PROFITABILITY ANALYSIS OF BANANA CULTIVATION IN SOME SELECTED AREAS OF GAZIPUR DISTRICT

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CERTIFICATE

This is to certify that the thesis entitled "**PROFITABILITY ANALYSIS OF BANANA CULTIVATION IN SOME SELECTED AREAS OF GAZIPUR DISTRICT**" submitted to the Department of Development and Poverty studies, Sher-e-Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in DEVELOPMENT AND POVERTY STUDIES**, embodies the result of a piece of bona fide research work carried out by **MD. ATIK BHUIYAN**, Registration No. **14-06253** 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.

Dated:

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Dedicated

to

My Beloved Parents

ABSTRACT

In Bangladesh, banana is a significant perishable multifunctional food crop. It is nutrient-dense, readily digested, high in carbohydrate and minerals, and has more calories than potatoes. The agriculture sector contributed about 13.35 percent to Gross Domestic Product (GDP) in FY 2019-20, with the crops sub-sector contributing approximately 6.76 percent to the agricultural sector's overall Gross Domestic Product. The general purpose of this research was to determine the profitability of banana cultivation by examining the sociodemographic profile of banana farmers. The district of Gazipur was chosen for the research due to its considerable banana cultivation. Through an interview schedule, data were gathered from 60 sample farmers using a simple random sampling approach. After analyzing the data, it was determined that the net return is Tk. Tk. 118932.30. Average total cost of banana cultivation were estimated to be Tk. 86330.70 per hectare. The Benefit Cost Ratio (BCR) for banana cultivation was determined to be 2.38. While the regression coefficients for labor cost (X_1), Urea cost (X_3), and MoP cost (X_5) were all positive, and mechanical power cost (X_7) were all negative and significant at various levels of significance. The coefficients for cost of sucker (X_2), the cost of TSP (X_4) and irrigation cost (X_6) were determined to be insignificant in relation to the return on banana cultivation. The positive indication shows that the return on bananas can be enhanced by raising labor costs, urea costs, and MoP costs, while the negative sign suggests that the return on bananas may be decreased by lowering irrigation and mechanical power costs As a result, it was discovered that banana cultivation was very lucrative. Additionally, this research highlighted a number of problems and constrains related with banana cultivation. These were classified as economic, technological, social, and marketing problems and needs attention of the appropriate authority.

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Md. Atik Bhuiyan
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ABBREVIATIONS AND ACRONYMS

BRRI	: Bangladesh Rice Research Institute
BBS	: Bangladesh Bureau of Statistic
BCR	: Benefit Cost Ratio
BDT	: Bangladeshi Taka
BER	: Bangladesh Economic Review
DAE	: Department of Agricultural Extension
et al.	: and others (at elli)
GR gm	: Gross Return : Gram
ha	: hectare
HIES	: Household Income and Expenditure Survey
HYV	: High Yielding Variety
IOC	: Interest on Operating Capital
kg	: Kilogram
MoP	: Muriate of Potash
mt	: Metric Ton
NGO	: Non-Government Organization
t	: Ton
TC	: Total Cost
TFC	: Total Fixed Cost
Tk.	: Taka
TSP	: Triple Super Phosphate
TVC	: Total Variable Cost
US	: United States
USDA	: United States Department of Agriculture
$	: Dollar

CHAPTER I
INTRODUCTION

1.1 Background of the study

Banana (*Musa paradisiaca*, family Musaceae) is a tropical and subtropical fruit crop that is produced on around 8.8 million hectares worldwide (Mohapatra et al., 2010). It is one among the world's perhaps first cultivated plants (Kumar et al., 2012). Bangladesh produces over 1,000,000 tons of bananas every year (Hossain, 2014). Additionally, it is a very nutritious fruit crop that is cultivated in a variety of tropical places where it is utilized as a staple meal and nutritional supplement (Assani et al., 2001). In Bangladesh, the average per capita intake of bananas is around 4.7 kg (FAOSTAT, 2019). This is far less than what Europe consumes, particularly Belgium (26.7 kg), Sweden (16.7 kg), and Germany (14.5 kg), whereas the USA consumes 13.1 kg and the UK consumes 10.5 kg (Siti Hawa, 1998).

In India and many other nations, including Bangladesh, banana is primarily produced for its ripe fruits, cooked veggies, and leaves (Khanum et al., 2000). It is the second most produced fruit after citrus, accounting for around 16% of global fruit output (FAO, 2009). The banana is very nutritious (Sharrock and Lustry, 2000) and easier to digest than a variety of other fruits, including the apple (Mohapatra et al., 2010). Banana is grown year-round practically everywhere in Bangladesh. Narsingdi, Gazipur, Tangail, Rangpur, Bogra, Natore, Pabna, Noakhali, Faridpur, and Khulna are the primary banana producing locations in Bangladesh. Additionally, Sylhet, Moulvibazar, Netrokona, Rangamati, Khagrachhari, and Bandarban are areas in Bangladesh where wild bananas are farmed.

In 2020-2021, Bangladesh produced 826151.76 metric tons of bananas and planted an area of around 122192.19 acres (BBS, 2021). When mature, the banana fruit varies in size, color, and hardness, but is typically elongated and curved, with soft starch-rich flesh covered in a peel that may be green, yellow, red, purple, or brown. Clusters of fruits dangle from the plant's top. Bananas are an abundant source of carbohydrate, with 67 calories per 100g fruit, and are one of the most popular and frequently traded fruits worldwide (Emaga et al., 2008; Kumar et al., 2012). Bananas are an excellent source of calories and the majority of the vitamins required for human sustenance. Bananas

are also a good source of glucose, potassium, and vitamins A, C, and B6. They are a wonderful source of dietary fiber that is fat-free. Bananas are often the first solid meal that infants are offered. A ripe banana combined with rice and milk is a typical Bangladeshi meal (Hossain, 2014). Numerous studies have been undertaken to assess Bangladesh's banana crop (Ahmad et al., 1973; 1974; Haque, 1984; Islam and Hoque, 2005; Hoque, 2006; Roy et al., 2006; Ara et al., 2011; Mukul and Rahman, 2013; Mohiuddin et al., 2014; Hossain et al., 2015).

Bangladesh's economy has always been agrarian. Over 80% of the population is directly or indirectly reliant on agriculture. Agriculture accounts for around 20.87 percent of gross domestic product (GDP) and accounts for two-thirds of total employment (BBS 2020). Despite these efforts, the nation continues to face a food grain cultivation shortfall. The causes vary, but the primary one is population pressure on land.

Bangladesh's populace is very malnourished. This malnutrition has a detrimental influence on the population's physical and mental development. Nutritional inadequacy and iron deficiency are more prevalent among youngsters and female members of all age groups. According to WHO report 2011, an estimated 250000–500000 children who are vitamin A-deficient become blind every year, and half of them die within 12 months of losing their sight. Vitamin A and C, riboflavin, and folic acid are the most often deficient nutrients in Bangladesh. Banana, tomato, and cauliflower are the most affordable and nutrient-dense foods. Bangladesh's environment is fairly favorable for the cultivation of a wide range of fruits and vegetables. The Fifth Five Year Plan (FFYP) places a premium on year-round cultivation of main fruits and vegetables and emphasizes the need of commercialization via proper research and development programs. Additionally, emphasis has been placed on quality and quantitative advances in the cultivation of diverse fruits and vegetables.

Banana is the only fruit crop that is accessible throughout the year in Bangladesh, and its consumption rate is significantly greater than that of any other fruit. It has been connected with man for ages, and many people regard it as one of the tastiest foods available to man. It is second only to citrus in terms of global fruit commerce. Bangladesh's government has developed a National Nutrition Action Plan. A National Council for Nutrition has been created to raise nutritional knowledge among farm families, to foster effective demand for healthy food products, and to promote balanced cultivation and consumption, particularly of nutrient-dense vegetables and fruits.

1.2 Importance of Banana

Banana is one of Bangladesh's primary fruit crops. It is significant among the country's fruits not only for its great output but also for its growing appeal among many farmers as an economic crop (Haque, 1983).

Banana is a delectable fruit crop that grows abundantly across Bangladesh and is the country's most significant fruit crop in terms of food value and availability throughout the year. Other significant fruit crops, such as litchis, jackfruits, and pineapples, suffer from the drawback of being seasonal in nature and accessible only for a few months of the year (USAID, 1969).

Vitamins and minerals are abundant in fruits. Not only do we consume less calories than our bodies need, but we also consume much fewer minerals and vitamins. Malnutrition impacts the health of almost three-fourths of the country's population. The reason for this is that there is a significant disparity between mineral requirements and food grain and other foodstuff supply (Rahman and Akbar, 1989). Being such, bananas, as a strong source of carbohydrate and minerals, may significantly help to closing the country's nutrition gap.

Bangladesh is one of the world's most populated nations, with over 168 million people living in an area of 147570 square kilometers (BBS, 2021), requiring around 23.08 million tons of food grains. The population density is one of the highest in the world, with 1265 inhabitants per square kilometer. There has been an average yearly food shortfall of roughly 4 million tons, which has been covered by food assistance and imports (BBS, 2020). The nation is mostly agricultural, and the majority of its inhabitants reside in rural regions. There is no food security for all of these individuals. Food security may be defined as a population's capacity to procure a subsistence diet over a certain time period. Adequate food supplies must be accessible, and individuals must have access to land and other resources in order to cultivate their own food or earn enough money to buy the food they need. As a result, food security is dictated by asset distribution, food availability and costs, and work prospects and pay. Food security is a problem of transcendent national significance in Bangladesh, where around 60-70 percent of the rural population and over half of the total population live below the poverty line (Hussain, 1994).

Bananas may play a significant influence in this respect. In Bangladesh, banana is a significant fruit crop. The edible portion is healthy, readily digestible, high in carbohydrate and mineral content, and has a higher calorie content than potatoes. Additionally, bananas are adaptable to all agricultural systems, even marginal farmers' homestead land. Additionally, the fruit crop generates a substantial financial return (Haque, 1983). Bananas are in great demand on the home market, and there is also the option of exporting bananas in bulk to international nations (Rahman, 1995). One may quickly become self-employed and solvent via banana gardening, since it grows in plenty throughout the year. Increased banana cultivation may help alleviate food and fruit shortages associated with hunger, as well as satisfy certain export requests in other nations.

1.3 Area, Cultivation and Yield of Banana in Bangladesh

The banana, or "Kola," is a member of the Musa genus of the Musaceae family. There are many significant commercial banana cultivars in Bangladesh, including Amritsagar, Mehersagar, Chinichampa, Dudhsagar, Sabri, Katali, Singapuri, Gerasundari, kabri, Barai, and green bananas (used as vegetables). Amritsagar, Sabri, and Chinichampa are the most widely grown commercial banana cultivars in Bangladesh. It grows in almost all soil types but thrives in high, sandy, loam, and clayey soils. For banana growth, well-drained soils are recommended. September-October is the best time to sow this cultivar (Haque, 1983). The cold temperatures that occur from December to February severely limit its vegetative development. Bananas are typically harvested nine to twelve months after planting.

Bananas may be cultivated in the highlands in a variety of soil types, most often with a pH value of 4.5 to 7.0. However, soils with a pH of 6.0 or above are more conducive to banana cultivation. The rainfall should never be less than 127 cm and not more than 254 cm per year. The reduced rainfall necessitates irrigation, and the maximum temperature may reach 35oC, whereas 350oC is preferable (Nargis, 1997). However, due to the variety in topographical and climatic circumstances, certain regions seem to be particularly well-suited for the cultivation of certain banana kinds.

Bangladesh's total expected banana output in 2020-21 was 826151.76 metric tons, up from 817908 metric tons the previous year (Table 1). In 2020-21, total cultivated land

was 122192.19 acres, up from 121777 acres in 2019-20. The yearly banana output in the nation is indicated in Table 1.

Table 1.1: The annual cultivation of banana in the country from 2018-19 to 2020-21

Year	Area (Acres)	Cultivation (M. Tones)	Per Acre Yield (Kg)
2018-19	48849.20	833309	6903.45
2019-20	49281.40	817908	6716
2020-21	49449.42	826151.76	6761.08

Source: BBS 2021

1.4 Justification of the study

Banana is a commercial fruit, however it is farmed commercially in a small region in Bangladesh. Inadequate care is not taken in cultivating it or, more importantly, in promoting it properly. Inadequate banana marketing facilities have a negative impact on farmers' revenue and trade, hence limiting the country's banana output increase. There is no government-sponsored initiative to promote banana farming and commercialization in Bangladesh.

Bananas are perishable. It need meticulous management and prompt promotion. The government has yet to establish a sophisticated banana storage facility. The sale of bananas at a fair price and at a convenient time is a key issue under the current insufficient marketing structure. A substantial amount of banana is apparently damaged and squandered throughout the marketing process, in part owing to a lack of suitable transportation and storage facilities. This waste represents a net leakage of the country's total fruit output, resulting in higher consumer prices and poorer producer returns.

Despite the banana's significance to the Bangladeshi economy, not so much research studies on banana cultivation have been conducted in Gazipur district. Thus, it is believed that a research on the economics of banana cultivation might be quite beneficial. The current research will give critical information to banana growers, merchants, and consumers. The study's results and suggestions will assist policymakers in developing suitable policies to enhance the manufacturing process and marketing

system. The researchers will get reliable and current data from this study, which will aid them in doing future research.

1.4 Objectives of the Study

1. To know the socio-economic profile of the banana farmers in the study area.
2. To analyze the profitability of banana cultivation in the study area.
3. To determine the factor influencing the gross return of banana cultivation.
4. To identify the problems in banana cultivation in the study area.

1.5 Organization of the Study

The study is divided into VIII chapters. Chapter I deals with the introduction of the study. The introductory chapter gives justification and organization of the study. Following the introduction, a brief review of related research works has been presented in Chapter II. Chapter III provides the methodology of the study, that is, how the study was conducted. Socioeconomic characteristics of the banana growers are presented in Chapter IV. Chapter V illustrates the estimation of the costs, returns and profitability analysis of banana cultivation. Chapter VI deals with the production function analysis. The major problems relating to banana cultivation are discussed in Chapter VII. Finally, the summary, conclusion, suggestions are given in Chapter VIII.

CHAPTER II
REVIEW OF LITERATURE

The number of small-scale commercial banana farmers has been declining in recent years in various regions of Bangladesh. Historically, banana was planted in homestead areas, with some farmers farming banana as a field crop. However, farmers are no longer planting bananas on a wide scale because they are unwilling to take a risk, and selling bananas is particularly difficult due to their perishability. This nation has undertaken just a few economic research on banana cultivation to date. However, this chapter makes an effort to evaluate some of the research relevant to the current topic.

Haque (1988) found that per hectare costs and net returns of Banana cultivation were Tk 103,614.88 and Tk 1,61,386.12 respectively. According to Haque, net return from banana cultivation was much higher than any other field crops.

Bairagi (1990) found that per hectare costs and returns of banana cultivation were Tk 53,714.50 and Tk 1,16,674.84, respectively. Bairaigi's study compared costs and returns from banana with those of sugarcane. He found that cultivation of banana was more promising than sugarcane.

Roy (1996) observed that per hectare gross expense of banana cultivation with intercrops was Tk. 65,583.13, while the per hectare gross return, net return above gross expenses stood at Tk. 111191297.24 and 12514.11 respectively. Per hectare gross expenses for producing banana without intercrops was Tk. 48503.70, while per hectare gross return and net return above gross expense were Tk. 149234.80 and 100731.10 respectively. Gross expenses for gross return, net return above gross expenses were Tk. 81394.22 and Tk. 35557.90 respectively.

Nargis (1997) found that the undiscounted benefit-cost ratios were calculated for evaluating the relative profitability of growing sole banana and banana with other selected vegetables. The major findings of the study were that per hectare costs of cultivation of sole banana were Tk. 121438 and Tk. 92011, respectively considering

full cost and cash cost. Per hectare cost of cultivation of banana with cucumber, banana with Indian spinach and banana with lady's finger based on full cost were Tk. 122896, Tk. 123328 and Tk. 123544 respectively. Per hectare net return of growing sole banana was Tk. 90032 and Tk. 11944459 considering full cost and cash cost, respectively. Per hectare net return of growing banana with cucumber, banana with Indian spinach and banana with lady's finger were Tk. 137974, Tk. 142482 and Tk. 149676 respectively on the basis of full cost. Per hectare net return from banana with cucumber, banana with Indian spinach and banana with lady's finger were Tk. 167909,Tk. 172499 and Tk. 179859 respectively considering cash cost.

Nessa (1998) found that banana cultivation was more profitable than sugarcane cultivation. Per hectare gross return, net return over full-cost of banana were Tk. 113295.08, Tk.70432.19 and Tk.43899.05 respectively, while the per hectare gross return, net return above cash-cost and net return above full-cost of sugarcane were Tk. 67505.81, Tk. 41807.75 and Tk 14539.30 respectively.

Rahman (2000) found that banana cultivation was more profitable than any other dominant cropping patterns in the study area. The per hectare gross return, total cost, gross margin and net return of banana cultivation were Tk. 1,86,356.89, Tk. 90,7771.35, Tk. 1,08,383.20 and Tk. 91,461.38 respectively. Analysis of dominant cropping patterns showed that per hectare gross return, total cost, gross margin and net return of the cropping pattern P2 (HYV Banana- T. Aman- Potato) were the highest and the corresponding figures were Tk. 1,23,032.11, Tk. 81,607.75 Tk. 56,413.66 and Tk. 41,424.36 respectively. The lowest gross return, total cost, gross margin, and net return per hectare were obtained by farmers following cropping pattern P4 Fallow-Jute-T. Aman) and the corresponding figures were Tk. 54,110.77, Tk 39,615.66, Tk. 24,928.48 and Tk. 14,495.12 respectively.

Hossain (2000) found that Amrit Sagar banana was more profitable than Meher Sagar banana cultivation. Per hectare gross returns, net returns above cash cost and net return above full cost of Amrit Sagar banana cultivation were Tk. 206782, Tk. 127516 and

Tk. 91793 respectively, while the corresponding returns for Meher Sagar banana cultivation were Tk. 182505.59, Tk. 106821.73 and Tk. 72167.55 respectively.

Begum (2001) determined that the existing marketing system of small, medium and large farmers per hectares gross cost was respectively Tk. 122926, Tk. 110579 and Tk. 96058 and gross returns were respectively Tk. 184066, Tk. 129689 and 185959. The study revealed the marketing cost for small, medium and large was respectively Tk.3554, Tk.3237 and Tk. 4389 per hectare.

Islam *et al.* (2013) revealed that, cost of cultivation of banana per hectare as maximum, minimum and mean were tk. 254000, tk. 20400 and tk. 231100 respectively. The gross returns obtained as maximum, minimum and mean were tk. 551000, tk. 521000 and tk. 529000. The net returns as maximum, minimum and mean were tk. 347000, tk. 278000 and tk. 297900. Despite of some limitations, the findings of the study confirm that the farmers can obtain positive net return from cultivation of banana. In the context of income generation and poverty alleviation, cultivation of crop like banana may play a crucial role in meeting the cash needs of the farmers. The findings of the study also revealed that the trading of banana is a profitable venture to different intermediaries. Moreover, a large number of people were involved in the cultivation and marketing of banana. So the farmers and intermediaries could be more benefited financially if cultivation and marketing of banana are to be well expanded.

Mukul and Rahman (2013) investigated the total cost, profit and benefit cost ratio for different marketing channel like banana producers, wholesalers and retailers. Profit for producer, wholesaler and retailer in banana cultivation were Tk. 55002.8 per Hectare, Tk. 59.08 per Chari, and Tk. 122.67 per Chari respectively and benefit cost ratio for producers, wholesalers and retailers were 1.40, 1.30 and 1.41 respectively. They had also followed Cobb-Douglas cultivation model was used to determine the contribution of some important inputs like land preparation, fertilizer, irrigation, insecticides, sucker and labor cost to cultivation of banana. They also investigate to explore the problems of producing banana and offer suggestion for possible improvement in the existing marketing system.

Kamal *et al.* (2015) revealed that banana cultivation under the institutional loan was a profitable business. It was estimated that average annual total cost of cultivation of banana was Tk. 34553.33, while gross return and net returns per farm were Tk. 127533.33 and Tk. 92980.00 respectively. The overall benefit cost ratio of banana farming came out to 3.69 indicating that one Taka investment resulted in a net benefit of Tk. 2.69. The findings also show that scientific uses of inputs have increased the cultivation of bananas.

Fonsah *et al.* (2018) conducted a study on a survey of agricultural value chain: a case study of Bangladesh banana industry. This survey focuses on bananas, one of the most important and popular fruits of the country and analyzes the complete value chain (VC) functions and relationships, targeting the producers, intermediaries and consumers' willingness to pay (WTP) for quality produce in three municipalities, Barisal, Faridpur, and Dhaka districts respectively. A total of 177 survey questionnaires were distributed amongst the three groups of VC key participants, out of which 130 were usable. The data collected were subjected to analysis of frequency of response using chi-square test in SAS v. 9.2 (SAS Institute, Cary, NC USA), zero responses were excluded from the statistical analyses of Chi-square. Our results show that 8% of the respondents in Barisal were willing to pay from 11-15 BDT/Kg of bananas compared to 43% in Faridpur and 49% in Dhaka. Furthermore, our result also illustrated that 100% of the farmers actually sold their bananas at prices ranging from 151-250 BDT, thus, an average price of from 193-225 BDT/bunch despite the quality of the produce. Finally, the major problems observed were lack of good agricultural practices, which affects overall quality, distribution, and marketing of this important fruit. Bangladesh has the potentials to become producer, marketer and exporter of premium quality bananas. Domestically there is a growing market demand and per capita consumption is more than 4.3 kg/annum. With a population growth rate of 1.6%, the demand for bananas, which is their most favorite fruit crops out of over 118 different fruits, will continue to increase, especially that the fruit is used for multiple functions including medicinal and health reasons. The problems plaguing the industry are pest and disease and lack of modern agricultural practices in producing quality bananas for both local and export market. Survey results across the complete banana VC indicate a willingness to adopt new technology and willingness to purchase (WTB) any variety of quality bananas at

higher prices. A Total Quality Management (TQM) strategy, which is an integrated banana management approach, is recommended to revamp the whole industry.

Islam *et al.* (2018) estimated that overall average annual total cost of cultivation of Banana per hectare was about Tk. 557710 while gross return and net returns were about Tk. 931024 and Tk. 373313, respectively. The overall benefit-cost ratio of Banana cultivation was 1.67.

Munia *et al.* (2019) revealed that banana farming is a profitable activity in Bangladesh as the estimated cost of cultivation was lower than the return in the selected study areas. However, the profitability differs among different farmers' group and large farmers are more profitable in banana farming than small and medium farmers. In addition, the functional analysis identifies four inputs such as the cost of human labor, manure, fertilizer and irrigation as the significant determinants of profitability of banana farming in the study area. In this study, resource use efficiency was also measured to show the efficient resource allocation to attain the goal of profit maximization which showed that human labor, seedling, manure, fertilizer, insecticides, irrigation and bamboo has inefficient use of the resources, and farmers should limit the use of these inputs. The researcher suggested some recommendations to improve the present cultivation situation so that banana farming could be more viable and attractive commercial enterprise.

Murry and Das (2019) found out that, the per hectare cost of banana cultivation for the sample farmer Rs. 59041.30. It was concluded that, the inputs cost is found to be highest for family labor which accounts for Rs. 24670.41 (41.79%), followed by hired human labor Rs. 17640.01(29.88%), interest on working capital Rs. 5044.89 (8.54%), marketing cost Rs. 5681.35(9.62%) etc. The fact that the contribution of human labor encompasses the highest percentage which accounts for almost fifty per cent of the total cost is because in tribal society like Nagaland farming is not depending on external inputs and make use of available natural resourses and intensive use of family labor. The average yield of banana farm in the study area was found to be 121.52 q/ha. Considering the prevailing price of banana in the study area which is Rs. 1300.00 per q the gross income was found to be Rs. 157980.33 with an average net return of Rs. 101819.82. From the analysis it was also concluded that the benefit cost ratio over

variable cost was 2.85 and the benefit cost ratio over total cost was found to 2.68. The result from the finding of benefit cost ratio analysis implies that cultivation of banana is profitable in the study area.

Rahman *et al.* (2020) found that gross return per bunch of banana was Tk. 450. Variable cost per Chari of banana was Tk. 62.35. Total cost per Chari of banana cultivation (with marketing) was Tk. 115.29. Gross margin was obtained by deducting total variable cost from gross return. Gross margin per Chari of banana was Tk. 387.65. Net return was estimated by subtracting total cost from gross return. Net return per Chari of banana was Tk. 334.65. The undiscounted benefit cost ratio (BCR) was found 3.90. In our study areas farmers faced many problems in the cultivation of banana. The major problems faced by them included lack of availability of adequate input, higher input cost; lack of subsidy, inadequate capital, Lack of quality sucker was a major problem for banana cultivation.

A general survey of the relevant literature reveals that a few studies on banana cultivation have been conducted in different areas of Bangladesh but not in Gazipur district. Therefore, the present study attempts to analyze the profitability of banana cultivation in some selected areas of Gazipur district.

CHAPTER III
METHODOLOGY

3.1. Introduction

The validity of farm management research is contingent upon the study's approach. Appropriate technique is a precondition for doing sound research. The design of every survey is largely governed by the study's nature, purpose, and goals. Additionally, it is contingent upon the availability of required resources, supplies, and time. There are a variety of data collection techniques available for farm management studies. A farm business research often entails the gathering of data from individual farmers; data collection for farm business analysis requires the analyst to use judgment in selecting data collecting techniques within the constraints given by the available resources for the assignment (Dillon and Hardaker 1993). The "survey approach" was used in this research primarily for two reasons:

i. It permits rapid analysis of a large number of instances; and
ii. Its conclusions have a broader application.

The primary drawback of this strategy is that the investigator must depend on the farmers' recollection. To address this issue, frequent trips to the research region were conducted to gather data, and in the event of any omission or contradiction, farmers were contacted to get the missing and/or correct information. The following stages were used in designing the survey for this investigation.

3.2. Selection of the Study Area

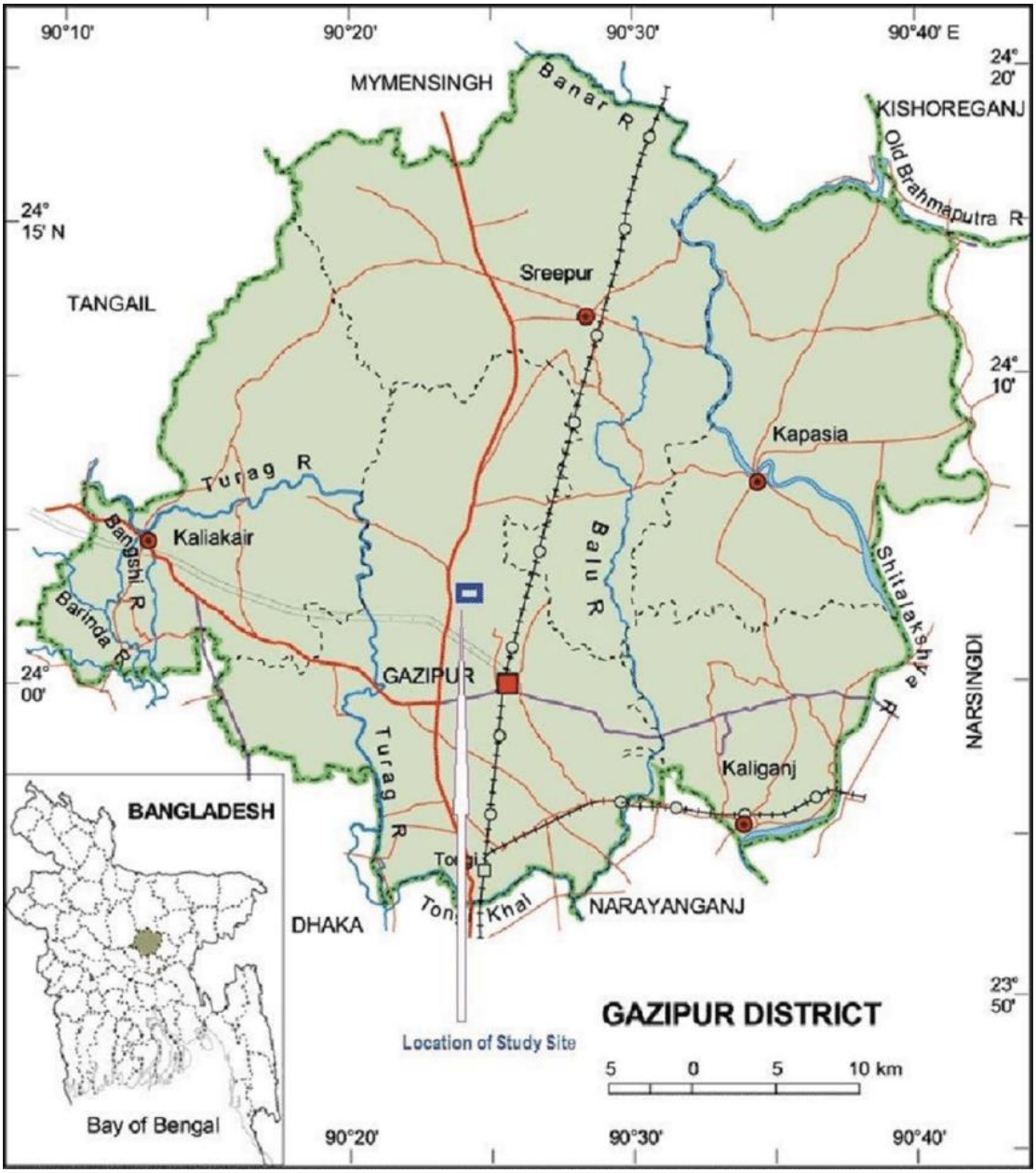
Selection of the study area is a crucial stage for farm management research. The area chosen suited both the study's specific objective and the possibility of cooperating with the farmer. This research was undertaken in certain chosen regions of Gazipur district to analyze the banana cultivation and marketing system. Although bananas are cultivated across Bangladesh, Gazipur district is one of the country's main banana producing areas. Gazipur district is divided into six upazilas. Thus, Kapasia Upazila and three villages, Aral, Ranigonj and Targaon in Gazipur district were purposefully chosen for the research due to their significant banana output concentration. The following were the primary reasons for choosing the research area:

a) When data gathering began, respondents cooperated.

b) These villages had some physical traits, such as topography, soil composition, and climate conditions conducive to banana cultivation.

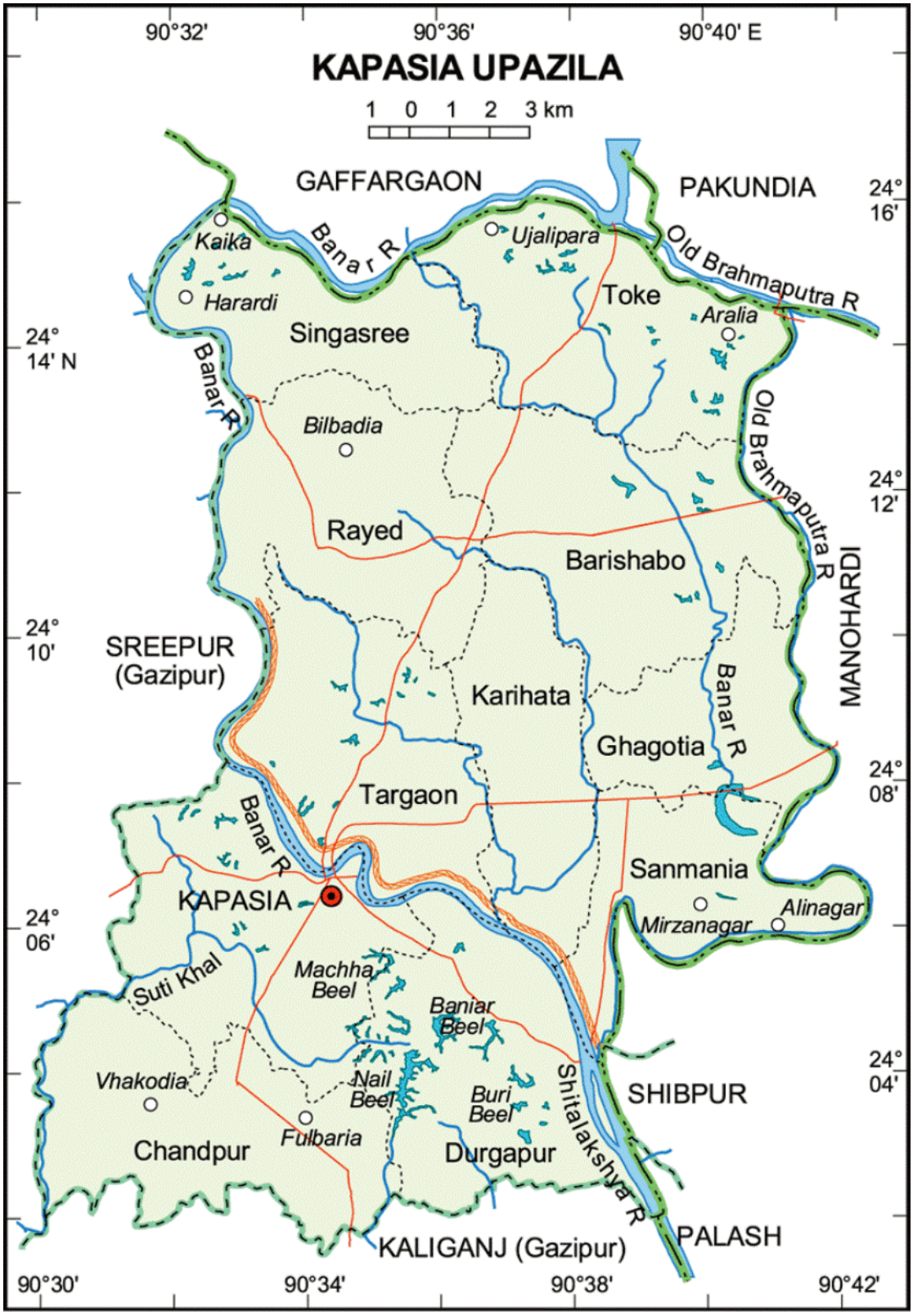
c) Access to these settlements was anticipated to be easy, as were communication facilities; and respondents' cooperation was expected to be strong, in order to acquire trustworthy data.

d) No study of this type was conducted previously in this area



Source: www.google.com

Figure 3.1: Map of Gazipur District



Source: www.google.com

Figure 3.2: Map of Kapasia Upazila

3.3. Sampling Technique and Sample Size

Two criteria must be considered while choosing samples for a research. The sample size should be as big as possible while yet providing sufficient degrees of freedom for statistical analysis. On the other hand, field research administration, data processing, and analysis should be doable within the constraints of physical, human, and financial resources (Mannan 2001). However, due to the variety of the technological and human environments, it is required to sample a representative sample of the population before drawing any conclusions. Thus, sampling's objective is to choose a subset of the population that is representative of the whole population (Rahman 2000). Due to time, financial, and manpower constraints, it was not feasible to enroll all of the study area's farmers. A total of 60 farmers were chosen at random. The current research used a simple random sampling to save costs and time and to accomplish the study's final aims.

3.4 Data Collection

Due to the enormous influence data collecting has on the quality of survey findings, it is recognized as a crucial component of a survey. Considering its significance, the following procedures were taken during the development of the questionnaire used to gather data:

3.4.1. Questionnaire Design

A questionnaire is a very effective assessment instrument that enables the collecting of data through multi-dimensional questions. A questionnaire created without a clear objective and aim would always ignore critical topics and waste the time of both enumerators and respondents by asking and responding to irrelevant questions. All of these points were considered to the degree practicable while constructing the survey questionnaire.

3.4.2. Pre-testing the questionnaire

The questionnaire was pre-tested to determine the length of time required to finish the interview, its reliability, i.e. if it caught the needed information, and also its consistency, i.e. whether the information acquired by it was connected to the survey's overall aim. Additionally, the test was designed to validate the logistics necessary for the survey's proper operation. To verify the questionnaire's optimal performance in terms of data

collecting, processing, and analysis, pre-testing was conducted prior to the survey in the research region during the months of March and April 2021.

3.4.3. Finalization of the Questionnaire and Method of Data Collection

After resolving all of the adjustments suggested by the pre-test, the questionnaire was delivered to my supervisor. My supervisor also contributed significantly to the questionnaire. Eventually, the questionnaire received permission. A face-to-face interview was conducted in response to the questionnaire.

3.4.4. Data Editing and Coding Data Editing and Coding

Editing and Coding of Data Other critical aspects of the survey included data editing and coding, which were required for data processing. It should be performed prior to the processing of data. Coding was completed concurrently with questionnaire creation in order for the enumerator to simply and properly mark the correct responses. The term "data editing" refers to the process of verifying and cleansing previously acquired data from the field.

3.5. Data Processing

Data processing included several procedures that were critical since they had an effect on the survey's findings. The following actions were conducted during data processing.

- Data entry
- Appending and Merging files
- Data validation (further computer checking, editing, and imputation)
- Final decision on errors
- Completion of data processing and generation of data files
- Final documentations
- Conversion of data files to another software.
- Storage of all files.

3.6. Processing, Tabulation and Analysis of Data

Manual editing and coding of the gathered data occurred. The acquired data was then meticulously compiled and analyzed. Additionally, data input was performed electronically, and analyses were conducted using the appropriate tools, Microsoft

Excel and STATA. It should be remembered that information was first gathered in local units. After required checks, it was converted to international standard units.

3.7 Procedure for computation of Cost and Returns

Input costs are critical in every organization. When estimating profit or loss, the cost elements must be clarified. To estimate the relative profitability of various crops, however, all cost elements must be computed. Which are subtracted from the result value. Farmers growing bananas have to pay for a variety of inputs. Some of these inputs were bought, while others were contributed by the user. Purchased inputs necessitated out-of-pocket or direct expenditures, and calculating the prices of these inputs was relatively uncomplicated. However, no financial payment was provided for the inputs given by the homeowner. The opportunity cost principle was used to estimate that a significant amount of the overall cost of manufacturing was obtained from locally provided inputs. When estimating gross expenditures, the primary components, such as human labor, input costs, and so on, were taken into account. These cost components are outlined briefly below:

3.7.1 Human labor Cost

Human labor is a significant element into banana cultivation. There were two distinct forms of human work: (a) family labor that did not need payment in cash and (b) hired labor that required payment in cash. Family work consists of the operator's personal labor plus that of his family members, such as his brother, children, and so forth. Women's and children's work has been converted to man equivalent hours using the following formula: 2 child hours = 1.5 woman hours = 1 adult male equivalent hour (Miah, 1987). The opportunity cost idea was utilized to calculate the cost of family labor. In the past, the opportunity cost of family labor was determined by the market pay rate, that is, the wage rate that farmers actually paid hired labor. On the other hand, in computing the cost of hired labor actual wages paid are considered.

Human labor was quantified in this research in terms of man-days, which typically equaled eight hours of work by an adult man. The salary rate per man day ranged between 350 and 500 taka, depending on the season and the availability of day labor in the research region. Thus, the average computed wage rate was 400 per man day, which was used to determine the human labor cost excluding the monetary value of kind

payment such as meal, tobacco etc. Human labor was utilized to perform the following tasks throughout the banana cultivation process:

1. Land preparation.
2. Transplanting
3. Fertilizer application.
4. Intercultural operation.
5. Weeding
6. Harvesting, carrying and grading.

3.7.2 Cost of Mechanical power

Mechanical power was mostly employed for land preparation, but also for transporting fertilizer. Land preparation was carried out by all groups of farmers using power tillers. Mechanical power, such as the usage of a power tiller, has increased significantly in the study region, and farmers have increasingly relied on mechanical power to prepare their land. The owner of the power tiller provides gasoline and a driver for land preparation. The power tiller and driver's labor costs were comparable. It was quite difficult to disentangle the cost of the power tiller from the cost of driver labor.

3.7.3 Material Input Cost

Material input cost was also an important cost item which included the cost of suckers, fertilizers, manure, irrigation water, insecticides, land use cost and interest on operating capital.

Cost of Sucker

Although bananas come in a number of types, practically all of the farmers in the study region produced mostly the "Champa" variety. Farmers in the research region mostly utilized bought suckers to produce bananas. Farmers were required to purchase suckers in cash at a cost of Tk.2-2.50 a piece, which was prevalent in the region throughout the study period.

Cost of Manure

Banana farmers employed two types of manures: cow dung and oil cakes. Farmers mostly bought cow dung and oil cake. However, a little proportion is used by farmers, which is essentially non-existent in the research region. However, if they utilized manure such as cow dung, it was collected mostly from domestic animals engaged in the agriculture process and milk cultivation.

Cost of Chemical Fertilizer

Farmers in the research region used four different types of fertilizers: Urea, Triple Super Phosphate (TSP), and Muriate of Potassium (MoP). The costs of these fertilizers were evaluated using market prices in effect throughout the research period. The average market price per kilogram of Urea, TSP, and MoP was Tk. 22, Tk. 50, and Tk. 30 respectively.

Cost of Insecticides

The majority of banana producers in the research region utilized pesticides such as diazinon, sobicrne, Tilt, and Oczim, as well as liquid insecticides. The cost of pesticides is calculated according to the quantity of bottles/packets used by farmers. And the rates vary according on the quantity of bottle/packet utilized by farmers. Average per bottle/packet prices range from Tk. 170 to Tk. 220.

Cost of Irrigation

Irrigation is a significant component in banana cultivation. In the research region, irrigation was accomplished by the employment of a machine. Costs associated with irrigation included gasoline and fees for the usage of the equipment. Irrigation was provided on average once or twice in their land, with an estimated cost of Tk.580-780.

Cost of Tools and Equipment

All of the farmers in the research region employed conventional tools and equipment in various activities of the banana producing process. Farmers employed basic

agricultural equipments such as a plough, yoke, ladder, spade, khupri, and sickle to cultivate bananas. The time-consuming task of calculating tool and equipment expenses was omitted since this item accounts for less than 1% of overall cost.

3.7.4 Land Use Cost

The cost of land use for different plots was different depending on the location. topography and fertility of the plots. Cost of land use estimated in one of the following three alternatives

i) Foreign incomes from alternative use.
ii) Interest on the value of land and
iii) Valuation of land as its rental price.

For this study, the third method was used for finding the cost of land , i.e., by taking into account the rental value of land. Land use cost for banana cultivation was estimated considering land use over a cultivation period for one year.

3.7.5 Interest on Operating Capital

The amount of money required to satisfy the demand on rented or bought inputs was considered an operational expense in the research. The average annual interest rate in the research region was 9% for the duration of the banana cultivation period. This annual interest rate was determined by Bangladesh Krishi Bank's local branch office. It was expected that if farmers obtained loans from a bank, they would be required to pay the above-mentioned rate of interest. All expenditures were not incurred at the start of the manufacturing process; rather, they were incurred over the duration of the cultivation. As a result, the operational cost was calculated using the following formula.

Interest on operating capital (IOC) = AIit

Where,

Al = Total operating capital/2.

i = Interest rate per annum.

t = Length of crop period.

This really reflected the average operational cost for the period, since investment in terms of operating capital was not made in one go; rather, it was spread out across the crop season, with producers getting no return until the crops were harvested.

3.8 Profitability Analysis

Cost and return calculations were conducted using enterprise costing. The economic performance of bananas, as well as their relative profitability, were determined using gross margin and net return analysis.

3.8.1 Gross margin analysis

Gross margin is calculated by subtracting entire revenue from total variable costs. The research was chosen because Bangladeshi farmers are very curious about their return on total variable cost.

3.8.2 Net return analysis

The net return on a per-hectare basis was calculated by deducting the entire cost (variable cost + fixed cost) from the total return on banana output.

3.8.3 Benefit cost ratio (BCR)

Benefit cost ratio (BCR) of banana was estimated as a ratio of gross return to total cost.

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

3.9 Functional analysis

There is no one function that can be used to describe agricultural productivity under all environmental situations. The algebraic shape and magnitude of the function will change depending on the soil, the kind and variety of crops, the size of other inputs in 'fixed quantities' for the farm, and so on. As a result, a challenge in each investigation is determining the right algebraic form of the function. This is compatible with the observed occurrences. To assess the influence of major factors on banana production,

the Cobb-Douglas cultivation function was employed. The Cobb-Douglas model's double log form was shown to be the better choice on theoretical and econometric grounds.

The specification of the Cobb-Douglas cultivation function model was as follows:

$$Y=ax_1^{b1}x_2^{b2}x_3^{b3}x_4^{b4}x_5^{b5}x_6^{b6}e^{ui}$$

By taking log on both sides, the Cobb-Douglas cultivation function was transformed in to the following logarithmic form because it could be solved by the ordinary least squares (OLS) method

.

$$\text{In } Y_i = \ln a + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + U_i$$

Where,

ln= Natural logarithm

Y = Gross return (Tk./ha)

X_1 = Cost of human labor (Tk./ha)

X_2 = Cost of sucker (Tk./ha)

X_3 = Cost of Urea (Tk./ha)

X_4 = Cost of Triple Super Phosphate (Tk./ha)

X_5 = Cost of Murate of Potash (Tk./ha)

X_6 = Cost of irrigation (Tk./ha)

X_7 = Cost of mechanical power (Tk./ha)

a= constant

$\beta_1,\beta_2.....\beta_7$ = Production Coefficients of respective input variables to be estimated

U_i = Error term

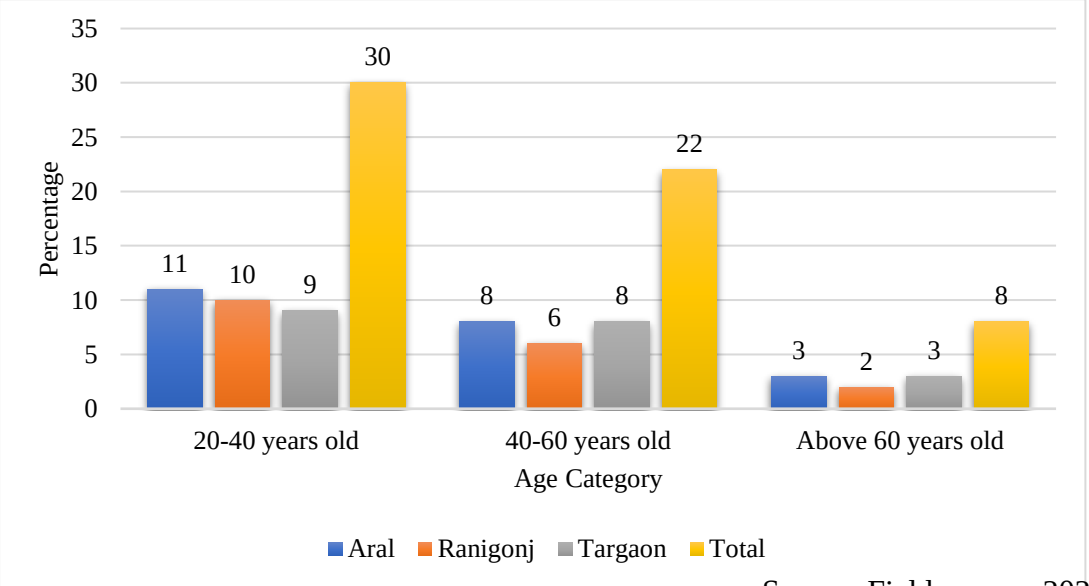
CHAPTER IV
SOCIO-ECONOMIC PROFILE OF BANANA GROWERS

4.1 Introduction

The purpose of this section is to provide a quick overview of the socioeconomic features of banana growers. The socioeconomic status of farmers may be interpreted in a variety of ways, depending on aspects such as their standard of living, the financial situation in which they live, and the type and extent of the grower's support for national progress initiatives. Due to time and asset constraints, it was difficult to collect full data on the financial characteristics of the sample farmers. The financial situation of the example farmers is critical in the event of study planning, as there are several connected and component aspects that identify a person and have a substantial influence on the development of his/her behavior and character. Individuals differ in their financial viewpoints. Nonetheless, for the sake of this study, a few of the financial characteristics have been considered for exchange.

4.2 Age

Twenty samples were taken from each of the three villages called Aral, Ranigonj, and Targaon, which represented the whole population. In Aral village, 55% of the farmers was between the ages of 20 and 40, 30% were between the ages of 40 and 60, and 15% were beyond 60.



Source: Field survey, 2021

Figure 4.1: Age of the respondent by Study Area

In Ranigonj village, 50% of the farmers was between the ages of 20 and 40, 40% were between the ages of 40 and 60, and 10% were beyond the age of 60. In Targaon village, 45 percent of the farmers was between the ages of 20 and 40, 40% were between the ages of 40 and 60, and 15% were beyond the age of 60. (Figure 4.1). We saw that the majority of persons in each villages were between the ages of 20 and 40.

4.3 Composition of the Family Size

Family size is critical in terms of producing adequate nourishing grain for the ranch family. In this research, family was defined as the total number of persons living in a same kitchen and eating meals under the influence of a single family leader. The term "relatives" refers to the husband, children, unmarried little girl, father, mother, sister, and several other relatives who reside in the family permanently. Average family size in Aral, Ranigonj and Targaon were 5.52, 5.44, and 5.50, respectively. Overall, average family size was 5.48 (Table 5.1).

Table 5.1: Average Family Size and Distribution of Members According to Sex of the Sample Farmers

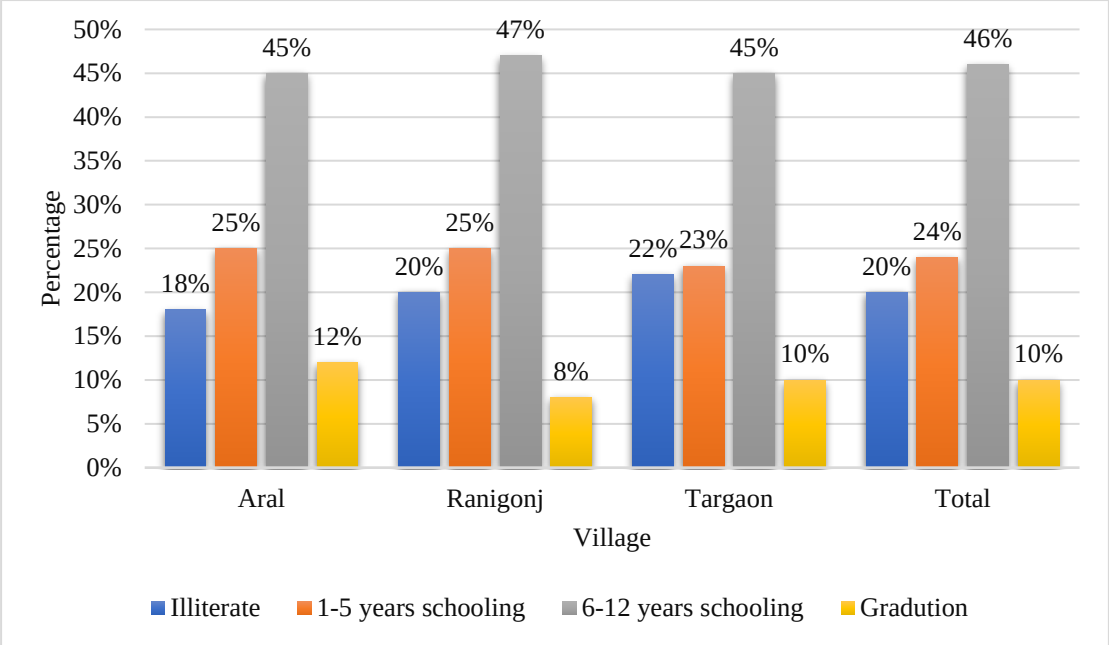
Particulars	Aral village		Ranigonj village		Targaon village		All Farmers		**National Average Family Size**
	Number	%	Number	%	Number	%	Number	%	
Male	3.16	57.25	3.05	56.07	3.15	57.27	3.12	56.93	
Female	2.36	42.75	2.39	43.93	2.35	42.73	2.36	43.07	4.06
Total	5.52	100.0	5.44	100.0	5.50	100.0	5.48	100.0	

Source: Field Survey, 2021

4.4 Education of the Household Members

According to Figure 4.2, approximately 18% of the farmers were unable to read or write, approximately 25% had 1 to 5 years of schooling, approximately 45% had 6 to 12 years of schooling, and approximately 12% had graduation level education. In Ranigonj village, approximately 20% of the farmers were unable to read or write, approximately 25% had 1 to 5 years of schooling, approximately 47% had 6 to 12 years of schooling, and approximately 8% had graduation level education.. In Targaon village, approximately 22% of the farmers were unable to read or write, approximately

23% had 1 to 5 years of schooling, approximately 45% had 6 to 12 years of schooling, and approximately 10% had graduation level education. Overall most household members had 6 to 12 years of schooling.



Source: Field survey, 2021

Figure 4.2: Education of the Household Members by Study Area

4.5. Annual Family income

a) Agricultural work

Table 4.2: Agricultural Work

Sector	Average annual Income (Tk.)	Total (Tk.)
Crops	218273	276332.3
Poultry	30977.3	
Livestock	20842	
Fisheries	6240	

Source: Field survey, 2021

Crops, poultry, livestock, and fisheries are the sample's primary agricultural revenue sources. The majority of framers earn their living through agriculture. Crop cultivation was the primary source of income for these individuals, with an average annual revenue from crop cultivation of TK 218273. Today, the study area has expanded into a poultry

and dairy farm. Farmers get Tk 30977.3 per year from poultry. Agriculture generated a mean yearly household income of Tk 276332.3.

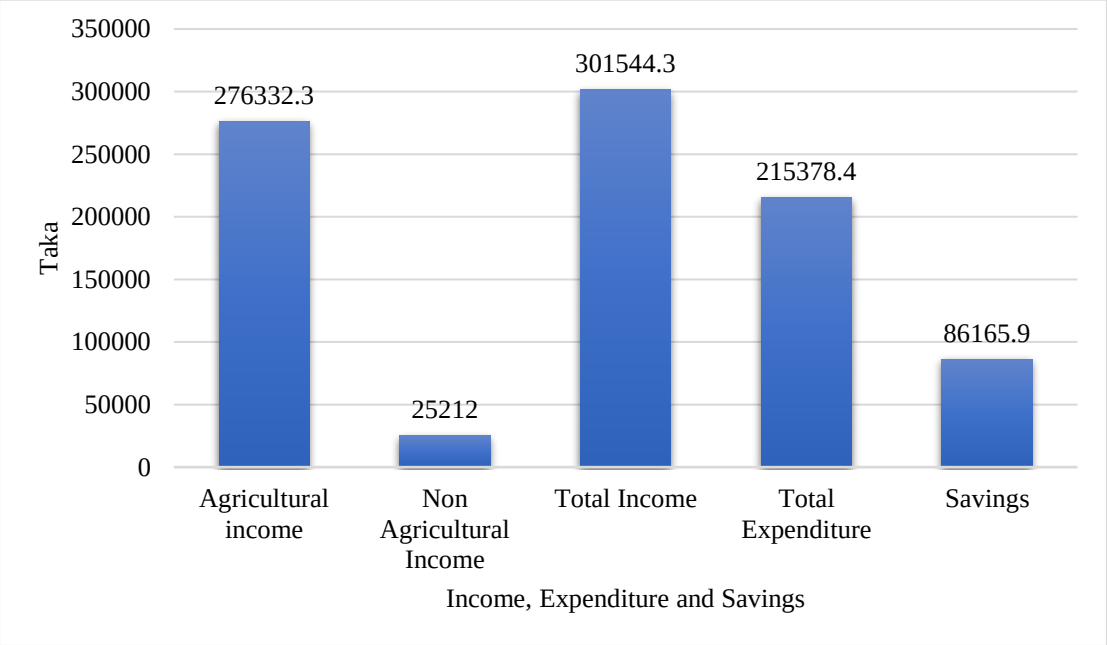
b) Non-Agriculture work

Non-agricultural activities included day labor, auto and truck driving, domestic labor, small business, overseas remittance, and services. Tk 25212 was reported to be the annual average revenue from non-agriculture sources.

The overall yearly average income was determined by (Agricultural Income + Non-Agricultural Income) = Tk. (276332.3 + 25212) = Tk 301544.3.

4.6 Annual Family Expenditure

The average yearly spending of a sample farmer was determined to be Tk. 215378.4. The majority of household expenditure was used for food consumption. Other significant costs were those associated with a child's education, clothes, medication, transportation, festival attendance, and entrainment. Tk 86165.9 was determined to be the average yearly household savings (Figure 4.3).



Source: Field survey, 2021

Figure 4.3: Annual Family Income, Expenditure and Savings by Study Area

4.7 Agricultural Training

About 40% of responding farmers in Aral village received training in banana growing, compared to 30% in Ranigonj village and 15% in Targaon village (Table 4.3). These

training sessions enhanced their perspectives of proper seed handling, the use of resistant cultivars, the administration of insecticides and herbicides, and proper water management, among other topics. The majority of DAE's Integrated Pest Management training (IPM).

Table 4.3: Agricultural Training of the respondent by Study Area

Training Received	Aral Village		Ranigonj Village		Targaon Village		All	
	Number	%	Number	%	Number	%	Number	%
Yes	4	20	6	30	3	15	13	21.67
No	16	80	14	70	17	85	47	78.33
Total	20	100	20	100	20	100	60	100

Source: Field survey, 2021

4.8 Membership of any social organization

In Aral village, 80 percent of banana farmers were found to be members of various NGOs and/or farmers' organizations, whereas in Ranigonj village, 50% of banana farmers were found to be members of various NGOs and/or farmers' organizations, and 80 percent of banana farmers were found to be members of various social organizations in Targaon village (Table 4.4).

Table 4.4: Membership in any organization of the respondent by Study Area

Membership	Aral Village		Ranigonj Village		Targaon Village		All	
	Number	%	Number	%	Number	%	Number	%
Yes	16	80	10	50	16	80	42	70
No	4	20	10	50	4	20	18	30
Total	20	100	20	100	20	100	60	100

Source: Field survey, 2021

CHAPTER V
PROFITABILITY OF BANANA CULTIVATION

5.1 Introduction

The primary objective of this chapter is to evaluate the costs, returns, and profitability of banana cultivation. Profitability is a critical factor in determining whether to produce any crop at the farm level. It may be quantified in terms of net return, gross margin, and return on total cost. The overall cost of manufacturing was determined by adding the expenses of all products. The crop returns have been approximated using the values of the primary products and by-products.

5.2 Profitability of Banana Cultivation

5.2.1 Variable Costs

5.2.1.1 Cost of Mechanical Power during land preparation

The preparation of the land is the most critical step in the manufacturing process. Land preparation efforts included plowing, laddering, and other tasks necessary to prepare the land for banana agriculture. Thus, the average cost of land preparation for banana cultivation was determined to be Tk. 4940 per hectare, or 5.72% of the overall cost (Table 5.1).

5.2.1.2 Cost of Hired Human Labor

Human labor is a significant cost component of the manufacturing process. It is a critical and widely utilized input in the cultivation of Banana. It is often needed for a variety of tasks including land preparation, seeding, weeding, fertilizer and pesticide treatment, irrigation, harvesting and hauling, threshing, cleaning, drying, and storage. The average amount of hired human labor utilized in banana cultivation was determined to be around 61 man-days per hectare, with an average wage of Tk. 400 per man-day. As a result, the entire cost of contracted human labor was determined to be Tk. 24400, or 28.26% of the overall cost (Table 5.1).

5.2.1.3 Cost of Sucker

Sucker prices vary significantly according on its quality and availability. Farmers used an average of 1835 sucker per hectare. The overall cost of sucker per hectare for banana cultivation was calculated to be Tk. 3673, or 4.25 percent of the total cost (Table 5.1).

5.2.1.4 Cost of Urea

In the study area, farmers used different types of fertilizers. On an average, farmers used urea 218 kg per hectare. Per hectare cost of urea was Tk. 4796, which represents 5.55 percent of the total cost (Table 5.1).

5.2.1.5 Cost of TSP

Among the different kinds of fertilizers used, the rate of application of TSP (163 kg). The average cost of TSP was Tk. 8150.00 which representing 9.44 percent of the total cost (Table 5.1).

5.2.1.6 Cost of MoP

The application of MoP per hectare (152 kg). Per hectare cost of MoP was found Tk. 4560.00, which represents 5.28 percent of the total cost (Table 5.1).

5.2.1.7 Cost of Insecticides

Farmers used different kinds of insecticides to keep their crop free from pests and diseases. The average cost of insecticides for Banana cultivation was found to be Tk. 2388.33 which was 2.77 percent of the total cost (Table 5.1).

5.2.1.8 Cost of Irrigation

Irrigation is one of the most significant expenditures associated with banana cultivation. Irrigation is critical for banana cultivation. Irrigation water used in the proper dosages aids in the growth of bulb diameter, clove number, leaf number, and plant height. As a consequence, the yield per hectare increases. Irrigation costs averaged Tk. 8616.67 per heater, accounting for 9.44 percent of the overall cost (Table 5.1).

5.2.1.9 Cost of manure

Farmers in the research region employed cow dung to produce their businesses. They purchased a substantial amount of cow excrement from milk producers. It was discovered that the cost per hectare is around Tk. 2500, which equals 2.90 percent of the overall cost (5.1)

Table 5.1: Per Hectare Return and Costs of Banana Cultivation

Cost Items	Costs/Returns (Tk/ha)	% of total
A. Gross Return		
Main product (Banana)	202670.00	98.74
By-product (Sucker)	2593.00	1.26
Total return	**205263.00**	**100.00**
B. Gross Cost		
C. Variable Cost		
Sucker	3673	4.25
Irrigation	8616.67	9.98
Mechanical Power	4940.00	5.72
Labor Cost	24400.00	28.26
Urea	4796.00	5.55
TSP	8150.00	9.44
MoP	4560.00	5.28
Total Fertilizers cost	**9354.60**	20.27
Manure	2500.00	2.90
Insecticides	2388.33	2.77
Total Variable cost	**64024.00**	**74.16**
D. Fixed Cost		
Land use cost	12067.75	13.98
Interest on operating capital @ 9%	10238.95	11.86
Total Fixed cost	**22306.70**	**25.84**
E. Total costs	**86330.70**	**100.00**

Source: Field survey, 2021

5.2.1.10 Total Variable Cost

Therefore, from the above different cost items it was clear that the total variable cost of Banana cultivation was Tk. 64024.00 per hectare, which was 74.16 percent of the total cost (Table 5.1).

5.2.2 Fixed Cost

5.2.2.1 Land use cost

The rental value of land was determined using the opportunity cost of land usage per hectare during a four-month cropping cycle. The cash rental value of land was used to calculate the cost of land usage. Land usage cost was determined to be Tk. 12067.75 per hectare using data acquired from banana producers, accounting for 13.98 percent of the overall cost (Table 5.1).

5.2.2.3 Interest on Operating Capital

It is worth noting that interest on operating capital was determined by factoring in all operational expenditures incurred throughout Banana's cultivation period. Interest on operating capital for banana cultivation was approximated at 9% and Tk. 10238.95 per hectare was computed, representing 11.86% of the total cost (Table 5.1).

5.2.3 Total Cost (TC) of Banana Cultivation

Total cost was calculated by adding all the cost of variable and fixed inputs. In the present study per hectare total cost of producing Banana was found to be Tk. 86330.70 (Table 5.1).

5.2.4 Return of Banana Cultivation

5.2.4.1 Gross Return

The return on banana cultivation per hectare is given in Table 5.2. The gross return per hectare was computed by multiplying the total quantity of product by the per-unit price. As a result, the total return on investment was determined to be Tk. 202670 per hectare (Table 5.2). Additionally, the product (straw) has an estimated value of Tk 2593 per hectare for banana cultivation. The total return or gross margin per hectare was determined to be Tk. 205263.00.

5.2.4.2 Gross Margin

Gross margin is the gross return over variable cost. Gross margin was calculated by deducting the total variable cost from the gross return. On the basis of the data, gross margin was found to be Tk. 141239.00 per hectare (Table 5.2).

Table 5.2: Per Hectare Cost, Return and BCR of Banana Cultivation

Cost Item	Cost/Returns (Tk/ha)
A. Gross Return	205263.00
B. Variable Cost	64024.00
C. Fixed Cost	22306.70
D. Total costs	86330.70
E. Gross Margin (A-B)	141239.00
F. Net Return (A-D)	118932.30
G. Undiscounted BCR on Full cost basis(A/D)	2.38
H. BCR on cash cost basis (A/B)	3.21

Source: Field survey, 2021

5.2.4.3 Net Return

Net return or profit was calculated by deducting the total cultivation cost from the gross return. On the basis of the data the net return was estimated as Tk. 118932.30 per hectare (Table 5.2).

5.2.5 Benefit Cost Ratio (Undiscounted)

Benefit Cost Ratio (BCR) is a relative measure, which is used to compare benefit per unit of cost. Benefit Cost Ratio (BCR) on full cost basis and cash cost basis were found to be 2.38 and 3.21 respectively which implies that one-taka investment in Banana cultivation generated Tk. 2.38 on the basis of full cost and Tk. 3.21 will be generated on the basis of cash cost (Table 5.2). From the above calculation it was found that Banana cultivation is profitable in Bangladesh.

CHAPTER SIX
MAJOR FACTOR AFFECTING IN BANANA CULTIVATION

The principal inputs used in the research region for banana cultivation were primarily human labor, mechanical power, sucker, urea, TSP, mop, and irrigation. These inputs were used as explanatory variables in the study of the banana cultivation function. As a result, these inputs are theorized to account for the diversity in banana output. As a result, a Cobb-Douglus production function was applied to ascertain plausible correlations between banana cultivation and inputs.

6.1 Interpretation of Cobb-Douglas Production Function:

Maximum likelihood estimation starts with the formulation of a mathematical equation for the sample data known as the Likelihood Function. The likelihood of acquiring a piece of data is defined as the probability of receiving that collection of data given the probability distribution model selected. This phrase comprises the model parameters that are unknown. Maximum Likelihood Estimates, or MLE's, are the values of these parameters that maximize the sample likelihood.

Table 6.1 shows the maximum likelihood estimates for the Cobb-Douglas production function model for banana cultivation for all farmers.

Table 6.1: Estimated values of the co-efficient and related statistics of Cobb-Douglas production model

Variables	Parameter	Co-efficient	Standard Error	T-value
Intercept	β_0	12.374	1.417	8.732
Labor Cost (X1)	β_1	0.072**	0.030	2.434
Cost of Sucker (X2)	β_2	0.008	0.084	0.095
Cost of Urea (X3)	β_3	0.183***	0.053	3.422
Cost of TSP (X4)	β_4	0.245	0.154	1.586
Cost of MoP (X5)	β_5	0.067**	0.031	2.178
Irrigation Cost (X6)	β_6	-0.178	0.55	-0.3236
Mechanical Power cost (X7)	β_7	-0.0096**	0.003	-3.19
R^2		0.61		
F-Value		25.61***		
Returns to scale ($\sum$bi)		0.387		

Note: *** = Significant at 1% level

** = Significant at 5% level

As evidenced by the F-values and R-square, the Cobb-Douglas model matched the data rather well. For banana farmers, the coefficient of multiple determinations (R-square) was 0.61. The R-square result indicates that the explanatory factors accounted for 61% of the variance in banana cultivation. The influence of specified variables impacting banana productivity may be noticed in the regression equation estimates. In the instance of banana growers, the results indicate that the co-efficient of urea and irrigation were significant at the 1% level, labor cost, cost of mop, and mechanical power cost were significant at the 5% level, but the co-efficient of sucker and TSP did not have the

predicted sign. Additionally, the F-value of the equation was significant at the 1% level of significance. This means that the variance in banana cultivation is mostly determined by the model's explanatory factors.

Labor cost

The value of the cultivation co-efficient for human labor was 0.072 for banana. The cultivation co-efficient was positive. The positive sign indicates that return from banana can be increased by increasing human labor. The estimated co-efficient 0.072 revealed that 1% increase in human labor in the pre-harvesting period with other factors remaining constant, would increase the gross return by 0.072% up to certain level.

Cost of Sucker

The value of cultivation co-efficient for sucker was 0.008 for banana. The cultivation co efficient was positive but not significant.

Cost of Urea

The regression co-efficient of urea was 0.183 for banana growers. The cultivation co-efficient was positive. The positive sign indicates that return from banana can be increased by using urea. The estimated co-efficient revealed that 1% increase in urea in the pre-harvesting period with other factors remaining constant, would increase the gross return by 0.183% up to certain level.

Cost of TSP

The value of cultivation co-efficient for TSP was 0.245 for banana. The cultivation co-efficient was positive but not significant.

Cost of MoP

The regression co-efficient of MP was 0.067 for banana growers. The cultivation co-efficient was positive. The positive sign indicates that return from banana can be increased by using MoP. The estimated co-efficient revealed that 1% increase in MoP in the pre-harvesting period with other factors remaining constant, would increase the gross return by 0.067% up to certain level.

Irrigation Cost

The value of cultivation co-efficient for irrigation was -0.178 for banana. The cultivation co efficient was negative but not significant.

Mechanical power cost

The value of cultivation co-efficient for mechanical power was -0.0096 for banana. The cultivation co-efficient was negative. The negative sign indicates that return from banana can be decreased by using mechanical power. The estimated co-efficient 0.0096 revealed that 1% increase in mechanical power in the pre-harvesting period with other factors remaining constant, would decrease the gross return by 0.0096 % up to certain level.

Returns to scale (∑bi)

The summation of all regression coefficients or production elasticity's of the estimated model gives information about the returns to scale, that id, in response of output to a proportionate change in all inputs. The sum of all the production coefficients of the equations for banana cultivation was 0.387. This indicates that the production function exhibited decreasing returns to scale in banana cultivation; implying that if all the inputs specified in the function are increased by 1 percent income will increase by 0.387 percent.

CHAPTER VII
PROBLEMS FACED BY FARMERS IN BANANA CULTIVATION

There were numerous difficulties encountered by farmers and intermediaries in the cultivation and marketing of bananas, similar to those encountered by farmers and intermediaries of other agricultural crops and in other areas of Bangladesh, even though Gazipur (study area) was ideally suited for banana cultivation and marketing, as reported by farmers and intermediaries in the study area.

7.1 Problems Faced by Farmers in Cultivation

Bangladesh's economy is heavily reliant on agriculture. However, this agricultural industry remains insignificant at the moment. This industry is fraught with a variety of issues. Farmers in Bangladesh seldom get the requisite number of land, appropriate money, fertilizers, professional assistance, and lastly, a market price for their output. Farmers encountered a variety of issues throughout one-year banana cultivation cycles, which are mentioned below:

Lack of Adequate Capital

The majority of farmers in the study region said that they lacked enough operational capital. The majority of them were denied institutional credit. As a consequence of their financial incompetence and urgent need for cash, they are forced to borrow money from non-institutional sources, incurring hefty interest rates. In the research region, the first significant issue was a lack of appropriate money.

High Price of Inputs

Banana cultivation required a variety of inputs, including labor, sucker, and fertilizer. Regrettably, the majority of farmers were forced to pay a higher market price than was fair. In the research region, the second most serious issue faced the sample farmers was high input prices.

Lack of Quality Sucker

Due to natural adversity and a lack of adequate information, the majority of farmers in the study region were unable to gather excellent sucker from their own land. As a result, they were forced to rely on other suckers. Even they were forced to pay an illogically high price. In the research region, the third most serious difficulty faced farmers was a scarcity of high-quality sucker.

Low Output Price

The majority of farmers were compelled to sell their crops immediately after harvesting at very cheap prices in order to cover home expenses, pay labor costs, and so on. Conscious farmers rated their goods' prices as very cheap in comparison to their cultivation costs. Low output prices were the third most serious concern faced by farmers in the research region.

Lack of Technical Knowledge

The banana farmers lacked understanding of science and contemporary technologies. They also emphasized the lack of effective weeding and fertilizer application procedures, owing to the fact that these activities required a huge number of laborers. Low output prices were the third most serious concern faced by farmers in the research region.

Storage Problem

Banana storage issues were also noted in the research location. Due to a lack of adequate storage facilities, the majority of items were sold at a discount following harvest. Additionally, significant spoiling happens throughout the harvesting process. However, the issue was not discovered in the situation of small farmers, but was prevalent in the case of big and medium farms. It was fourth restriction issue in the study area.

Disease and Insects Infestation

This is one of the issues confronting banana growers. Cultivation may be diminished as a result of illness and insect infestation. To address this issue, they sometimes utilized insecticides and pesticides, which increased their manufacturing costs. Disease and insect infestation were the fourth limiting concern identified by farmers in the research region.

Table 7.1: Problems faced by the farmers in Banana Cultivation

Nature of Problem	No. of Respondents	Rank
Lack of adequate capital	50	1st
High Price of Inputs	45	2nd
Lack of quality sucker	45	2nd
Low output price	40	3rd
Lack of technical knowledge	40	3rd
Storage problem	35	4th
Disease and insects infestation	35	4th
Problems of theft	30	5th
Problems of natural calamities	30	5th
Carrying Problem	20	6th
Lack of Fertilizer	15	7th

Source: Field survey, 2021

Problems of Theft

During the harvesting season, banana theft was a widespread occurrence, discouraging producers from growing this fruit crop. Around thirty percent of banana producers in the research region reported theft incidences that had a negative impact on banana output.

Problems of Natural Calamities

About eighty percent of banana growers claimed that natural calamity was also a major constraint to expansion of banana cultivation.

Carrying Problem

It was one of the problems in the study area. To carry various inputs and outputs from market field and field to market has hampered greatly due to proper carrying.

Lack of fertilizer

Fertilizer is the most critical component in banana cultivation. They often use urea, TSP, and mop. Farmers have employed fertilizer multiple times in their land to increase productivity. Fertilizer shortages are prevalent throughout our country's cultivation era. Certain merchants created a fictitious fertilizer crisis in order to increase the price. The last issue in the research region was a lack of fertilizer.

CHAPTER VIII
SUMMARY, CONCLUSIONS AND SUGGESTIONS

8.1 Summary

In Bangladesh, banana is a significant perishable multifunctional food crop. It is nutrient-dense, readily digested, high in carbohydrate and minerals, and has more calories than potatoes. It has the potential to contribute to our people's nutritional food security. Banana cultivation may assist in achieving import substitution by lowering reliance on foreign goods. Additionally, this product is critical for farmers' monetary demands. The crop is critical for nutrition, profitability, and revenue, particularly in the research region.

Bananas are mostly eaten as fruits in Bangladesh. Occasionally, its residuals are utilized as cow fodder. Bananas are not just a source of nutrition; they also provide farmers with a source of monetary revenue. However, its output is heavily reliant on its marketing capabilities. If producers are unable to sell bananas at attractive rates and on schedule, they are likely to cease cultivation. The marketing of bananas is critical in determining its profitability. In that regard, the current research was undertaken to ascertain the profitability of banana cultivation, to ascertain the cultivation area's difficulties, and to provide likely recommendations at those levels.

The research area consisted of one upazila and three villages. Kapasia is the upazila, while Aral, Ranigonj, and Targaon are the villages. The population of the research was composed of banana producer-farmers and intermediates in a chosen banana market. Thirty farmers and forty dealers were randomly chosen for the research from the designated region. In terms of sample selection, a total of 60 banana producers were chosen for the research.

Primary and secondary sources of data were consulted. Primary data were gathered from respondents through in-depth interviews. The survey was done by the researcher during March and April of 2021. Additionally, secondary data is required for the investigation. Secondary data sources included pertinent books, journals, and other Bangladesh Bureau of Statistics publications. The study's results were reported in straightforward language such as count, percentage, mean, and standard error of mean.

The statistical approach STATA is utilized to determine the study's regression coefficient.

The costs of manufacturing were calculated for analytical purposes using gross margin analysis. Analysis of net margins, benefit-cost ratios, and functional analysis. To assess the influence of major factors on banana production, the Cobb-Douglas cultivation function was employed. The Cobb-Douglas model's double log form was shown to be the better choice on theoretical and econometric grounds.

According to the socio-economic study, the majority of persons in study area were between the ages of 20 and 40. Overall most household members had 6 to 12 years of schooling in study area. The average family size was 5.4. The average yearly income was determined to be Tk 301544.3, the average annual expenditure was determined to be Tk 215378.4, and the average annual family savings was determined to be Tk 86165.9. About 22% of the farmers received agricultural training in study area. Most of farmers (70%) were the members of social/agricultural organization

Economic profitability is a critical factor in determining whether to produce any crop at the farm level. It may be quantified in terms of net return, gross margin, and return on total cost. The mechanical power cost for banana cultivation was estimated to be Tk. 4940 per hectare on average. The amount of hired human labor utilized in banana cultivation was estimated to be around 61 man-days per hectare, with an average wage of Tk. 400 per man-day. As a result, the entire cost of contracted human labor was determined to be Tk. 24400, or 28.26% of the overall cost. Sucker cost per hectare was calculated to be Tk. 3673 for banana cultivation. Farmers used an average of 218 kg of urea, 163 kg of TSP, and 152 kilogram of MoP per hectare. Total fertilizers cost was Tk.9354.60 per hectare. Tk. 2388.33 was discovered to be the average cost of pesticides used in banana cultivation. Whereas the average irrigation cost per hectare was determined to be Tk. 8616.67. Total variable cost was Tk. 64024 per hectare, or 74.16 percent of the overall cost.

Banana cultivation had an average gross return of Tk. 205263.00. The gross margin, and net return per hectare were determined to be Tk. 141239.00, and Tk. 118932.30. The Benefit Cost Ratio (BCR) was determined to be 2.38, implying that a single taka investment in banana cultivation yielded Tk. 2.38.

Cobb-Douglas production function model was used to determine the effects some important inputs of output from Banana cultivation. Labor cost (X1), sucker cost (X2), urea cost (X3), TSP cost (X4), MoP cost (X5), irrigation cost (X6), and mechanical power cost (X7) were the independent variables (X7). While the regression coefficients for Labor Cost (X1), Urea Cost (X3), and MoP Cost (X5) were all positive, the coefficient for Mechanical Power Cost (X7) were negative and significant at 1% and 5% levels of significance. The cost of sucker (X2), cost of TSP (X4), and Irrigation Cost (X6) were determined to be insignificant in relation to the return on banana cultivation. The positive indication shows that the return on bananas can be enhanced by raising labor costs, urea costs, and MoP costs, while the negative sign suggests that the return on bananas may be decreased by lowering irrigation and mechanical power costs.

Farmers had several difficulties while growing bananas. The issues were social and cultural in nature, as well as financial and technological in nature. Inadequate capital was identified as one of the most significant constraints to producing Banana in the research. Farmers faced several challenges including high input costs, a scarcity of high-quality produce, poor output prices, a lack of technical expertise, storage issues, disease and insect infestation, theft issues, natural disaster issues, transportation issues, and a shortage of fertilizer. These are the primary restrictions for banana farmers in the research region. Public and commercial actions should be conducted to mitigate or remove these issues in order to improve banana output.

8.2 Conclusions

The following conclusions are drawn from the findings of this study and its interpretation in light of other relevant factors:

a) The Benefit Cost Ratio (BCR) was 2.38, implying that a single taka investment in banana cultivation yielded Tk. 2.38.
b) Cost of sucker, cost of TSP, and irrigation cost had no significant contribution to gross return in terms of banana cultivation.

c) Labor cost, cost of Urea, cost of MoP had positive significant contribution to gross return in terms of banana cultivation. This implies that increasing the labor cost, cost of Urea and cost of MoP will increase the gross return in terms of banana cultivation.
d) Mechanical power cost had negative significant contribution to gross return in terms of sugarcane production. Hence, we can say that reducing the cost of cow dung will increase the gross return in terms of banana cultivation.
e) High input costs, a scarcity of high-quality produce, poor output prices, a lack of technical expertise, storage issues, disease and insect infestation, theft issues, natural disaster issues, transportation issues, and a shortage of fertilizer like problems faced by the farmers in banana cultivation.

9.3 Recommendations

The following recommendations may be made based on the outcomes of this research and feedback from operational farmers:

a) Mechanical power cost had negative significant contribution to gross return in terms of sugarcane production. So, it is recommended that the price of mechanical should be minimized and reasonable.
b) Proper training should be provided by the respected authorities
c) This research was conducted only 3 villages Gazipur Sadar upazila under Gazipur district. To justify the findings of the current study, it is important to make scope for more research in other regions.
d) The study was based on the profitability of banana cultivation. Further studies may be conducted on the impact of banana cultivation on poverty reduction.
e) In this study the investigations explore only 7 selected variables affecting the gross return in terms of banana cultivation. Other factors like age, experience, training may have influenced gross return in terms of banana cultivation.

8.4 Limitation of the study

There are some limitations associated with the present study. There are as follows:

1. The research was limited to a specific location with a high concentration of banana cultivation. A purposive random selection of one upazila and four

villages was made. The study's findings could be more significant if it included a sufficient number of banana-producing upazilas.

2. Another significant constraint was a lack of time and funding, which precluded the research from including a large number of farmers and intermediaries and therefore expanding the study area.
3. Another significant issue was the respondents' initial unwillingness to cooperate.

However, this difficulty was overcome through persuasive explanation with the respondents of the study area.

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APPENDIX A

DEPARTMENT OF DEVELOPMENT AND POVERTY STUDIES
SHER-E-BANGLA AGRICULTURAL UNIVERSITY

"Profitability Analysis of Banana Cultivation in Some Selected Area of Gazipur District"

(English Version of Questionnaire)

1. Identification of the farmers:

Name of the Farmer: ……

Village: ……. Upazila: ……

District: …….

2. Socio-economic characteristics:

Age (Years)	
Main Occupation	
Secondary Occupation	
Experience in Banana Production	

(Note: 1= Agriculture, 2= Business, 3= Service, 4= Livestock, 5= Fishing, 6= Others)

3. Level of Education:

Mentions your level of education:

a) I can't read
b) I can sign only
c) I Have passed …….. years

4. Family Structure:

Indicators		**Number**
Gender	Male	
	Female	
	Total	
Members involved in agriculture		

5. Land holding and tenancy:

Category of land	Area (Decimal)
Homestead	
Orchards	
Pond	
Own land	
Leased in	
Leased out	
Total banana cultivated area	

6. Training Exposure:

Have you received any training program related to banana production? Yes/No

If yes then furnish the following information

Sl. No	Name of the training Course	Duration (Days)
1		
2		
3		
4		
Total		

7. Extent Contact:

Please state the extent of your contact with the following communication information sources.

Name of Information Sources	Extent of Contact				
	Regularly (4)	Often (3)	Occasionally (2)	Rarely (1)	Not at all (0)
Meeting with agricultural officer/SAAO	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Meeting with progressive farmer	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Visiting exhibition block	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Listening agricultural program in Radio	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Watching agricultural program on TV	>5 times/month	3-4 times/month	2 times/month	1 time/month	

Reading printed media (e.g., agricultural news, poster, leaflet)	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Participation in group discussion	>5 times/month	3-4 times/month	2 times/month	1 time/month	

8. Organizational Participation:

Are you member of any organization? Yes/No

If yes then mention the name of the organization

……

9. Input use and Cost analysis:

A. Human Labor use

Activities		**Man-days**	**Wage rate (Tk./day)**	**Total Cost (Tk.)**
Land Preparation	Family			
	Hired			
Fertilizer application	Family			
	Hired			
Carrying farmyard manure and application	Family			
	Hired			
Weeding	Family			
	Hired			
Irrigation	Family			
	Hired			
Pesticide Application	Family			
	Hired			
Harvesting and Carrying	Family			
	Hired			

Storage and post harvesting activities	Family			
	Hired			

B. Cost of Mechanical Power:

Items		**No.**	**Rate (Tk./unit)**	**Total Cost (Tk.)**
Ploughing (Power tiller/Tractor)	Owned			
	Hired			
Ridge Preparation	Owned			
	Hired			

C. Material Inputs:

Items	**Unit**	**Cost/Unit (Tk.)**	**Total Cost (Tk.)**
Seed (Kg)			
Cow dung (Kg)			
Green Manure (Kg)			
Urea (Kg)			
TSP (Kg)			
MoP (Kg)			
Others (Kg)			
Insecticides			
Irrigation (Times)			
Rental value of land			

10. Information about annual income from Banana cultivation:

Items	Quantity	Price (Tk.)	Total Income

11. Other income sources:

Sources	Items	Total Amount (Tk.)
Farming	Agriculture	
	Livestock	
	Fish	
	Poultry	
Non-farming	Service	
	Business	
	Labor	
	Foreign	
	Others	

12. Information of Expenses:

Items	Total Amount (Tk.)
Food	
Medicine	
Cloth	
Festivals	
Education	
Others	

13. Mention some problems faced in the time of Banana cultivation:

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14. Give some suggestions:

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Sign of the enumerator:

Date: ……../……./……..