etc. They often use socio economic characteristics as a means of predicting behavior. So socioeconomic characteristics depends on a combination of variables, including occupation, education, income, maritual status, wealth's ratio, place of residence and so on. These characteristics affect the production pattern of the farmer. This chapter provides information on socio-economic characteristics of the tenant households (owner, cash tenants and crop share tenants) .So for getting the socioeconomic characteristics of the sample farmer some of the characteristics have been taken into consideration for discussion.

5.2 Distribution of Respondents According to Age

In the present study, all categories (owner, cash tenant and crop share tenant) of farmers of the study area were classified into different age groups such as: 15-30 years, 30 to 40 years, 40 to 50 years and above 50 years (Table 5.1). Among owner farmer, the highest number of farmers (50.00 percent) belonged to age group 40-50 years. On the other hand, the highest number of cash tenant farmer and crop share farmer were (47.00 percent) and (38.00 percent) respectively, also belonged to the age group of 40-50 year. This information imply that the major portion of all categories of farmers fell into age group 40-50 years, indicating that they were in a position to put more physical effort to paddy production.

Table 5.1: Age Distribution of Respondents

Age Group(years)	Owner		Cash Tenant		Crop Share Tenant		All Farmers	
	No.	Percent (%)	No.	Percent (%)	No.	Percent (%)	No.	Percent (%)
15-30	3	10	2	7	5	17	10	11.11
30-40	9	30	8	26	12	40	29	32.22
40-50	15	50	14	47	9	30	38	42.22
Above 50	3	10	6	20	4	13	13	14.44
Total	30	100	30	100	30	100	90	100

Source: Field Survey, 2013

5.3 Educational Status of the Respondents

Education was defined as the ability of an individual aged above 6 years to read and write or formal education received up to certain standard. The government and various organizations placed greater emphasis and extend special facilities (like free education, stipend etc) for increasing the literacy rate. Education helps a person to have day to day information about the modern techniques, production costs and also production in his field.

To examine the educational status of owner, cash tenant and crop share tenant farmers, the educational status of the sample farmers were divided into five categories. These were (i) illiterate; (ii) signature ability only; (iii) Primary level (class I-V); (iv) secondary level (VI to X); and (v) above secondary level of education. Those who cannot put signature, read and write were considered as illiterate.

Table 5.2: Education Levels of Respondent

Education	Owner		Cash Tenant		Crop Share Tenant		All	
	No.	Percent (%)	No.	Percent (%)	No.	Percent (%)	No.	Percent (%)
Illiterate	1	3.33	4	13.33	5	16.67	10	11.11
Signature only	5	16.67	7	23.33	9	30	21	23.33
Up to Primary	9	30	10	33.33	11	36.67	30	33.33
Up to Secondary	11	36.67	7	23.33	4	13.33	22	24.44
Above Secondary	4	13.33	2	6.7	1	3.33	7	7.8
Total	30	100	30	100	30	100	90	100

Source: Field Survey, 2013

It is evident from the (Table 5.2) that about 3.33, 13.33 and 16.67 per cent of owner, owner-cum-tenant and tenant farmers respectively, were illiterate having no formal or informal education. About 16.67, 23.33 and 30 per cent of owner, cash tenant and crop share tenant farmers were able to sign, respectively. Again, it reveals that owner, cash tenant and crop share tenant farmers completing up to primary level were 30, 33.33 and 36.67 percent and 13.33, 6.7 and 3.33 percent had above secondary level education. It is observed from the table (5.2) that owner farmers had higher level of education than the other categories of farmers.

5.4 Distribution of Family Members by Literacy

Table 5.3and figure 5.1 shows the educational level of family members including respondent. It is observed from the illiteracy rate of the family members of owner farmers better than other farmers. About 31.41 percent crop share tenant farmer is

illiterate which is greater than cash tenant farmer (24.85%) and owner farmer (14.92%). It may also be noted that on average highest 29.56 percent farmers can only write their name. Owner, cash tenant and crop share tenant farmers completing up to primary school (class-1 to V) constituted 34.78, 24.26 and 19.37 percent and about 16.15, 11.24 and 6.81 percent respectively, had up to secondary level of education . Taking all respondents together, 11.13 percent family members have up to secondary level and 6.91 percent family members have above secondary. It may also the noted that on average secondary and above secondary level education have higher in owner farmers than the members of cash tenants and crop share tenant farmers.

Table 5.3 Educational Level of the Family Member

Education	Owner		Cash Tenant		Crop Share Tenant		All	
	No.	Percent (%)	No.	Percent (%)	No.	Percent (%)	No.	Percent (%)
Illiterate	24	14.92	42	24.85	60	31.41	139	26.68
Signature only	37	22.98	57	33.73	73	38.22	154	29.56
Up to Primary	56	34.78	41	24.26	37	19.37	134	25.72
Up to Secondary	26	16.15	19	11.24	13	6.81	58	11.13
Above Secondary	18	11.18	10	5.92	8	4.19	36	6.91
Total	161	100	169	100	191	100	521	100

Source: Field Survey, 2014

5.5 Average Family Size and Composition

In the present study, family size (members) has been defined as total number of persons living together and taking meals from the same kitchen under the administration of the same head of the family. The family members include wife, sons and unmarried daughter, parents, etc. Again, persons who have been employed in a family for household works like servants, caretakers etc., are excluded from the family members in the present study. Table 5.4 reveals family size, age and sex distribution of the sampled households. All the family members of tenant households were classified into the following age groups:

i. Infant(below 5 years);
ii. Child(between 5.00-15.00 years);
iii. Working member(between 15.00-55.00 years);and
iv. Old (above 55 years).

Table 5.4 Average Family Size and Age Composition of Family Members

Age Groups	Owner			Cash Tenant			Crop share Tenant		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Below 5	6	9	15	5	9	14	10	9	19
5.00-15.00	22	18	40	18	19	37	25	26	65
15.01-55..00	49	43	92	56	38	94	58	35	79
Above 55	8	6	14	11	13	24	14	18	32
Total	85	76	161	90	79	169	107	88	195
Average	2.83	2.53	5.4	3	2.63	5.63	3.57	2.93	6.5

Source: Field Survey, 2014

Table 5.4 reveals that average family size of owner farmers was 5.4, cash tenant farmer was 5.63 and crop tenant farmer was 6.5. So the table clearly indicates that crop tenant farmers had a higher family size than other farmers. It appears that the number of working members (between 15 to 55 years) for both farm families was relatively higher than family members in other age groups. So they have the vast

potential human resources to engage in different income generating activities and to increase the productivity as a whole.

5.6 Occupational Status of Sample Farmers

Agriculture is the main occupation of most of the farmers in the study area. Besides agriculture, some farmers were engaged in other occupations like, small business, services, rickshaw/van pulling, day labors and others.

Table 5.5 Occupational Status of Sample Farmers

Occupation	Owner		Cash Tenant		Crop Share Tenant	
	No.	Percent	No.	Percent	No.	Percent
Main Occupation						
Agriculture	20	66.67	24	80	27	90
Small Business	6	20	-	-	1	3.33
Service	4	13.33	2	6.67	-	-
Driver	-	-	-	-	-	-
Day Labor	-	-	4	13.33	2	6.67
Others			-	-	-	-
Total	30	100	30	100	30	100
Subsidiary Occupation						
Agriculture	10	33.33	6	20	3	10
Small Business	9	30	5	16.67	5	16.67
Service	2	6.67	-	-	-	
Driver	-	-	5	16.67	6	20
Day Labor	-	-	9	30	12	40
Others	9	30	5	16.67	4	13.33
Total	30	100	30	100	30	100

Source: Field Survey, 2014

Table 5.5 shows that 66.67 percent owner farmers were engaged in agriculture, 20 percent in small business and 13.33 percent in services as their main occupation. In the case of cash tenant farmer 80 per-cent farmers were engaged in agriculture 6.67

percent in services and 13.33 percent in day labor as their main occupation. About 90 percent crop share tenant farmers were involved in agriculture as their main occupation of and 3.33 percent in small business and 6.67 per cent of crop share tenant farmers were engaged as day labor as main occupation.

But for subsidiary occupation only 10,6 and 3 percent owner, cash tenant and crop share tenant farmer respectively, depend on agriculture .About 30 percent of cash tenant farmers was engaged as day labor as their subsidiary occupation, whereas this was 40 per cent in crop share tenant farmers. None of owner farmers was engaged as day labor. About 30 percent owner farmer depend on small business as their subsidiary occupation and only 16.67 percent cash tenant farmer and crop share tenant farmer depend on small business as subsidiary occupation. The occupational status of family members including responded of different tenure groups are presented in Table 5.6 It shows that Agriculture is the main occupation which was 29.81 percent, 35.50 per cent and 35.08 percent for owner, cash tenant and crop share tenant farmers, respectively.

5.7 Average Annual Income

The average annual income of owner, cash tenant farmer and crop share tenant were Tk 97800, Tk78450 and Tk 58700, respectively. From the table 5.6 it was observed that owner annual income is higher than other farmer .The dependency on agriculture were higher of crop share tenant farmers than other farmers which were 80.41, 79.03 and 76.68 percent respectively. The subsidiary income of owner, cash tenant farmer and crop share tenant were 23.32, 20.97 and 19.59 percent, respectively. The subsidiary incomes of owner farmers were higher than other farmers.

Table 5.6 Average Annual Income of Sample Farmers

Source	Owner	Cash Tenant	Crop Share Tenant
	Amount(Tk/year)	Amount(Tk/year)	Amount(Tk/year)
Main	75000(76.68)	62000(79.03)	47200(80.41)
Subsidiary	22800(23.32)	16450(20.97)	11500(19.59)
Total	97800(100)	78450(100)	58700(100)

Source: Field Survey, 2014

Note: Figure within parenthesis indicates percentages.

5.8 Land Ownership Pattern and Farm Size

According to Yang (1965) farm size refers to the entire land area operated by the operator. The land holding of the respondents are categorized into several categories such as homestead land, own land in cultivation, rented in, mortgage in, current fallow land, pond, rented out and mortgage out. Table 5.7 reveals that the average farm size of owners was .564 ha while it was .50 ha decimal for cash tenant and .377 ha for crop share tenant farmers. The farm size of owner and cash share tenant farmer was higher than crop share farmer. Homestead area is big in owner farmer than cash and crop share farmer and crop share farmers have more tendency to mortgage out of their land for any financial crisis. The average farm size was calculated using the following formula:

Average Farm Size= Own Land + Rented/Leased in + Mortgaged in + Current Fallow Land +Pond– Rented/Leased Out – Mortgaged Out

Table 5.7 Average Land Holding of Farm Families (ha)

Types of Land	Owner	Cash Tenant	Crop Share Tenant
	Area	Area	Area
Homestead	0.025	0.019	0.018
Own Land in Cultivation	0.511	-	-
Rented in	-	0.461	0.304
Rented Out	-	-	-
Mortgage in	0.024	0.015	0.04
Mortgage Out	0.009	0.012	0.021
Current Fallow Land	0.002	0.002	0.007
Pond	0.002	0.003	0.008
Average Farm Size	0.564	0.50	0.377

Source: Field Survey, 2014

5.9 Tenure Status

The possession of right to the use of land is known as land tenure system. People hold varying kinds of right in the use of land and are considered to belong to different tenure classes. There are, as stated earlier, three tenure categories of farms were found in this villages. These are- a) Owner operators; b) Cash tenant operators; and c) Crop share tenant operators.

5.10 Sharing Arrangement

In the study area the local name of contractual arrangements is "Borga".The traditional sharing arrangements 50:50 crop sharing was the common practice where land owner did not share any input cost but received half of the produce. Sometimes land owner shares half of the input costs (fertilizer and irrigation costs) and receives half of the produce (main product and by-product) .In the study area some contractual arrangements is practiced now. In this regulation the tenant must give the landowner a fixed amount of taka, or fixed amount of paddy per kata land within a year, whether the tenant can produce or not and land owner bear no production cost. The amount of rent paid in cash tenant was largely fixed in advance of production. In case of low production or lower output prices, the agreement was not revised. But land owner have the right to get back land ownership right any time. So tenancy arrangements are very in secured in our country.

5.11 Concluding Remarks

From the above discussion it is clear that the socio-economic condition of owner farmer is better than cash and crop share tenant farmer. The farm size, literacy and occupation status is better in owner farmer so the socio-economic status is different for three categories of farmer.

CHAPTER 6

PROFITABILITY AND FUNCTIONAL ANALYSIS OF BORO PADDY PRODUCTION

CHAPTER 6

PROFITABILITY AND FUNCTIONAL ANALYSIS OF BORO PADDY PRODUCTION

6.1 Introduction

This chapter is designed to analyze and compare the per hectare profitability HYV Boro paddy in owner, cash tenant and crop share tenant farmers. The related cost items include fertilizer cost, seed cost, animal and power tiller cost, manure cost, insecticide cost, irrigation cost, threshing cost, labor cost, land rental value, land preparation cost, and interest on operating capital. The average gross return and average net return are estimated in this chapter. The Benefit cost ratio (BCR) is also estimated for determining the profitability of the farmers.

6.2 Profitability of Boro Paddy Production

To determine the profitability and compare it among the rice growing owner, cash tenant and crop share tenant farmers the following costs and returns items were calculated.

6.2.1 Estimation of Costs

Costs are the expenses incurred in organizing and carrying out the production process (Doll and Orazem, 1984).In the production process farmers used two categories of cost, variable cost and fixed cost. The variable costs of Boro paddy include the cost of seed, animal and power tiller cost for land preparation, fertilizer, manure, irrigation and pesticide. In this study the fixed costs include interest on operating capital and land rental value. Farmers used both home supplied and purchased inputs. The costs of purchased inputs were estimated on the basis of the actual payments made by the farmers and for home supplied inputs, opportunity cost principle was applied to determine their value.

$\text{Total cost} = \sum_{i=1}^{n}(P_{xi}.X_i)$ + TFC (notations are previously stated)

6.2.1.1 Cost of Seed

In the study area, farmers used both home supplied and purchased seed. The costs of home supplied seed were determined at the ongoing market rate and costs of purchased seed were calculated on the basis of actual prices paid by the farmers in the study area. Per hectare costs of seedlings of Boro paddy were Tk 5189040, Tk

4944.84 and Tk 4672, respectively for owner, cash tenant and crop share tenant farmers which were 5.48, 5.46 and 6.01 percent of their respective total costs of production (Table-6.2). From the Table-6.2 it shows that per hectare cost of seed was higher for owner farmers than other tenurial groups.

6.2.1.2 Cost of Animal Labor & Power Tiller

In the study area, power tiller was mainly used for land preparation. Power tiller was used on contact basis .Most of the farmer used home supplied animal labor for leveling their land. By adding power tiller cost and animal labor cost total cost of animal labor and power tiller was found. Table 6.2 indicates that the per hectare animal labor and power tiller cost costs for producing HYV Boro paddy were Tk. 9309, Tk. 8094, and Tk. 9718.88, in owner, cash tenant and crop share tenant farmers, respectively.

6.2.1.3 Cost of Human Labor

For HYV Boro paddy production human labor is the most important inputs. It was required for different operations like land preparation, transplantation ,weeding, fertilizing, using pesticide, harvesting, carrying, threshing drying storing, etc. In this study, human labor was measured in man-days. One man-day was equivalent to 8 hours work of an adult man. For women and children, man equivalent day was estimated. This was computed by converting all women and children day into man equivalent day according to the following ratio. 1 man –day = 1.5 woman day = 2 child day.

The per hectare human labor cost of different tenure groups is shown in table 6.1 The per hectare human labor costs were Tk 36207, Tk 32830.20, and Tk 22185.24 in owner, cash tenant and crop share tenant farmers respectively which comprised 38.26,36.25 and 28.54 percent of their respective total costs of production(Table-6.2).

Table 6.1 Per Hectare Cost of Human Labor

Category	Total Family Labor (m-d)	Total Hired Labor (m-d)	Total Labor (m-d)	Total Labor Cost (Tk)	Percent of Total Cost
Owner	25	124	149	243	36207
Cash Tenant	27	113.3	140.30	234	32830.20
Crop Tenant	40	56.04	96.04	231	22185.24

Source: Field Survey, 2014

The results presented in the table-6.1 reveal that the owner farms are more dependent on hired labor than the cash tenant and crop share tenant farmers. The dependence on family labor is higher in cash tenant operators than in owner and cash tenant farmers.

6.2.1.4 Cost of Fertilizer

In the study area farmers used five types of chemical fertilizer namely, Urea, Triple Supper Phosphate (TSP), Muriate of Potash (MP), Gypsum and Zinc Sulphate ($Znso_4$). These chemical fertilizers were charged at the rate of price paid by the farmers. Table 6.2 shows per hectare costs of chemical fertilizers.

Per hectare costs of Urea were Tk 5200, Tk 4900 and Tk 3482 for owner, cash tenant and crop share tenant farmers respectively and their percentages of total cost of production were 5.49, 5.41and 4.48 percent, respectively.

Per hectare costs of TSP were Tk 3525, Tk 3300 and Tk 3132 for owner, cash tenant and crop share tenant farmers respectively and their percentages of total cost of production were 3.72, 3.64 and 4.03 percent, respectively.

Per hectare costs of MOP were Tk 1035, Tk 1155 and Tk 930 for owner, cash tenant and crop share tenant farmers respectively and their percentages of total cost of production were 1.09, 1.28 and 1.20 percent, respectively.

Per hectare costs of Gypsum were Tk 505, Tk511, and Tk 414.60 for owner, cash tenant and crop share tenant farmers, respectively and their percentages of total cost of production were .53, .56 and .53 percent, respectively.

Per hectare costs of Zinc were Tk 659.36, Tk 656 and Tk 548.25 for owner, cash tenant and crop share tenant farmers respectively and their percentages of total cost of production were .69, .72and .70 percent, respectively.

Per hectare costs of Manure were Tk 2997, Tk 3234 and Tk 1911.24 for owner, cash tenant and crop share tenant farmers, respectively and their percentages of total cost of production were 3.17, 3.57 and 2.46 percent, respectively.

6.2.1.5 Cost of Irrigation

Boro rice needs a huge amount of water. In the study area, farmers had to depend on one shallow tube well (STW) and deep tube-well (DTW). These tube-wells were diesel operated and/or electricity operated. The cost of irrigation water was charged at fixes rate for per unit area of irrigated land .All irrigation water charges were paid in cash. Per hectare costs of irrigation cost were Tk 4106, Tk 4491 and Tk 5291.58 for owner, cash tenant and crop share tenant farmers, respectively and their percentages of total cost of production were 4.34, 4.96 and 6.18 percent respectively. The irrigation cost was highest in crop share tenant farmers and lowest in owner farmers.

6.2.1.6 Cost of Pesticides

The pesticides used by the farmers in the study area were Basudin, Dimocrone, Sumithion , Theovit, Furadon, Malathianon, etc. Table 6.2 reveals that per hector cost of pesticides were Tk 1978, Tk 2723 and Tk 2133.01 for owner, cash tenant, and crop share tenant farmers respectively and their percentages of total cost of production were 2.09, 3.01 and 2.74 percent respectively. The irrigation cost was highest in cash tenant farmers and lowest in owner farmers.

6.2.1.7 Interest on Operating Capital

Interests on operating capital per hectare were Tk. 3535.54, Tk. 3341.97, and Tk. 2133.01 in Table 6.2 reveals that interest on operating capital for HYV Boro rice production was highest in owner farms and lowest in crop share tenant farms.

6.2.1.8 Land Use Cost

In the present study the cost of land use was estimated on the basis of cost rental value per hectare land for the period of 12 months. The land use cost per hectare was Tk.21612 for all tenure categories.

It was observed from the Table-6.2 study that, the per hectare gross costs of HYV Boro rice production were Tk 27970.99, Tk 25828.28, Tk 22721.18 and Tk 24113.90 in owner, cash tenant and crop share tenant farmers, respectively. Per hectare gross cost was higher of owner farmer than other farmer.

6.2.2 Estimation Average Yields and Gross Return

The average yields of HYV Boro rice were kg 6330.50, kg 6803.00, kg and kg 6723.03 in owner; cash tenant and crop share tenant farmers, respectively (Table 6.1). Thus the average yield per hectare in cash tenant farmers was higher than that of owner and crop share tenant farmers. In this case gross return was estimated by by summing up all the returns earned from selling paddy and its bye product. The average gross returns per hectare were Tk 108933.00, Tk 119079.50 and Tk 117368.48 in owner, cash tenant, and crop share tenant farmers, respectively. Gross return was higher for cash tenant farmer than other farmer but the total cost of production was higher in owner farmer and cash tenant farmer so their net return is lower than crop share tenant farmer. The Figure -6.1 presents the total cost, gross return and net return of all farms. It is clear from the figure that total cost of production was higher for owner farmer, net return was higher for crop share tenant farmer than others.

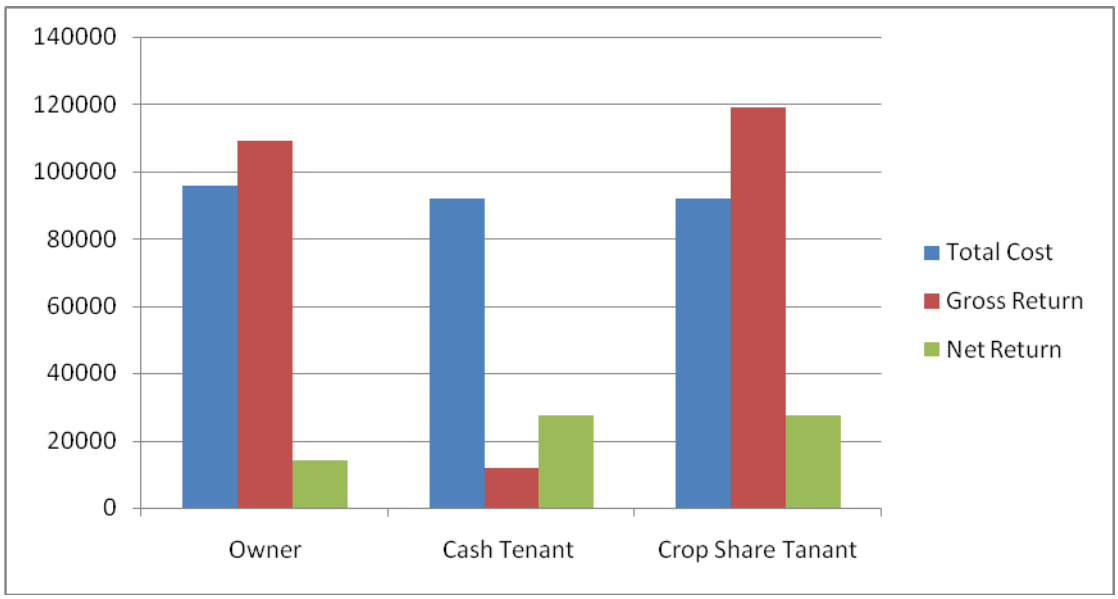

Figure-6.1: Total Cost, Gross Return and Net Return of all Categories of Farmers.

6.2.3 Benefit Cost Ratio (BCR)

The undiscounted benefit cost ratio (BCR) is a relative measure which is used to compare benefits per unit of cost. Table 6.1 reveals that the BCR were 1.14, 1.30, and

1.49 in owner, cash tenant and crop share tenant farmers, respectively which mean that, crop share tenant farmers get higher profit.

Table: 6.2 Per Hectare Costs, Returns, and Other Parameters for HYV Boro Paddy Producing Farmers

Particulars	Quantity	Rate (Tk/unit)	Cost (Tk/ha)	% of Total Cost
Owner Farmer				
Seed (Kg/ha)	55.80	93.00	5189.40	5.41
Animal Labor /Power Tiller cost (Tk/ha)			9309.00	9.71
Human labor cost (No. of Man-days/ha)	149.00	243.00	36207.00	37.77
Urea(Kg/ha)	260.00	20.00	5200.00	5.42
TSP (Kg/ha)	141.00	25.00	3525.00	3.68
MoP (Kg/ha)	69.00	15.00	1035.00	1.08
Gypsum (Kg/ha)	50.50	10.00	505.00	0.53
Zinc Sulphate (Kg/ha)	12.68	52.00	659.36	0.69
Manure (Kg/ha)	5994.00	0.50	2997.00	3.13
Cost of irrigation (Tk/ha)			4106.00	4.28
Cost of Pesticides (Tk/ha)			1978.00	2.06
A. Total Variable Cost (TVC)			**70710.76**	**73.77**
Interest on operating capital @ of 10% for 6 months			3535.54	3.69
Rental value of land			21612.50	22.55
B. Fixed Cost (FC)			**25148.04**	**26.23**
C. Total Cost (A+B)			**95858.80**	**100.00**
Main product value	6330.50	16.00	101288.00	
By-product value			7645.00	
D.Gross Return (Tk/ha) i. e. (GR)			**108933.00**	
Total variable cost (Tk/ha) i. e. (TVC)			70710.76	
Total cost (Tk/ha) i.e. (FC+TVC)			95858.80	
E.Gross Margin (Tk/ha) i.e. (D-A)			38222.24	
F.Net Return (Tk/ha) i.e. (D-C)			13074.20	
G.BCR (undiscounted) i.e. (GR/GC)			**1.14**	
Cash Tenant Farmer				
Seed (Kg/ha)	55.56	89.00	4944.84	5.16
Animal Labor /Power Tiller cost (Tk/ha)			8094.00	8.44
Human labor cost (No. of Man-days/ha)	140.30	234.00	32830.20	34.25
Urea(Kg/ha)	245.00	20.00	4900.00	5.11
TSP (Kg/ha)	132.00	25.00	3300.00	3.44
MoP (Kg/ha)	77.00	15.00	1155.00	1.20
Gypsum (Kg/ha)	51.10	10.00	511.00	0.53
Zinc Sulphate (Kg/ha)	12.48	52.60	656.45	0.68
Manure (Kg/ha)	6468.00	0.50	3234.00	3.37
Cost of irrigation (Tk/ha)			4491.00	4.69
Cost of Pesticides (Tk/ha)			2723.00	2.84

Particulars	Quantity	Rate (Tk/unit)	Cost (Tk/ha)	% of Total Cost
A. Total Variable Cost (TVC)			**66839.49**	**69.73**
Interest on operating capital @ of 10% for 6 months			3341.97	3.49
Rental value of land			21612.50	22.55
B. Fixed Cost (FC)			**24954.47**	**26.03**
C. Total Cost (A+B)			**91793.96**	**95.76**
Main product value	6803.00	16.50	112249.50	
By-product value			6830.00	
D.Gross Return (Tk/ha) i. e. (GR)			**119079.50**	
Total variable cost (Tk/ha) i. e. (TVC)			66839.49	
Total cost (Tk/ha) i.e. (FC+TVC)			91793.96	
E.Gross Margin (Tk/ha) i.e. (D-A)			52240.01	
F.Net Return (Tk/ha) i.e. (D-C)			27285.54	
G.BCR (undiscounted) i.e. (GR/GC)			**1.30**	
Crop Share Tenant Farmer				
Seed (Kg/ha)	73.00	64.00	4672.00	4.87
Animal Labor /Power Tiller cost (Tk/ha)			9718.88	10.14
Human labor cost (No. of Man-days/ha)	96.04	231.00	22185.24	23.14
Urea(Kg/ha)	174.10	20.00	3482.00	3.63
TSP (Kg/ha)	125.30	25.00	3132.50	3.27
MoP (Kg/ha)	62.00	15.00	930.00	0.97
Gypsum (Kg/ha)	41.46	10.00	414.60	0.43
Zinc Sulphate (Kg/ha)	10.75	51.00	548.25	0.57
Manure (Kg/ha)	3822.48	0.50	1911.24	1.99
Cost of irrigation (Tk/ha)			5291.58	5.52
Cost of Pesticides (Tk/ha)			2133.01	2.23
A. Total Variable Cost (TVC)			**54419.30**	**56.77**
Interest on operating capital @ of 10% for 6 months			2720.97	2.84
Rental value of land			21612.50	22.55
B. Fixed Cost (FC)			**24333.47**	**25.38**
C. Total Cost (A+B)			**78752.77**	**82.15**
Main product value	6723.03	16.00	107568.48	
By-product value			9800.00	
D.Gross Return (Tk/ha) i. e. (GR)			117368.48	
Total variable cost (Tk/ha) i. e. (TVC)			54419.30	
Total cost (Tk/ha) i.e. (FC+TVC)			78752.77	
E.Gross Margin (Tk/ha) i.e. (D-A)			62949.18	
F.Net Return (Tk/ha) i.e. (D-C)			38615.72	
G.BCR (undiscounted) i.e. (GR/GC)			**1.49**	

Source: Field Survey, 2014

The results of profitability analysis clearly indicate that HYV Boro paddy production was profitable for both categories of farmer .From the Table-6.2 it was observed that per hectare net return was Tk. 14296.78, 27285.54 and 38615.72 for the owner, cash tenant and crop share tenant farmers, respectively. This indicates that crop share tenant farmer earned more profit than the other farmers it was because total cost of production is lower in crop share tenant farmers than other farmers and in this study for crop share tenant farmers consider total portion of production and their input management is better than other farmer. But they didn't got full portion of production, they provide certain amount of production to their landlords according to sharing agreement.

7.12 Concluding Remarks

From the above discussion and the results presented in Table 6.2 it is clear that HYV Boro rice production is a profitable business for both categories of farmers. It also shows that there exists a difference in profitability among owner, cash tenant, and crop share tenant farmers.

CHAPTER 7

EFFECTS AND RESOURCE USE EFFICIENCY OF INPUTS USED

CHAPTER 7

EFFECTS AND RESOURCE USE EFFICIENCY OF INPUTS USED

7.1 Introduction

This chapter is designed to estimate and compare the relative economic potential of HYV Boro rice production in tabular form. The main focus of the present chapter is to estimate the contribution of the individual key variables to the production process of HYV Boro rice.

7.2 Factors Affecting Production of HYV Boro Paddy

For producing HYV Boro rice different kinds of inputs, such as human labor, power tiller, seed, fertilizer, manure, irrigation and insecticides were employed which were considered as a priori explanatory variables responsible for variation in HYV Boro rice production. Multiple regression analysis was employed to understand the possible relationships between the production of HYV Boro rice and the inputs used.

7.3 Method of Estimation

For determining the effect of variable inputs to the production of HYV Boro rice, Cobb-Douglas production function was chosen on the basis of best fit and significance result on output. Moreover, use of Cobb-Douglas production function enables one to obtain the returns to scale directly. This model is also popular in applied work. The functional form of the multiple regression equation is as follows.

$$Y= a\, X_1^{b1}\, X_2^{b2}\, X_3^{b3}\, X_4^{b4}\, X_5^{b5}\, X_6^{b6}\, X_7^{b7} + U_i$$

This equation may be alternatively expressed as:

$$\ln Y= \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + U_i$$

Where,

Y = Per hectare yield of HYV Boro paddy (Tk. /ha)

a = Intercept

X_1 = Quantity of seed in producing HYV Boro paddy (Kg/ha)

X_2 = Cost of animal labor and power tiller (Tk. /ha)

X_3=No. of human labor (man days/ha)

X_4= Quantity of fertilizer in producing HYV Boro paddy (Kg /ha)

X_5= Quantity of manure in producing HYV Boro paddy (Kg/ha)

X_6=Cost of irrigation in producing HYV Boro paddy (Tk. /ha)

X_7= Cost of pesticide in producing HYV Boro paddy (Tk. /ha)

b_1,b_2……b_7=Coefficient of relevant variables.

Ui=Disturbance term

ln=Natural logarithm.

This equation is individually applicable for owner, cash tenant and crop share tenant farmer for HYV Boro paddy production because the same set of inputs as indicated in the model were used.

7.4 Interpretation of Results

Interpretation of the estimated co-efficients and related statistics of Cobb-Douglas production function of the farms which produced HYV Boro rice have been shown in Table 7.1. The following features were noted.

1. Cobb-Douglas production function fitted well for HYV Boro paddy growing farms as indicated by F-values and R.

2. The values of coefficients of multiple determinations R^2 were 0.656, 0.853 and 0.878 and for owner, cash tenant and crop share tenant farms, respectively, which indicates that 65 percent, 85 percent, and 87 percent of the total variations in returns were explained by the independent variables included in the model.

3. The F-values were highly significant implying that all the included explanatory variables are important for explaining the variation of income of farmers in HYV Boro rice production.

4. The results from the summation of all production co-efficient of owner, cash tenant and crop share tenant farmers were, 0.967, 1.019 and 1.101, respectively. These figures imply that production function for owner, cash tenant and crop share tenant farmers presents increasing returns to scale, On the other hand, production function for owner farmers exhibits diminishing returns to scale.

5. The relative contribution of individual key variables affecting productivity of owner, cash tenant and crop share tenant farms can be seen from the estimates of

regression equation. The results showed that most of the co-efficients had expected sign. However, the explanatory variables like seed/seedling (X_1), animal and power tiller (X_2), human labor (X_3), fertilizer (X_4), and irrigation (X_7) were found to have significant effect on production in the case of owner, cash tenant and crop share tenant farms, but manure (X_5) was found to have insignificant effect on production of owner and cash tenant farmers. Pesticides (X7) also have insignificant effect on owner farmers.

Table 7.1 Estimated Values of Co-efficient for Different Categories of Tenure Groups and Their Related Statistics of Cobb-Douglas Production Function Model

Explanatory variable	Estimated coefficients					
	Owner farmer		Cash Tenant Farmer		Crop Share Tenant	
	Co-efficient	t-value	Co-efficient	t-value	Co-efficient	t-value
Intercept	3.05 (1.916)	1.916	1.676 (1.066)	1.57	1.022 (1.367)	0.747
Seed/Seedling cost (X_1)	0.175** (0.066)	2.630	0.155** (0.071)	2.162	0.018 (0.096)	0.191
Animal/Power tiller cost (X_2)	0.162** (0.0635)	2.550	0.471*** (0.109)	4.296	0.295** (0.117)	2.506
Human labor cost (X_3)	0.322** (0.1762)	1.828	0.234** (0.089)	2.617	0.253* (0.136)	1.860
Fertilizer cost (X_4)	0.344** (0.140)	2.460	0.099* (0.050)	1.976	0.259* (0.137)	1.882
Manure cost (X_5)	-0.073 (0.071)	-1.029	-0.060 (0.046)	-1.310	0.053* (0.073)	0.729
Irrigation cost (X_6)	0.077** (0.037)	2.089	0.101* (0.032)	3.097	0.210*** (0.063)	3.323
Pesticide cost (X_7)	-0.04 (0.067)	-0.615	0.018* (0.041)	0.436	0.011* (0.045)	0.246
R^2	0.656		0.853		0.878	
F value	8.92		18.257		22.79	
Returns to scale [$\sum bi$]	0.967		1.019		1.101	

Source: Field Survey, 2014

Note: Figures in the parenthesis indicate standard error of the co-effecients.

*** = Significant at 1 percent level

** = Significant at 5 percent level

* = Significant at 10 percent level

7.4.1 Owner Farmer

Seed/Seedling Cost (X_1): The estimated co-efficient of seed was 0.175 which was significant at 5 per cent level. This indicates that an increase of 1 per cent in cost of this input keeping other factors constant would result in an increase of gross return by 0.175 per cent.

Animal/Power Tiller Cost (X_2): It is evident from Table 7.1 that the coefficient of animal and power tiller cost was 0.162 which was significant at 5 percent level. That means, 1 percent in cost of this input keeping other factors constant would result in an increase of gross return by 0.162 per cent.

Human Labor Cost (X_3): The co-efficient for human labor was 0.322 and was significant at 5 per cent level. This indicates that 1 percent increase in human labor cost keeping other factors constant, would increase the gross returns by 0.322 percent.

Fertilizer Cost (X_4): The estimated value of the co-efficient of fertilizer was 0.344 for owner farmer and was significant at 5 per cent level .It can be said that 1 percent increase in fertilizer cost keeping other factors constant, would increase the gross returns by 0.344 percent.

Manure (X5): Table 7.1 reveals that the coefficient of manure cost was negative (-0.073) which indicated an inverse relationship between gross return and manure cost. That means, in 1 percent increase of manure cost decreased gross return by 0.073 percent while other factors were kept constant.

Irrigation Cost (X_6): The co-efficient of the variable was 0.077 and significant at 5 percent level. This suggests that an additional spending of 1 percent on irrigation water would enable the owner farmers to earn 0.077 percent of gross return from HYV Boro paddy.

Pesticide Cost (X7): It can be seen from the Table 7.1 the estimated coefficient of pesticide cost was negative for owner farmers (-0.04) which indicated an inverse relationship between gross return and manure cost. That means, in 1 percent increase of manure cost decreased gross return by 0.04 percent while other factors were kept constant.

Value of R^2: The co-efficient of multiple determinations, R^2 was 0.656 for owner farmer which indicates that about 65 percent of the total variation in return of HYV Boro paddy production is explained by the variables included in the model. In other words the excluded variables accounted for 35 percent of the total variation in return of HYV Boro paddy.

F-Value: The F-value of the equation was highly significant and it implies that the included variables are important for explaining the variation in returns under tenancy arrangements.

Returns to Scale [$\sum bi$]**:** The summation of all the production coefficients indicates returns to scale. For HYV Boro paddy production in owner farms the summation of the coefficients was 0.967. This indicated that the production function showed diminishing returns to scale.

7.4.2 Cash Tenant Farmer

Seed/Seedling Cost (X_1): The estimated co-efficient of seed cost for cash tenant farmer was 0.155 which was significant at 5 per cent level. This indicates that an increase of 1 per cent in cost of this input keeping other factors constant would result in an increase of gross return by 0.155 per cent.

Animal/Power Tiller Cost (X_2): It is evident from Table 7.1 that the coefficient of animal and power tiller cost was 0.471 which was significant at 1 percent level. That means, 1 percent in cost of this input keeping other factors constant would result in an increase of gross return by 0.471 per cent.

Human Labor Cost (X_3): The co-efficient for human labor was 0.234 and was significant at 5 per cent level. This indicates that 1 percent increase in human labor cost keeping other factors constant, would increase the gross returns by 0.234 percent.

Fertilizer Cost (X_4): The estimated value of the co-efficient of fertilizer was 0.099 for cash tenant farmer and was significant at 10 per cent level .It can be said that 1 percent increase in fertilizer cost keeping other factors constant, would increase the gross returns by 0.099 percent.

Manure (X5): Table 7.1 reveals that the coefficient of manure cost was negative (-0.060) which indicated an inverse relationship between gross return and manure cost.

That means, in 1 percent increase of manure cost decreased gross return by 0.060 percent while other factors were kept constant.

Irrigation Cost (X_6): The co-efficient of the variable was 0.101 and significant at 1 percent level. This suggests that an additional spending of 1 percent on irrigation water would enable the cash tenant farmers to earn 0.101 percent of gross return from HYV Boro paddy.

Pesticide Cost (X7): It can be seen from the Table 7.1 the estimated coefficient of pesticide cost was 0.018 for cash tenant farmers and was significant at 10 percent level which indicated a positive relationship between gross return and pesticide cost. That means, in 1 percent increase of pesticide cost increased gross return by 0.018 percent while other factors were kept constant.

Value of R^2: The co-efficient of multiple determinations, R^2 was 0.853 for cash tenant farmer which indicates that about 85 percent of the total variation in return of HYV Boro paddy production is explained by the variables included in the model. In other words the excluded variables accounted for 15 percent of the total variation in return of HYV Boro paddy.

F-Value: The F-value of the equation was highly significant and it implies that the included variables are important for explaining the variation in returns under tenancy arrangements.

Returns to Scale [$\sum bi$]: The summation of all the production coefficients indicates returns to scale. For HYV Boro paddy production in owner farms the summation of the coefficients was 1.02. This indicated that the production function showed increasing returns to scale.

7.4.3 Crop Tenant Farmer

Seed/Seedling Cost (X_1): The estimated co-efficient of seed was 0.018 which was significant at 10 per cent level. This indicates that an increase of 1 per cent in cost of this input keeping other factors constant would result in an increase of gross return by 0.018 per cent.

Animal/Power Tiller Cost (X_2): It is evident from Table 7.1 that the coefficient of animal and power tiller cost was 0.295 which was significant at 5 percent level. That

means, 1 percent in cost of this input keeping other factors constant would result in an increase of gross return by 0.295 per cent.

Human Labor Cost (X_3): The co-efficient for human labor was 0.253 and was significant at 10 per cent level. This indicates that 1 percent increase in human labor cost keeping other factors constant, would increase the gross returns by 0.322 percent.

Fertilizer Cost (X_4): The estimated value of the co-efficient of fertilizer was 0.259 for crop share tenant farmer and was significant at 10 per cent level .It can be said that 1 percent increase in fertilizer cost keeping other factors constant, would increase the gross returns by 0.259 percent.

Manure (X5): Table 7.1 reveals that the coefficient of manure cost was 0.053 and significant at 10 percent level. This indicated a positive relationship between gross return and manure cost. That means, in 1 percent increase of manure cost gross return increased by0 .053 percent while other factors were kept constant.

Irrigation Cost (X_6): The co-efficient of the variable was 0.210 and significant at 1 percent level. This suggests that an additional spending of 1 percent on irrigation water would enable the crop share tenant farmers to earn 0.210 percent of gross return from HYV Boro paddy.

Pesticide Cost (X7): It can be seen from the Table 7.1 the estimated coefficient of pesticide cost was 0.011 for crop share tenant farmers and was significant at 10 percent level which indicated a positive relationship between gross return and pesticide cost. That means, in 1 percent increase of pesticide cost gross return increased by 0.011 percent while other factors were kept constant.

Value of R^2: The co-efficient of multiple determinations, R^2 was 0.878 for crop share tenant farmer which indicates that about 87 percent of the total variation in return of HYV Boro paddy production is explained by the variables included in the model. In other words the excluded variables accounted for 13 percent of the total variation in return of HYV Boro paddy.

F-Value: The F-value of the equation was highly significant and it implies that the included variables are important for explaining the variation in returns under tenancy arrangements.

Returns to Scale [$\sum bi$]**:** The summation of all the production coefficients indicates returns to scale. For HYV Boro paddy production in owner farms the summation of the coefficients was 1.01. This indicated that the production function showed increasing returns to scale.

7.5 Resource Use Efficiency

The estimated marginal value products (MVPs) and MFC of different inputs are presented in Table 7.2.

Table 7.2: Resource Use Efficiency of HYV Boro Paddy Production

Variables	GM	MVP	MFC	MVP/MFC	Comments
Owner Farmer					
Seed	54.76	322.586	91.91	3.509	Under utilized
Animal Labor and Power tiller	1	16282.9	9153.54	1.77	Under utilized
Human labor	148.44	218.147	242.33	0.900	Over utilized
Fertilizer	521.64	66.60	20.70	3.217	Under utilized
Manure	5932.87	-1.2412	0.50	-2.482	Over utilized
Irrigation	1	7814.99	3937.54	1.984	Under utilized
Insecticides	1	-4164.2	1949.58	-2.135	Indiscriminate
Cash Tenant Farmer					
Seed	55.08	315.114	88.07	3.577	Under utilized
Animal Labor and Power tiller	1	52703.9	8075.44	6.526	Under utilized
Human labor	139.58	187.758	233.46	0.8042	Over utilized
Fertilizer	512.92	21.64	20.33	1.064	Under utilized
Manure	6376.29	-1.0679	0.50	-2.135	Over utilized
Irrigation	1	11383.9	4319.23	2.635	Under utilized
Insecticides	1	2014.92	2682.64	0.751	Over utilized
Crop Share Tenant Farmer					
Seed	72.11	27.0019	62.16	0.434	Over utilized
Animal Labor and Power tiller	1	31228.5	9525.16	3.278	Under utilized
Human labor	95.21	281.744	230.51	1.222	Under utilized
Fertilizer	411.65	66.6027	60	1.110	Under utilized
Manure	3714.73	1.51751	0.50	3.035	Under utilized
Irrigation	1	22322.3	5040.11	4.428	Under utilized
Insecticides	1	1182.14	2004.25	0.589	Over utilized

Source: Field Survey, 2014

Note: MVP = Marginal value product, MFC = Marginal Factor Cost,

GM = Geometric mean.

From the analysis of the regression equations we can study the ability of farmers to allocate resources in HYV Boro rice production. In order to test resource use efficiency, it was considered that a ratio equal to unity indicated the optimum use of that factor, a ratio more than unity indicated that the yield could be increased by using

more of the resources. A value of less than unity indicated the unprofitable level of resource use, which should be decreased to minimize the losses because farmers over used this variable. The negative value of MVP indicates the indiscriminate and inefficient use of resource.

The ratios of MVPxi and MFCxi for seed, animal/power tiller, fertilizer, and irrigation of owner farmers were positive and greater than one which implied that these inputs have high productivity in HYV Boro rice production and it also implied that more profit can be obtained by increasing investment in this inputs. But the ratios of MVPxi and MFCxi for human labor and manure were over utilized these indicated that unprofitable level of resource use which should be decreased to minimize the losses.
For cash tenant farmers the ratio between MVPxi and MFCxi for seed, animal/power tiller, fertilizer and irrigation were greater than one which implied that these inputs have high productivity in HYV Boro rice production and it also implied that more profit can be obtained by increasing investment in this inputs. But The ratios of MVPxi and MFCxi for human labor, manure and insecticides was less than one which indicates overuse of these resources and needs to be adjusted to bring it closer to unity. The ratio MVPxi and MFCxi for manure is negative so it indicates indiscriminate and inefficiently used.

The ratio between MVPxi and MFCxi for animal/power tiller, human labor, fertilizer, manure and irrigation of crop share tenant farmers were positive and greater than one which implied that these inputs have high productivity in HYV Boro rice production and it also implied that more profit can be obtained by increasing investment in these inputs.
The ratio between MVPxi and MFCxi for of seed and insecticide was positive but less than one which indicates overuse of these resources and needs to be adjusted to bring it closer to unity.

7.6 Concluding Remarks

From the estimated value of the production function model and the findings it may be suggested that the overall performances of the model for all tenure groups were good as indicated by estimated $R^2$and F- value. But all the explanatory variables included in the model were not significant as were generally expected. Form the findings of marginal productivity and resource use efficiency in the study, it may be suggested that the study area have significant difference in resource use efficiency of owner, cash tenant and crop share tenant farmers. So the farmers of the study area have scope to attain full efficiency by reallocating the resources.

CHAPTER 8

SUMMARY, CONCLUSION AND POLICY RECOMMENDATION

CHAPTER 8

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),Description of the study area(Chapter 4), Socio-economic characteristics (Chapter 5), Cost and returns (Chapter 6), Effect of input use and resource use efficiency of HYV Boro paddy production (Chapter 7), Finally Chapter 8 presents summary, conclusion and policy recommendations of the study**.**

8.2 Summary

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 2013) which causes the decreases of farm size in a horrid manner. As a result, farmers are often forced to cultivate land under different tenure systems. The area under study was a rice growing area. Three types of tenurial system were practiced there.

An attempt has been made in this study to examine the profitability and resource use efficiency of Boro paddy producing farms according to these three tenure groups such as owner, cash tenant and crop share tenant farmers.

The overall objective of the study will be measure profitability and resource use efficiency of Boro paddy producing farms under different tenurial system and also identify the socioeconomic characteristics of the farmers in the study area. The following are the specific objectives:

- To identify the major socio-economic characteristics of tenant farmers;
- To assess the profitability of HYV Boro paddy production farmers and compare profitability under different tenure system;
- To estimate the contribution of key inputs to the production processes of HYV Boro paddy production;
- To measure resource use efficiency of different land tenure system; and
- To suggest some policy guidelines of land tenure system.

The villages of Shailkupa Upazila of Jhenidah district were purposively selected to collect for fulfilling the objectives of the study. Three villages Aruyakandi, Habibpur and Baroipara were selected for collecting information. These villages were selected because it possesses similar socio-economic attributes and homogeneous physiographic conditions. List of these farmers was collected from Chairman of Union Parishad of the area. These lists served as the population of the study. About 90 sample farmers, 30 owner farmers, 30 cash tenant farmers and 30 crop share tenant farmers were selected for the present study. A stratified random sampling technique was used in the study. A complete list of the farmers in the selected village was done by the researcher himself. The field survey was conducted over the period from July-September, 2014.The tabular and different statistical analysis was done to examine the objectives.

The socio economic status of the owner farmers is slightly better than other farmers. It was observed from the socioeconomic characteristics that the highest number of owner farmers (50.00 percent) belonged to age group 40-50 years. On the other hand, the highest number of cash tenant farmer and crop share farmer were (47.00 percent) and (38.00 percent), respectively also belonged to the age group of 40-50 year. This information implies that the major portion of all categories of farmers fell into age group 40-50 years. About 3.33, 13.33 and 16.67 per cent of owner, owner-cum-tenant and tenant farmers, respectively were illiterate having no formal or informal education.

Average family size of owner farmers was 5.4, cash tenant farmer was 5.63 and crop tenant farmer was 6.5. So crop tenant farmers had a higher family size than other

farmers. It appears that the number of working members (between 15 to 55 years) for both farm families was relatively higher than family members in other age groups.

Agriculture is the main occupation of the majority of the sample farmers. It was noted that agriculture was the major occupation of 66.67 percent of owner farmers, 80 percent of cash share tenant farmers and 90 percent of crop share tenant farmers. Fifty-fifty share cropping is the most common sharing arrangement in the study area.

The results of profitability analysis of Boro rice it was found that per hectare costs of seedlings of Boro paddy were Tk 5189040, Tk 4944.84 and Tk 4672, respectively for owner, cash tenant and crop share tenant farmers, respectively. Again per hectare animal labor and power tiller cost costs for producing HYV Boro paddy were Tk. 9309, Tk. 8094, and Tk. 9718.88, in owner, cash tenant and crop share tenant farmers.

The per hectare human labor costs were Tk 36207, Tk 32830.20, and Tk 22185.24 in owner, cash tenant and crop share tenant farmers, respectively which comprised 38.26,36.25 and 28.54 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 owner farmers than in cash tenant and crop share tenant farmers. The tenants used minimum hired human labor.

Per hectare chemical fertilizer cost were Tk 1092.36, Tk 10511 and Tk 10418.59 for owner, cash tenant and crop share tenant farmers, respectively, so the cost of chemical fertilizer cost were higher of owner farmers than other farmers.

Per hectare costs of irrigation cost were Tk 4106, Tk 4491 and Tk 5291.58 for owner, cash tenant and crop share tenant farmers respectively and cost of pesticides per hectare were Tk 1978, Tk 2723 and Tk 2133.01 for owner, cash tenant and crop share tenant farmers, respectively.

Interests on operating capital per hectare were Tk. 3535.54, Tk. 3341.97, and Tk. 2133.01 in Table 6.1 reveals that interest on operating capital for HYV Boro rice production was highest in owner farms and lowest in crop share tenant farms. The land use cost per hectare was Tk.21612 for all tenure categories.

The average yields of HYV Boro rice were 6330.50 kg, 6803.00 kg, and 6723.03kg in owner, cash tenant, and crop share tenant farmers, respectively. Thus the average

yield per hectare in cash tenant farmers was higher than that of owner and crop share tenant farmers. The average gross returns per hectare were Tk 108933.00, Tk 119079.50 and Tk 117368.48 in owner, cash tenant, and crop share tenant farmers respectively. Gross return was higher of cash tenant farmer than other farmer but the total cost of production was higher in owner farmer and cash tenant farmer so their net return is lower than crop share tenant farmer.

It was observed that per hectare net return was Tk. 14296.78, 27285.54 and 38615.72 for the owner, cash tenant, and crop share tenant farmers, respectively. Which indicates that crop share tenant farmer earned more profit than the other farmers.

Cobb-Douglas production function analysis was carried out for examining the effect of input use and resource use efficiency. In most of the cases the coefficients of seedling, human labor, animal/power tiller and irrigation appeared to be significant. The summation of co-effecients of different inputs were greater than one implying that the production functions exhibited increasing returns to scale but owner the decreasing returns to scale. This is because of the overuse of the variable inputs in their land.

Finally, it was observed that most of the MVPs of inputs were positive or more than one which indicate that more profit can be obtained by increasing each input included in production function.

8.3 Conclusion

From the above discussions it can be said that that crop share tenant farmer were more profitable than other farmers if we consider their total production. But they didn't receive their full production. They receive only half of the produce after investing in all the costs of production along with the share of their labor and management inputs .Cash tenant and crop share tenant farmer had work hard to earn more profit from their investment.

8.4 Policy Recommendations

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

- Measures should be taken to ensure more equitable distribution of resources in rented land of owner-cum-tenant farmers;
- The cost of sharing between land owner and tenant should be 50:50 in the case of all inputs except land and labor;
- Farmers should be given proper training on optimum application of inputs;
- Measures should be taken to provide credit facilities or banking facilities in rural areas.

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APPENDIX

APPENDIX

Interview Schedule for Field Survey

Interview Schedule

On

AN ECONOMIC ANALYSIS OF HYV BORO PADDY PRODUCTION UNDER DIFFERENT LAND TENURE SYSTEMS IN SOME SELECTED AREAS OF JHENAIDAH DISTRICT OF BANGLADESH

Sample No: Date:

Name of the Respondent:

Village: Upazila: District:

1. Personal Details:

Sl. No.	Name	Relation	Age	Education	Occupation		Income	
					Main	Subsidiary	Main	subsidiary
1								
2								
3								
4								
5								
6								
7								

NB: i=Illiterate ii=Signature only iii=up to Primary iv= up to Secondary, v = above secondary

2. Types of Tenancy

	Code
Owner	
Cash Tenant	
Crop Share Tenant	

NB: 1=owner 2= Cash tenant 3= Crop share tenant

3. Land area: (in Local unit)

	Own land	**Mortgage in Land**	**Rented in Land**	**Tenant in Land**	**Homestead Land**	**Pond**	**Fallow Land**	**Total Land**
Area								

4. Cost of Production

4.1 Cost of Seed

Amount Of Seed(kg/ha)	**Home Supplied**		**Purchased**	
	Amount	Price(Tk)	Amount	Price(Tk)
Total Cost of Seed/Seedling				

4.2 Cost of Labor

Particulars	**Number of Labor day**		**Wage/Labor Day (Tk)**	**Total Cost (Tk)**
	Home Supplied	**Hired**		
Land Preparation: • Power Tiller • Animal Labor				
Transplanting				
Weeding				

Fertilizer Application				
Pesticide Application				
Harvesting				
Threshing & storing				
Total Cost of labour				

4.3 Cost of Fertilizer

Type of Fertilizer	**Amount (Kg)**		**Price(Tk/Kg)**	**Total (Tk)**
	Home Supplied	Purchased		
Urea				
TSP				
MOP				
Gypsum				
Zinc Sulphate				
Cow Dung(manure)				
Total Cost of Fertilizer				

4.4 Cost of Irrigation

Number of Times Applied	**Payment Mode**			**Total Cost**
	Cash (Tk)	**In Kind**		
		Amount	**Value (Tk)**	

4.5 Cost of Pesticides

Particulars	Unit	Price/Unit	Quantity used	Total Cost (Tk)
Dimocron				
Dia then-45				
Furadon -5G				
Theobit				
Others				

5. Value Production

Particulars	Unit	Price/Unit (Tk)	Quantity Produced	Total Value
Paddy				
Paddy Straw				

6. What types of problem do you face in Boro rice cultivation?

1.

2.

3.

Signature with date