PROFITABILITY ANALYSIS OF SUGARCANE PRODUCTION IN SOME SELECTED AREAS OF MANIKGANJ DISTRICT

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CERTIFICATE

This is to certify that the thesis entitled "**PROFITABILITY ANALYSIS OF SUGARCANE PRODUCTION IN SOME SELECTED AREAS OF MANIKGANJ 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 **SADMAN HASIB AHMED**, Registration No. **14-06271** under my supervision and guidance. To the best of my knowledge, 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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TO

MY BELOVED PARENTS

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The Author

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ABBREVIATIONS AND ACRONYMS

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

PROFITABILITY ANALYSIS OF SUGARCANE PRODUCTION IN SOME SELECTED AREAS OF MANIKGANJ DISTRICT

- SADMAN HASIB AHMED

ABSTRACT

Sugarcane is second in terms of cash crops and third in terms of key crops in the agricultural sector. The main objective of this research was to determine the profitability of sugarcane production. The district of Manikganj was chosen for the research due to its considerable sugarcane production. Through an interview schedule, data were gathered from 100 sample farmers using a simple random sampling approach. After analyzing the data, it was determined that the net return is Tk. 338936.00. Average total cost of sugarcane was estimated to be Tk. 211050.80 per hectare. The Benefit Cost Ratio (BCR) for sugarcane production was determined to be 2.61. While the regression coefficients for cost of MoP and cost of gypsum were all positive, the coefficients for cost of TSP and cost of cow dung were all negative and significant at various levels of significance. The human labor cost, cost of setts, cost of urea, cost of zinc, irrigation cost and pesticide cost were determined to be insignificant in relation to the return on sugarcane production. As a result, it was discovered that sugarcane production was very lucrative. Additionally, this research highlighted a number of problems and constrains related with sugarcane production. These were inadequate capitals, lack of proper knowledge, high price of input, low product price, labor scarcity in the peak period, delay payment of taka, theft of sugarcane and top cutting.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Bangladesh is an agricultural nation, spanning 57320 square miles (148460 square kilometers). The physiographic qualities are almost identical, with the land being dominated by low, flat alluvial soil. In Bangladesh, rural population is mostly rural. They are illiterate in the majority of cases. The economy of Bangladesh is heavily reliant on agriculture. Its expansion is a necessary condition for the economy to achieve its total growth rate. Crop production is one of the four subsectors of agriculture. While agriculture accounts for 13.35 percent of GDP, the crop sub-sector accounts for 6.76 percent of GDP (BBS, 2020).

In Bangladesh, sugarcane is one of the cash crops. *Saccharum officenarum* is the scientific name for sugarcane. It is a member of the Gramineae family. It is grown across the tropical and subtropical climates of the world. In Bangladesh, sugarcane is also a lucrative crop. Not only it is a significant cash crop, but also it is a significant food and industrial crop. This crop is used as a raw ingredient in the manufacturing of sugar and gur. Sugarcane accounts for more than half of the world sugar supply. Although it is cultivated in all districts of Bangladesh, commercial production for industrial supplies is focused mostly in the northern districts. Sugarcane is critical for the growth of the sugar industry and the general economy because it increases farmers' cash income by assuring them of selling outlets and hence encourages farmers to invest in high-value industries. On the other hand, farmers cultivate sugarcane in their own unique style, using their own methods and management.

1.2 Importance of Sugarcane in Bangladesh

Bangladesh is one of the developing nations in the world, with a high population density and an unfavorable land man ratio. Agriculture is the primary source of revenue and employment in Bangladesh. Sugarcane has a significant impact on employment. Numerous individuals are employed in sugarcane production, sugarcane commerce, and sugar industry.

Thus, in addition to providing energy to the human body, sugarcane produces two key products, juice sugar and 'Gur,' which are essential components of human nourishment. Sugar provides energy to the human body and enhances the palatability of meals. There are six sugar-consuming regions in the world. The first of these, is found in Asia, with a deficit of 6.3 million tonnes and an annual consumption of 14.9kg per capita (Izquierdo, 2013). However, we get less than 6 kilogram per capita. As a result, an endeavor will be made to boost sugar and sugarcane output. Sugarcane production and sugar mills provide significant contributions to rural road construction and infrastructure development, providing jobs and improving socioeconomic circumstances.

1.3 Internal Production and Import of Sugar in Bangladesh

Cultivable land is depleting daily as a result of population growth. According to BBS 2020, sugarcane planted area was 86 thousand hectares in 2019-20 and fell to 78 thousand hectares in 2020-21 (Table 1.1). Sugarcane production also declined in 2020-21, falling to 332 thousand MT from 332 thousand MT in 2019-20, owing to shrinking sugarcane acreage. To entice sugarcane growers to enhance output, the government has taken a further step in formulating a program for resurrection of the sector. A sufficient supply of certified setts and improvements in production techniques are required to assure quality and increased output per hectare. The availability of high-quality setts is critical for the development of high-quality sugarcane.

Table 1.1 Total area and production of Sugarcane in Bangladesh (2010-11 to 2020-21)

Year	Area (‘000 hectare)	Total Production (‘000 MT)
2010-11	116	4671
2011-12	108	4603
2012-13	109	4469
2013-14	107	4508
2014-15	104	4434
2015-16	98	4208
2016-17	92	3863
2017-18	90	3639
2018-19	84	3203
2019-20	86	3683
2020-21	78	3332

Source: BBS 2021

Sugar imports are determined by domestic output and demand. As shown in Table 1.2, sugar production and imports have fluctuated significantly.

Table 1.2 Year wise production and import of Sugar in Bangladesh (2010 to 2021)

Year	Sugar Produced ('000 MT)	Import of Sugar ('000 MT)
2010	65	1361
2011	110	1537
2012	75	1700
2013	115	1547
2014	140	2085
2015	85	1982
2016	65	2283
2017	125	2097
2018	100	2654
2019	75	2429
2020	85	2397
2021	55	2351

Source: BBS 2021

1.4 Nutritional Value of Sugarcane

Sugarcane juice is one of the purest forms of sugarcane, second only to the plant stalks, and has the greatest concentration of inherent of the plant vitamins and minerals. In Bangladesh, sugarcane has been farmed. For millennia, it has been used as a popular remedy for a variety of diseases in the Ayurveda and Unani systems of medicine in Bangladesh, Nepal, Pakistan, and other regions of South and Southeast Asia. Natural sugarcane and its direct derivatives have historically been used to cure a variety of ailments, including hemorrhage (bleeding), inflammation, jaundice, and urinary system disorders. Both sugarcane and sugar beet plants are planted for the purpose of producing refined white sugar, albeit each plant has somewhat different features and is cultivated in various parts of the globe. Additional study is necessary before concluding definitively on the advantages of natural sugarcane. A glass of sugarcane juice contains 113.43 calories (Table 1.3).

Table 1.3 Nutritional Value of Sugarcane Juice

One serving (28.35 grams) of sugarcane juice contains	
Calories	113.43
Protein	0.20 gm
Fat	0.66 gm
Carbohydrates	25.40 gm

Source: https://www.webmd.com

Sugarcane is rich in vitamins and minerals, including trace levels of iron, magnesium, vitamin B1, and riboflavin. When ingested in moderation, sugarcane and its derivatives offer a number of well-documented health advantages. Chewing sugarcane or drinking sugarcane water or syrup may aid in the treatment of urinary tract disorders and offer an antioxidant boost, as well as assist pregnant women and diabetic patients.

Sugarcane has diuretic qualities that assist the kidneys in functioning correctly by removing excess salt and water. It is high in antioxidants, which are necessary for the development and maintenance of a healthy immune system.

1.5 Justification of the Study

Increased agricultural productivity is widely regarded as necessary for economic growth. In Bangladesh agricultural product supplies must expand to fulfill local demand caused by population expansion and increased affluence. Otherwise, industrial expansion may be impeded. Indeed, no large-scale industrial program can continue without agricultural expansion, since the increasing industrial output must find consumers inside the nation.

Sugarcane has a significant role in the national economy. In this context, a cost-benefit analysis of sugarcane farming operations is critical, since many individuals are unaware of the relative profitability of sugarcane production.

To the knowledge of the author, there have been few studies on the profitability of sugarcane production in Manikganj district in the past. Previous study was not conducted on the specific upazilas. Thus, the current research is justified on the grounds that it will give significant information to interested parties on various agricultural management techniques and their degree of profitability.

1.6 Objectives of the Study

The general objectives of the study is to assess the relative profitability of sugarcane production in a region of Bangladesh. The particular aims were as follows:

i. To identify the socio-economic characteristics of the sugarcane growers,

ii. To measure the profitability of sugarcane production,

iii. To determine the major factors affecting the gross return of sugarcane, and

iv. To identify the major problems faced by the farmers in producing sugarcane.

1.7 Assumption of the Study

An assumption is a presumption that an apparent fact or principle is true in light of the facts available (Goode and Hatt, 1952).The researcher made the following assumptions while conducting this study.

The respondents chosen for the study were able to respond appropriately to the questions on the interview schedule.

1. The information provided by the respondents was accurate. They were truthful about their involvement in income-generating activities.
2. The information provided by the sampled respondents was representative of the entire population of the research area.
3. The data were non-biased and normally distributed.
4. The respondents were able to provide proper replies to the interview questions.
5. The respondents were able to provide appropriate response to the interview questions.
6. The researcher was at ease with the social environment of the study area. As a result, the data collected from the respondents was devoid of bias.

The researcher who conducted the interviews was well-acquainted with the social context of the study area. As a result, the data he gathered from the respondents was free of biased.

1.8 Limitation of the Study

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

i. The research was limited to a specific location with a high concentration of sugarcane production. A random selection of one upazila and four villages was made. Findings of the study could be more significant if it included a sufficient number of sugarcane-producing upazilas.

ii. 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.

iii. Due to illiteracy, the majority of respondents did not keep written records, forcing the researcher to rely entirely on their recollection.

iv. 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.

1.9 Definition of Terms

A researcher needs to know the meaning and contents of every term that he uses. It should clarify the issue as well as explain the fact to the investigator and readers. However, for clarity of understanding, a number of key concepts/terms frequently used throughout the study defined are interpreted as follows:

Age

Age of a respondent defined as the span of his/her life and is operationally measured by the number of years from his/her birth to the time of interviewing.

Education

Education referred to the development of desirable knowledge, skill, attitudes, etc. of an individual through the experiences of reading, writing, observation and related matters.

Farm size

Farm size referred to the total area on which a family of farmer carries on farming operations, the area being estimated in terms of full benefit to the family of farmer.

Annual family income

Annual income referred to the total annual earnings of all the family members of a respondent from agriculture, livestock and fisheries and other accessible sources (business, service, daily working etc.).

Organizational participation

Organization participation of an individual refers to his participation in various organizations as ordinary member, executive committee member or executive officer within a specified period of time.

Respondent

Respondents are those who have answered questions for a social survey from an interviewer.

Assumption

"The supposition that an apparent fact or principle is correct in light of the available evidence," according to the definition of an assumption (Goode and Hatt, 1952).

Problem faced

Problem faced referred to the degree of difficulties faced by concerned people in accomplishment of particular project activities. In this study problem faced meant extent of problem sugarcane growers faced problems in sugarcane production.

Sugarcane farmers

Sugarcane farmers referred to those fanners who have cultivated sugarcane during 2020-2021. The terms were used synonymously as sugarcane, farmers, respondents and subjects. They, however, have cultivated other crops too.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this Chapter is to conduct a study of applicable literature with the objective of addressing the topic labeled "Profitability Analysis of Sugarcane Production in Some Selected Areas of Manikganj District." Again, although some of these studies are not totally relevant to the current investigation, their results, analytical methods, and recommendations all had a significant effect on the current study. A few attempts have been made to determine the profitability of sugarcane production. This chapter is divided into three sections that are given below:

Section 1: Profitability of sugarcane production in Bangladesh

Section 2: Profitability of sugarcane production in other countries

Section 3: Problems confronted by farmers in sugarcane production

2.1 Profitability of Sugarcane Production in Bangladesh

Hasan *et al.* (2018) found that most of the sugarcane farmers were illiterate and sugarcane production was the main occupation of them. The study found that the per hectare total costs stood at Tk. 126663 and Tk. 110143 with and without intercropping farm, respectively. Per hectare, total cash cost of with and without intercrops farms was accounted for 74.46 and 72.90 per cent of their total cost, whereas the total non-cash costs per hectare amounted for 25.53 and 27.10 per cent of their respective total cost. Gross returns per hectare stood at Tk. 249416 and Tk. 159204 for with intercropping and without intercropping farms, respectively.

Islam *et al.* (2016) estimated that the per hectare cost of sugarcane production in char areas were Tk. 113976.5 which was higher in Gaibandha districts (Tk.121113) followed by Kurigram district (Tk.106840). Average yield of sugarcane in two districts were 62.04 t ha-1. Per hectare net return was Tk. 62252 in the study area. Average BCR over variable cost of two districts was 1.81 which was higher in Gaibandha district 2.06 followed by Kurigram district 1.53. Human labor, Urea, TSP and irrigation were positively significant but organic fertilizer was negatively significant in the study areas.

Kabir and Alam (2000) estimated technical and allocative efficiency of irrigated sugarcane farms in Northwest and Southwest regions in Bangladesh in 1997-98. The study revealed that the mean technical and allocative efficiency of irrigated sugarcane were 0.61 and 0.60 respectively. The study concluded that there is enough scope of increasing sugarcane output using the available inputs and technology.

Kamruzzaman and Hasanuzzaman (2007) revealed that the sugarcane plus potato combination produced the highest net return followed by sugarcane plus maize, sugarcane plus lentil and sole sugarcane production. Family labor cost, cost of urea, number of fertilizing, sowing/planting time of intercrop, cost of sett were the important factors which influence the profitability of sugarcane production both as intercrop and as monoculture.

Nazma (2003) found that the BCRs of sugarcane of small, medium and large farms were 1.29, 1.30 and 1.21 respectively, which indicate that the medium farmers possess the higher BCR which is higher than the average BCR of all farms 1.26.

Reza *et al.* (2016) found that farmers gain profit from sugarcane production and the profit margin increases if the farmers grow inter-crop with sugarcane. Fertilizer, seed and pesticides significantly affect the sugarcane production where the use of fertilizer and pesticides are positively and seed is negatively related with sugarcane production. In case of sugarcane production with inter-crop, tilling and pesticides are positively and significantly and human labor is significantly but negatively related with sugarcane production.

Shamim (2001) found that the total costs per hectare of sugarcane production were Tk. 43059.61 and Tk. 45084.44 for the traditional and the STP methods, respectively. He also found that the net returns per hectare were Tk. 8187.24 and Tk. 2374.11 for the traditional and the STP methods, respectively.

2.2 Profitability of Sugarcane Production in other Countries

Elasraag (2019) found that the area of sugarcane in Egypt is significant at the level of 1%, the regression coefficient of this variable equal 0.944 this result indicates that 1

percent increase in the area of sugarcane resulted in an increase in the sugarcane production by 0.922.

Kumar *et al*. (2010) examined that the cost was Rs. 5261/ha/year increase in Maharashtra followed by Karnataka (Rs. 3778/ha/year), Haryana (Rs. 3657/ha/year) and Uttar Pradesh (Rs. 1248/ha/year). In case of value of sugarcane, there was 8.38% growth in Haryana followed by 5.84% in Karnataka and 4.74% in Maharashtra per year.

Nazir *et al.* (2012) depicted that average production cost of sugarcane fresh crop was higher Rs.109,040/ha, in NWFP followed by the Punjab Rs.98,234/ha and in Sindh Rs.76,157/ha. In contrast, production cost of sugarcane for 1st ratoon was higher Rs.72, 986/ha in Punjab, followed by NWFP Rs.66,082/ha and in Sindh Rs.46,565/ha. Gross margins of sugarcane production in Sindh was higher Rs.48,578/ha than the other province Rs.24,315/ha and Rs.-1,294/ha in Punjab and NWFP respectively. Comparing the gross margin with other competing crops, it was accounted that gross margin of sugarcane is lower than of rice crop in Pakistan.

Pandey *et al.* (2020) determined that the benefit cost ratio of main crop was found 1.02 and ratoon crop was 2.08, whereas overall benefit cost ratio was 1.35. Labor, setts, irrigation and nutrient were found to have significant and positive effect on gross return of sugarcane. Furthermore, labor and tillage hour were found to be over-utilized whereas irrigation, nutrient and setts were found to be underutilized.

Ranjan *et al.* (2020) examined that on an average cost of production per hectare was found to be Rs.95124.68. The gross income and net income were found to be Rs.146587.00 and 63156.54 per hectare on overall farms respectively the input output ratio was found to be 1:1.67 on Cost C.

Singh and Srivastava (2003) examined that acreage, production and yield growth rate of sugarcane are 1.60, 3.48 and 1.85 percent per annum respectively in Uttar Pradesh.

Upreti and Singh (2017) found the positive and significant contribution of human labor, machine, fertilizers, pesticides and size of plot towards productivity of

sugarcane and thus efficient management of these inputs can certainly led to increasing the productivity of sugarcane in India.

2.3 Problems Confronted by Farmers in Sugarcane Production

Hasan *et al.* (2018) determined that lack of adequate operating capital, lack of certified sets of sugarcane, labor scarcity and ownership are major acute problems that farmers had to face in producing the sugarcane.

Hoque *et al.* (2021) found that some opportunities for the policymakers to address the dominant factors i.e. credit received, input availability, and extension media contact for increasing sugarcane production. Moreover, credit facilities, supply of inputs, proper training and access to extension services could play a vital role in lessening problems in sugarcane production.

Islam *et al.* (2016) examined that irrigation problem, lack of clean seed, lack of adequate crusher machine, infestation of disease and pests, low price of sugarcane, lack of transportation facility and lack of money are the major constraints of char sugarcane farmers.

Kamruzzaman and Hasanuzzaman (2007) found that high prices of inputs, lack of scientific knowledge, and dishonesty of officials are the major problems in sugarcane production. In order to promote intercropping in a large scale with sugarcane, government and other related organizations must encourage farmers to produce sugarcane as intercrop in order to earn higher net return.

Karim *et al*. (2016) observed that among the 16 selected problems, shortage and high wages of labor ranked first (PFI=297) which was followed by high price of inputs (seed, fertilizer, pesticide, pesticide); low price of cane; non availability of fertilizers, pesticide and pesticide in time; pest, pest and diseases; lack of clean seed; lack of mechanization in plantation; weeding and harvesting; payment system of cane; getting loan; irrigation and drainage system; lack of capital; lack of training facilities; non co-operation from mills; lack of high yielding varieties; adverse climate condition and

difficulty in getting purji from mills with lowest PFI (36) problems among the farmers in cultivating of sugarcane.

Pandey *et al.* (2020) found that insufficiency and unavailability of chemical fertilizer, absence of irrigation and drainage facilities and unavailability of quality setts were reasons for underutilization. Assurance of availability and affordability of setts, fertilizers, irrigation and intervention of modern-integrated agro-machineries can play significant role for efficient use of resources. Moreover, subsidy on inputs and mechanization are recommended to reduce the cost of production and maximize the profit.

Pandey and Devkota (2020) found that delay payment to the farmers, traditional technologies, lack of high yielding varieties and poor access of farmers to the agriculture loan and insurance are found as major challenges of sugarcane production in Nepal.

Sapkota *et al.* (2017) examined that easy access of proper variety and fertilizer in the production phase and bill settlement from the sugarcane mill in the marketing phase, insufficient incentives to promote technology by lead firms and lack of regular follow up after training are the prominent problems faced by the sugarcane farmers.

Singapur (2019) found that the basic problem confronting the cane growers is to meet the high cost of production. This problem is aggravated by the unreasonable statutory price paid for the cane by the sugar mills. High cost of production and the low price fixed for the cane supply is not, however, the only problem of cane growers but marketing and financial problems are also becoming very acute.

According to the evaluations above, just a few examples include a profitability study of sugarcane production. However, no empirical research on the profitability analysis of sugarcane production in the Manikganj area has been conducted. As a result, this research represents a modest effort in that direction. Thus, the purpose of this research is to do a profitability analysis on sugarcane production in the Manikganj area. Thus,

the research would significantly contribute to the current body of knowledge about the measuring of sugarcane profitability in the Manikganj area.

2.4 Conceptual Framework of the Study

When properly developed, a research hypothesis includes at least two key elements: "a dependent variable" and "an independent variable. A dependent variable is a factor that arises, eliminates, or changes as the researcher presents, removes, or changes the independent variables (Townsend, 1953),. An independent variable is a factor that the researcher manipulates in order to determine its relevance to an observed phenomenon. The causes are the variables, and the phenomena are the effect, therefore there is a cause-and-effect relation everywhere in the cosmos. While making structural arrangements for the dependent and independent variables, the conceptual framework of Rosenberg and Hovland (1960) was kept in mind. The purpose of this study is to determine the major factor affection on the gross return of sugarcane production. As a result, the dependent variable was the gross return, whereas the independent variables were 10 specific variables. Individual perception can be influenced by the interactions of several independent variables. In a single study, it is impossible to address all independent variables. For this study, it was necessary to limit the independent variables, which included human labor cost, cost of setts, cost of urea, cost of TSP, cost of MoP, cos of zinc, cost of gypsum, cost of cow dung, irrigation cost and pesticide cost. A conceptual framework for this study has been constructed based on the above-mentioned debate. This is depicted in the following figure 2.1.

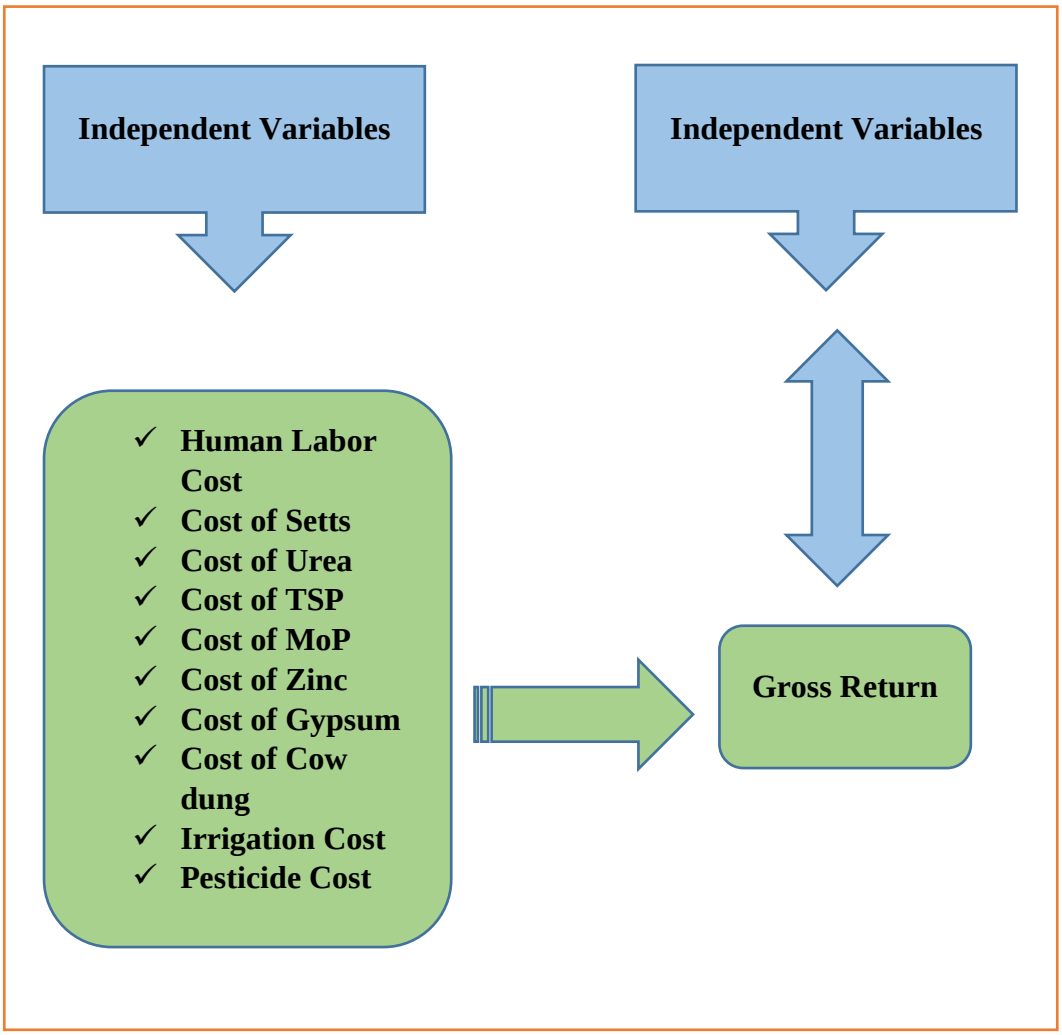

Figure 2.1 The conceptual framework of the study

CHAPTER 3

METHODOLOGY

3.1 Introduction

The validity of farm management research is contingent upon the research approach. Appropriate technique is a precondition for doing sound research. The design of every survey is largely governed by nature, purpose, and goals of the study. 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 to given by the available resources for the assignment (Dillon and Hardaker 1993). The "survey approach" was mostly used in this research for two reasons:

i. The survey permits rapid analysis of a large number of instances; and
ii. Findings of the survey have a broader application.

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

The study area selection is a critical stage in conducting a farm management research. The region chosen suited both the research specific objective and the possibility of cooperating with the farmer. Although sugarcane is cultivated across Bangladesh, the Manikganj area is particularly notable for its enormous production. A total of 685 hectares of land was brought under sugarcane production during 2019-20 in the Manikganj district. (Thedailysun, 21 July, 2019)

Thus, two large upazilas in Manikganj district were purposefully chosen for the research based on their significant concentration of sugarcane production: namely Harirampur and Saturia. The following were the primary reasons for choosing the research area:

a) There were several sugarcane planters in the research region;
b) These upazilas had certain physical features, such as topography, soil, and climatic conditions for sugarcane production.
c) Accessibility and communication facilities were anticipated to be readily available in these communities; and
d) Respondents' cooperation was expected to be strong in order to acquire trustworthy data.

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 (Kabir 2016). 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, objective of sampling is to choose a subset of the population that is representative of the whole population. (Kabir 2016)

Due to time, financial, and manpower constraints, it was not feasible to enroll all of the farmers of study area. A total of 100 farmers were chosen at random. The current research used a purposive random sample strategy to save costs and time and to accomplish the final aims of research.

Table 3.1 Distribution of sample size of respondents in two selected upazila of Manikganj district

District	Upazila	Sample Size
Manikganj	Harirampur	50
	Saturia	50
Total		100

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 issues were considered to the greatest degree feasible 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 overall aim of the survey. Additionally, the test was designed to validate the logistics necessary for the survey proper operation. To guarantee optimal performance of the questionnaire in terms of data collecting, processing, and analysis, pre-testing was conducted prior to the survey in rural areas of Harirampur and Saturia, Manikganj District. Farmers were randomly picked for interview.

After the pre-test, the questionnaire was updated for the final round of data collection. A face-to-face interview was conducted in response to the questionnaire during the period of 10 July and 09 August 2021.

3.4.4 Data Editing and Coding

Data editing and coding are the important requirement for data processing. 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 findings of the study. 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 Analytical Techniques

The data were evaluated according to the objectives of the study. A number of analytical techniques were used in this investigation. A significant portion of the data analysis was conducted using the tabular technique. This approach is widely utilized because it has the natural ability to provide the most accurate image of the agricultural economics in the simplest manner. To analyze data and define socio-economic features of sugarcane producers, input consumption, expenses and returns on sugarcane production, and to determine the undiscounted benefit cost ratio, relatively

basic statistical methods such as percentage and arithmetic mean or average were used (BCR).

To estimate the degree of technological efficiency in a way compatible with production function theory, the current research employed a Cobb-Douglas type stochastic frontier production function.

3.7.1 Profitability Analysis

The net returns of Sugarcane production were assessed using a set of financial pricing. The financial prices were the market prices obtained by farmers for products and inputs acquired during the research period. The following cost elements were found for the study:

- ✓ Land preparation
- ✓ Human labor
- ✓ Setts
- ✓ Cow dung
- ✓ Urea
- ✓ TSP
- ✓ MoP
- ✓ Gypsum
- ✓ Zinc
- ✓ Pesticide
- ✓ Irrigation
- ✓ Interest on operating capital
- ✓ Land use

The returns from the crops were estimated based on the value of main products. In this study variable cost, fixed cost and total cost had been described. Total variable cost (TVC) included land preparation, human labor, setts, cow dung, urea, TSP, MoP, gypsum, zinc pesticides, irrigation. Fixed cost (FC) included rental value of land and interest on operating capital. Total cost (TC) included total variable cost and fixed cost.

Cost of Land Preparation

Land preparation is a critical component of the industrial process. Preparation of the land for sugarcane production includes plowing, laddering, and other actions necessary to prepare the soil for seedling planting. It was discovered that the number of ploughings varied considerably across farms and between locations.

Cost of Human Labor

Human labor was once seen as a significant cost component of the manufacturing process. It is often needed for a variety of tasks including land preparation, seeding and transplanting, weeding, fertilizer and pesticide treatment, irrigation, harvesting and hauling, threshing, cleaning, drying, and storage. To assess the cost of human work, we multiplied the recorded man-days per hectare by the pay per man-day for a specific activity.

Cost of Setts

The cost of setts varied significantly according on their quality and availability. The market prices of respectable sugarcane setts were utilized to calculate the cost of setts. To determine the cost of setts in the research locations, the total number of setts required per hectare was multiplied by the market price of setts.

Cost of Cow dung

Farmers in the study area produced their products using cow dung as manure. They acquired a huge quantity of cow dung from milk producers. To determine the cost of cow dung, we multiplied the reported unit of cow dung per hectare by the market price of cow dung.

Cost of Urea

Urea was a critical component in sugarcane production. The cost of urea was determined using market prices. To determine the cost of urea, we multiplied the reported unit of urea per hectare by the market price of urea.

Cost of TSP

The cost of TSP was also computed on the basis of market price. In order to calculate cost of TSP the recorded unit of TSP per hectare were multiplied by the market price of TSP.

Cost of MoP

Among the five main fertilizers used in sugarcane production, MoP was one of them. To calculate the cost of MoP per hectare, the market price of MoP was multiplied by per unit of that input per hectare for a particular operation.

Cost of Gypsum

The cost of Gypsum was also computed on the basis of market price. In order to calculate the cost of Gypsum the recorded unit of Gypsum per hectare were multiplied by the market price of Gypsum.

Cost of Zinc

The cost of Zinc was also computed on the basis of market price. In order to calculate the cost of Zinc the recorded unit of Zinc per hectare were multiplied by the market price of Zinc.

Cost of Pesticides

Farmers used different kinds of pesticides for 5-7 times to keep their crop free from pests and diseases. Cost of pesticides was calculated based on the market price of the pesticides which was used in the study areas per hectare.

Cost of Irrigation

Water management aids in sugarcane output expansion. Irrigation costs vary considerably amongst farms. It was determined by the number of times irrigation was required per hectare and the associated expense.

Interest on Operating Capital

The interest rate on operational capital was calculated using the opportunity cost concept. Because not all expenditures were incurred at the start or at any one point in time, the operating capital really reflected the average operating cost across the period. The expense was incurred during the duration of the manufacturing process;

Thus, interest on working capital for four months was calculated at a rate of 9% per year. The following formula was used to compute interest on operating capital:

IOC= AIit

Where,

IOC= Interest on operating capital

i= Rate of interest

AI= Total investment / 2

t = Total time period of a cycle

Land Use Costs

Land use cost was calculated on the basis of opportunity cost of the use of land per hectare for the cropping period of four months. So, cash rental value of land has been used for cost of land use.

Calculation of Returns

Gross Return

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

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

Gross Margin

The term "gross margin" refers to the difference between the gross return on investment and variable costs. Generally, farmers want the highest possible return on their variable cost of production. The reason for employing gross margin analysis is that farmers are motivated by the desire to earn a profit on their variable costs. Gross margin was determined on a television commercial basis.

Gross margins per hectare were calculated by deducting variable expenses from gross return. That is to say

Gross margin = Gross return – Total variable cost

Net Return

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

Net return = Total return – Total cost.

Undiscounted Benefit Cost Ratio (BCR)

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

BCR = Total return (Gross return)/ Total cost

3.7.2 Statistical Analysis

Due to its mathematical features, ease of comprehension, and computational simplicity, the Cobb-Douglas production function is arguably the most extensively used form for fitting agricultural output data (Heady and Dillion, 1961; Fuss and Mcfadden, 1978). Although the Cobb-Douglas function contains convex isoquants, it does not account for technically independent or competitive variables, nor does it account for Stages I and III in addition to Stage II. That is, MPP and APP are monotonically declining functions for every X, implying that the whole factor-factor space is Stage II-given 0 to 1, as is often the case.

Cobb-Douglas, on the other hand, may be a reasonable approximation for production systems in which components are imperfect replacements across a wide range of input values. Additionally, the Cobb-Douglas is generally straightforward to estimate since it is linear in parameters in logarithmic form; it is parsimonious in parameters (Beattie and Taylor, 1985).

A stochastic Cobb-Douglas production frontier model is denoted by the following formula:

$$Yi = f(Xi, \beta) \exp(Vi-Ui) \quad i = 1, 2, 3, \ldots\ldots\ldots, N$$

Where the stochastic production frontier is f (Xi, β) exp.(Vi), Vi having some symmetric distribution to capture the random effects of measurement error and exogenous shocks which cause the placement of the deterministic kernel f(Xi,β) to vary across firms.

The technical inefficiency relative to the stochastic production frontier is then captured by the one-sided error component Ui > 0.

The explicit form of the stochastic Cobb-Douglas production frontier is given by

$$Y_i = \alpha X_{1i}^{\beta 1}\, X_{2i}^{\beta 2}\, X_{3i}^{\beta 3}\, X_{4i}^{\beta 4}\, X_{5i}^{\beta 5}\, X_{6i}^{\beta 6}\, e^{ui}$$

Where Y is the frontier output, X is physical input, b the elasticity of Y with respect to X, a is intercept and Ɛ = V-U is a composed error term as defined earlier. For simplicity, we have ignored the subscript.

Specification of Production Model

We have specified the Cobb-Douglas Stochastic Frontier Production Function in order to estimate the level of technical efficiency. The functional form of stochastic frontier is as follows:

$$Y = \beta_0 X_1^{\beta_1} X_2^{\beta_2} \ldots\ldots\ldots X_{10}^{\beta_{10}}\, eVi\text{-}Ui$$

The above function is linearized double-log form:

$$\ln Y = \ln\beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + \beta_9 \ln X_9 + \beta_{10} \ln X_{10} + u_i$$

Where,

Y = Gross return from sugarcane production (Tk./ha)

X_1 = Human labor Cost (Tk./ha)

X_2 = Cost of Setts (Tk./ha)

X_3 = Cost of Urea (Tk./ha)

X_4 = Cost of TSP (Tk/ha)

X_5 = Cost of MoP (Tk./ha)

X_6 = Cost of Gypsum (Tk./ha)

X_7 = Cost of Zinc (Tk./ha)

X_8 = Cost of Cow dung (Tk./ha)

X_9 = Pesticide cost (Tk./ha)

X_{10} = Irrigation cost (Tk./ha).

β_0, β_1, ...,β_{10} = Co-efficient of respected independent variables

u_i = error term

3.7.3 Percentage Formula

Problems faced by the sugarcane farmers and some socio-economic characteristics were shown in percentage which was calculated by using following formula:

$$P = \frac{F}{N} X\ 100$$

Here,

P = Percentage

F = Frequency/sample of the respondent

N = Total number of respondent

CHAPTER 4

DESCRIPTION OF THE STUDY AREA

4.1 Introduction

This chapter provides an overview of the research field. A working understanding of the subject region is necessary for comprehending and interpreting the results. It covers the location, physical characteristics and terrain, climate, temperature and precipitation, occupation, industry, non-governmental organizations, roadways, communication, and marketing infrastructure of the research area.

4.2 Location

Two upazilas from Manikganj district were included in the research area. Harirampur and Saturia were chosen as upazilas. Harirampur upazila has an area of 245.42 square kilometers and is situated between latitudes 23°38' and 23°48' north and longitudes 89°50' and 90°03' east (ADB, 2013). It is flanked on the north by the upazilas of Shivalaya, Ghior, and Manikganj Sadar, on the south by the upazilas of Char Bhadrasan and Faridpur Sadar, on the east by the upazilas of Manikganj sadar, Nawabganj, and Dohar, and on the west by the upazilas of Shibalaya, Goalanda, and Faridpur sadar. Saturia upazila has an area of 140.12 square kilometers and is situated between 23°51' and 24°03' north latitudes and 89°55' to 90°08' east longitudes (ADB, 2013). It is flanked on the north by the upazilas of Nagarpur and Dhamrai, on the south by the upazila of Manikganj Sadar, on the east by the upazila of Dhamrai, and on the west by the upazilas of Daulatpur and Ghior.

4.3 Physical Features and Topography

The study area is located in the western section of Dhaka. The region is located in the floodplain of the Brahmaputra and Jamuna rivers. This area has six distinct geomorphological units: active channel, abandoned channel, natural levee, crevasse splay, floodplain, and flood basin deposits. The main rivers of the area are the ancient Kaliganhga and Dhalewsahri.

Figure 4.1 A map of Manikganj district showing the study area

Figure 4.2 A map of Harirampur upazila

Figure 4.3 A map of Saturia upazila

4.4 Climate, Temperature and Rainfall

The climate of the area is believed to be distinct from that of the rest of the district. Summer temperatures are fairly consistent. There are no local instruments that monitor the climate. Annual average temperatures, on the other hand, range between 36 and 12.7 degrees Celsius, with an annual rainfall total of 2,376 millimeters (93.5 in). Summers are very hot and springs are extremely humid, followed by colder days in the winter months. It usually begins pouring in July and lasts until September. August is the wettest month.

4.5 Occupation of the People

Agriculture is the primary source of income in this region. Only a small number of individuals work in business and as government, semi-government, or private or casual or seasonal employees in sugar mills and other wealthy farms.

4.6 Non-Government Organization

Several non-governmental organizations (NGOs) like as Grameen Bank, BRAC, PROSHIKA, ASA, and CDA are now involved in a variety of rural development activities. NGOs have been giving technical training in sugarcane production, handicraft production, animal management, and domestic gardening in recent years. Additionally, they give loans to impoverished women and landless farmers.

4.7 Roads, Communication, Transport and Marketing facilities

Roads, communication, transportation, and marketing infrastructure comprise the bulk of agricultural infrastructure and are critical to an agricultural success of a region. In this backdrop, the zonal region lacks suitable infrastructure in terms of pucca roads, which would enable farmers to sell their goods at a lower cost. There are a few earthen roads that connect several communities. Farmers must transport their marketable produce to the market using a tractor, truck, rickshaw, or van. There are a few small local markets where farmers purchase and sell their daily necessities twice a week.

CHAPTER 5

SOCIO-ECONOMIC PROFILE OF SUGARCANE GROWERS

5.1 Introduction

This chapter will provide an outline of the socioeconomic features of sugarcane growers. The socio-economic status of farmers may be interpreted in a variety of ways, depending on aspects such as their manner of life, their financial situation, and the extent to which growers support national progress initiatives. Due to time and asset constraints, it was unable to collect comprehensive data on the sample farmers' financial characteristics. Nonetheless, some information was gathered. The financial situation of the example farmers is critical in the event of study planning because there are several interconnected and component aspects that define an individual and have a significant impact on the development of his or her behavior and character, and one of these aspects is the farmers' financial situation. Individuals have a number of distinct financial viewpoints. Nonetheless, for the sake of this study, a few financial elements have been considered for the purpose of exchanging.

5.2 Age

In Harirampur upazila, 54% of the sample population were up to 40 years old, 30% between the ages of 40 and 50, and 16% were above 50 years old.

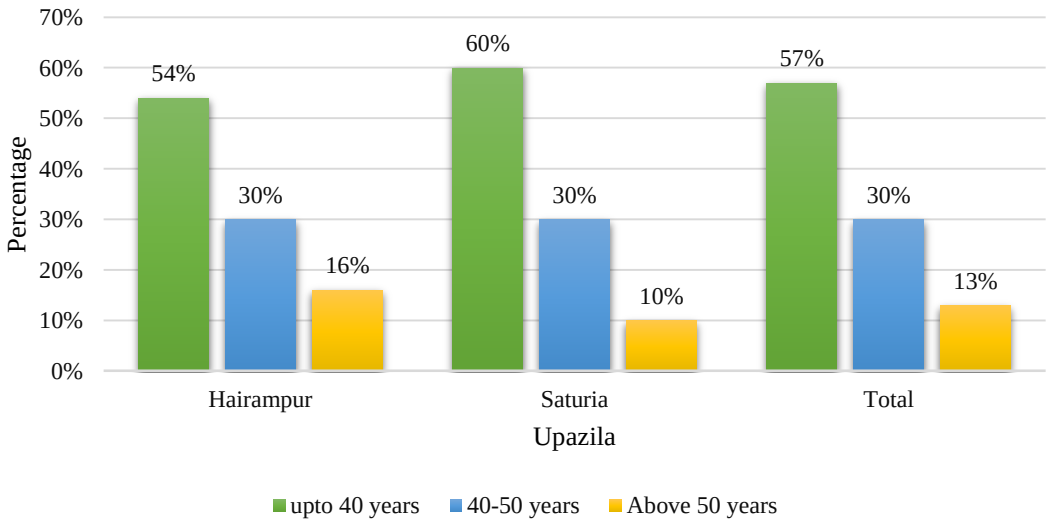

Figure 5.1 Age of the respondent by the study area

In Saturia upazila, 60% of the sample population were up to 40 years old, 30% were between the ages of 40 and 50, and 10% were above 50 years old. (Figure 5.1.) The majority of people in each neighborhood were up to 40 years old, as we discovered.

5.3 Education of the Farmers

According to Figure 5.2, around 42% of the study population aged had no education and/or were unable to read or write, 20% were able to sign their name, 20% have primary level education and 18% had secondary level education, in Harirampur. In Saturia, 28% of the people aged had no education and/or were unable to read or write, 18% were able to sign their name, 26% had primary level education, and 28 % had secondary level education.

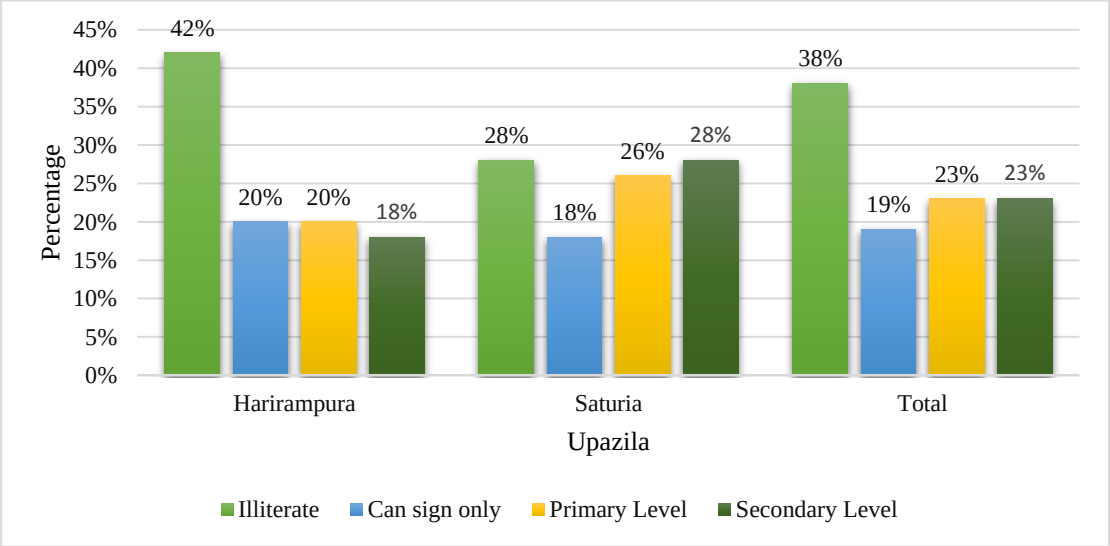

Figure 5.2 Education of the farmers by the study area

5.4 Composition of the Family Size

When it comes to providing enough nutritional grain for the ranch family, the size of the family is crucial. In this study, a family was defined as the total number of people who lived in the same kitchen and ate meals under the direction of a single family head, as described by the researchers. Families include the spouse, children, an unmarried young girl, the father, mother, sister and numerous other relatives who live with the family on a permanent basis, as well as extended family members who visit. Average family was 5.80, 6.31 in Harirampur and Satura upazila respectively (Table 5.1).

Table 5.1 Average family size and distribution of members according to sex of the sample farmers

Particulars	Harirampur		Saturia		All Farmers		National Average Family Size
	Number	Percent	Number	Percent	Number	Percent	
Male	3.33	57.41	3.02	56.01	3.18	53.26	4.06
Female	2.47	42.59	3.11	43.99	2.79	46.73	
Total	5.80	100.0	6.31	100.0	5.97	100.0	

5.5. Annual Family Income

a) Agricultural Work

Crops, poultry, livestock, and fisheries are the principal sources of agricultural income in the sample population. Agricultural production accounts for the bulk of framers' income. Crop farming was the principal source of income for these people, who earned an average of Tk. 37222.22 each year from crop production on a year-to-year basis.

Table 5.2 Average family income from agricultural work

Sector	Average Annual Income (Tk.)	Total Average Annual Income from Agriculture
Crops	37222.22	67222.22
Livestock	20000.00	
Fisheries	10000.00	

Today, the research area includes livestock and fish farm, in addition to the original study site. Farmers get Tk. 20000, and Tk. 10000 from livestock, and fisheries, respectively, in a year worth of work. Agriculture contributed an annual household income of Tk. 67222.22 on average per family. (Table 5.2)

b) Non-Agriculture Work

Among the non-agricultural activities were day labor, vehicle and truck driving, domestic work, small business, international remittances, and service. According to reports, the yearly average earnings from non-agricultural sources is Tk 126543.12

each year. Tk 193765.30 was calculated to be the annual average income for the farmers in the study area.

5.6 Annual Family Expenditure

According to the findings, the average annual expenditure of a sample farmer is Tk. 104100.00. Dietary expenses accounted for the vast bulk of family expenditures. Education, clothing, medicine, transportation, festival participation, and entertainment were all substantial expenditures for a kid, as were the costs involved with his or her upbringing. The average annual family savings was calculated to be Tk 89665.35. (Figure 5.3)

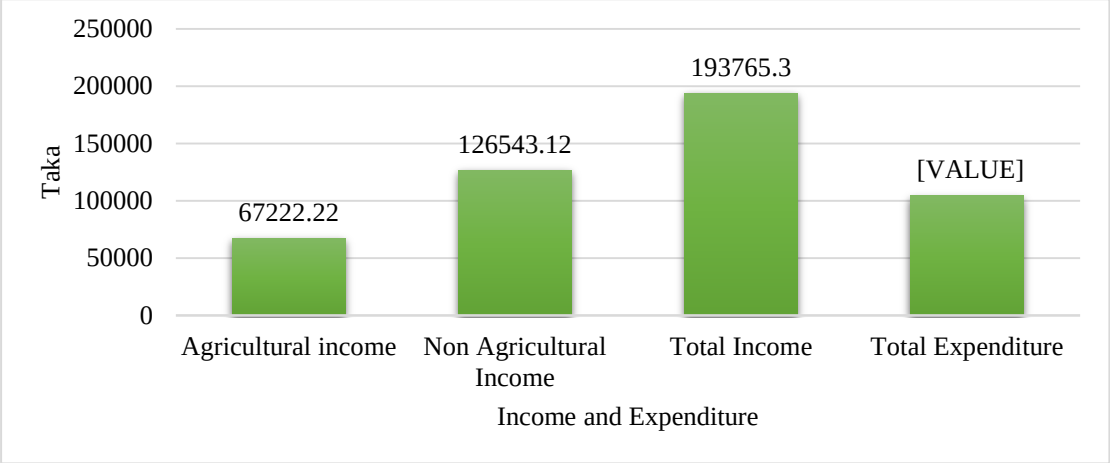

Figure 5.3 Annual family income and expenditure by the study area

5.7 Agricultural Training

In Harirampur, 64 percent of responding farmers got instruction in sugarcane growing, compared to 52 percent in Saturia (Table 5.3). These training sessions broadened their views on a variety of issues, including correct seedling handling, the use of resistant cultivars, the application of pesticides and herbicides, and adequate water management, among others.

Table 5.3 Agricultural training of the respondent by the study area

Training Received	Harirampur		Saturia		Total	
	Number	%	Number	%	Number	%
Yes	32	64.00	26	52.00	58	58.00
No	18	36.00	24	48.00	42	42.00
Total	50	100.00	50	100.00	100	100.00

5.8 Social Organization Membership

On average, 52 percent of sugarcane farmers in Harirampur were members of various non-governmental organizations (NGOs) and/or farmers' organizations, whereas 68 percent of sugarcane farmers in Saturia were members of various NGOs and/or farmers' organizations (Table 5.4).

Table 5.4 Membership in social organization of the respondent by the study area

Membership	Harirampur		Saturia		Total	
	Number	%	Number	%	No.	%
Yes	26	52.00	34	68.00	60	60.00
No	24	48.00	16	32.00	40	40.00
Total	50	100.00	50	100.00	100	100.00

CHAPTER 6

PROFITABILITY OF SUGARCANE PRODUCTION

6.1 Introduction

The primary objective of the chapter is to investigate the costs, returns, and profitability of sugarcane production. A series of case studies is used to achieve this. Profitability is a critical factor in determining whether to grow a certain crop on a small farm. It may be quantified using a variety of measures, including net return, gross margin, and return on total cost. The overall cost of manufacturing was determined by summing the costs of all products. Crop returns have been calculated using the values of the primary products and by-products of the field.

6.2 Profitability of Sugarcane Production

6.2.1 Variable Costs

Cost of Land Preparation

The preparation of the land is the most critical step in the manufacturing process. Land preparation efforts included plowing, laddering, mulching and other tasks necessary to prepare the land for sugarcane agriculture. Thus, the average cost of land preparation for sugarcane production was determined to be Tk. 10232.74 per hectare, or 4.85% of the total cost (Table 6.1).

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 production of Sugarcane. 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 sugarcane production was determined to be around 105 man-days per hectare, with an average wage of Tk. 500 per man-day. As a result, the entire cost of contracted human labor was determined to be Tk. 52500, or 24.88% of the total cost (Table 6.1).

Cost of Setts

Setts prices vary significantly according on its quality and availability. Farmers used an average of 4000.59 kg setts per hectare. The total cost of setts per hectare for sugarcane production was calculated to be Tk. 20002.96, or 9.48 percent of the total cost (Table 6.1).

Table 6.1 Per hectare return and costs of sugarcane production

Cost Items	Quantity (No. or Kg/ha)	Price Per Unit (Tk.)	Costs/Returns (Tk./ha)	% of total
A. Gross Return				
Main product	54998.67	10	549986.70	100.00
Total return			**549986.70**	**100.00**
B. Gross Cost				
C. Variable Cost				
Land Preparation Cost			10232.74	4.85
Hired labor	105	500	52500.00	24.88
Sett	4000.59	5	20002.96	9.48
Urea	454.64	17	7728.96	3.66
TSP	300.54	30	9016.12	4.27
MoP	348.07	18	6265.34	2.97
Gypsum	150.44	50	7522.08	3.56
Zinc	17.98	200	3595.91	1.70
Cow dung	15127.31	1.5	22690.96	10.75
Green Manure	498.57	35	17449.93	8.27
Pesticides			1100.16	0.52
Irrigation			7188.45	3.41
Total Variable cost (TVC)			**165293.60**	**78.32**
D. Fixed Cost				
Land use cost			9500.00	4.50
Family labor	60	500	30000.00	14.21
Interest on operating capital			6257.23	2.96
Total Fixed cost (TFC)			**45757.23**	**21.68**
E. Total costs (TC)			**211050.80**	**100.00**

Cost of Urea

In the study area, farmers used different types of fertilizers. On an average, farmers used urea 454.64 kg per hectare. Per hectare cost of urea was Tk. 7728.96, which represents 3.66% of the total cost (Table 6.1).

Cost of TSP

Among the different kinds of fertilizers used, the rate of application of TSP was 300.54 kg. The average cost of TSP was Tk. 9016.12 which representing 4.27% of the total cost (Table 6.1).

Cost of MoP

The application of MoP per hectare was 348.07 kg. Per hectare cost of MoP was found Tk. 6265.34, which represents 2.97% of the total cost (Table 6.1).

Cost of Gypsum

The application of Sulphate per hectare was 150.44 kg. Per hectare cost of Gypsum was found Tk. 7522.08, which represents 3.56% of the total cost (Table 6.1).

Cost of Zinc

The application of Zinc per hectare was 17.98 kg. Per hectare cost of Zinc was found Tk. 3595.91, which represents 1.70% of the total cost (Table 6.1).

Cost of Cow dung

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. 22690.96, which equals 3.41 percent of the total cost (Table 6.1).

Cost of Green Manure

The application of Manure per hectare was 498.57 kg. Per hectare cost of manure was found Tk. 17449.93 which was 8.27% of the total cost (Table 6.1).

Cost of Pesticides

Farmers used different kinds of pesticides to keep their crop free from pests and diseases. The average cost of pesticides for Sugarcane production was found to be Tk. 1100.16 which was 0.52% of the total cost (Table 6.1).

Cost of Irrigation

Irrigation is one of the most significant expenditures associated with sugarcane production. Irrigation is critical for sugarcane production. Irrigation costs averaged Tk. 7188.45 per hectare, accounting for 3.41% of the total cost (Table 6.1).

Total Variable Cost

Therefore, from the above different cost items it was clear that the total variable cost of Sugarcane production was Tk. 165293.60 per hectare, which was 78.32% of the total cost (Table 6.1).

6.2.2 Fixed Cost

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. 9500.00 per hectare using data acquired from sugarcane producers, accounting for 4.50% of the total cost (Table 6.1).

Interest on Operating Capital

It is worth noting that interest on operating capital was determined by factoring in all operational expenditures incurred throughout sugarcane production period. Interest on operating capital for sugarcane production was approximated at 9% and Tk. 6257.23 per hectare was computed, representing 2.96% of the total cost (Table 6.1).

Cost of Family Labor

The quantity of human labor required in sugarcane production was 60 man-days per hectare (Table 6.1). The total cost of human labor was calculated to be Tk. 30000.00, representing 14.21 percent of the total cost of Sugarcane production.

Total Cost (TC) of Sugarcane Production

Total cost was calculated by adding all the cost of variable and fixed inputs. In the present study per hectare total cost of producing sugarcane was found to be Tk. 211050.80 (Table 6.1).

6.2.3 Return of Sugarcane Production

Gross Return

The return on sugarcane production 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. 549986.70 per hectare (Table 6.2).

Gross Margin

Gross margin is the gross return over total 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. 384693.10 per hectare (Table 6.2).

Net Return

Net return or profit was calculated by deducting the total production cost from the gross return. On the basis of the data the net return was estimated as Tk. 338935.90 per hectare (Table 6.2).

Table 6.2 Per hectare cost, return and BCR of sugarcane production

Cost Item	Cost/Returns (Tk./ha)
A. Gross Return	549986.70
B. Total Variable Cost	165293.60
C. Fixed Cost	45757.20
D. Total Costs	211050.80

E. Gross Margin (A-B)	384693.10
F. Net Return (A-D)	338935.90
G. Undiscounted BCR (A/D)	2.61
H. BCR on cash cost basis (A/B)	3.33

6.2.4 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) were found to be 2.61 which implies that one-taka investment in Sugarcane production generated Tk. 2.61 (Table 6.2). From the above calculation it was found that sugarcane production is profitable in Bangladesh.

CHAPTER 7

MAJOR FACTOR AFFECTING ON SUGARCANE PRODUCTION

Human labor, cost of setts, cost of Urea, cost of TSP, cost of MoP, cost of gypsum, cost of zinc, cost of cow dung, pesticides cost, and irrigation cost were the major inputs used in sugarcane production in the research region. Fertilizer and pesticides were also significant inputs. These inputs were used as explanatory factors in the sugarcane production function study to help explain the findings. As a result, it is theorized that these inputs were responsible for sugarcane production variance. As a result, a Cobb-Douglas production function was used to estimate likely relationships between sugarcane output and inputs, with the findings reported in study.

7.1 Interpretation of Cobb-Douglas Production Function

The construction of a mathematical equation for the sample data, known as the Likelihood Function, is the first step in the process of maximum likelihood estimation. It is defined as the probability of getting a collection of data based on the probability distribution model that has been chosen for collecting that collection of data. This phrase contains the parameters of the model that are unknown at this time. Maximum Probability Estimates, often known as MLEs, are the values of these parameters that maximize the likelihood of the sample being correct.

Table 7.1 presents the maximum likelihood estimates for the Cobb-Douglas production function model of sugarcane growing for all farmers, as calculated using the maximum likelihood method.

Table 7.1 Estimated values of the co-efficient and related statistics of Cobb-Douglas production model

Variables	Parameter	Co-efficient	Standard Error	T-value	P-value
Intercept	β_0	11.667***	2.059	5.67	0.000
Human Labor cost (X1)	$\beta 1$	0.0001	0.002	0.64	0.527
Cost of Setts (X2)	$\beta 2$	0.159	0.205	0.77	0.441
Cost of Urea (X3)	$\beta 3$	-0.0001	0.001	-0.11	0.914
Cost of TSP (X4)	$\beta 4$	-0.14***	0.004	-3.22	0.002
Cost of MoP (X5)	β_5	0.013**	0.006	2.15	0.034
Cost of Gypsum (X6)	β_6	0.009***	0.003	2.91	0.005
Cost of Zinc (X7)	β_7	0.001	0.001	1.02	0.309
Cost of Cow dung (X8)	β_8	-0.009***	0.003	-3.25	0.002
Irrigation Cost (X9)	β_9	-0.0002	0.005	-0.12	0.906
Pesticide Cost (X10)	β_{10}	-0.00018	0.004	-0.14	0.888
R^2		0.33			
F-Value		4.295***			

Note: *** = Significant at 1% level, ** = Significant at 5% level, * = Significant at 10% level

As indicated by the F-values and R-square, the Cobb-Douglas model performed well in terms of matching the data. R-square values of 0.33 were found for sugarcane producers. Sugarcane production was shown to be 33 percent more variable when the explanatory variables were included. The effect of stated factors on sugarcane production may be seen in the regression equation estimates, which are derived from the regression equation. For sugarcane growers, the results show that the co-efficient cost of TSP, cost gypsum and cost of cow dung was significant at the 1 percent level, and the cost of MoP were significant at the 5 percent level. But the co-efficient of Human labor, cost of setts, cost of urea, cost of zinc and the cost of irrigation did not have the predicted sign. Aside from that, the F-value of the equation was statistically significant at the one percent level of significance. This suggests that the explanatory variables in the model account for the majority of the variation in sugarcane production.

In summary, the models suggest that the respective authority should be considered the cost of TSP, cost of MoP, cost of gypsum, cost of cow dung, and some predictive importance has been discussed below:

7.1.1 Significant Contribution of Cost of TSP to Gross Return

From the multiple regression, it was concluded that the contribution of cost of TSP to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of cost of TSP to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the cost of TSP was significant at 1% level (.002)

b) So, the null hypothesis will be rejected.

c) The β-value of education is (-0.14). So, it can be stated that as cost of TSP increased by 1%, gross return is decreased by 0.14%. Considering the effects of all other factors are held constant.

Cost of TSP has negative significant contribution to gross return in terms of sugarcane production. Hence, we can say that reducing the cost of TSP will increase the gross return in terms of sugarcane production. Similar findings found in previously in the findings of Hasan *et al*., (2018).

7.1.2 Significant Contribution of Cost of MoP to Gross Return

From the multiple regression, it was concluded that the contribution of cost of MoP to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of cost of MoP to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the cost of MoP was significant at 5% level (.034)

b) So, the null hypothesis will be rejected.

c) The β-value of education is (0.013). So, it can be stated that as cost of MoP increased by 1%, gross return is increased by 0.013%. Considering the effects of all other factors are held constant.

Cost of MoP has positive significant contribution to gross return in terms of sugarcane production. Hence, we can say that increasing the cost of MoP will increase the gross return in terms of sugarcane production. Similar findings found in previously in the findings of Reza *et al.*, (2016), Upreti and Singh (2017) and Hasan *et al.*, (2018).

7.1.3 Significant Contribution of Cost of Gypsum to Gross Return

From the multiple regression, it was concluded that the contribution of cost of gypsum to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of cost of gypsum to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the cost of Gypsum was significant at 1% level (.005)

b) So, the null hypothesis will be rejected.

c) The β-value of education is (0.009). So, it can be stated that as cost of gypsum increased by 1%, gross return is increased by 0.009%. Considering the effects of all other factors are held constant.

Cost of gypsum has positive significant contribution to gross return in terms of sugarcane production. Hence, we can say that increasing the cost of gypsum will increase the gross return in terms of sugarcane production. Similar findings found in previously in the findings of Reza et al., (2016), Upreti and Singh (2017) and Hasan et al., (2018).

7.1.4 Significant Contribution of Cost of Cow dung to Gross Return

From the multiple regression, it was concluded that the contribution of cost of cow dung to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of cost of cow dung to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the cost of cow dung was significant at 1% level (.002)

b) So, the null hypothesis will be rejected.

c) The β-value of education is (-0.009). So, it can be stated that as cost of cow dung increased by 1%, gross return is decreased by 0.009%. Considering the effects of all other factors are held constant.

Cost of cow dung has 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 sugarcane production. Similar findings found in previously in the findings of Islam *et al.*, (2016) and Hasan *et al.*, (2018).

CHAPTER 8

PROBLEMS FACED BY THE SUGARCANE GROWERS

Farmers in the study regions spoke about a variety of socio-economic restrictions affecting sugarcane output. These problems were first counted in response of the number of respondents. Then the counts were transformed into percentage. Hereafter, the problem that obtained the greatest percentage was ranked number 1. And the other problems were ranked accordingly on the basis of greater percentage of respondents facing these problems, constraints (Table 8.1).

8.1 Lack of Proper Knowledge

Sugarcane farmers in the research area said that they lacked enough understanding about contemporary sugarcane producing technologies. The knowledge gap exists at every level of sugarcane production, but is most pronounced when contemporary sugarcane production equipment is used. The majority of farmers lacked information about new varieties, seed treatment, planting time, spacing, suggested fertilizer management, irrigation timing, and monitoring pest and disease control, all of which were critical for yield augmentation. Around 57% of farmers said that they lacked enough information regarding sugarcane production, which placed third on the list of restrictions (Table 8.1).

8.2 Lack of Adequate Operating Capital

Sugarcane is a costly crop to grow. Capital is a persistent difficulty in subsistence farming of Bangladesh. It is very difficult for small farmers, in particular, to absorb the investment cost of sugarcane production. On the other hand, agricultural finance from official sources is very restricted, and farmers often lack the financial means to get it for a variety of reasons. An average of 88 percent of farmers in the study region identified insufficient capital as a restriction, ranking it first among the restraints (Table 8.1).

8.3 High Price of Input

The high cost of inputs hampered sugarcane production on a socio-economic level. About 48% of sugarcane farmers in the research region identified high input costs as a restraint on sugarcane output, ranking it fourth on the list of constraints (Table 8.1).

Table 8.1 Problems faced by the sugarcane growers

Types of problems	Frequency of the respondents	Percentage	Rank
Lack of proper knowledge	57	57.00	3rd
Lack of adequate operating capital	88	88.00	1st
High price of input	48	48.00	4th
Low product price	70	70.00	2nd
Labor scarcity in the peak period	43	43.00	5th
Theft of sugarcane	18	18.00	7th
Infestation of pest	33	33.00	6th

8.4 Low Product Price

The issue of low sugarcane prices was noted by 70% of respondents in the research regions and ranks second in terms of restrictions. They said that the sugarcane price was insufficient and that it should be raised (Table 8.1).

8.5 Labor Scarcity in the Peak Period

Human labor shortages were a seasonal issue that often emerge during the peak time of sugarcane production. Human labor shortages inhibited intercultural management and resulted in delayed harvesting, reducing production. On average, around 43% of farmers had labor shortages during the peak season, ranking it fifth among limitations (Table 8.1).

8.6 Theft of Sugarcane

Around 18% of farmers said that theft of sugarcane is a frequent occurrence, ranking it seventh among limitations (Table 8.1).

8.7 Infestation of Pest

Pest is another issue that 33% of them reported, ranking it sixth on the list of restraints (Table 8.1).

CHAPTER 9

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

9.1 Summary

Sugar is a calorie-dense food that is a necessary component of our diet. Sugarcane and sugar beet are used to make sugar. It is manufactured only from sugarcane in Bangladesh. Bangladesh is the sixth largest producer of sugarcane in the world. Sugarcane is second in terms of cash crops and third in terms of key crops in the country. It is the fundamental raw ingredient for the paper industry and chemical factories, including wine and alcohol. It is a significant source of cash revenue for its producers and a significant source of foreign currency savings for the government. The geography, soil, and climatic conditions of Bangladesh have long been regarded ideal for producing high yields of sugarcane. Bangladesh ranks sixteenth and twenty-first sugarcane growing nations in the world in terms of area and output, respectively, but ranks towards the bottom in terms of yield per hectare. Sugarcane producers are being confronted with many serious issues. The apparent answer to these challenges is to enhance the benefit-cost ratio or yield rate via technical advancements, while also lowering the per-unit cost of manufacturing. The promise of maximizing output may be fulfilled by providing incentives to farmers that will aid in the formulation of an appropriate pricing strategy aimed at increasing agricultural productivity.

Sugarcane, on the other hand, is a long-term crop, occupying the land for 12 to 18 months from planting to harvesting. The majority of small and medium-sized farmers, who are mostly share croppers, cannot afford to commit their land for such a lengthy time to a single crop. They limit cane production as a result of their financial difficulties and increased demand for food and vegetables.

The research area consisted of two upazilas. Harirampur and Saturia are the upazilas. The population of the research was composed of sugarcane producer-farmers and intermediates in a chosen sugarcane market. In terms of sample selection, a total of 100 sugarcane 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 10 July and 09 August of 2021. Additionally, secondary data is required for the investigation. Secondary data sources included pertinent books, journals, and other Bangladesh Bureau of Statistics publications. Results of the study were reported in straightforward language such as count, percentage, mean, and standard error of mean. The statistical approach STATA is utilized to determine the regression coefficient.

For analytical reasons, manufacturing expenses were computed using gross margin analysis. Net margin analysis, benefit-cost ratio analysis, and functional analysis. The Cobb-Douglas production function was used to determine the effect of primary variables on sugarcane manufacturing operations. On theoretical and economic grounds, the Cobb-Douglas model double log form was proven to be the superior option.

In Harirampur upazila, 54% of the sample population was between the ages of 30 and 40, 30% between the ages of 40 and 50, and 16% were above 50. In Saturia upazila, 60% of the sample population was between the ages of 30 and 40, 30% were between the ages of 40 and 50, and 10% were above 50. The majority of people in each neighborhood were between the ages of 30 and 40, as discovered. Around 42% of the study population aged had no education and/or were unable to read or write, 20% were able to sign their name, 20% had primary level education and 18% had secondary level education, in Harirampur. In Saturia, 28% of the people aged had no education and/or were unable to read or write, 18% were able to sign their name, 26% had primary level education, and 28 % had secondary level education. Crop farming was the principal source of income for these people, who earned an average of TK 37222.22 each year from crop production on a year-to-year basis. Today, the research area includes livestock and fish farm, in addition to the original study site. Farmers get Tk 20000, Tk and Tk 10000 from poultry, dairy, and fisheries, respectively, in a year worth of work. Agriculture contributed an annual household income of Tk 67222.22 on average per family. Among the nonagricultural activities were day labor, vehicle and truck driving, domestic work, small business, international remittances, and service. According to reports, the yearly average earnings from non-agricultural

sources is Tk 126543.12 each year. Tk 193765.30 was calculated to be the annual average income for the farmers in the study area. The average annual expenditure of a sample farmer is Tk. 104100.00. The average annual family savings was calculated to be Tk 89665.35. In Harirampur, 64 percent of responding farmers got instruction in sugarcane growing, compared to 52 percent in Saturia. On average, 52 percent of sugarcane farmers in Harirampur were members of various non-governmental organizations (NGOs) and/or farmers' organizations, whereas 68 percent of sugarcane farmers in Saturia were members of various NGOs and/or farmers' organizations.

Economic profitability was 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 cost of land preparation for sugarcane production was estimated to be Tk. 10232.74 per hectare on average. The amount of hired human labor utilized in sugarcane production was estimated to be around 105 man-days per hectare, with an average wage of Tk. 500 per man-day. As a result, the entire cost of contracted human labor was determined to be Tk. 525000. Setts cost per hectare was calculated to be Tk. 20002.98 for sugarcane production. Farmers used an average of 454.64 kg of urea, 300.54 kg of TSP, 348.07 kg of MoP, 150.44 kg of gypsum, 17.98 kg of zinc, and 498.57 kg of manure per hectare. Tk. 1100.16 was discovered to be the average cost of pesticides used in sugarcane production. Whereas the average irrigation cost per hectare was determined to be Tk. 7188.45. Total variable cost was Tk. 165293.60 per hectare and the total cost was Tk. 211050.80.

The total return, gross margin, and net return per hectare were determined to be Tk. 549986.70, Tk. 384693.00, and Tk. 338936.00. The Benefit Cost Ratio (BCR) was determined to be 2.61, implying that a single taka investment in sugarcane production yielded Tk. 2.61.

Cobb-Douglas production function model was used to determine the effects some important inputs of output from Sugarcane production. Human labor cost (x1), cost of setts (x2), cost of urea (x3), cost of TSP (x4), cost of MoP (x5), cost of gypsum (x6), cost of zinc (x7), cost of cow dung (x8), irrigation cost (x9), and pesticide cost (x10) were the independent variables. While the regression coefficients for cost of MoP (x5) and cost of gypsum (x6) were all positive, the coefficients for cost of TSP (x4)

and cost of cow dung(x8) were all negative and significant at various levels of significance. Human labor cost (x1), cost of setts (x2), cost of urea (x3), cost of zinc (x7) , irrigation cost (x9) and pesticide cost (x10) were determined to be insignificant in relation to the return on sugarcane production. The positive indication shows that the return on sugarcanes can be enhanced by raising cost of MoP and cost of gypsum, while the negative sign suggests that the return on sugarcanes may be decreased by lowering cost of TSP and cost of cow dung.

Farmers had several difficulties while growing sugarcanes. Inadequate capital was identified as one of the most significant constraints to producing Sugarcane in the research. Farmers faced several challenges including lack of proper knowledge, high price of input, low product price, labor scarcity in the peak period, theft of sugarcane and infestation of pest. These are the primary restrictions for sugarcane farmers in the research region. Public and commercial actions should be conducted to mitigate or remove these issues in order to improve sugarcane output.

9.2 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 determined to be 2.61, implying that a single taka investment in sugarcane production yielded Tk. 2.61.
b) Human labor cost, cost of setts, cost of urea, cost of zinc, irrigation cost and pesticide cost had no significant contribution to gross return in terms of sugarcane production.
c) Cost of TSP has negative significant contribution to gross return in terms of sugarcane production. This implies that reducing the cost of TSP will increase the gross return in terms of sugarcane production.
d) Cost of MoP has positive significant contribution to gross return in terms of sugarcane production. This implies that increasing the cost of MoP will increase the gross return in terms of sugarcane production.
e) Cost of gypsum has positive significant contribution to gross return in terms of sugarcane production. This implies that increasing the cost of gypsum will increase the gross return in terms of sugarcane production.

f) Cost of cow dung has 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 sugarcane production.
g) In adequate capital, lack of proper knowledge, high price of input, low product price, labor scarcity in the peak period, theft of sugarcane and top cutting like problems faced by the farmers in sugarcane production.

9.3 Recommendations

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

a) Cost of TSP and cost of cow dung had negative significant contribution to gross return in terms of sugarcane production. So, it is recommended that the price of TSP and cow dung should be minimized and reasonable.
b) Cost of MoP and gypsum had positive significant contribution to gross return in terms of sugarcane production. So, it is recommended that the applied amount of MoP and gypsum should be maximized.
c) This research was conducted only 6 villages in Harirampur and Saturia upazila under Manikganj 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 sugarcane production. Further studies may be conducted on the profitability of mustard production.
e) In this study the investigations explore only 10 selected variables affecting the gross return in terms of sugarcane production. Other factors like age, experience, and training may have influenced gross return in terms of sugarcane production.

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APPENDIX A

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

"Profitability Analysis of Sugarcane Production in Some Selected Areas of Manikganj District"

(English Version of Questionnaire)

1. Identification of Respondent:

Name: ---------- Village: ----------

Upazilla/Thana: ---------- District: ----------

Age (Years)	
Main Occupation	
Others Occupation	
Experience in Sugarcane Production (Years)	

2. Socio-Economic Characteristics of Respondent:

3. Level of Education

Please mention your level of education.
a) Can't read and write/ read only
b) I can sign only
c) I have passed…….class.

4. Family Structure:

Family Member		Number
Gender:	Male	
	Female	
Number of Children (below 12 years)		
Members involved in agriculture		

Gender code: 1= male, 2= female

5. Land holding and tenancy:

Category of Land	**Area (acres)**
Homestead	
Own land	
Land under sharecropping	
Leased out land	
Leased in land	
Total sugarcane cultivated area	
Others (specify):	

6. Information about annual income from Sugarcane Production:

Items	**Quantity (mounds)**	**Price (Tk./mound)**	**Total Income (Tk.)**
Value of sugarcane			

7. Primary disposal pattern of Sugarcane:

Items	**Quantity**	
	(Local Unit)	**(Kg.)**
Total production of Sugarcane		
Paid as kind (harvesting)		
Used for family consumption		
Sold		

9. Sources of Seedlings:

Owned source seedlings (kg.)	
Purchased seedlings (kg.)	
Amount of seedlings (number/kg./decimal)	
Price of seeds/seedlings (Tk./decimal/kg.)	

10. Inputs use patterns of Sugarcane Production: (per bigha or decimal). Take bigger size of land under production. It is a plot specific question. And is essential.

A. Labor Cost:

Sl. No.	**Items**	**Human Labor (man-days)**	**Animal Labor (man-days)**	**Labor Wage (Tk./man-days)/ wage rate with food or without food**	**Total Cost (Tk.)**
01	Labor for land preparation				
03	Labor for fertilizer application				
04	For carrying farmyard manure and application				
05	Labor for weeding				
06	Labor for irrigation				
07	Labor for pesticide and herbicide application				
08	Labor for harvesting and carrying				
09	Labor for drying and storage				
	Total				

B. Cost of land preparation:

Items	**Medium (put tick mark)**	**Owned**	**Hired**	**Cost (Ploughing/bigha)**	**Total Cost (Tk.)**
No. of ploughing	Plough/power tiller/tractor				
No. of laddering	Plough/power tiller/tractor				

C. Irrigation Cost:

Items	**Medium or Ways (put tick mark)**	**Cost (Tk./Plot)**	**Total Cost (Tk.)**
No. of irrigation			
Types of irrigation	STW/DTW/Electricity operated/ Surface irrigation		
Cost of fuel/electricity in case of own machine			

D. Fertilizer Cost:

Organic Fertilizers		
Items	**Amounts (Kg.) or Total Amount Price (Tk. /Kg.)**	
Cow dung		
Excreta of chickens		
Ash		
Vermi-compost		
Compost		
Others (specify):		
Inorganic Fertilizers		
Items	**Amounts (Kg.)**	**(Tk. / Kg.)**
Urea		

MoP		
TSP		
DAP		
Gypsum		
Zinc sulphate		
Magnesium sulphate		
Boric acid/Boron		
Others (specify):		

- **Fertilizer Price (Tk./Kg.):** Urea----------, TSP----------, MoP----------, DAP----------, Gypsum----------, Zinc sulphate----------, Boric acid----------, Magnesium sulphate---------, Compost----------, Vermi-compost----------, Farm yard manure----------.

E. Other Costs:

Items	**Amounts (Kg.) or (ml)**	**Price (Tk./Kg.) or (Tk./ml)**	**Total cost (Tk.)**
Pesticides			
Herbicides			
Others (specify):			

N.B. Problems of Sugarcane Production:

1.

2.

3.

4.

Name of Enumerator: ----------

Date: -------/-------/----------.