FINANCIAL PROFITABILITY ANALYSIS AND ESTIMATING THE PRODUCTIVITY OF BEAN PRODUCTION IN SOME SELECTED AREAS OF MYMENSINGH DISTRICT

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BY

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CERTIFICATE

This is to certify that thesis entitled, **"FINANCIAL PROFITABILITY ANALYSIS AND ESTIMATING THE PRODUCTIVITY OF BEAN PRODUCTION IN SOME SELECTED AREAS OF MYMENSINGH DISTRICT"** *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 STATISTICS,*** *embodies the result of a piece of bona fide research work carried out* ***SANJOY CHANDRA DAS****, Registration No.* ***19-10268*** *under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

Dated: December, 2021

Place: Dhaka, Bangladesh

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DEDICATED TO

MY BELOVED

PARENTS

ABSTRACT

Leguminous crops like beans play a vital role to meet up our protein requirement. Beans contain 20-30% protein on a dry weight basis which is nearly three times than that in most cereals. Among all the leguminous crops, beans are very popular and nutritious vegetables in Bangladesh. Beans provide a good amount of protein in addition to vitamins and minerals. In Bangladesh total land area under bean cultivation is 15385 hectares and the production is 83,000 metric tons during 2006-2007(BBS, 2008). There is a great demand of bean seeds in the overseas market which may open a new horizon of export of this vegetables in those markets. The present study was conducted to estimate the farm productivity of bean production in Muktagacha and Fulbaria Upazila of Mymensingh district of Bangladesh. Three villages from each Upazila were specially selected for this study. In total, 80 bean farmers were selected specially for the study. Out of 80 samples, 40 were from Muktagacha Upazilla and 40 were from Fulbaria Upazila. Primary data were collected during September to October of 2021 through field visit. The required data were collected through structured interview schedule from the 80 jute farmers. The secondary information sources were DAE reports, Bangladesh economic review, BBS, different journals, newspaper, relevant websites etc. Descriptive statistics and Cobb-Douglas production function model were used to address the main objectives of the study. The results of the study showed that, per hectare average total cost for producing bean was Tk. 32402.38. Per hectare gross returns above cash cost from bean production was estimated Tk. 99302.06 and per hectare average net return of bean production was Tk. 66899.68. It was also expressed that net return was higher at Fulbaria upazila. The study considered human labor cost, tillage cost, seed cost, fertilizer cost, irrigation cost, and pesticides cost, these six variables. The study showed that seed cost and fertilizers cost had significant impact on bean production. The study also marked out that bean producers were facing some problems such as: low price of bean, high labor cost, unavailability of human labor, farmers not keeping any records of bean production etc. If these problems could be solved within the shortest possible time, all the bean producers could be able to earn a much higher profit than the existing level. On the basis of findings, some recommendations were made for the development of bean sector in Bangladesh.

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All praise is due to Allah, the Merciful, the Almighty, who made it possible and allow me to continue my studies in Agricultural Statistics and to successfully finish the research and writing of my thesis for the Master of Science in Agricultural Statistics degree.

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I'd want to convey my appreciation to the 80 farmers who participated actively in this survey and, more significantly, helped me understand their efforts and actions linked to bean production. Their amazing assistance throughout the data gathering procedure is much appreciated.

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Sanjoy Chandra Das

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ACRONYMS AND ABBREVIATIONS

BBS : Bangladesh Bureau of Statistics

BER : Bangladesh Economic Review

DAE : Department of Agricultural Extension

et al. : et alia (and others)

etc : Etcetra (and others)

eg. : Exempli gratia (for example)

Fig. : Figure

FAO : Food and Agricultural Organization

HYV : High Yielding Variety

kg : Kilogram

mt : Metric Ton

IOC : Interest on Operating Capital

Ln : Natural log

MoP : Muriate of Potash

TSP : Triple Super Phosphate

% : Percentage

Tk. : Taka (Bangladeshi Currency)

CHAPTER 1

INTRODUCTION

1.1 Background of the study

The United Nations declared 2022 as the "International Year of Fruit and Vegetables". The importance of fruit and vegetables across the world will be highlighted throughout the year. Campaigns will be launched and events will be organized on the fateful of fruit and vegetables in nutrition and the problems experienced in the process from production to consumption, losses, the importance of fighting hunger, the contribution of fruit and vegetable growing to sustainable development goals, its role in providing income for small family businesses. These kinds of campaigns and events build important awareness. The United Nations also declared 2016 the International Year of Legumes. The global legumes production increased by 4 percent with the outcome of the studies carried out that year. Legumes consumption has started to spread as a trend around the world. As a matter of fact, after the emergence of corona virus (Covid-19) emerged, when people had to stay at home due to restrictions, legumes consumption increased by 9 percent in 2020 (BBS,2020). Fruit and vegetables are among the product groups consumption whose grown the most during the pandemic. In order to strengthen the immune system, the demand for fruits and vegetables containing vitamin C has grown even more. Fruits and vegetables are inevitable to a healthy and balanced diet. It contributes to the introduction of many nutrients into the human body and strengthening the immune system and reducing the risk of a number of diseases. However, despite these great benefits, we do not consume enough fruits and vegetables. It is hard to assert that Turkey, which ranks 4th in vegetable production across the globe, harness its potential enough. Therefore, campaigns to be launched and promotional activities can be an important opportunity for Turkey. According to the 2020 Crop Production data of Turkey Statistical Institute,

Turkey's fruit production equals to 23 million 585 thousand 768 tons. And its vegetable Production is 31 million 196 thousand 717 tons (FAO,2015). According to FAO data, China ranks first in the world with 554 million tons of vegetable production, India ranks second with 127 million tons and the United States ranks third with 30.8 million tons. Beans are one of the most familiar legumes, along with peas, peanuts, soybeans, lentils, and others. Dry beans are a legume, which is a plant, fruit or, seed that is in the Fabaceae family of flowering plants. The black bean is a medium-sized black-colored. Black beans are native to the Americas and are a staple of Latin American, Cajun, and Creole cuisines. Broad beans, also known as fava beans, are small and have a light green color. Broad beans are one of the earliest plants to have been cultivated by humans. Evidence indicates that these beans were cultivated as early as the seventh century BC in Thailand, with regional variants grown all around the world today. Dry beans can either be purchased canned where they are ready to be eaten right away, although it is recommended they still be cooked. They can also be packaged where most types have to be soaked and then cooked. Dry beans are often used to complement a variety of different dishes and foods like rice, salads, tacos, soups and more. Dry beans can also be seasoned with as several different food items, like chicken broth, ham, olive oil, onions and more. An additional benefit is that dry beans can last for many years if they are stored properly. Dry beans have many healthy aspects to them if one can deal with the flatulence that they are known to cause. Dry beans are known to be high in fiber, iron, zinc, magnesium, copper, and some key vitamins. They are also low in terms of fat content. On top of all of these benefits, dry beans can also serve as a way to get a cheapsource of protein.

Dry beans are known to be high in fiber, iron, zinc, magnesium, copper, and some key vitamins. They are also low in terms of fat content. On top of all of these benefits, dry beans can also serve as a way to get a cheapsource of protein. Indian produces more dry beans than any other country on Earth, followed by Myanmar, Brazil, and the United States. See the table below for the world's top dry bean producing countries .

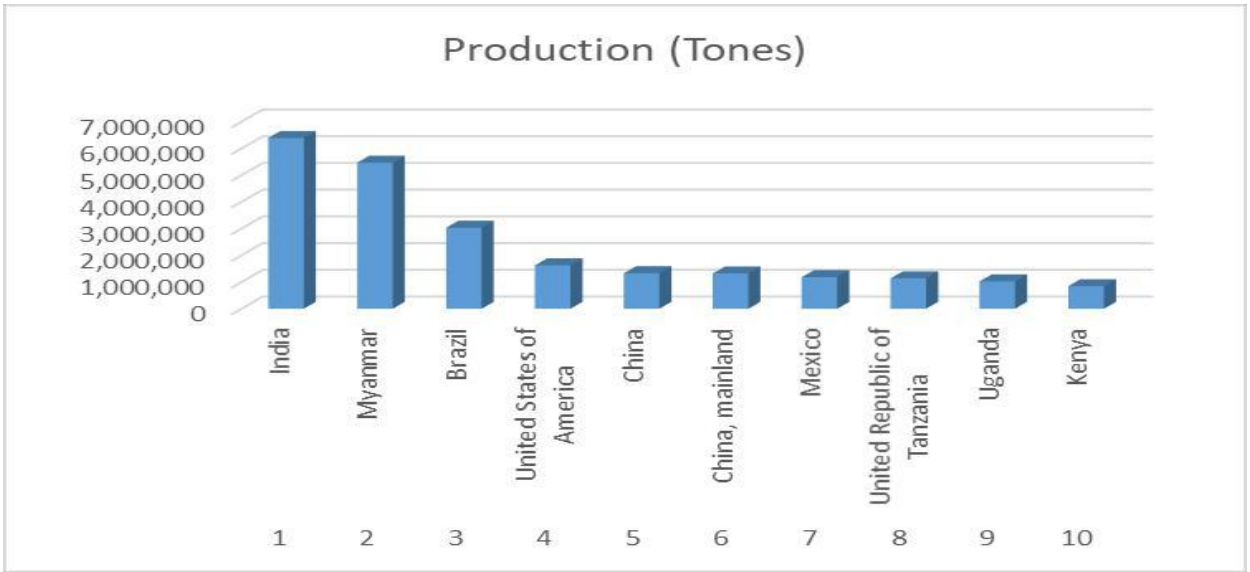


Figure 1: The World's Top Dry Bean Producing Countries

Bangladesh is a densely populated country. The current population of Bangladesh is 166,316,638 in 2021 based on projections of the latest United Nations data and the growth rate is 1.03 percent in 2020 (BBS,2020). Food production needs to increase to fulfill the demand of the increasing population. Although rice is the staple food of this country, government also tries to give incentives for vegetable production, which is very important in improving the diversification of food and farmer's revenue because vegetables are an important source of cash in come for almost all farmers. A large number of vegetables are produced by the farmers of Bangladesh throughout the year. Although there is a great need for commercial vegetables production, farmers usually grow vegetables in and around the homestead areas and to make human diet complete and balanced, intake of vegetables is essential. In Bangladesh vegetables are grown in 2.63 percent of cultivable land (BBS, 2015).

Vegetables are the sources of many essential vitamins such as vitamin A, C, niacin, rivoflavin and thiamin and minerals such as calcium and iron. They contribute to the intake of essential nutrients from other food by making them more palatable (Bithi, 2014). In Bangladesh, the average per capita daily vegetable intake is 56g per day, whereas the recommended intake is 250g/day (FAO, 2015). Historically different types of vegetables are grown in Bangladesh, categorized into two types, summer and winter vegetables. The major winter vegetables are rabi brinjal, rabi pumpkin, cauliflower, cabbage, water gourd, tomato, radish, beans and carrot and the summer vegetables mainly included teasle gourd, kharif pumpkin, kharif brinjal, pointed gourd, lady's finger, ribbed gourd and bitter gourd (Hasan et al., 2014). There are evidences that vegetable production and per acre yield of vegetables have increased in the recent years.

Table 1: Key Statistics of Vegetable production

Item	Year	Area „000" Acres	Production „000" Metric Tons
Vegetable	2019-20	1111	4574
	2018-19	1072	4336
	2017-18	1020	4115

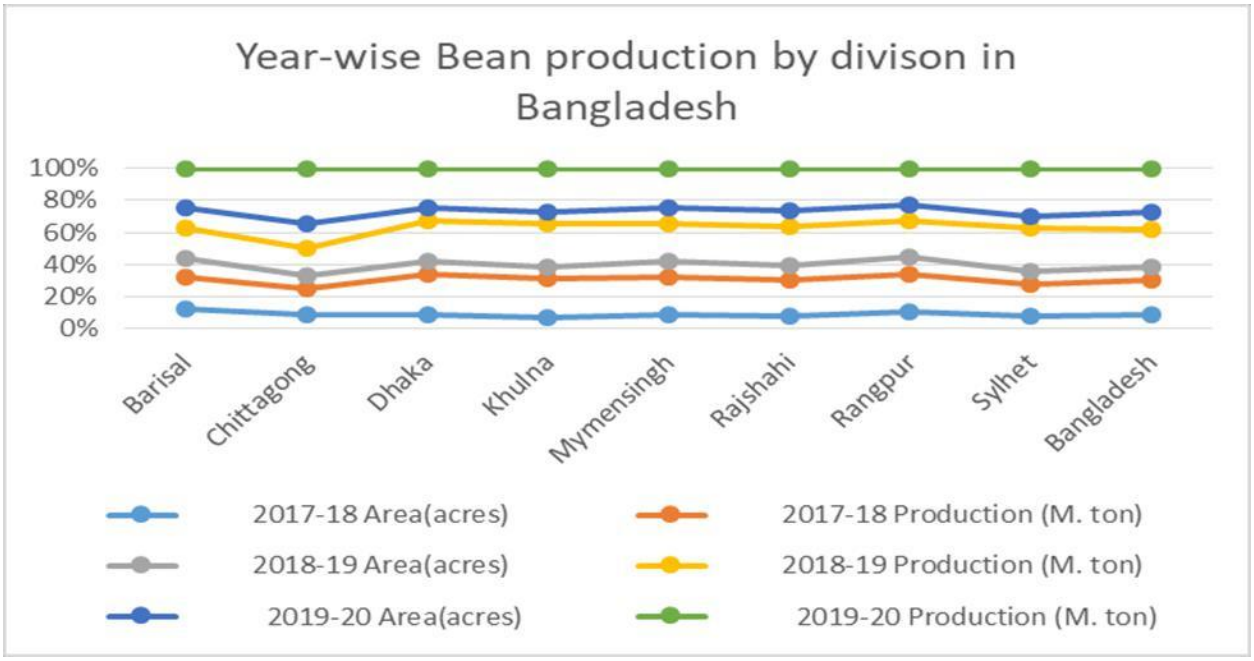
(Yearbook of Agricultural Statistics 2020)

According to Year the look of Agricultural Statistics of Bangladesh, 2020, the data imply that the area and production of vegetables in the country are increasing substantially in recent years.

Leguminous crops like beans play a vital role to meet up our protein requirement. Beans contain 20-30% protein on a dry weight basis which is nearly three times than that in most cereals (Bithi, 2014). Among all the leguminous crops, beans are very popular and nutritious vegetables in Bangladesh and this also provide a good amount of protein in addition to vitamins and minerals.

Bean is an indigenous vegetable of Indo-Bangladesh region. The plant is long trailing and branched. It is treated as a perennial crop at some places. It is a very Important vegetable of Bangladesh and India. In trem of dry matter, calorie, protein, fat,

vitamin A and B, the pods are superior to most other vegetables of creeping nature. Nutritionally, the seed is also nearly at the top of the pulse's list. Country bean is very rich in carbohydrate, protein, fat, vitamins and minerals (Islam et al., 1997). Hundreds grams of green pods of country bean (Dolichos lablab) contain 3.8 gm protein, 8 gm carbohydrate, 85 gm moisture, 1.8 gm fiber, 0.7 gm fat, 48 kilo calorie heat energy and 312 IU (International unit) carotene (Rehana, 2006).In the past years, it was a homestead vegetable in Bangladesh but recently it is cultivated commercially as field crop in flood free high land.



(Yearbook of Agricultural Statistics 2020)

Figure 2: Area and Production of Bean by division in 2017-18 to 2019-20

In different parts of Bangladesh, farmers cultivated beans in fields, house yards, and isles of fish enclosures. Last couple of years, bean production has been increasing in different parts of Bangladesh. The bumper production of beans made the bean farmers happy with the prospect of handsome profit. Bean cultivation is growing in the Mymensingh district as it brings financial benefits to the farmers. There is a great demand of bean seeds in the overseas market which may open a new horizon of export of this vegetable in those markets. Many farmers have changed their lot by growing bean.

Farming of beans has been gaining popularity everywhere in the district for the last couple of years as a result of the rising number of commercial farmers of the cash crop. Growers are seen getting lucrative price of the newly harvested vegetable besides other early variety winter vegetables making the consumers in general also happy at present. The plants were covered with massive green leaves, multicolor flowers and beans. At present, harvested beans have appeared in the local markets abundantly. Beans cultivation has become an effective means of bringing fortune for many farmers in the region comprising two upazilas of the districts in both summer and winter seasons. The farmers are becoming habituated to cultivating beans on homesteads, demarcating lands of paddy fields and other catchment areas as they are earning money regularly. Marginal farmers and the poor people in the region are mostly engaged in this venture by making the best use of spaces around their homes over the last couple of years. The farmers are now not dependent on selling their cash crops in nearly hats and Bazar because the wholesalers are seen purchasing all the seasonal vegetables from the farming fields directly. Large-scale promotion of homestead gardening is being adjudged as an effective means of making the villagers self-reliant as they are getting regular cash crops together with meeting up the nutritional demands.

Bean production will be made sustainable by making production system efficient, effeciently use of inputs to increasing production, efforts should be made toward output growth through enhanced technical efficiency. Growing marginalization of agricultural holdings has constrained the scope for scaling up the yield. Lack of appropriate farm technology further compounded this problem. Technical efficiency in agriculture, affects farm productivity both directly as well as indirectly. Farmers are facing many constraints at the time of being producing bean in the land and make loses for them. The present study attempts to measuring technical efficiency at the farm level, to recast the link between technical efficiency and farm productivity. Policymakers should, therefore, foster the development of the socio-economic, institutional and farm specific factors in order to enhanced the capacity of the bean producing farmers.

1.2 Justification of the study

Bean occupies small share of total cropped area of Mymensingh as well as Bangladesh. To increase bean production it is necessary to develop and adopt latest technologies. Using available resources more efficiently becomes viable in the current situation. Productivity is vital for the future of mankind to meet its basic needs of food, fiber and shelter. Thus, this study is distinct and new one in Mymensingh district, because it is the first ever attempt made to determine profitability in bean production and to identify the factors affecting the level of production of farm household in cultivating bean. It is assumed that sustainable vegetable production in the country can be made at the farm level, identifying key factors linked with an efficient production system and assessing the possibility for and sources of future. An alternative to increase production, efforts should be made to increase output through advanced technical skills. It is necessary to investigate the level of productivity in producing bean in Bangladesh. Some researcher highlights different aspect of bean production in different countries. Only a limited socioeconomic study were done earlier on some bean production in Bangladesh but no study emphasized on analyzing the productivity of bean production at the same time in a single research in the well-known bean producing area. To overcome the existing research gap the present study is undertaken in well-known bean producing districts namely Mymensingh in Bangladesh and popular vegetables namely bean is selected.

Key research questions of the present study are:

i) What are the socioeconomic characteristics of bean growers?

ii) Are bean production profitable for farmers?

iii) Are bean farmers fully efficient to produce bean?

iv) What are the problems of farmers to produce bean?

Therefore, this study has been designed to determine technical efficiency in bean production and to identify factors responsible for various levels of technical efficiency. Another aspect of this study is to ascertain profitability of growing bean and to examine various factors limiting bean production. Results of the study will be helpful for those who are involved in decision making process at the farm level and national level. At the farm level, results would provide information to vegetable growers about better farm management practices and profitability of bean.

1.3 Objectives of the study

The specific objectives of the study are as follows:

- To know the socio-economics status of bean farmers in this study area.
- To determine cost and returns of bean cultivation.
- To identify the factors affecting the profitability of bean farm;
- To identify major problems faced by bean farmers and producers.

1.4 Outline of the study

The study is divided into 5 separate chapters. Chapter 1 deals with the introduction of study. The introduction presents the reasons and main characteristics of the research. After the introduction chapter 2 provides a brief review of research on the topic. Chapter 3 presents the methodology that was used to conduct the study. Chapter 4 includes results and discussion which concerns with some socio-economic characteristics of bean farmers, cost and profit analysis of bean production and production function analysis. Finally, a summary, conclusion and some recommendations are presented in chapter 5.

CHAPTER 2

REVIEW OF LITERATURE

A review of literature presents much more than a summary of relevant sources. The act of reviewing involves evaluating individual sources as well as synthesizing these sources in order to gain a broad view of the field. At this field level, a literature review discusses common and emerging approaches, notable patterns and trends, areas of conflict and controversies, and gaps within the relevant literature. When I was clearly observed these things, I would be able to situate my own research and contribute to ongoing debates within the field. However, the studies, which were to some extent relevant to the present study, were reviewed to justify the merits of the study.

Parvin et al., (2021). analysed the costs, revenues and production problems of tomato in two districts namely Cumilla and Rangpur in Bangladesh. It is necessary to enunciate that through purposive sampling technique, the data were collected from 240 tomato cultivators of Cumilla and Rangpur districts. The essentials of tomato's production include human labour, fertilizer, bamboo stick, thread, seed/seedlings, ploughing, irrigation, insecticides/pesticides, hormone etc. The mentioned factors were collectively considered to estimate the cost of production of tomato. All the data were analyzed statistically and economically while their results have been substantiated through consecutive tables. Farmers are facing different types of problems and this research highlights this issue. The findings show that the total cost of tomato was higher in Cumilla (Tk. 155,515/acre) than that of Rangpur (Tk. 151,224/acre). Gross returns from tomato in Cumilla and Rangpur were Tk. 234,942/acre and Tk. 212,213/acre respectively. The net returns were found higher in Cumilla (Tk. 77,010/acre) than that of Rangpur (Tk. 60,989/acre). Undiscounted benefit cost ratio of tomato production per acre was found to be 1.51 and 1.40 on the basis of total cost for Cumilla and Rangpur districts respectively. The high price of input, lack of storage facilities, price fluctuation, insect and disease damage were the most salient constraints in producing tomato. Up-to-date policy and well-organized extension services have, therefore, to be ensured to augment the income as well as the employment opportunities of the tomato growers.

Beyene et al., (2020). conducted the technical efficiency and impact of improved farm inputs adoption on the yield of haricot bean producer in Hadiya zone, SNNP region, Ethiopia. This study was to analyze the technical efficiency and impact of improved farm inputs adoption on the yield of haricot bean producers. A multi-stage sampling technique was employed to select 231 sample household heads and they were interviewed using structured interview schedule. Data analysis was done with the help of Stochastic Frontier Analysis; mainly Cobb- Douglas Production Function, logistic regression model were employed. The Stochastic Production Frontier result revealed that the allocated amount of land, labor, seed, chemical fertilizer and oxen were appeared to be positively and significantly influencing haricot bean production of both adopters and total sampled householders.

Musaba et al., (2020) analysed the technical efficiency and its determinants in soybean production, applying a Cobb-Douglas stochastic frontier production model on survey data collected from 79 soybean growing households in Mpongwe district of Zambia. The result indicates presence of inefficiencies in soybean production in the area. The efficiency ranged from 5.82% to 85.7% with a mean of 50.3%. This implies that a chance exists for improving soybean output by 49.7% from using existing resources and technology in the study area. The inefficiency model results show that level of education, household size, extension contact, and market distance tend to increase technical inefficiency level among the soybean farmers. On the other hand, herbicide usage has significant negative effects on technical inefficiency of smallholder soybean production in the study area.

Nassary et al., (2020) conducted an assessing the Productivity of Common Bean in Intercrop with Maize across Agro-Ecological Zones of Smallholder Farms in the Northern Highlands of Tanzania. This study tried to assess the productivity of common bean bushy varieties when are involved as part of an intercrop with maize (Zea mays L.) in varying agro-ecological zones. Bean and maize grain yields were used to calculatethe partial (P) and total land equivalent ratio (LER). Results also indicated that continuous intercropping of bean with maize over two cropping seasons resulted in the increase of bean grain yields.

Sousa et al., (2020) analyzed the productivity and Economics of Inoculated Common Beans Affected by Nitrogen Application at Different Phenological Phases. This paper aimed to assessing the agro-economic response of the inoculated common to N-fertilizer topdressing at different phenological phases of the common bean. N-fertilizer in a total of 90 kg ha −1 was applied in the form of urea at 3 phases: planting(P), phenological phase V4 (V4), and phenological phase R5 (R5) of the common bean, in two field experiments. The used all treatments were inoculated with peat inoculum containing the commercial strain SEMIA 4077 (Rhizobium tropici). The number of nodules (NN), nodule dry mass (NDM), leaf area index (LAI), root dry mass (RDM), shoot dry mass (SDM), grain yield (GY), production cost (PC), gross revenue (GR), net revenue (NR), and benefit-cost ratio (BCR) were determined. Inoculated treatment presented higher GY and lower PC, resulting in greater NR and BCR.

Temesgen et al., (2020) studied the factors that affecting the Level of Technical efficiency of Haricot Bean Producing for Smallholder Farmers in Bosat district, East Shoa Zone, Oromia National Regional State, Ethiopia. This study aimed to analyze the level of technical efficiency by smallholder farmers in Bosat district of Oromia National state of Ethiopia. Cobb-Douglas stochastic frontier with a one-step approach used to estimate levels of the technical efficiency. The maximum likelihood parameter estimates showed that haricot bean output was positive and significantly influenced by land, NPSB fertilizer, oxen and labor in man-days. The mean technical efficiency of farmers in the production of haricot bean was 81.4%. This showed that there exists a possibility to increase the level of haricot bean output by 18.6% through efficiently utilizing the existing resources.

Narcisse et al., (2019) analyzed the factors Affecting Technical Efficiency of Beans Production among Smallholder Farmers in Rwanda. This study were to estimate the technical efficiency level in beans production in both Nyanza and Bugesera districts and to determine some socio-economic factors affecting technical efficiency of beans producers in Rwanda. Stochastic Frontier Analysis (SFA) with the Cobb-Douglas function on a random sample of 276 beans farmers. The findings indicated that the mean technical efficiency for beans production in both districts is 23% which means that farmers can increase their output through efficient use of available resources and existing technology if they are to be technically efficient. The study concluded that age,

educational level, fertilizers, labor, land size, seeds, visit of agent of extensions and access to credit were significant variables leading to technical inefficiency in Rwanda. On the other hand, family size, type of seeds, and experience, had no significant impact on farmers' efficiency.

Mitra et al., (2018) conducted an input oriented Data Envelopment Analysis (DEA) was employed for measuring efficiency while Tobit regression model was used to estimate the factors affecting efficiency. Since farmers were operating under the frontier, there is a vast room for efficiency improvement. Moreover, lack of training and education exacerbates the inefficiency. Training, education and local high yielding variety adoption have positive and significant effect on farmers‟ efficiency while age of tomato farmers has negative effect on efficiency. This study will help the tomato producers to facilitate the optimal input use that assist them to reduce the input cost and increase productivity of tomato.

Rana et al., (2018) analyzed farm specific technical efficiency scores using the Cobb-Douglas Stochastic Frontier Production function approach. The study found that technical efficiency of Boro rice farms in Pabna district are 92.3% which indicate that Boro rice farms have been operating below the maximum level of production frontier. It is also found that 'ploughing cost' 'pesticide cost', 'labor cost', and 'irrigation' are the significant elements that affect the level of technical efficiency while ''fertilizer cost' and 'seed' are found insignificant in moving technical efficiency of Boro rice production in the study area.

Wambua et al., (2018) conducted influence of productive resources on bean production in male- and female-headed households in selected bean corridors of Kenya. Data collected from 412 households in the major bean corridors of Kenya (Homa Bay, Machakos, Bomet and Narok counties) were used to explain the importance of access to productive resources and income use in deter- mining the quantity of beans produced by households. The study found that the sex of the respondent was significantly correlated with bean production, with female-headed households producing less beans than the male-headed ones (p = 0.0.08). With regard to access and control of productive resources, households with more agricultural incomes and those who put a larger proportion of their land to agriculture produced more beans (p = 0.008; p = 0.000, respectively). Access and use of fertilized and hired labor was also highly significant.

Moses et al. (2017) conducted technical Efficiency of Soya Beans Production in Mubi North Local Government Area of Adamawa State, Nigeria. The study was to examine the inputs and output relationship of soya bean production in the study area. A multi stage random sampling techniques was used to select 80 respondents in the study area who were noted for soya beans production. Primary data were collected from the respondents with the aid of structured questionnaire and were analyzed using stochastic frontier function. It was therefore recommended that inputs such as seeds, fertilizers and agrochemicals which were the major inputs that increase the output of soya bean production in the study area should be made available on time, in right amounts and at affordable prices to the farmer‟s stakeholders in agriculture.

Nazrul et al., (2017) studied the production potential and Economics of Mung Bean in Rice based Cropping Pattern in Sylhet Region under AEZ 20. Results showed that the improve pattern with management practices provided 10.85 and 14.32% higher grain yield of T. aus and T. aman rice, respectively; also contributed more T. aman mean rice equivalent yield (11.81 t ha-1) compared to farmer‟s pattern. Mean sustainable yield index (77.63%), production efficiency (47.88 kg ha-1day-1), and land use efficiency (67.66%) were maximum in Mung bean-T. aus- T. aman rice cropping system. Similarly, the highest mean gross margin (Tk.126762 ha-1) with benefit cost ratio (2.10) was obtained from improved pattern. Three years results revealed that 42% extra cost provides an ample scope of considerable improvement of the productivity of improved pattern with the inclusion of Mungbean before T. aus rice.

Uddin et al., (2017) used translog Stochastic Frontier production function which is applied to estimate the technical efficiency of both seasons‟ maize. The results showthat mean technical efficiency is found as 87.5% in the case of Rabi season maize, whilst it is 92% for Kharif season maize. An inefficiency effect model estimated by the Maximum Likelihood method shows that variables like education, household size, own land holding, access to credit and total income are negatively related to technical inefficiency of maize production in the Rabi season.

Ali et al., (2016) studied an analysis of off-Season Cucumber Production Efficiency in Punjab: A DEA Approach. Simple random sampling was selected for the collection of primary data from 70 off-season cucumber growers in 2014. Data Envelopment Analysis Procedure revealed that average value of technical efficiency was higher (87.4%). It shows the potential of 12.6% reduction in the level of input use and 58.0% reduction in total cost for obtaining same output level with same technology. The lowest value of technical efficiency (60.7%) was also calculated. Medium farmer shows high value of technical efficiency (96.7%) in case of small farmer. Inefficiency determinants shows that the education, experience in off-season cucumber production and number of meetings with extension staff had significant and negative effect on inefficiency scores.

Contreras et al., (2015) conducted the determinant factors in the technical efficiency of bean farms. The Data Envelopment Analysis (DEA) method was used, a product-oriented model. In the sample of farms bean, the overall technical efficiency (ETG) was 81.2%, broken down into pure technical efficiency (PTE) of 86% and scale efficiency (EE) of 95.1%. Similarly, the inefficiencies caused by technology are higher than those generated by a suboptimal size or scale production.

Kabir et al., (2015) applied translog production function through Stochastic Frontier Approach (SFA) for estimating the efficiency of Boro production. Data were collected from biogas users in the four district of Bangladesh: Mymensingh, Pabna, Thakur gaon and Dinajpur. The efficiency differences are explained mostly by farm size, year of education, family size and off-farm income.

Hasan et al., (2014) analyzed the profitability of Cauliflower and Bean Production in Bangladesh - A Case Study in Three Districts. The results show that total cost of bean is

higher in Comilla than Mymensingh while net farm income is higher in Mymensingh than Comilla. On the other hand, total cost of cauliflower is higher in Comilla than Rajshahi while net farm income is higher in Rajshahi than Comilla. The results indicate that cauliflower and bean productions are profitable in the case study areas. The Problem Confrontation Index (PCI) was applied to rank each problem faced by the farmers. Correlation analysis indicates that farmer's age, education, number of agricultural training; numbers of extension contact and farmer's homestead area are significantly and negatively correlated with problem confrontation.

Sibiko et al., (2013) analysed the determinants of Productivity and Technical Efficiency among Smallholder Common Bean Farmers in Eastern Uganda. Their findings revealed that bean productivity was significantly influenced by plot-size, seeds and planting fertilizer; mean technical efficiency for sampled farms was 48.2%. There were large discrepancies between the most technically efficient and the least technically efficient farms. It was also encouraging that at least half of the farms had technical efficiency scores exceeding the 50% limit and could easily improve to the level of the most efficient farm. The Tobit model estimation showed that technical efficiency was positively influenced by value of assets (at 1% level), extension service and group membership (at 5% level); while age and distance to the factor market negatively influenced technical efficiency at 10 and 5% levels respectively.

Sibiko et al., (2012) estimated the determinants of Common Bean Productivity and Efficiency: A Case of Smallholder Farmers in Eastern Uganda. It was established that bean productivity was positively influenced by plot size, ordinary seeds, certified seeds and planting fertilizers. The mean technical efficiency among bean farms was 48.2%. Finally, Tobit model estimation revealed that technical efficiency was positively influenced by value of assets at 1% level and extension service and group membership at 5% level; while age and distance to the factor market negatively influenced technical efficiency at 10% and 5% levels respectively.

Islam et al., (2011) conducted an economic analysis of Mungbean (Vigna Radiata) Cultivation in some coastal areas of Bangladesh. Their study revealed that Mungbean production was found profitable. The benefit cost ratio (BCR) was 2.22 on full cost basis. The estimated results showed that the average level of technical efficiency among the

sample farmers was 89%. This implies that given the existing technology and level of inputs, the output could be increased by 11 percent. The co-efficients of land preparation, seed, urea and TSP were found positive and significant. Farmer's education and experience had positive significant effect on Mung bean production. Technical Efficiency and Farm Size Productivity—Micro Level Evidence From Jammu & Kashmir studied by Bhatt et al., (2014) and Non-parametric Data Envelopment Analysis (DEA) was used to estimate the technical efficiency using farm level field survey data of 461 farmers in study area for the year 2013-14. Average technical efficiency worked out to be 48%. Most of the farms were operating at low level of technical efficiency. Farm size and productivity efficiency relationship was found to be non-linear, with efficiency first falling and then rising with size. Large farms tend to have higher net farm income per acre and are technically efficient compared to other small farm size categories.

Frito (2008) conducted the technical Efficiency of Traditional and Non-Traditional Crop Production: A Case Study from Haiti. From this paper showed that a stochastic production frontier function to examine the factors socioeconomic and demographic that influence technical efficiency of a traditional crop (bean) and a non-traditional crop (potato) in Haiti. Data from 243 limited resource farmers were used in the empirical analysis. Estimated production efficiency, measured by the production efficiency index, ranged from 2 to 85% for bean and from 5.6 to 91.8% for potato farms. The analysis reveals that average levels of technical efficiency were 48 and 61% for bean and potato farms respectively. Results indicate that technical efficiency for bean and potato was related to credit access and education level.

Bakhsh et al., (2007) used stochastic frontier production function to estimate technical efficiency and its determinants. Results indicated that irrigation, labor and location were contributing towards higher yield whereas fertilizer was negatively related with yield in the production function. Inefficiency effect model showed that age of bitter gourd growers was positively related with technical inefficiency while family size, fertilizer and plant protection measures were found decreasing technical inefficiency.

Makoko et al., (2007) analyzed cost efficiency of the smallholder cotton farms using a stochastic translog cost function model. The inefficiency model in which cost

inefficiency effects are specified to be functions of socioeconomic variables, is also estimated to determine factors influencing cost efficiency.

Shao et al., (2001) examined the technical efficiency analysis of information technology investments: a two-stage empirical investigation. This paper has focused on the relationship between IT investments and technical efficiency in the firm's production process and employed a two-stage analytical investigation, DEA and the Tobit regression model. This study have obtained statistical evidence suggesting that IT, in general, exerts a significantly positive influence on the firm's technical efficiency. Due to the close relationship between technical efficiency and productivity, this study offers another way to explain the productivity paradox associated with IT.

Remarks: An essential preliminary task for any researcher is to go through the existing relevant literature in order to acquire with the available knowledge. The literature review is helpful to know the present status of the problem, what has been done and what is left to be done. The main purpose of this chapter is to review the previous relevant studies. The literature reviews mentioned above clearly indicate that most of the research studies include production practices of bean, profitability, factors of bean production, technical efficiency of bean farmers, productivity of bean production and problem faced by them. But there is few research in the perspective of Bangladesh that will help to present the technical efficiency of bean producer. The present study is completely a new one and hence, no systematic research has yet been carried out in Mymensingh district. Therefore, to minimize the research gap, this research would be helpful.

Chapter 3

METHODOLOGY OF THE STUDY

3.1 Introduction

This chapter provides a discussion on Methodology applied in this study. Proper methodology is a prerequisite of a good research. The reliability of a scientific research depends to a great extent on the appropriate methodology used in the research. Using an inappropriate methodology may lead to an erroneous result. A researcher has to give a careful consideration in following a scientific and logical methodology for carrying out any scientific research. Selection of a particular method depends on many considerations, such as, nature and scope of the research, availability of literature and primary information, availability of funds, time etc. Survey method has been used in the present study because it is thought to have some advantages over the other methods. This method enables quick investigation, the result achieved has wider applicability and the method is usually more comprehensive. However, survey method has also some drawbacks.

3.2 Selection of the study area

The selection of the study area is an important step in a farm management. It largely depends on the objectives of the study. It is necessary to select an area where a particular set of objectives can be fulfilled. Mymensingh district is a major bean growing area of Bangladesh. Besides, the farmers of Mymensingh district are being interested to grow bean. The upazila is the second lowest tier of administrative government in Bangladesh. The districts of Bangladesh are divided into sub-districts called Upazilas (Sarker, 2010). Spatial variation of different household characteristics was found in the different studies in Bangladesh (Sarker, 2012).

Considering the objectives of the study, three villages of Muktagacha Upazila and three villages of Fulbaria Upazila of Mymensingh district were selected purposively.

The reasons behind the selection of these areas are:

i. The study area is accessible to the researcher, who is familiar with the local dialects.

ii. The villages of the two Upazilas were found to be good bean growing areas.

iii. Desired better co-operation from the farmers.

iv. It was easier to communicate with expected respondents of these areas.

3.2.1 Location

Mymensingh District, with a latitude of 24.75 (24° 45' 0 N) and a longitude of 90.4 (90° 24' 0 E), is situated 93 kilometers North East (26°) of the approximate center of Bangladesh and 114 kilometers North (0°) to the capital city Dhaka. The study areas are Muktagacha and Fulbaria upazilas of Mymensingh district. The area of Muktagacha upazila is 314.71 km2 and area of Fulbaria upazila is 402.41 km2.

Fig: 3.1 A map of Mymensingh District

3.3 Sampling technique and selection of sample

Due to limitations of time and resources it was not possible to interview all the bean growing farmers in the study area. For this reason, a reasonable size of sample was taken. Total 80 farmers, 40 from each Upazila, were selected for the study. Among the sample farmers, 20 farmers were from Shibrampur village, 12 from Salna village, 8 from Banarpar village, 17 from Shipganj village, 16 from Dhamor village and 7 from Patira village were selected.

Table 3.1 Distribution of sample farmers.

Upazilla	Union	Villages	Bean farmers
Muktagacha	Kashimpur	Shibrampur	20
	Dulla	Salna	12
		Banarpar	8
Trishal	Putijana	Shipganj	17
		Dhamor	16
	Asim-Patuli	Patira	7
Total			**80**

Source: Field survey (2022)

3.4 Preparation of interview schedule

A draft questionnaire was prepared in order to collect episodic information from the selected farmers. The interview schedule was formulated in such a way that it covered all the information needed in the analysis and all aspects associated with the objectives could be covered. The questions were covered logically and in appropriate sequence to confirm that they could easily be understood by the informers and their responses could be quicker. The questionnaire was pre tested by interviewing some bean farmers and then necessary modification and additions were made and then the draft questionnaire was finalized. The final questionnaire contained three types of information about the sample farmers, their socio-economic condition, cost and return from bean cultivation and the problems faced by them.

3.5 Period of the study

Bean is grown in this country only in kharif 1 season (Mid March to mid July). Data were collected during the period of September to October in 2021 through direct interview with the bean farmers. Data relating to inputs and outputs were collected by making time to time visits in the study area during this period.

3.6 Data collection methods

For the present study, data were collected from primary sources through field survey and its collection was accomplished by direct interviews with the bean farmers. Researcher herself collected the relevant data from the selected bean growers. At the time of interview, the researcher asked questions systematically and a brief introduction about the aims and objectives of the study was given to each respondent. The questions were asked in a very simple manner and information was recorded on the interview schedule. It was explained to the Farmers that the study was purely academic. Each time, when interview was over, the interview schedule was checked again to confirm that these were correct and properly recorded.

3.7 Processing, editing and tabulation of data

The collected data were manually coded and edited. Then all the collected data were anatomized and summarized carefully. Data were processed and transfer to Excel sheets to simplifying in order to meet the objectives of the study. Moreover, data entry was made in computer and analyses were done using the concerned software Microsoft Excel and SPSS.

3.8 Analytical technique

Data were analyzed in order to reach a meaningful result and achieving the objectives of the study. Descriptive statistics and profitability analysis as well as Cobb-Douglas production function model were chosen for this study.

3.8.1 Descriptive statistics

The descriptive statistic is a technique commonly used for the sum, average, and percentage of costs, gross returns, net returns and profitability of bean growing farmers. It is also used for analyzing socioeconomic conditions like, age, income, literacy, occupation etc and problems faced by the bean producers.

3.8.2 Profitability analysis

Per hectare net return was determined by subtracting per hectare total costs (variable and fixed cost) of production from per hectare total return. The following profit equation was used to count the profitability of bean production.

$\pi = TR-TC$
Or, $\pi = TR- (TVC+TFC)$

Where ,

Profit (π) = Net return from bean production (Tk/ha).

TVC = Total variable cost involved in bean production.

TFC = Total fixed cost involved in bean production.

3.8.3 Cobb-Douglas production function model

The production function represents the technological relationship between output and factor inputs. The Cobb-Douglas form of production function model was used to estimate the effects of key variables to the production of bean. Cobb-Douglas production function has the following characteristics:

i. The function is linear in logs.

= It directly provides the elasticities of bean production with respect to inputs.

= Total variations in the output explained by the selected inputs are measured by co-efficient of multiple determination.

= The individual co-efficient represents relative factors share if there is constant return to scale.

= It simplifies the calculations by reducing the number of regressors to be handled in regression analysis.

The specification of the Cobb-Douglas production (a multiplicative term) for bean was as follows:

$$Yi = a\ X_1^{b_1}\ X_2^{b_2}\ X_3^{b_3}\ X_4^{b_4}\ X_5^{b_5}\ X_6^{b_6}\ U_i \quad \text{..... (i)}$$

In the Linear form it can be written as follows:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + U_i \quad \text{..... (ii)}$$

Where,

Y = Gross Return (TK/ha)

X_1 = Tillage cost (TK/ha)

X_2 = Seed cost (TK/ha)

X_3 = Human labor cost (TK/ha)

X_4 =Fertilizer cost (TK/ha)

X_5= Pesticides cost (TK/ha)

X_6 = Irrigation cost (TK/ha)

a = Intercept/ constant

b_1, b_2, b_3, b_4, b_5, b_6 = Production Co-efficient

U_i = Error term

3.9 Problems faced in collecting data

There are some problems and difficulties faced by the researcher during the period of data collection. Data were collected within shortest possible time, due to limited fund. Most of the respondents did not keep any accurate records of cost and returns, so the researcher had to depend on only the memory of the respondents for collecting necessary information. Morever, the farmers always tried to avoid providing proper information relating to the actual size of holding income accrued from bean production. In a few cases, the farmers were not found at home. This needed two or three visits to conduct even a single interview. To overcome all these problems and to obtain accurate information, it required a good deal of patience of the researcher.

3.10 Limitations of the study

The present study provides some useful information for researcher, farmers and decision makers regarding bean production. However, there are some limitations of the study, the main limitations are as follows:

(a) The present study was conducted on a small sample size and in a specific geographic area (Muktagacha and Fulbaria Upazila of Mymensingh District) of Bangladesh due to shortage of time and fund. Observation of only 80 samples may be inadequate to represent actual situation. The result might be more accurate and reliable if data were collected from large sample covering a large area.

(b) In rural Bangladesh, most of the farmers are illiterate or have a few years formal education, they do not keep any records of farm transactions.

(c) Some farmers at first did not show interest to give information as there was no direct benefit for them.

There was difference in data of cost and return collected from different farmers having same amount of area in bean production. It created some confusing situations

Chapter 4

RESULTS AND DISCUSSION

4.1. Socioeconomic Characteristics of Sample Farmers

4.1.1 Introduction

The purpose of this chapter is to discuss the socioeconomic characteristics of the farmer producing bean. Socio-economic characteristics of any decision maker are very important for overall farm decision, as crop selection, production pattern and technology adoption are largely influenced by individual's socio-economic characteristics. People differ from one another in many aspects, because there are mass interrelated and constituent attributes that determine the development of behavior and personality. Some important features of the socio-economic profiles such as age, education, family size, farm size, occupation, income, etc. of the sample farmers are presented below.

4.1.2 Age

The selected bean farmers were grouped into four categories according to their age. The different age groups of the bean farm owners from two locations, e.g. Muktagacha and Fulbaria upazilas are given in Table 4.1. It is revealed from the Table that the highest number of farmer (42.5 percent) came from age group 31-45 years and the lowest (3.75 percent) came from age group less than 31 years. It is also presented that 41.75% of the bean farmers fell into the 46-55 years age group and remaining 12.5% fell into above 55 years age group. The study revealed that majority of the farmers were of middle age to old age group.

Table 4.1 Age distribution status of the respondents

Age Range	No of farmers			Percentage
	Muktagacha	Fulbaria	All farmers	
Below 31 years	2	1	3	3.75
31-45 years	14	19	34	42.5
46-55 years	18	16	33	41.75
Above 55 years	6	4	10	12.5
Total			**80**	**100**

Source: Field survey (2022)

4.1.3 Occupational status of the selected respondents

Agriculture was the main occupation and major source of livelihood of most of the selected household in both locations of the study areas. Beside agriculture, a few numbers of farmers were engaged in business, service and others as their main occupation. Table 4.2 shows the occupation status of the sample farmers. It is showed that farming was the main occupation of about 84% of the sample farmers. More than 6% farmers were engaged in business and 10% in service, who had taken agriculture as subsidiary occupation. At Fulbaria upazila, many farmers were engaged in fruits and vegetables gardening along with bean production. Occupational diversity was comparatively less at Muktagacha upazila.

Table 4.2 Occupational status of sample farmers

Occupation	Muktagacha		Fulbaria	
	Main occupation (no)	Subsidiary occupation (no)	Main occupation (no)	Subsidiary occupation (no)
Agriculture	35	5	32	8
Business	1	9	4	14
Service	4	6	4	2

Source: Field survey (2022)

4.1.4 Land ownership pattern and farm size

Land is the most important asset of crop farming. Farm size refers to the whole land operated by the farmers during study period, whether it is their own land or obtained from others by rented in. Table 4.3 presents the land holding, utilization pattern and farm size of the selected sample Farmers.

Table 4.3 Average land distribution of the sample farmers

Categories of land	Average Area (ha)			Percentage
	Muktagacha	Fulbaria	All farmers	
Own land	0.44	0.78	0.61	73.49
Rented land	0.08	0.10	0.09	10.85
Shared land	0.05	0.09	0.07	8.43
Leased land	0.10	0.02	0.06	7.23
Total	**0.67**	**0.99**	**0.83**	**100**

Source: Field survey (2022)

Table 4.3 shows that the average cultivable land of the sample farmers is 0.61 hectare and their average total land holding is 0.83 hectare. It was revealed that, own cultivable land and total farm size of the farmers belonging Fulbaria upazila was larger than Muktagacha. The study found that average land holding of the farmers of Muktagacha upazila was 0.67 hactare and in Fulbaria upazila it was 0.99 hectare.

4.1.5 Conclusion

It is clear from the above discussion that socio-economic characteristics differ among farmers. There are many socio-economic differences between two upazilas. Mainly there was remarkable variation in land ownership pattern and occupation.

4.2 Cost and Returns of Bean Cultivation

4.2.1 Introduction

This chapter attempts to estimate the cost, return and profitability of bean cultivators of the study area. Cost of input used has a vital role on producer's decision making. So, clarification of cost items is needed to calculate profit or loss. All the components of costs and returns of bean production are discussed in this chapter. The following cost components of bean production were considered:

1. Cost of tillage
2. Cost of human labor
3. Cost of seed
4. Cost of manures and fertilizers
5. Cost of pesticides
6. Cost of irrigation
7. Interest on operating capital (10% for 4 month)

4.2.2 Cost of tillage

Power tiller has been widely used for tillage operation in the study area. Almost all farmers used power tiller for land preparation. There was a fixed rent of power tiller for per local unit of land. Per hectare land preparation cost at Muktagacha upazila was Tk. 2909.50 and Tk. 3804.38 at Fulbaria Upazila. Per hectare average cost of tillage was Tk. 3356.94, which was 10.36% of total cost of bean cultivation.

4.2.3 Cost of human labor

The larger portion of bean production cost was the cost of human labor. It was the most important and largely used input of bean production. Human labor required for different operations of bean production such as land preparation, operating power tiller, seed sowing, fertilizer sowing, controlling insect and pesticides etc. In the study area, some farmers and their family members worked as family labor, besides hiring purchased labor. Total hired labor cost of per hectare land was Tk. 5243.78 at Muktagacha upazila and Fulbaria was Tk. 6877.82. From the table 5.1, it was found that per hectare hired labor cost was higher in Fulbaria upazila than Muktagacha upazila.

4.2.4 Cost of seed

All of the farmers used purchased seed collected from local market, in the study area. Cost of bean seed varied in the study area depending upon the quality and availability of seeds. Average price of one kg seed was Tk. 274.50. The average quantity of bean seed used by the farmer was 7.08 kg/ha from the table no.4.1. Cost of seed per hectare was calculated Tk. 1955.63, which was 6.04% of total cost from the table no.4.5.

4.2.5 Cost of fertilizer and manure

Mainly five kinds of inorganic fertilizers namely Urea, Triple Super Phosphate (TSP), and Muriate of Potash (MOP), compost, oilcake are applied by most of the farmers in the study area. Optimum amount of fertilizer application is very important for a good yield. Farmers also used manure e.g. cowdung in their bean field. All fertilizers were bought from local market and manure was mostly collected from their own household. This cost was determined at the prevailing market rate. The average price of Urea, TSP, MoP, compost and oilcake were 18 Tk./kg, 28 Tk./kg , 16 Tk./kg ,12 Tk/kg, and 37 Tk./kg respectively from the table no. 4.4. Per hectare cost of Urea, TSP, MoP, compost and oilcake were Tk. 102.95, Tk. 479.73, Tk. 188.64, Tk. 791.84 and Tk. 2049.60 respectively from the table no 4.5.

4.2.6 Cost of irrigation

The irrigation cost was Tk. 3855 at Muktagacha upazila and Tk. 5395 at Fulbaria upazila. Cost of irrigation per hectare was calculated Tk. 4625, which was 14.27% of total cost from the table no 4.5 in the study area.

4.2.7 Cost of pesticides

Bean cultivators used various pesticides to protect their crops from pest attack and diseases. Per hectare pesticide cost in bean cultivation in the study area was Tk. 7469.38 per hectare which was 23.25% of total cost.

4.2.8 Interest on operating capital

All operating costs such as the costs of power tiller, human labor, seeds, fertilizers, manure etc. were taken into consideration to calculate the interest on operating capital. It was estimated on the average operating cost over the production period because all costs were not incurred at the beginning or at any fixed time. In this study, interest on operating capital was charged for the duration of four months and at the rate of 10 percent per annum assuming that, if the growers borrowed that money from bank, they had to pay interest at the same rate. It was estimated by the following formula (Miah 1987) :

$$\text{Interest on operating capital} = \frac{Al \; x \; i \; x \; t}{2}$$

Where,

Al = Total operating capital

i = Interest rate per year (%) and

t = Length of the bean production period (month)

In this study, interest on operating capital was charged at the rate of 10 percent per annum and was estimated for the duration of 4 months. Average Interest on operating capital was calculated Tk. 904.35 per hectare from the table no.4.5 in the study area.

4.2.9 Land use cost

Land use cost usually varies depending on location, accessibility and fertility of land. Duration of four months was considered as the cropping period of bean production in the study area and the land rent was estimated at a prevailing rate. Per hectare average rental value of land in both location was estimated Tk. 3532.70 from the table no.4.5, considering all the sample farmers. It is noted that there was a little variation of fixed cost among farmers according to their land holding.

4.2.10 Total cost

Total cost is a sum of total variable cost and total fixed cost. Costs of all resources used in production were added together in order to estimate per hectare total cost. Land use cost, cost of family labor and cost of interest on operating capital were added as fixed cost. Per hectare total cost was estimated Tk. 32402.38 from the table no.4.5 in the study area.

Table 4.4: Level of input use per farm of bean cultivation

Particulars	Muktagacha	Fulbaria	All farms	Price (Tk/unit)
Human Labor (Man Days)				
Hired	13.9	17.00	15.45	390
Family	2.10	2.18	2.14	390
Seed (kg)	5.79	8.36	7.08	274.50
Urea (kg)	4.96	6.54	5.75	18
TSP (kg)	15.24	20.09	17.66	28
MoP (kg)	10.01	12.98	11.49	16
Compost (kg)	55	74.50	65	12
Oilcake (kg)	48.65	61.93	55.29	37

Source: Field survey (2022)

Per hectare cost of the sample farmers are given bellow:

Table 4.5: Per hectare cost of bean production in the study Location

Items		**Muktagacha (Tk./ha)**	**Fulbaria (Tk./ha)**	**Total cost (Tk./ha)**	**Percentage**
Variable Cost					
Tillage cost		2909.50	3804.38	3356.94	10.36
Hired Labor		5243.78	6877.82	6110.80	18.86
Seed		1703.13	2208.13	1955.63	6.04
Fertilizers	Urea	88.98	116.93	102.95	0.32
	TSP	415.78	543.68	479.73	1.48
	MoP	161.45	215.83	188.64	0.58
	Compost	667.45	916.23	791.84	2.44
	Oilcake	1763.00	2335.60	2049.60	6.33
Irrigation cost		3855.00	5395.00	4625.00	14.27
Pesticides cost		6464.25	8474.50	7469.38	23.25
Total Variable Cost (TVC)		**23272.32**	**30888.10**	**27130.51**	**83.73**
Family labor		788.21	880.93	834.82	2.58
Land use cost		3163.73	3868.13	3532.70	10.90
Interest on operating capital (10% for 4 months)		775.75	1029.60	904.35	2.29
Total Fixed Cost (TFC)		**4727.69**	**5778.66**	**5271.87**	**16.27**
Total Cost (TVC+TFC)		**28000.01**	**36666.76**	**32402.38**	**100**

Source: Field survey (2022)

4.2.11 Gross return

Gross return from bean production is the sum of monetary value. Average yield of bean production was 3472.10 Tk./ha. Per hectare gross return from bean production was Tk. 88516.76 and Tk. 109929.24 from the table no. 4.6 at Muktagacha and Fulbaria upazila respectively.

Table 4.6 Per hectare return of bean production in the study area

Particulars	**Muktagacha (Tk.)**	**Fulbaria (Tk.)**	**All (Tk.)**
Average Yield(kg)	3046.00	3898.20	3472.10
Average Price (Tk./kg)	29.06	28.20	28.60
Gross Return	88516.76	109929.24	99302.06
Total Variable Cost	232772.32	30888.10	27130.51
Total Cost	28000.01	36666.76	32402.38
Net Return	60516.75	73262.48	66899.68
BCR	3.16	3.00	3.06

Source: Field survey (2022)

4.2.12 Benefit cost ratio

BCR refers to undiscounted benefits and costs which was calculated by dividing gross return by total cost. This measure helps to see the resource use efficiency. Benefit Cost Ratio on total cost basis was 3.06 from the table no.(4.6) which indicates that bean cultivation was profitable in the study area.

4.2.13 Concluding remarks

From the above result and discussion it is seen that there are some variation in the profitability of bean between two selected upazilas. Per hectare total cost and return was found higher at Fulbaria upazila than Muktagacha upazila. BCR was also higher at Fulbaria upazila. The findings show that bean cultivation in Fulbaria upazila was more profitable than Muktagacha upazila. It is clear from above mentioned discussion that in the study areas of Mymensingh district, bean cultivation was profitable.

4.3 Production Function Analysis

4.3.1 Introduction

In this chapter, an attempt has been made to identify and measure the effects of the factors on gross return of bean production in the framework of production function analysis. Cobb-Douglas production function model was chosen. This analysis is expected to provide a clear view about the productivity situation. Under bean production, six variables were identified as key contributor to the production process. These are tillage cost (X_1), seed cost (X_2), human labor cost (X_3), fertilizer cost (X_4), pesticides cost (X_5) and irrigation cost (X_6). There are many other variables which affect the production process directly or indirectly. However, these were not considered in this study.

4.3.2 Functional relationship

Findings from a log-linear specification are measured in table 4.7. The estimated Cobb-Douglas production function for bean was:

$$\ln Y = 5.446 - 0.052\ln X_1 + 0.128\ln X_2 + 0.012\ln X_3 + 0.565\ln X_4 + 0.027\ln X_5 + 0.065 \ln X_6 + U_i$$

Where,

Y = Gross Return (TK/ha)

X_1 = Tillage cost (TK/ha)

X_2 = Seed cost (TK/ha)

X_3 = human labor cost (TK/ha)

X_4 = Fertilizer cost (TK/ha)

X_5 = Pesticides cost (TK/ha)

X_6 = Irrigation cost (TK/ha)

U_i = Error term

4.3.3 In

Interpretations of the estimated coefficients and related statistics of the model are given below:

Table 4.7 Estimated values of Regression Coefficients and related statistics of Cobb-Douglas production function model.

Explanatory variables	**Coefficients**	**t-value**	**Standard error**
Intercept	5.446	12.447***	0.438
Tillage cost	-0.052	-0.553	0.093
Seed cost	0.128	2.711**	0.047
Human labour cost	0.012	0.150	0.083
Fertilizer cost	0.565	4.073***	0.139
Pesticides cost	0.027	0.222	0.121
Irrigation cost	0.065	0.465	0.140
R^2	0.765		
F-value	105.852***		
Return to scale	0.745		

Note:*Significant at 10 Percent level.

**Significant at 5 Percent level.

***Significant at 1 Percent level.

4.3.3.1 Constant or intercept term

The value of constant represents the composite impact of all other influencing variables that are excluded from the model. Six individual variables were taken into consideration for production analysis of bean.

4.3.3.2 Tillage cost

It can be seen from Table 6.1 that the estimated co-efficient of tillage cost was negative (-0.052) for bean production. There was a negative relationship between tillage cost and gross return. It indicated that holding other variables constant, one percent increase in tillage cost would decrease gross return by 0.052 percent.

4.3.3.3 Seed cost

The regression co-efficient of seed cost was (0.128) for bean production, which was significant at 5 percent level. It indicated that considering all other factors constant, one percent increase in seed cost would increase gross return by 0.128 percent.

4.3.3.4 Human labor cost

The co-efficient of human labor cost was estimated as 0.012 for bean production which was positive. It indicated a positive relationship between gross return and human labor cost. That means 1 percent increase in human labor cost would increase gross return by 0.012 percent.

4.3.3.5 Fertilizer cost

The regression coefficient of fertilizer cost for bean production was estimated 0.565 which was highly significant at 1 percent level of significance. Thus there was a positive relationship between fertilizer cost and gross return. It indicated that considering all other variables constant, one percent increase in fertilizer cost, would increase gross return by 0.565 percent for bean production.

4.3.3.6 Pesticides cost

The regression coefficient of pesticides cost was 0.027 for bean production which was positive. It indicated that considering all other variables constant, one percent increase in pesticides cost, would increase gross return by 0.027 percent for bean production.

4.3.3.7 Irrigation cost

The coefficient of irrigation cost was estimated as 0.065 for bean production which was positive. It indicated a positive relationship between gross return and irrigation cost. That means one percent increase in irrigation cost would increase gross return by 0.065 percent for bean production.

4.3.4 Value of R^2

The estimated value of the goodness of fit, R^2 of the model was 0.765 for bean production. R^2 value of 0.765 indicated that about 76 percent of the total variations in gross returns under bean production have been explained by the variables included in the model. In other words, 24 percent of the total variation in the gross return is unexplained.

4.3.5 F Value

F-statistic was estimated for overall significance of the estimated model. The F-values of the model derived for bean production was 105.85 which was highly significant at one percent level of significance which signifying that all the explanatory variables included in the model were important for explaining the variations in gross returns under bean production.

4.3.6 Returns to scale ($\sum b_i$)

Return to scale reflects the degree to which a proportional increase in all inputs increased the output. Constant returns to scale occurs when a proportional increase in all inputs results in the same proportional increase in output. Increasing and reducing returns to scale occurs when proportional increase in all inputs results in more proportional increase in outputs than proportional increase in inputs and results a decrease in output, respectively. The summation of all the regression co-efficient of the estimated model gives information about the returns to scale, that is, the response of output to a proportionate change in all inputs. In the present research, The value of returns to scale was estimated as 0.745 for bean production. It indicates that if all the inputs specified in the model were increased by 1 percent, the gross return of bean production would increase by 0.745 percent. That is, the production function displays reducing returns to scale.

4.4. Problems faced in Bean Production

4.4.1 Introduction

This chapter emphasizes the major problems of the bean growers in managing bean cultivation in the study area. Every respondent farmer was asked if there were any problems faced by them related to farming of bean. Their opinions were recorded by the researcher. There were multiple numbers of problem faced by the farmers, these problems confronted by the individual farmers were not identical for the production. All of these problems are briefly discussed below.

4.4.2 Low Price of bean

Bean is one of the most popular and widely vegetables in Bangladesh. Many farmers family expect to meet their family needs by selling bean with a good return. So, low price of bean is a very big problem. Most of the time bean growers are deprived of a reasonable price for selling peak time. Only a few respondents said that they were satisfied with the selling price due to early harvest. There was frequently fluctuated in the market price of bean.

4.4.3. Labor shortage

Bean is a perishable crop. So, hired labors are needed for performing various operations of bean cultivation in peak time. According to many researchers, the highest percentage of production cost goes for labor wages. During the period of harvesting, shortage of human labor was found in the study area. Following the shortage of labor, wage increased significantly during the production season. About 45.75% sample farmers complained about unavailability of labor at due time.

4.4.4 High price of seed and Low quality of fertilizer

Now a days, the price of inputs particularly fertilizers is higher than the government rates and its distribution channel is a quite inefficient and unserviceable. Farmers said that price of bean seed was very high. The price of urea was reasonable but price of TSP and MoP fertilizer was higher than urea. Majority of the farmers of this study are small farmers and most of them can hardly afford proper dose of fertilizers.

4.4.5. Insect and pest attack

A few farmers (25.5%) reported that, attack of insects and pest e.g. red mites attack leads to a decrease in bean production.

4.4.6. Non-availability of Credit

Huge amount of cash money is needed in bean cultivation. Farmers need to purchase various inputs like seed, human labor, fertilizers and pesticides in proper time. Most of the sample farmers were not well off and they faced this financial constraint. About 64% farmers had lack of capital at different stage of cultivation.

4.4.7 Marketing cost

Farmers usually prefer to sell their product at their field in order to save the transportation cost. Most of the times, they sold their products to the paikers at a lower rate than village market. Some farmers sold their products at village market. It was observed that, selling at their field has the demerits of lower price and selling at market considering transportation cost. About 13% farmers complained about transportation cost.

4.4.8 Concluding remarks

Bean plays an important role in earning cash money for the small farmers . There are many internal and external problems faced by the farmers in producing bean. It can, therefore, be concluded that hectarage of bean production could possibly be increased to a large extent if the above mentioned problems can be solved immediately.

Table 4.8 Problems faced by the bean farmers in the study area

Types of problems	Rank	No of respondents	Percentage
Non-availability of credit	1	52	64
High rate of interest	2	51	61.25
Labor supply shortage in peak season	3	38	45.75
High price of labor	4	30	38.5
Insect and Pest attack	5	21	25.5
High price of seed	6	16	19
Low quality of fertilizers	7	14	16.5
Marketing cost	8	12	13
Natural calamity	9	11	11.75

Source: Field survey (2022)

CHAPTER 5

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATION

5.1 Summary

Legumes consumption has ongoing to spread as a trend around the world. Fruits and vegetables are inevitable to a healthy and balanced diet. It contributes to the introduction of many nutrients into the human body and strengthening the immune system and reducing the risk of a number of diseases. Beans are one of the most familiar legumes, along with peas, peanuts, soybeans, lentils, and others. Bean production will be made sustainable by making production system efficient, effeciently use of inputs to increasing production, efforts should be made toward output growth through enhanced technical efficiency. The present study was undertaken with a view to determine the technical efficiency in bean production and to identify factors responsible covering 80 sampled farmers from two upazilas (Muktagacha and Fulbaria) of Mymensingh district. Data were analyzed with the purpose of achieving the objectives of the study.

In studying the socio-economic characteristics, it was found that, maximum farmers are in age group of 31 to 45 years. The illiteracy rate of bean farmers was high. Most of the Bean farmers had 11 to 20 years of bean production experience. Maximum farmer was marginal on the basis of land farm holding size. Most of the bean farmers had not received any training and extension services. Cobb-Douglas production function method has been used due to its importance according to the data and objectives and Regression model based on constant, variable and return to scale were used in this study. For this two model, the explanatory variables were Tillage cost, Seed price, Human labor cost, Fertilizer cost, Pesticides cost, Irrigation cost. The result from Cobb-Douglas production function indicated that the co-efficient of Seed price and Fertilizer cost had a significant and positive impact on bean production. The results of the study showed that, per hectare average total cost for producing bean was Tk. 32402.38. Per

hectare gross returns above cash cost from bean production was estimated Tk. 99302.06 and per hectare average net return of bean production was Tk. 66899.68. It was also expressed that net return was higher at Fulbaria upazila. The study considered human labor cost, tillage cost, seed cost, fertilizer cost, irrigation cost, and pesticides cost, these six variables. The study also marked out that bean producers were facing some problems such as: low price of bean, high labor cost, unavailability of human labor, farmers not keeping any records of bean production etc. If these problems could be solved within the shortest possible time, all the bean producers could be able to earn a much higher profit than the existing level. On the basis of findings, some recommendations were made for the development of bean sector in Bangladesh.

The main problems faced by the farmers were found as non-availability of credit, high rate of interest, labor supply shortage in peak season, high price of labor, high price of seed, high price of fertilizer, low quality of fertilizer, disease, insect and pest attack, insecticide or pesticide is not available in time and natural calamity.

5.2. Conclusions

The empherical result of cobb-douglas production function indicated that the co-efficient are tillage cost, Seed price, Human labor cost, Fertilizer cost, irrigation cost and pesticide cost. Furthermore, estimated co-efficient model showed that bean seed cost, and fertilizer cost had significantly positive effect and tillage cost had significantly negative effect on the efficiency of bean production. The estimated value of the goodness of fit was about 91 percent of the total variations in gross returns under bean production have been explained by the variables included in the model. Bean was found severely affected by insect and disease and high price of labor, seed, and fertilizer were found a common problem for the Bean production. Findings of this research will be helpful as a significant potential for the improvement of technical efficiency in bean production.

5.3. Recommendations

The following recommendations would be followed for efficient bean production:

- Government should improve the technical education of farmers for the decrease and insects management.
- Proper agricultural extension services and training program on correct input application and improved farming technologies may have a great impact in increasing the level of technical efficiency and hence bean productivity.
- Government should control the prices of various inputs like fertilizers, seed and fertilizers and also improve the quality of inputs like seed, sprays and fertilizers.
- Bean farmers are more efficient, therefore, special efforts are required to cater their needs of inputs and credit.

5.4. Limitation of the Study

The present study provides some useful information for farmers, researcher and extension workers and decision makers regarding bean cultivation. However, there are some limitation of the study. There are follows:

The findings of the study are based on micro-level data of a specific area (Muktagacha and Fulbaria upazilas at Mymensingh district) at Bangladesh. These results should be carefully interpreted if any larger generalization is required for different regions of Bangladesh, including individual topographic ones. In rural Bangladesh, most of the farmers do not keep any records. As a result, the accuracy of data fully depends upon their memories and sincerity. The task of obtaining accurate data proved to be very challenging and the possibility of data errors, therefore, cannot be ruled out.

5.5. Scope for further Research

Further research may be conducted covering the bean producing of areas of Bangladesh, which are not adequately addressed in the study due to limitation of time and resources. The possible future researches are outlined below:

An Empirical analysis of problems related to bean production efficiency or case study can be done on the basis of different tenancy arrangement in different regions of Bangladesh. A broad based study on bean production covering all topographical areas could be undertaken to examine various aspects of bean production. Such a study may be useful not only to check for conclusion of the present study but also to derive total demand a supply function of bean for a particular region on the country as a whole.

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APPENDICES

Questionnaire

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(The Research is conducted for academic purpose only. So please do not hesitate to answer. Your information will be kept confidential.)

Research title:

Financial profitability analysis and estimating the productivity of bean production in some selected areas of Mymensingh district.

Interview schedule

Questionnaire for individual Bean Growing farmers:

Sample No. Date: …….

1. **Respondent Information:**

Name: …….

Address: Village: ……. Upazila: ……. District: ……..
Gender: Male /Female

		Code
Age	0=Below 31 years, 1=31-45 years, 2=46-55 years, 3= Above 55 years	
Education level	0=Illiterate, 1=Up to Primary, 2=Up to Secondary, 3=Higher Secondary & above	
Marital status	0=Unmarried, 1=Married	

2. Main Occupation:

On farm	Off farm

3. Experience on farming (Years):

4. Household size: Nuclear /Join Family member no .

5. Total Bean Cultivated Area:

6. Variety Adoption:

0= If High yielding exotic variety adopted
1= If Local High yielding variety adopted

7. Mode of land ownership under Bean production with cost:

Put √ mark	Tenure system	Land Amount (decimal)	Cost of land per decimal
	Own land		
	Rented land		
	Shared land		
	Leased land		

9. Any kind of training received on Bean cultivation or overall farming practice(e. g. fertilization, sowing, irrigation etc.)?

☐ Yes ☐ No

If yes, then the duration of the training (in day):…….

10. Whether any extension service received? Yes No

If yes, tick mark the source: DAE NGO Others (trained person, relatives).

11. How many distance of market from your locality (km)?

12. Total cost of production up to harvesting (Tk.):

13. Cost of production:

Particulars		Description
Tillage cost (Tk.)		
Seed	Variety Name	
	Amount (Kg)	
	Price (Tk/kg)	
Human labor	Family labor (man-days)	
	Hired labor (man-day	
	Wage (Tk/man-days)	

Particulars		Description	
Irrigation cost (Tk.)			
Pesticide cost (Tk.)			
Fertilizers cost (Tk)	Urea	Amount(kg)	Price(Tk/Kg)
	TSP		
	MoP		
	Oil Cake		
	Compost		

14. Production:

Crop Yield (kg/)	
Crop Price (Tk/kg)	

15. Harvesting cost (Tk.):

16. Selling/marketing cost (Tk.):

17. Total income (Tk):

18. Sources of finance/credit facilities:

Own fund	Bank	NGO	Friend and relatives	Cooperative society	Other

19. Market information:

Sources of information (%)				
Visit to the market	Fellow traders	Telephone/ Mobile	Email/Internet	Others

20. Problem faced by Farmer:

Types of problems	**Rank**	**No of respondents**
Non-availability of credit		
High rate of interest		
Labor supply shortage in peak season		
High price of labor		
Insect and Pest attack		
High price of seed		
Low quality of fertilizers		
Marketing cost		
Natural calamity		

……..
Signature of Interviewer

Thank you for your kind Co-operation.