PROFITABILITY AND RESOURCE USE EFFICIENCY OF WHEAT PRODUCTION IN SOME SELECTED AREAS OF NAOGAON DISTRICT IN BANGLADESH

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CERTIFICATE

*This is to certify that thesis entitled, "**PROFITABILITY AND RESOURCE USE EFFICIENCY OF WHEAT PRODUCTION IN SOME SELECTED AREAS OF NAOGAON DISTRICT IN BANGLADESH**" submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (M.S.) in AGRICULTURAL ECONOMICS**, embodies the result of a piece of bona-fide research work carried out by **JANNATUN NAIMA**, Registration no. **13-05474** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

Dated: June, 2021
Place: Dhaka, Bangladesh

.....
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DEDICATED TO

MY

BELOVED PARENTS

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Jannatun Naima

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ABBREVIATIONS AND ACRONYMS

BARI : Bangladesh Agricultural 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 : Gross Return

gm : Gram

ha : Hectare

HIES : Household Income and Expenditure Survey

HYV : High Yielding Variety

IOC : Interest on Operating Capital

kg : Kilogram

TSP : Triple Super Phosphate

DAP : Di-Ammonium Phosphate

MoP : Muriate of Potash

TC : Total Cost

TFC : Total Fixed Cost

TVC : Total Variable Cost

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ABSTRACT

Bangladesh is an agricultural country and wheat is one of the most important crops of our daily life. The study was conducted at Nagaon Sadar upazila to examine the profitability, resource use efficiency, socioeconomic conditions, constraints and some probable solutions for wheat cultivation. A total of 80 respondents selected from the four villages as a sample for the present study. A simple random sampling technique was used for the selection of samples. Both primary and secondary data were used for the study. Different statistical analysis including Cobb-Douglas model are employed to fulfill the objectives of the study. The results reveal that the total variable cost was Tk. 66468, fixed cost was Tk. 17994 and total cost was Tk. 84462 per hectare for wheat production. Gross return of the wheat production was Tk. 113528. Net return was Tk. 29066 and Benefit-Cost Ratio (BCR) was 1.34. In the study area, use of labor, land preparation, manure and irrigation for wheat farming was overused as well as seed, fertilizer and pesticide were underused. Use of labor, seed, fertilizer, pesticide, and irrigation were statistically significant except manure and land preparation were not significant. Wheat cultivars faced some problems such as lack of operating capital, scarcity of fertilizers, lack of good quality seeds, disease and pest infestation, lack of storage facilities, lack of transportation facility, low market price of wheat product and higher price of wheat inputs etc. The findings of the study can help the policy makers to make policy for eliminating the problems of the farmers; overall the development of the economy. Government should emphasize on providing sufficient storage facilities, proper financial assistance and support of agricultural inputs with low price.

CHAPTER I

INTRODUCTION

1.1 Background of the study

The People's Republic of Bangladesh is a country with distinct agricultural and rural significance. It is the eighth most populous country in the world, with 166.50 million people creating high population density, prevalence of poverty (20.5% people below poverty line), concern for food security and livelihood and an intensive dependence on agriculture and agricultural products (MoF, 2020). Bangladesh is predominantly an agricultural country where agriculture sector plays a central role in expediting the economic growth through making a significant contribution to the country's Gross Domestic Product (GDP). Previously, this industry contributed more than half of GDP. When industrialization begins, the population's activities begin to diversify into new industries. As a result, the agricultural sector's contribution to GDP is gradually declining, and it presently accounts for 12.92 percent of GDP (BBS, 2021). Agriculture continues to play a key role and is considered as the most important sector of the economy. So, the role of agriculture is undeniable in ensuring food security for a growing population from the declining arable land as well as the impact of climate change. This country produces a wide range of crops. Bangladesh, by birth, has exceptionally rich ground on which to cultivate a wide variety of crops. These crops may have been divided into two categories: food crops and cash crops. This country produces three varieties of paddy, aus, aman, and boro, as well as another cereal crop, wheat, which are referred to as key cereal crops. Wheat is a significant cereal crop, accounting for around 4% of total major cereal output (BBS, 2020). Wheat production is heavily reliant on the usage of fertilizers, irrigation, and other agricultural inputs. Wheat is regarded as one of the world's most important cereal crops, particularly in Bangladesh. It has provided more calories and protein to the global diet than any other food crop. The continual cultivation of rice monoculture gives us self-sufficiency in food production to some extent but it creates many complexities like reduction of soil fertility, pests and diseases outbreaks in the crop fields and decline in water table, reduces production of non-rice crops, erodes bio- diversity, creates nutritional deficiency.

The current rice production cannot fulfill Bangladesh's entire food demands, particularly its nutritious requirements. Wheat is an excellent rice alternative and may play an important part in achieving food self-sufficiency. It is broadly cultivated as a cash crop because it generates a good yield per unit area, grows well in a temperate climate even with a moderately short growing season and yields a versatile, high quality flour. Wheat cultivation is easier and requires less time and irrigation than other alternative crops like boro rice, potatoes, and legumes; additionally it has low cultivation costs (Akter *et al*., 2010). It is but one of the world's most important cereal crops, as well as a major crop in Bangladesh. Wheat is second only to rice as a source of calories in the diets of consumers in developing countries and is first as a source of protein (Braun *et al*., 2010). Wheat accounts for about half of the total global grain crop production. Although it is less significant than rice in Bangladesh, it is currently acknowledged as the country's second alternative cereal crop (Mehereunnahar *et al*., 2018). Wheat's popularity as a cuisine is growing year after year, and it has reached the point where very few people in Bangladesh deny this cereal at the dinner table. The sufficient quantity of wheat can improve the nutrition situation in the country (Wadud *et al*., 2001). It is a high energy, high nutritional dietary source. Wheat is not only consumed by human population alone, livestock particularly poultry industry consume a large amount of wheat in Bangladesh. The probable reasoning is that wheat is cultivated during the dry season, which is free of natural disasters. Due to a lack of irrigation water this season, alternative crops such as boro cannot be produced. Wheat can be cultivated in areas where boro rice cannot be grown successfully. Again, wheat saves soil from deposition of toxic elements such as arsenic on the soil surface. Wheat growing often does not necessitate the use of pesticides heavily, and hence wheat agriculture helps to the reduction of environmental pollution (WRC, 2000). Given these circumstances, the Bangladeshi government is keen to boost wheat area and output in the nation, and it has been included in the country's food security agenda of the government. Arable cultivable land in Bangladesh is restricted, and there is little room for expansion. So, in order to boost wheat output, wheat productivity should be raised by the use of better technology. Approximately 3.1 million hectares of land are physically appropriate for wheat growth (SRDI, 2019).

Table 1.1: Production and import data of wheat in Bangladesh

Fiscal Year	Production (000'MT)	Imports (000'MT)
2000	1673	1293
2001	1610	1565
2002	1510	1335
2003	1253	1945
2004	976	2058
2005	820	2034
2006	740	1731
2007	1200	1500
2008	849	2882
2009	850	3353
2010	972	3951
2011	996	2039
2012	1260	2725
2013	1280	3354
2014	1300	3929
2015	1290	4720
2016	1250	5556
2017	1153	6472
2018	1100	5100
2019	1200	6800
2020	1180	7200
2021	1130	7400

Source: USDA, 2021

However, after reserving land for other winter crops, the net area available for wheat is presently at 1.5 million hectares. Bangladesh now produces around 1130 thousand metric tons of wheat and imports 7400 thousand metric tons from foreign nations to fulfill national need (Table 1.1). Taking into account the adequate public stock, the private sectors carried over stock, and the substantially higher import parity prices for wheat. The current harvest's procurement objective of 110 thousand metric tons of wheat is likewise projected to be fulfilled (USDA, 2021). To keep up with the future demand of the growing population, the current trend of wheat production and productivity should be increased, as well as the yield level for maintaining food security of the population without substantial and unaffordable imports, and a relevant research and production plan should be undertaken to boost the country's yield of wheat.

1.2 History of wheat production in Bangladesh

Following initial Bangladesh's independence in 1971, a succession of catastrophic crops (mainly due to bad weather) resulted in significant food shortages. As a result, the government was compelled to turn to the international community for emergency relief aid. Massive imports of grains, edible oils, and dairy goods became commonplace, and Bangladesh earned a reputation as one of the world's poorest countries. From March to December 1974, Bangladesh had a severe food crisis as the price of rice rose dramatically on the global market (OECD-FAO, 2009) and output fell (Alamgir, 1980). From 1971 to 1975, global rice prices rose dramatically, resulting in food shortages in Bangladesh (OECD, 2008). Rice output has reduced (Alamgir, 1980).

From 1971 to 1975, global rice prices increased dramatically, resulting in food shortages in Bangladesh (OECD, 2008). Rice production has fallen as a result of disruptions to nearly all agricultural activity during the Liberation War in 1971, as well as natural calamities like as floods, droughts, and cyclones, as well as rapid population increase (Sobhan, 1979; Alamgir, 1980; Sen, 1982; Hugo, 2006). At the time, it was apparent that rice alone could not fulfill the country's food requirements (Banglapedia, 2006). As a result, wheat was chosen as an alternate winter food crop. In 1965, two Mexican cultivars ('Sonora 64' and 'Penjamo 62') were tried in the northern region of Bangladesh for the first time (BARI, 2010). Their outstanding performance prompted scientists to expand the

use of wheat in this country. Through the time Bangladesh gained independence (1971), it had grown heavily reliant on wheat imports, while dietary tastes were shifting, making wheat a very sought food complement to rice. Domestic wheat output increased to more than 1 million tons per year in the first half of the 1980s, although it remained only 7–9% of overall food grain production (BARI, 2010). Approximately half of wheat was cultivated on irrigated land, and the amount of acreage allocated to wheat remained basically stable between 1980 and 1986, at little less than 6% of total planted area (Index Mundi, 2012a). Wheat also accounted for the lion's share of imported food grains, topping 1 million tons per year and exceeding 1.8 million tons in 1984. The vast majority of wheat imports are funded by aid programs run by the United States, the European Union, and the World Food Programme (Index Mundi, 2012b). Bangladesh imported 3.1 million metric tons of wheat per year to meet local demand over a three-year period (2008–09–2010–11). Since Bangladesh's independence, Wheat Research Center (WRC) of the Bangladesh Agricultural Research Institute (BARI) has created and recommended 28 high yielding wheat cultivars for farmers' usage. Although produced since the late 1960s, the wheat cultivars Sanora-65, Mexipak-65, Iniya-66, Norteno-67, and Sonalika-68 were formally released in Bangladesh in 1974. Balaka was the very first variety selected in Bangladesh, with the help of CIMMYT germplasm. Kanchan, which was introduced in 1983, has since become the most common type farmed today. The majority of wheat varieties developed in the 1980s and 1990s have been adopted by farmers. Rashid and Hossain (2016) reported that BARI 26, 28 and 30 wheat cultivars are the newly released wheat varieties from the BARI. BARI 26 has accepted for its cultivation environment due to its good heat endurance, diseases resistance and above all rapid growth and maturity. The BARI 28 and 30 cultivars are also receiving attention with their spatial attributes like disease resistance to leaf, heat tolerance and high yield (Rashid and Hossain, 2016). These two varieties are proved to be profitable for the farmers. The BARI 32 and 33 cultivars are in the conditions of under experiment. The new BARI wheat varieties could be produced in massive scale and the food products making from these varieties could be included in the human food chain.

Table 1.2: Recommended wheat varieties and their year of approval

Variety	Released Year	Farm Level Expected Yield (t/ha)	Maximum Yield (t/ha)
Sanora-64	1974	1.6-2.2	NA
Mexipak-65/ Kalyansona	1974	2.6-3.2	NA
Iniya-66	1974	3.5-3.8	NA
Norteno-67	1974	3.2-3.9	NA
Sonalika-68	1974	3.2-3.4	NA
Tenori-71	1975	3.4-3.5	NA
Nuri-70	1975	2.5-3.0	NA
Jupatico-73	1975	3.5-3.7	NA
Pavon-76	1979	3.7-4.2	NA
Bolaka	1979	3.7-4.1	NA
Doel	1979	3.5-4.0	NA
Ananda	1983	3.4-3.8	4.86
Kanchan	1983	3.5-4.8	6.60
Akbar	1983	3.5-4.2	4.63
Barkat	1983	3.4-3.8	5.39
Aghrani	1987	3.0-3.5	5.02
BARI Gam-17 (Shaugat)	1993	NA	5.13
BARI Gam-18 (Provati)	1993	3.8-4.5	5.08
BARI Gam-19 (Sourav)	1998	3.5-4.6	5.39
BARI Gam-20 (Gaurav)	1998	3.5-4.8	5.28
BARI Gam-21 (Shatabdi)	2000	3.6-4.6	4.87
BARI Gam-22 (Sufi)	2005	3.6-4.8	NA
BARI Gam-23 (Bijoy)	2005	4.3-5.0	NA
BARI Gam-24 (Prodip)	2005	3.5-5.1	NA
BARI Gam-25	2010	3.60-5.00	NA
BARI Gam-26	2010	3.50-5.00	NA
BARI Gam-27	2012	4.0-5.4	NA
BARI Gam-28	2012	4.0-5.5	NA
BARI Gam-29	2014	4.0-5.0	NA
BARI Gam-30	2014	4.5-5.5	NA
BARI Gam-31	2017	4.5-5.0	NA
BARI Gam-32	2017	4.6-5.0	NA
BARI Gam-33	2017	4.0-5.0	NA

Source: BARI (2018), digital herbarium of crop plants

NA= Not Available

1.3 Justification of the study

Wheat, the second most significant grain crop after rice, is one of the most prominent winter crops and is temperature sensitive (Hossain *et al*., 2013). In terms of calorie consumption, 820 million people (or 11% of the present world population) are undernourished, while 1.3 billion (17%) suffer from micronutrient deficiencies (FAO *et al*., 2019). The majority of them are found in Asia and Sub-Saharan Africa (SSA). The COVID-19 pandemic is projected to increase the number of vulnerable and food insecure individuals, particularly in Sub-Saharan Africa. The global recession disrupts global supply systems and will make it more difficult to finance the enormous food imports on which certain countries, particularly in SSA, rely (FSIN, 2020a; OECD, 2020). Improved food security will be dependent on the sustainable use and management of resources, such as land and water (particularly in Asia) and water and nutrients (particularly in Sub-Saharan Africa), while remaining within planetary limitations. Finding the correct compromise between food and nutritional security, environmental protection, and climate change mitigation remain important problems for sustainable food systems and the management and use of water and land (IPCC, 2019; Willett *et al*., 2019). Wheat demand is expected to rise in the future as the world's population grows. Wheat production will have a significant impact on food security and the global economy in the future decades, with the world's population expected to exceed 9.6 billion by 2050 (The Guardian, 2020). Farmers throughout the world will need to expand wheat productivity while using limited resources such as fertilizers, herbicides, and water as climate change and growing energy prices exacerbate the demands on agriculture. Wheat, along with rice and other crops, must be regarded key crops when considering our country's food security. And while many research have been undertaken on the production efficiency and yield gap of major foodgrains, studies on wheat varieties, but particularly studies on the profitability and economic potentials of wheat production at the national and farm levels, are sparse. As a result, it is critical to investigate if wheat production is socially acceptable, commercially feasible for its final users, and environmentally favorable for long-term agricultural expansion. In fact, farmers, extension workers, and policy makers have little concrete data on these challenges. As a result, the current study is a modest attempt to assess the profitability and resource use efficiency of wheat production in light of the farmers'

difficult condition. Given the conditions, the current study might be regarded as a significant piece of work in the subject of Agricultural Economics. The current study is an attempt to examine the profitability of wheat production and to determine the major factors influencing yields. As a result, individual farmers will profit from this study in terms of good farm operation and management. In other words, the study would undoubtedly increase comprehension of the socioeconomic performances of wheat production in the context of Bangladesh agriculture's real-world condition. The study's conclusions would be useful for policymakers and/or extension professionals analyzing policy choices, as well as helping researchers set their priorities and focus on those concerns.

1.4 Objectives of the study

The objectives of the study are given bellow:

1. To identify the socioeconomic characteristics of the wheat producing farmers.
2. To assess the profitability of the wheat producing farmers.
3. To determine factors affecting the gross return of the wheat producing farmers.
4. To identify the major constraints associated with wheat production.

1.5 Outline of the study

The study consists of eight chapters. Chapter I describes introduction of the study, Chapter II is relevant of literature. Chapter III deals with the methodology of the study. Socioeconomic characteristics of the sample farmers are presented in Chapter IV. Chapter V estimated and analyzed the costs and returns of the wheat production. The results of Cobb- Douglas production function analysis are given in Chapter VI. Chapter VII is designed to identify production problems of the wheat growers. Finally, conclusion and recommendations of the study are presented in Chapter VIII.

CHAPTER II
REVIEW OF LITERATURE

2.1 Introduction

This chapter will describe some previously completed studies connected to the current investigation. In Bangladesh, economic researches on wheat cultivation are few. Some of the most important works on the subject of the current research are discussed below.

Grote *et al*. (2021) did research to add to this discussion by evaluating the case of wheat and maize value chains and their contributions to food security in Africa and Asia. We begin by identifying the forces that are altering food systems. The following points were identified in the review: (1) Environmental factors such as land degradation, water shortage, and climate change will exacerbate wheat and maize output. (2) There are potential technologies to boost and sustain production, but barriers to adoption must be addressed (e.g., access to seeds, funding, and education/training).

Hasan and Fakhrul (2020) attempted to find and assess wheat production inefficiencies and yield gaps in Bangladesh. The study used farm level cross-sectional data from three of Bangladesh's key wheat growing districts. Wheat yield was discovered to differ among regions and farm types. In Bangladesh, the average technological inefficiency of wheat production is 16. This suggests that given current technology and input levels, there is a strong chance of boosting wheat yield by 16%. Farm operator’s education and training of wheat was proven to have a substantial influence on yield and technical efficiency of wheat production.

Mottaleb *et al*. (2018) analyzed Bangladesh's chances for increasing wheat production. The rice–wheat farming system provides promising potential for expanding wheat output in Bangladesh and meeting rising local demand. Based on the findings, this research recommends that wheat production be expanded on seasonally fallow area, particularly in southern Bangladesh.

Begum *et al*. (2017) conducted a research to examine the profitability of wheat farming in several chosen locations of Bangladesh's Sylhet district. Fifty farmers were chosen from various villages in Sylhet district's Fenchugong upazila. Wheat production accounts for around half of overall income. The yearly savings of the studied farmers were seen to be larger in big farms, followed by medium and small farms.

Hossain (2013) evaluated and attempted to present up-to-date and thorough description of wheat research of Bangladesh and the influence of global warming on agriculture, particularly wheat output. Although flooding is not yet of great relevance or effect to the wheat crop, some perspectives on this stress are presented because wheat is flood sensitive and the occurrence of floods is projected to grow.

Huq *et al*. (2013) assessed wheat supply response in Bangladesh using a contemporary co-integration approach with a Vector Error Correction Model (VECM). According to our unit root analysis, the underlying data series were not steady. The presence of a co-integrating link in the supply response model is shown by the Johansen multivariate co-integration technique. Wheat acreage is significantly influenced by price of wheat, and other competing crops such as Boro rice.

Islam *et al*. (2012) calculated the costs, returns, and relative profitability of BARI GOM-24 and BARI GOM-23 production in the Dinajpur district. In all, 60 farmers were chosen from two villages in Dinajpur's Khanshama upazila, 30 of whom produced BARI GOM-23 and 30 of whom produced BARI GOM-24. To meet the study's objectives, cost-return and functional assessments were performed. Farmers were able to profit from the cultivation of both BARI GOM-24 and BARI GOM-23. The gross production costs per hectare of BARI GOM-23 and BARI GOM-24 were Tk. 49898.54 and Tk. 54104.15, respectively, with matching gross returns of Tk. 77715.02 and Tk.65608.44.

Rahman *et al*. (2012) used survey data from 293 wheat farmers from three areas of Bangladesh to assess the impact of environmental restrictions on profitability and resource utilization in agriculture. The analysis is based on a profit function, with the

specified variables indicating environmental restrictions added as fixed components. Environmental restrictions have a major impact on both profitability and farmers' resource allocation decisions, according to the findings. Policy implications include developing wheat varieties that are suited for low-lying and/or marginal locations, are resistant to insect and pest assaults, and can survive weather changes.

Barmon *et al*. (2012) performed research to quantify the effects of price and price variability on rice and wheat crop land allocation in Bangladesh. This study uses time series data from the Bangladesh Bureau of Statistics (BBS) on rice and wheat output pricing and acreage allocation from 1983-84 to 2007-08. Nerlovian and compound growth rate models were utilized. According to the study, the wholesale price of rice and wheat had a considerable influence on land allocation for rice and wheat cultivation. Price volatility was shown to be significant in both the short-run (SR) and long-run (LR) cases of rice and wheat crops.

Karim *et al*. (2010) done in order to find out the appropriate model using seven mainstream model selection criteria that could adequately describe the pattern of development of wheat production in Bangladesh and its three major areas like Dinajpur, Rajshahi, and Rangpur districts during the time periods 1971-72 to 2004-05. According to the study, the best fitting models for wheat output in Bangladesh, Dinajpur, Rajshahi, and Rangpur were quadratic, linear, and cubic. It means that the assumption of constant annual rate of growth in percent, which underpins the use of the exponential/compound model, which is widely used to describe growth patterns, did not hold true for the growth pattern of wheat production in Bangladesh.

Kamruzzaman *et al*. (2009) investigated the technical efficiency of wheat farms in Bangladesh using cross-sectional farm level data and secondary time series data from 150 farms in the Khulna division of Bangladesh. The authors employ window analysis, slacks variable analysis, and data envelopment analysis (DEA) to refine the efficiency estimates, assuming constant and variable returns to scale and using input-orientation techniques. Through Tobit analysis, the predicted overall efficiency indicators were regressed on the

farmers' socioeconomic variables to find factors impacting the technical efficiency of wheat fields.

Kamruzzaman *et al*. (2008) investigated the technical efficiency and variables influencing inefficiency of wheat production in Bangladesh's Dinajpur district. The range of technological efficiency is 40 percent to 99 percent, with an average of 70.33 percent. Farmers who sowed and harvested optimally were technically more efficient than farmers who sowed late. There was a favorable association between wheat producers' educational level and technological efficiency. Farmers who had regular contact with extension workers were technically more efficient than farmers who made less contacts with extension workers. As a result, maintaining optimal planting and harvesting times, using sandy loam soil, and having a high degree of agricultural expertise and knowledge are all critical variables in achieving the highest possible yield.

Karim (2008) evaluated the whole wheat scenario in terms of productivity increase in Bangladesh from 1980 to 2006. During the golden revolution period, technological changes in wheat production benefited consumers more than farmers. The most significant sources of growth in total factor productivity are research, mechanization, and the market. The level of yearly variation in wheat productivity will have to be reduced by more effective input utilisation.

Hasan (2007) assessed the farm specific economic efficiency of wheat production and identified and measured the effects of several parameters connected with wheat producers' economic efficiency. The study used farm level cross-sectional data from three of Bangladesh's key wheat growing districts. Wheat producers' economic efficiency varied between locales and farm types. Wheat farmers' economic efficiency was found to be highly influenced by the cost of seed and urea, land rent, and the timing of planting. In Bangladesh, the average economic efficiency of wheat production is 76%.

Saiyem (2007) evaluated the wheat selling mechanism in several upazilas of the Rangpur district. The sample consists of 60 farmers and middlemen. Production cost, yield,

marketing cost, marketing margin, net margin, and marketing channel were all calculated in this study.

Kamruzzaman *et al*. (2006) analyzed the economic efficiency of wheat farms in the rural area using Data Envelopment Analysis (DEA) of farm level data from 2002. The aggregate mean efficiency score of the sample farms was 0.86, indicating that the sample farms' economic efficiency was 14% lower than what might be attained. To assist discover inefficiency-related issues, computed efficiency scores were regressed on explanatory variables using a Tobit analysis.

Kamruzzaman *et al*. (2006) estimated wheat productivity in Bangladesh and forecast the future expected population and food requirements in the country by 2010. This paper reaches the objectives using total factors productivity approach, Box Jenkins approach, and sensitivity analysis for wheat farms in the country.

Hossain (2004) studied the wheat marketing system in selected areas of Dinajpur district. This study was mainly based on Sadar upazila of Bogra district. The sample included 30 farmers and 30 intermediaries. Production cost, yield, marketing cost, marketing margin and net margin of wheat farmers and intermediaries were calculated in this study.

According to Nahar (1998), Mymensingh district farmers profited from a bountiful crop of wheat in 1998. In that year, around 20 thousand farmers from the upazilla who were producing wheat on a total of 180 hectares of land were brought into wheat cultivation.

Miah (1987) performed a research in Mymensingh district's Sadar thana to examine crop and wheat production on marginal land, as well as farmer resource efficiency. The profitability of various cropping patterns was examined in relation to farm size and land type. Wheat grain equivalent, land use efficiency, and production efficiency were evaluated to assess the effectiveness of prevailing cropping patterns. The author discovered that farmers profited more from wheat than from other crops.

Sabur and Gangwar (1984) conducted a research on wheat production and structure in Bangladesh and discovered that the growth rate of wheat in terms of output, area, and productivity was greater in the northern districts.

2.2 Research gap

We found various evaluations on the profitability and technical inefficiency of wheat (Kamruzzaman *et al*., 2006; Hasan, 2007; Kamruzzaman *et al*., 2008; Karim, 2008; Kamruzzaman *et al*., 2009; Islam *et al*., 2012; Begum *et al*., 2017 and Hasan *et al*., 2020). There have been few researches on projecting wheat production (Kamruzzaman *et al*., 2006; Karim *et al*., 2010; Huq *et al*., 2013 and Mottaleb *et al*., 2018). Another study was conducted on the wheat value chain and the significance of wheat food security (Kamruzzaman *et al*., 2006 and Grote *et al*., 2021). Rahman *et al*. (2012) sought to quantify the impact of environmental restrictions on wheat farming profitability and resource utilization. Barmon *et al*. (2012) performed research to quantify the effects of price and price variability on rice and wheat crop land allocation in Bangladesh. The wheat marketing mechanism was investigated by Hossain (2004) and Saiyem (2007). So far as the researcher is aware, there has been no research on the profitability and resource use efficiency of wheat and its constraints in the study area. This research gap inspired me to conduct the research on the subject.

CHAPTER III
RESEARCH METHODOLODY

3.1 Introduction

This chapter outlines the precise sequential phases of research activity, such as the selection of study areas, the selection of study period, data sources, data processing, and analytical tools.

3.2 Selection of the study area

Selection of the study area is a crucial step for farm management study. The selection of an area fulfilled the special purpose which was set for the study and also the possible cooperation from the farmer. Naogaon Sadar upazila has a land area of 275.73 square kilometers and is located between 24°43' and 24°55' north latitudes and 88°47' and 89°01' east longitudes. It is flanked on the north by Badalgachhi upazila, on the south by Raninagar and Manda upazilas, on the east by Adamdighi and Akkelpur upazilas, and on the west by Mahadebpur and Manda upazilas. The total population is 354570, with males 183618 and females 170952. Agriculture (70.96 percent) and non-agricultural revenue are the two most important sources of income. Laborer 5.42 percent, industry 0.47 percent, commerce 9.6 percent, transport and communication 3.72 percent, service 4.83 percent, construction 0.73 percent, religious service 0.15 percent, rent and remittance 0.13 percent, and others 3.99 percent make up the non-agricultural sector (BBS, 2018). The main reasons in selecting the study area were for some identical physical characteristics of villages like topography, soil and climatic conditions for producing wheat, easy accessibility and good communication facilities in these villages and co-operation from the respondents was expected to be high so that the reliable data would be obtained.

Figure 3.1: Map of Naogaon Sadar upazila, Naogaon

Source: Banglapedia.com/map/naogaon

3.3 Study population and sampling strategy

This study's population consists of all agricultural households residing in the designated villages. As a result, there are a lot of agricultural homes. The conventional statistical procedure for determining sample size produces a large number, which is problematic for a single researcher due to time and budget restrictions (Gilbert, 2008 and Blaikie, 2010). Because all of the farmers in the region confront comparable socioeconomic, environmental, and climate circumstances in their farming operations, they form a

relatively homogenous group, validating the use of a small sample size that can be representative of the whole community (Gilbert, 2008; Blaikie, 2010 and Alam, 2016). Therefore, sample size is determined purposively depending on the context rather than a statistical formula. This study aimed to survey a sample of 80 wheat farming households. Respondents were chosen at random from the villages. It was believed that this would represent the farming characteristics of all farmers in the villages. The Sub-Assistant Agricultural Officers (SAAOs) in the study regions provided a full list of all wheat farming households in the relevant villages. The numbered list included farmers' names and addresses, as well as farm sizes. Following that, a computer-generated random number table was used to choose 80 farm households from the list. In this way the randomness in the sampling procedure was ensured.

Table 3.1: Selected study areas for primary data collection

Upazila	Villages	No. of respondents
Naogaon Sadar Upazila	Barshail	20
	Chakgoali	20
	Komaigari	20
	Chakpathuria	20
Total		80

3.4 Sources of data

The data for this study were gathered from both primary and secondary sources. Farmers provided primary data, while secondary data were gathered from several public sources. Secondary sources included the Bangladesh Bureau of Statistics (BBS), the Department of Agricultural Extension (DAE), the Department of Agricultural Marketing (DAM), and other Bangladesh-based organizations etc.

3.5 Preparation of the survey schedule

The creation of survey schedules is critical in this investigation. A complete survey schedule was created in order to collect vital information from the concerned respondents in such a way that all important information needed for wheat farming could be easily

collected in the least amount of time. The interview schedule was pre-tested in order to determine their appropriateness. The timetable was decided after pre-testing.

3.6 Collection of data

To meet the study's objectives, the relevant data were gathered by physically visiting each farm and interviewing them using a pretested interview schedule. The majority of respondents do not keep track of their activities. As a result, collecting real data is extremely difficult, and the researcher must rely on the respondent's recollection. Each respondent was given a brief overview of the study's goals and objectives before to the actual interview. The questions were asked in a methodical and straightforward way, and the information was documented on the interview schedule.

When each interview was completed, the interview schedule was examined and confirmed to ensure that all information for each item was appropriately recorded. Data were gathered in local units to reduce mistakes. These were then transformed into the appropriate standard unit. The data collecting period was from September 1 to November 30, 2020. In order to acquire trustworthy data, the researcher first visited the study locations multiple times during the season to introduce herself to the residents. Secondary data were gathered from the literature from various publications.

3.7 Editing and tabulation of data

The filled schedules were altered for analysis once the original data was collected. These data were double checked to ensure that there were no mistakes or contradictions. All of the information gathered was thoroughly compiled and examined. Microsoft Excel, as well as SPSS and STATA, were utilized for data entry and analysis. It is possible to see here that information was first gathered in local units and then changed to standard units after being checked. Finally, a few important tables were developed based on the requirement of analysis to achieve the study's objectives.

3.8 Analytical techniques

Data were analyzed with the purpose of fulfilling the objectives of the study. Both descriptive and statistical analysis were used for analyzing the data.

3.8.1 Descriptive analysis

Tabular technique of analysis was generally used to find out the socio-demographic profile of the respondents, to determine the cost, returns and profitability of wheat farm enterprises. It is simple in calculation, widely used and easy to understand. It was used to get the simple measures like average, percentage etc.

3.8.2 Production function analysis

The technological relationship between output and factor inputs is represented by the production function. Estimating the production function necessitates the development of its attributes, which leads to the definition of an explicit functional form. The Cobb Douglas production function is one of the most commonly used production functions for empirical estimation. C.W. Cobb and P.H. Douglas developed this function in the 1920s to estimate the marginal productivities of labor and capital in American manufacturing businesses. Their major goal was to estimate the labor and capital portions of total product; hence, they employed this function with the restriction that the sum of elasticities or regression coefficients should equal one. Later on, they relaxed this restraint. Cobb and Douglas first used the function to time series from the 1930s and 1940s; the same form was later applied to a cross-section of industries. This version of the function was afterwards employed in several production function studies for agricultural technical units (crops, animals) and farm-firms. This function's popularity can be attributed to the following characteristics:

i) It directly provides the elasticities of production in relation to inputs;
ii) It allows more degrees of freedom than other algebraic forms (such as a quadratic function) that allow increasing or decreasing marginal productivities; and
iii) It simplifies calculations by reducing the number of regression to be handled in regression analysis. Cobb and Douglas's initial format.

$\mathbf{Q = aL^{\beta}K^{1-\beta}U}$

This forces sum of elasticities to one. Their later modification was

$\mathbf{Q = aL^{\alpha}K^{\beta}U}$

Where, $\alpha + Q$ need not equal one. In agriculture, this form of function has not been used in its original form. Neither the sum of elasticities is kept equal to one nor is the number of variables limited to two. Even then as the basic idea of functional form was provided by Cobb and Douglas, various forms of this function have continued to be called as Cobb-Douglas production function. The Cobb–Douglas production function, in its stochastic form, may be expressed as

$Yi = \beta_1 X_{1i}^{\beta 1} X_{2i}^{\beta 2} \ldots\ldots\ldots\ldots\ldots\ldots X_{ni}^{\beta n} e^{u}$ (3.1)

Where,

Y = Output

X_1 = Labor input

X_2 = Capital input

u = Stochastic disturbance term

e = Base of natural logarithm

From Eq. (3.1) it is clear that the relationship between output and the two inputs is nonlinear. However, if we log-transform this model, we obtain:

$\ln Y_i = \ln\beta_1 + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \ldots\ldots\ldots\ldots\ldots\ldots\ldots B_n \ln X_{ni} + u_i$ (3.2)

Thus written, the model is linear in the parameters β_1, β_2, and β_3.

The properties of the Cobb–Douglas production function are quite well known and is, therefore, a linear regression model. Notice, though, it is nonlinear in the variables Y and X but linear in the logs of these variables. In short, (3.2) is a log-log, double-log, or log-linear model, the multiple regression counter part of the two-variable log-linear model.

The properties of the Cobb–Douglas production function are quite well known:

1. β_1 is the (partial) elasticity of output with regard to labor input; that is, it measures the percentage change in production for a 1% change in labor input while maintaining capital input constant.

2. β_2 is the (partial) elasticity of output with respect to the capital input, holding the labor input constant.

3. The sum ($\beta_1 + \beta_{2)}$ provides information on the returns to scale, or the output's response

to a proportionate change in the inputs. If this sum is one, then there are constant returns to scale, which means that doubling the inputs doubles the output, tripling the inputs triples the output, and so on. If the sum is less than 1, there are decreasing returns to scale—doubling the inputs will less than double the output. Finally, if the sum is greater than 1, there are increasing returns to scale— doubling the inputs will more than double the output.

Before proceeding further, note that whenever you have a log–linear regression model involving any number of variables the coefficient of each of the X variables measures the (partial) elasticity of the dependent variable Y with respect to that variable. Thus, having a k-variable log-linear model:

$\ln Y_i = \alpha + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \ldots \ldots + \beta_n \ln X_{ni} + u_i$ (3.3)

Each of the (partial) regression coefficients, β_1 through β_n, is the (partial) elasticity of Y with respect to variables X_1 through X_n. Assuming that the model (3.2) satisfies the assumptions of the classical linear regression model; we obtained the regression by the OLS (Sujan *et al*., 2017; Rasha *et al*., 2018).

3.8.3 Specification of the Cobb-Douglas production function

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

$\ln Y = \alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + U_i$ (3.4)

Where, Y= Gross return from year round wheat (Tk./ha);

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

X_2= Cost of land preparation (Tk./ha);

X_3= Cost of seed (Tk./ha);

X_4= Cost of manure (Tk./ha);

X_5 = Cost of fertilizer (Tk./ha);

X_6 = Cost of pesticide (Tk./ha);

X_7 = Cost of irrigation (Tk./ha).α

= Intercept of the function

β_1, β_2. . ….. β_7 are coefficients of the respective input to be estimated; and

U_i = Error term. Coefficient of the respective variable; i= 1, 2,…….7.

Few studies were found where they used return as return as dependent variable and cost of factors as independent variable (Islam *et al*., 1997; Sujan *et al*., 2017).

3.9 Measurement of resource use efficiency

In order to test the efficiency, the ratio of Marginal Value Product (MVP) to the Marginal Factor Cost (MFC) for each input were computed and tested for its equality to 1. i.e., (Rasha *et al*., 2018).

MVP/MFC = 1.

The marginal productivity of a certain resource is the increase in gross returns in value terms induced by adding one unit of that resource while holding other inputs constant.

The MVP is calculated by multiplying the marginal physical product (MPP) by the product price per unit. Taking resources (Xi) and gross return (Y) at their geometric means yields the most reliable, and possibly most relevant, estimate of MVP.

In this study the MPP and the corresponding values of MVP were obtained as follows:

MPPxi*Pyi = MFC

Where,

MPPxi *Pyi=MVP

But, MPP = bi*(Y/Xi)

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

Y = Mean output

bi = regression coefficient per resource

Xi = Mean value of inputs

Pyi= output

MFC = price per unit of input.

3.10 Decision criteria

The choice criterion for selecting efficiency will be-

*When the ratio of MVP and MFC is equal to unity, the resource is being used efficiently.

* When the ratio of MVP to MFC is greater than one, the resource is underused.

*When the ratio of MVP to MFC is less than one, the resource is overutilized.

3.11 Profitability analysis

The most popular way of measuring and comparing the profitability of different farm households is cost and return analysis. The profitability of wheat cultivation is calculated in the current study in the following manner.

3.11.1 Calculation of gross return

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

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

3.11.2 Calculation of gross margin

The gap between the gross return and the variable costs is known as the gross margin. Farmers, in general, desire the highest possible return on their variable production costs. The justification for utilizing gross margin analysis is that farmers want to maximize returns over variable costs. On a TVC basis, the gross margin was determined. The gross margin per hectare was calculated by deducting variable expenses from gross return. That is, Gross margin = Gross return – Variable cost.

3.11.3 Calculation of net return

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

Net return = Total return – Total production cost.

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

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

Where, π = Net profit/Net return from wheat farming (Tk./ha);

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

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

Q_f = Per unit price of other relevant wheat (Tk./kg);

P_f = Total quantity of other relevant wheat (kg/ha);

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

TFC = Total fixed cost (Tk.); and

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

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

3.11.4 Undiscounted Benefit Cost Ratio (BCR)

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

BCR= Total Return /Total Cost.

3.12 Problem Faced Index (PFI)

Wheat producers in the study region experienced a variety of challenges, including increasing wheat input prices, storage issues and perishability, a lack of quality seed, a lack of capital, a lack of fertilizer, a lack of transportation facility, and wheat price instability etc. Due to their limited capital basis, they are not economically capable of investing the needed amount for agricultural production. Each action was assessed using a three-point Likert-type scale. High difficulty, medium problem, and low problem were awarded ratings of 3, 2, and 1, respectively. For clear understanding of Problem Faced Index (PFI) was computed using the following formula:

PFI = (Php x 3) + (Pmp x 2) + (Plp x 1)

Where,

Php= Number of high problem respondents;

Pmp = Number of medium problem respondents;

Plp = Number of low problem respondents.

3.13 Problems faced in collecting data

During the data gathering period, the researcher observed the following obstacles:

i) The majority of farmers were hesitant to answer questions because they feared the researcher would use the information against them. A significant amount of time was spent in order to gain the farmers' trust.

ii) Farmers do not keep track of their daily activities and costs. As a result, the author had to rely on their memories.

iii) The farmers were generally preoccupied with their paperwork. As a result, the researcher had to make further visits to speak with the farmer on occasion.

CHAPTER IV
SOCIOECONOMIC CHARACTERISTICS

4.1 Introduction

The socioeconomic characteristics of the sample farmers are discussed in this chapter. Farmers' socioeconomic qualities have a significant impact on production planning. People differ from one another in a variety of ways. An individual's behavior is heavily influenced by his or her qualities. There are several interconnected and component traits that describe an individual and have a significant impact on the development of his/her conduct and personality. As a result, it was believed that the diverse features of different farm households would impact their enterprise combination, consumption pattern, purchasing pattern, and employment patterns. Finally socioeconomic aspects of the sample households were examined. These were family size and composition, age distribution, occupation, level of education, involvement of women, land ownership pattern etc. A brief discussion of these aspects is given below.

4.2 Socioeconomic characteristics of sample households

4.2.1 Age distribution

Age is one of the major components of respondents to identify the roles. The age range is as follows: 0-14 years old (children), 15-24 years old (early working age), 25-54 years old (primary working age), 55-64 years old (mature working age), and 65 years and older (elderly) (WB, 2019). Figure 4.1 depicts how all types of farmers in the research region were divided into different age groups. The chart shows that the majority of the farmers in the study area were in their forties and fifties. Out of the total sample farmers, 21 percent were between the ages of 15 and 24, 56 percent were between the ages of 25 and 54, and 23 percent were between the ages of 55 and 64. This finding imply that majority of the sample farmers were in the most active age group of 25-54 years indicating that they provided more physical efforts for farming.

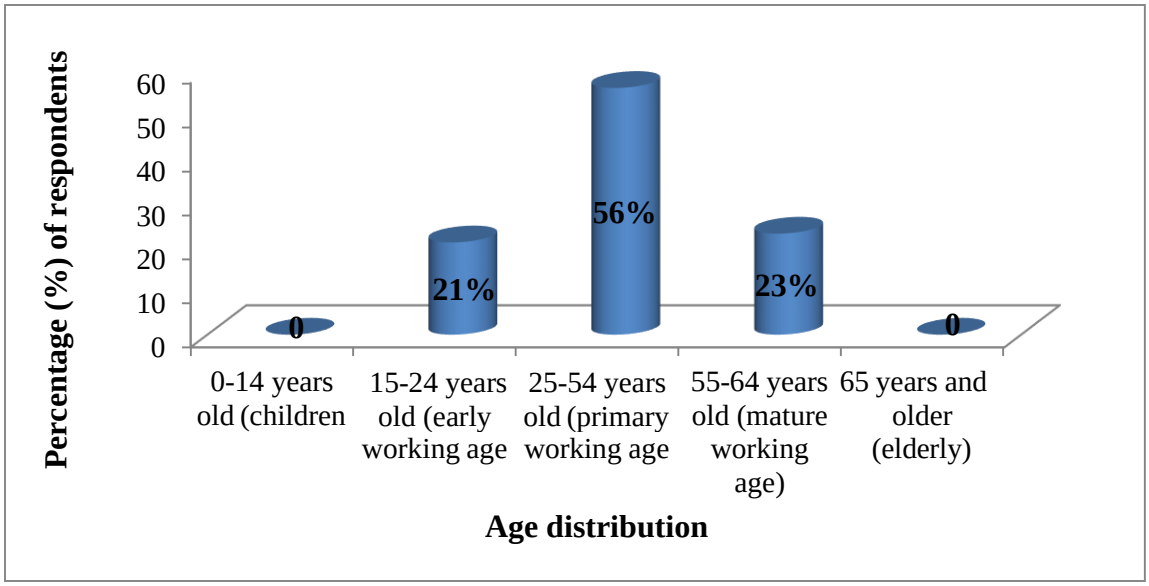

Figure 4.1: Age distribution of the respondents

Source: Field survey, 2020

4.2.2 Family size

The following table 4.1 summarizes the study area's family size; it reveals that the least family member of a household is four and the maximum member is ten, with an average family size of 6.63. According to the Household Income and Expenditure Survey (HIES, 2016), Bangladesh has a family size of 4.06. The family size is larger than the national average.

Table 4.1: Family size distribution of the respondents

No. of family member	Frequency	Percent	Standard deviation	Mean	Minimum	Maximum
4	8	10	1.35	6.63	4	10
5	16	20				
6	25	31				
7	14	18				
8	8	10				
9	6	7				
10	3	4				

Source: Field survey, 2020

4.2.3 Educational status

Man's efficiency improves as a result of education. Figure 4.2 demonstrates that 6% of farmers were illiterate, 58 percent had elementary education, 27 percent had finished J.S.C level schooling, and 9% had completed secondary level education. Bangladesh's adult literacy rate in 2019 was 74.7 percent (WB, 2019). It denotes that the educational level is greater than the national average.

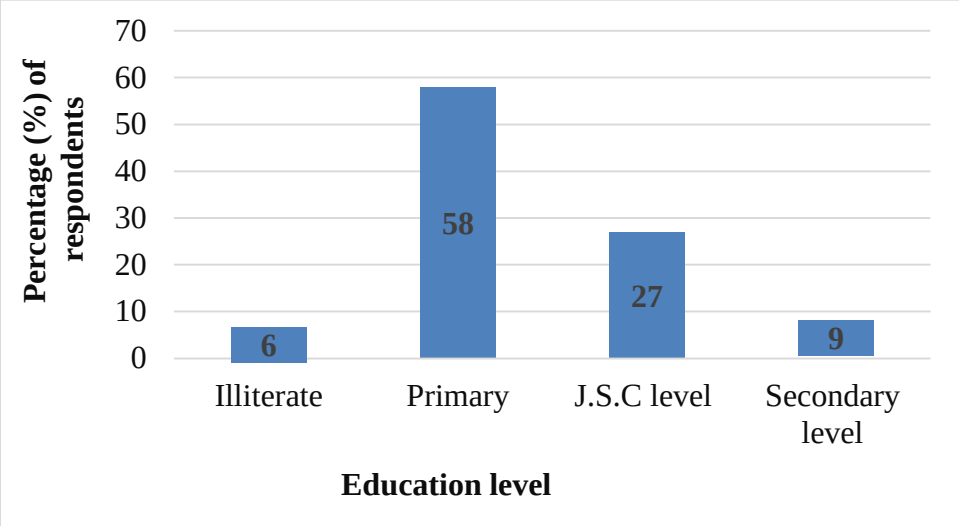

Figure 4.2: Educational status of the respondents

Source: Field survey, 2020

4.2.4 Occupational status

The selected farmers in the study area were involved in a variety of occupations in addition to wheat growing. It was discovered that agriculture was the primary source of income for wheat growers. Some of them got the opportunity to participate in additional activities. The occupational status of farmers is indicated in figure 4.3. According to the data, 57 percent of farmers were active in agriculture, while 21 percent were involved in wheateries. Only a few of them were also involved in business and other sectors. According to Quarterly Labour Force Survey 2018-19, agriculture employs around 41% of the labor force. Here, the author have shown separately the wheat cultivar because the study is based on wheat farmers and several thesis paper foucused on their study crops separately (Rahat, 2018 and Sonya, 2018).

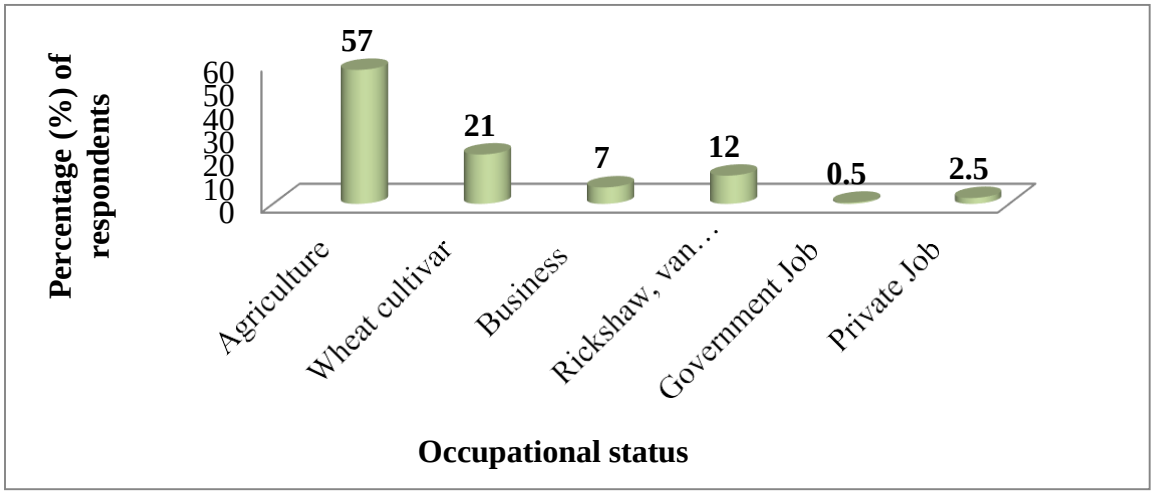

Figure 4.3: Occupational status of the respondents

Source: Field survey, 2020

4.2.5 Gender and marital status

Table 4.2 depicts that 93 percent of farmers were male and 7 percent were female. In the study area, 89 percent of the farmers were married and 8 percent were unmarried, divorced were 2.4 percent and 0.6 percent were widow.

Table 4.2: Gender and marital status of the respondents

Particulars	Percent (%)
Male	93
Female	7
Married	89
Unmarried	8
Divorced	2.4
Widow	0.6

Source: Field survey, 2020

4.2.6 Farm size and ownership

Farmers in the survey are divided into four groups: landless farmers (less than 49 decimal), small farmers (50-249 decimal), medium farmers (250-749 decimal), and big farmers (above 750 decimal) (GoB, 2009). According to table 4.3, 19% of the sample were landless farmers, 58 percent were small farmers, 16 percent were medium farmers, and just 7% were large farmers. According to national data 2016-2017, 11.33 percent of households are landless, 57.60 percent are small farm households, 5.17 percent are medium farm households, and 0.34 percent are big farm households, indicating that the situation of the study area is better than the national level.

Table 4.3: Farm size and ownership pattern of the respondents

Types of farmers	Percentage (%)
Land less (less than 49 decimal)	19
Small Farmer (50-249 decimal)	58
Medium Farmer (250-749 decimal)	16
Large Farmer (above 750 decimal)	7

Source: Field survey, 2020

4.2.7 Income distribution of the respondent

Almost 21.80 percent of the population is poor, with 11.30 percent living in extreme poverty (MoF, 2018). The current definition of extreme poverty is the $1.90/person/day Purchasing Power Parity (PPP) level (World Bank, 2011). According to table 4.4, 11 percent of farmers fall below the extreme poverty level, indicating that their annual income is less than Tk. 56000. The majority of the farmer's yearly revenue was in the range of Tk. 57000-150,000. A Bangladeshi's per capita income is Tk. 219549 (US $2554) (BBS, 2021). As a result, over 60% of farm households in the study region had a per capita income below the national average, demonstrating income inequality among the population.

Table 4.4: Income status of the respondents

Level of income	Percent (%)
Less than Tk. 56000	11
Tk. 57000- Tk. 160,000	49
Tk. 161,000- Tk. 250,000	27
Above Tk. 261,000	13

Source: Field survey, 2020

4.2.8 Distribution of agricultural and non-agricultural income

In the study area, the selected farmers were engaged with various types of occupation along with wheat cultivation. The occupation was classified into agriculture and non-agriculture. It was observed from the table that, the average agricultural income is Tk. 84209 and non-agricultural income is Tk. 50837. Around 84 percent of the rural people of the country depend on agriculture for their livelihood directly or indirectly (Mirza *et al.*, 2015). Some of them had opportunity to be engaged in other activities. The following table 4.5 showed that 63 percent income comes from crops, fisheries, livestock, duck and poultry.

Table 4.5: Agricultural and non-agricultural income status of the respondents

Particulars	Income (Tk.)	Percent (%)
Agricultural income	84209	63
Non-agricultural income	50837	37

Source: Field survey, 2020

4.2.9 Sources of fund facilities of the respondents

The quantity of financing availability is a significant consideration for any type of farming. Wheat farmers can obtain financing from a variety of sources, including banks, non-governmental organizations (NGOs), relatives, and their own funds. According to the sample farmers, around 18% of farmers received loans from banks, 37% received credit from non-governmental organizations, and 17% received loans from relatives. In

addition, 28% of farmers utilized their own funds (Figure 4.4). Several authors included own fund in the list of sources of fund (Rasha, 2013; Manna, 2019 and Tanha, 2019).

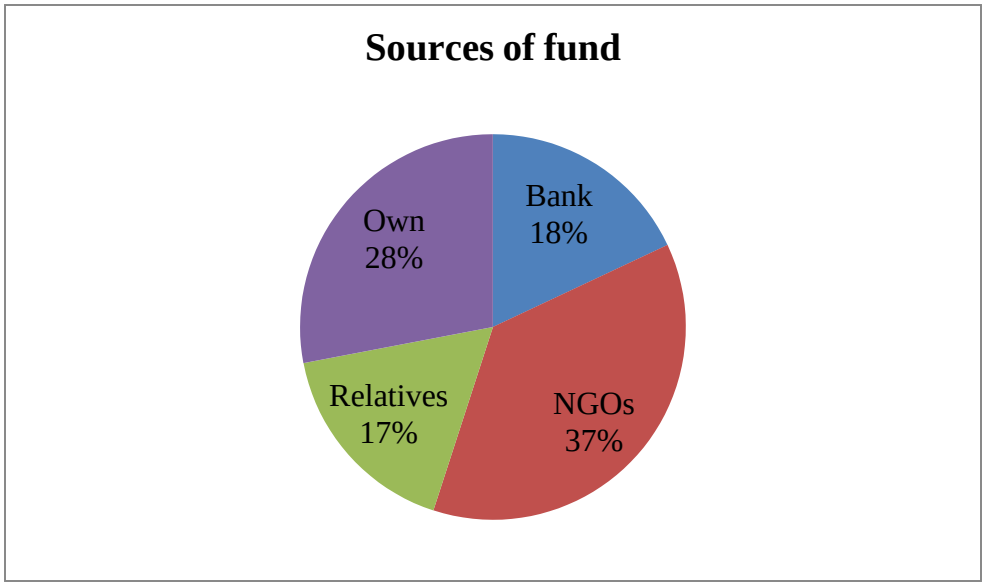

Figure 4.4: Sources of fund facilities of the respondents

Source: Field survey, 2020

4.2.10 Involvement of women

Women in our country are the most disadvantaged, yet this condition is improving. Women make up almost half of our country's population. As a result, without their growth, our country's comprehensive social and economic development is impossible. In the current study, women's engagement in wheat farming was divided into three categories: one woman's involvement, two women's involvement, and three women's involvement. According to table 4.6, 22 percent of farmers employed one woman to labor on their farm, while 12 percent used two women to labor on their farm. As a consequence, the data suggests that women's participation in wheat growing operations was minimal. Approximately, 66 percent of farmers did not employ women on their farms.

Table 4.6: Involvement of women with wheat production in the study area

No. of women involvement	Percent (%)
No women involvement	66
One woman involvement	22
Two women involvement	12

Source: Field survey, 2020

4.2.11 Size of land holdings of the sample farmers

The size of land holdings of wheat producing farmers is categorized into distinct groups in the current study. As indicated by the sample farmers, the size of land holdings comprises homestead area, own land, mortgage in, mortgage out, rent in, rent out, leased in, leased out, fellow land, and pond. According to table 4.7, the average area held by the sample farmers was homestead area, own land, mortgage in, mortgage out, rent in, rent out, leased in, leased out, fellow land, and pond area (21 decimal, 49 decimal, 14 decimal, 12 decimal, 43 decimal, 8 decimal, 11 decimal, 5 decimal, 0.36 decimal, and 7.2 decimal respectively).

Table 4.7: Size of land holdings of the sample farmers

Particulars	Decimal
Home stead	21
Own land	49
Mortgage in	14
Mortgage out	12
Rent in	43
Rent out	8
Leased in	11
Leased out	5
Fellow land	0.36
Pond	7.2

Source: Field survey, 2020

4.3 Concluding remarks

This chapter analyzed the socio-economic attributes of the sample farmers. The findings of the analysis clearly indicate the socio-economic characteristics from each other in respect of age distribution, family size, education, occupation, marital status, farm size, ownership pattern, income status, fund facilities, involvement of women and size of land holdings etc.

CHAPTER V
COST AND RETURNS OF WHEAT FARMERS

5.1 Introduction

The primary goal of this chapter is to evaluate the costs and returns associated with wheat production. Furthermore, an attempt was made to assess the costs and returns of farming wheat per hectare. As a result, the costs and returns on wheat are calculated in this chapter. For the purposes of estimating the costs and returns of wheat production, the cost elements were divided into two categories: (1) variable cost and (2) fixed cost. Human labor, tillage, seed, fertilizer, manure and ash, irrigation water, vitamin and pesticides were all included in variable costs. Fixed costs, on the other hand, were computed for interest on operating capital and rental value. In this chapter, the net return and the undiscounted Benefit-Cost Ratio (BCR) were calculated.

5.2 Variable cost

5.2. 1 Cost of human labor

Human labor was regarded as the most significant and widely used input in wheat production. It contributed a significant amount of the entire cost of wheat production. Human labor is necessary for a variety of operations and management, including land preparation, weeding, fertilizing, the use of pesticides and herbicides, harvesting, and other tasks. In the research region, there were two sources of human labor: family-supplied labor and hired labor. The hired labor was valued using the nominal cash compensation provided to the farmers. Table 5.1 shows that the quantity of human labor utilized for wheat production was 111 man days per hectare. The total cost of human labor per hectare was Tk. 38850. The opportunity cost of family provided labor was calculated by using the average wage of hired labor as the opportunity cost of family-supplied labor. Wheat producers utilized an average of 111 man-days/ha total human labor, with an additional 20 man-days/ha contributed by family members. The average wage rate in the study region was Tk. 350 per man-day. As a result, the total cost of family-supplied labor for wheat was Tk. 7000 per hectare. Table 5.1 reveals that the majority of the human labor was required to operate the operations of harvesting and

carrying, land preparation and threshing. The cost of land preparation is Tk. 6300, while the cost of weeding is Tk. 3150. The cost of harvesting and carrying is likewise Tk. 7700; this is the greatest labor cost. Wheat production is a labor-intensive activity. It helps to alleviate the problem of unemployment. Group-based wheat growing in the specified region is critical for poverty reduction at Naogaon Sadar upazila in Naogaon district. According to Table 5.1, the largest cost item during wheat production in Naogaon Sadar upazila is harvesting and carrying.

Table 5.1: Operation wise per hectare human labor cost of wheat production

Particulars	Man-days	Average wage rate	Cost (Tk.)
Land preparation	18	350	6300
Sowing/broadcasting	6		2100
Soil earthing up	5		1750
Weeding	9		3150
Application of fertilizer	7		2450
Application of manure	3		1050
Application of pesticides	3		1050
Application of irrigation	5		1750
Thinning	3		1050
Harvesting and carrying	22		7700
Threshing	16		5600
Drying and storing	8		2800
Marketing	6		2100
Total	111	-	38850

Source: Field survey, 2020

5.2.2 Cost of tillage

Adopting suitable soil tillage and sowing methods, which are the initial steps of wheat planting, can facilitate growth and yield. Choosing the most suitable methods depends on multiple factors, especially on soil tillage. The farmers of the study area used power tiller for tillage. The owner charged a fixed amount of money as service charge for using tiller which was Tk. 300 per bigha (local unit) for one tillage and no. of tillage was required 2-3 per bigha wheat production. The average tillage cost per hectare wheat production was found to be Tk. 5120 (Table 5.2).

5.2.3 Cost of seeds

One of the most important cost components for wheat production is the cost of seed. The total amount of seed required per hectare for wheat production was 118 kg/ha. 120-130 kg seed per hectare is recommended for wheat cultivation (BARC, 2013). In the study area, the average wheat seed cost was Tk. 40 per kg. According to (Table 5.2), the total cost of seeds for wheat cultivation was Tk. 4720. To maintain increased production levels, a high yield variety is essential.

Table 5.2: Per hectare variable cost of wheat production

Cost items	Quantity	Unit price (Tk.)	Cost (Tk.)
Labor (man-days)	111	350	38850
Seeds (kg)	118	40	4720
Tillage (kg)	-	-	5120
Cowdung (kg)	6000	0.43	2580
Ash (kg)	520	0.51	265
Urea (kg)	116	22	2552
TSP (kg)	78	25	1950
MoP (kg)	61	15	915
Gypsum (kg)	42	12	504
Zinc sulphate (kg)	12	130	1560
DAP (kg)	68	30	2040
Pesticides & vitamin (ml)	-	N/A	1800
Irrigation charges (Tk.)	-	N/A	3612
Grand total	-	-	66468

Source: Field survey, 2020

5.2.4 Cost of fertilizers

It was found that farmers used different kinds of fertilizer for producing wheat such as Urea, MoP, TSP, Gypsum, Zing sulphate and DAP. On an average, farmers used Urea, TSP, MoP, Gypsum, Zing sulphate and DAP which were 116 kg, 78 kg, 61 kg, 42 kg, 12 kg and 68 kg per hectare. The recommended doses of Urea, TSP, MoP and Gypsum are 180-220 kg, 140-180 kg, 40-50 kg and 110-120 kg per hectare respectively following the Fertilizer Recommendation Guide (FRG, 2018). In the study area, per hactare cost of Urea, TSP, MoP, Gypsum, Zing sulphate and DAP were Tk. 2552, Tk. 1950, Tk. 915,

Tk. 504, Tk. 1560 and Tk. 2040. The total cost of fertilizer for wheat production was Tk. 9521 per hectare (Table 5.2).

5.2.5 Cost of manure

Manure is useful for increasing organic matter of soil to eventually increase crop yield. The sampled farmers in the study area applied manure in their wheat field during land preparation. Farmers used both cowdung and ash to increase the soil fertility. In the study area, the average quantity of manure per hectare was 6.52 tons per hectare. Applicationof organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare is recommended (FRG, 2018). In this study, total manure cost was Tk. 2845 per hectare (Table 5.2).

5.2.6 Cost of irrigation

Irrigation is an essential input for cultivating wheat. Most of the farmers had to pay mechanical irrigation water charges and they used manual labor for irrigation. In the study area, the average cost of irrigation for wheat production was found to be Tk. 3612 per hectare (Table 5.2).

5.2.7 Cost of pesticides and vitamin

Wheat growers used different kinds of pesticides like Malathion, Basudin, Diaginon, Sumitheon, Dusban, Ripkord, Furadan, Sunfuran, Dinecron, Meghappos, Nogos etc. to keep their crop free from disease. Theovit, Mackvit, Vitafuran etc. are the name of vitamin which applied for wheat production. The average cost of pesticide and vitamin for wheat production was estimated at Tk. 1800 per hectare (Table 5.2).

5.2.8 Total variable cost

Summation of the costs of variable inputs gave the total variable costs which were Tk. 66468 per hectare for wheat production (Table 5.2).

5.3 Total fixed cost

5.3.1 Interest on operating capital

The interest on operational capital was computed by factoring in all of the operating expenditures incurred throughout the wheat production period. It is a fixed cost since farmers must pay the interest on the loan if it is obtained from a bank. The interest on operating capital per hectare was Tk. 1994, while the rental value of one hectare land for wheat cultivation is Tk. 16000. As a result, the total fixed cost is Tk. 17994 (Table 5.3).

Table 5.3: Per hectare fixed cost of wheat production

Items of returns/costs	Quantity (Tk.)	Total value (Tk.)
Interest on Operating Capital for 4 months @ 9%	66468	1994
Rental value	16000	16000
Total	-	17994

Source: Field survey, 2020

5.4 Total cost

In order to estimate the total cost per hectare all the resources were used in wheat production recapturing together. Per hectare total cost of wheat production was Tk. 84462 (Table 5.4).

Table 5.4: Per hectare total cost (variable cost + fixed cost) of wheat production

Items of returns/costs	Variable cost (Tk.)	Fixed cost (Tk.)	Total cost (Tk.)
Total cost	66468	17994	84462

Source: Field survey, 2020

5.5 Activity budgets:

The valuation of by-product of wheat is very little. Total value of by-product is Tk. 11778 per hectare. The quantity of main product is 4625 Kg per hectare. If the price per unit of wheat is Tk. 22/kg, then the total value of wheat main product is Tk. 101750 per hectare. So, the gross return of the wheat production per hectare is Tk. 113528 (Table

5.5). Here, Net return = Gross return – Total cost = Tk. 29066. So, the net return of wheat production is depending on both gross return and total cost of the wheat production.Net return is Tk. 29066 (Table 5.5).

Table 5.5: Gross returns and BCR of wheat production

Measuring Criteria	Quantity (Kg/ha)	Wheat per unit (Tk./kg)	Amount (Tk./ha)
Main Product Value	4625	22	101750
By Product value	-	-	11778
Gross Return (GR)	-	-	113528
Total Variable Cost (TVC)	-	-	66468
Total Cost (TC)	-	-	84462
Gross Margin (GR-TVC)	-	-	47060
Net Return (GR-TC)	-	-	29066
BCR (undiscounted) (GR/TC)	-	-	1.34

Source: Field survey, 2020

The benefit cost ratio was determined by dividing the gross return by the gross cost or total cost. It denotes a return on investment per taka. It aids in the analysis of the farm's financial efficiency. The study revealed that the benefit cost ratio of wheat cultivation was 1.34, suggesting that Tk. 1.34 would be returned by investing Tk. 1.00 in wheat production. Wheat cultivation has shown to be beneficial for farmers (Table 5.5).

5.6 Concluding remarks

It was evident from the results that per hectare total variable cost for wheat farming was more than per hectare total fixed costs. Wheat farming provides returns to the farmers. Sample farmers showed their opinion that higher yield and income encouraged them to continue wheat production.

CHAPTER VI
FACTORS AFFECTING OF WHEAT PRODUCTION

6.1 Introduction

An attempt has been made this chapter to identify and measure the effects of the major variables on wheat production. Cobb-Douglas production function was chosen to estimate the contribution of key variables on the production process of wheat farming.

6.2 Functional analysis for measuring production efficiency

A production function is a relationship or a mathematical function that specifies the greatest output that can be generated with certain inputs and at a specific degree of technology. Keeping in mind the study's aims and the influence of explanatory factors on wheat farming production, seven explanatory variables were chosen to assess the quantitative effect of inputs on output. The management element was not included in the model since specifying and measuring. It is very difficult, especially in the current research, where a farm operator is both a laborer and a manager. Other independent factors, such as water quality, soil condition, time, and so on, that may have influenced farm enterprise productivity, were eliminated from the model based on early estimates. A brief description is presented here about the explanatory variables included in the model.

6.3 Estimated values of the production function analysis

The F-value was used to assess the quality of fit for various sorts of inputs. The coefficient of multiple determinations (R^2) represents the entire variance in output explained by the model's independent variables. Coefficients with appropriate degrees of freedom were assessed for significance at 1%, 5%, and 10% levels of significance. Returns to scale were used to estimate the stage of production, which was the total of all the production elasticity of various inputs. The estimated coefficients and related statistics of the Cobb-Douglas production function for wheat production are shown in Table 6.1.

Table 6.1: Estimated values of coefficients and related statistics of Cobb-Douglas production function model for wheat

Explanatory variables	Values of coefficients	Standard error	T-Value
Intercept/Constant	7.0080***	0.8035	8.7219
Labor	0.1732**	0.0676	2.5634
Land Preparation	0.0200NS	0.0132	1.5109
Seed	0.1081***	0.0292	3.6953
Manure	0.0073 NS	0.0146	0.5036
Fertilizer	0.0873*	0.0438	1.9615
Pesticide	0.1503***	0.0386	3.8947
Irrigation	0.0223**	0.0106	2.1010
F-value	18.521***		
R^2	0.7324		
Returns to scale	0.5685		

Note: *** = Significant at 1% level
**=Significant at 5% level
* = Significant at 10% level
Source: Author's estimation

6.4 Interpretation of the results

Labor cost (X_1). The magnitude of the human labor cost regression coefficient was 0.1732 with a positive sign. At a 5% probability level, it was significant. It suggests that a 1% increase in labor costs, while all other parameters remain constant, would result in a 0.1732 percent rise in gross return for wheat (Table 6.1).

Land preparation cost (X_2). The value of the regression coefficient of land preparation cost was 0.0200 with a positive sign. It was statistically non-significant. It indicates that land preparation cost did not have significant effect on the gross return of wheat production (Table 6.1).

Seed cost (X_3). The magnitude of the regression coefficient of seed cost was 0.1081 with a positive sign. It was significant at one percent probability level. It implies that one percent increase of seed cost, keeping other factors constant, would lead to an increase in the gross return by 0.1081 percent for wheat (Table 6.1).

Manure cost (X_4). The value of the regression coefficient of manure cost was 0.0073 with a positive sign. It was statistically non-significant. It indicates that manure cost did not have significant effect on the gross return of wheat production (Table 6.1).

Fertilizer cost (X_5). The amount of the fertilizer cost regression coefficient was 0.0873 with a positive sign. At a 10% probability level, it was statistically significant. It predicts that a 1% increase in fertilizer costs, while all other factors remain constant, will result in a 0.0873 percent increase in wheat gross return (Table 6.1).

Pesticide cost (X_6). The magnitude of the regression coefficient of pesticide cost was 0.1503 with a positive sign. It was significant at one percent probability level. It implies that one percent increase of pesticide cost, keeping other factors constant, would lead to an increase in the gross return by 0.1503 percent for wheat (Table 6.1).

Irrigation cost (X_7). It can be seen from Table 6.1 that the magnitude of the regression coefficient of irrigation cost was 0.0223 for wheat. It was positive and was statistically significant at five percent probability level. This indicates that an increase in one percent of irrigation remaining other factors constant, would result in an increase in the gross return by 0.0223 percent.

Coefficient of multiple determinations (R^2). It is evident from Table 6.1 that the value of the coefficient of multiple determinations (R^2) was 0.7324 for wheat. It indicates that about 73 percent of the total variation of the gross returns are explained by the explanatory variables included in the model.

Goodness of fit (F -value). The F-value was 18.521 for wheat, which implies good fit of the model. That is, all the explanatory variables included in the model were important for explaining variation of wheat production (Table 6.1).

Returns to scale: The summation of all the regression coefficients or production elasticity's of the estimated model gives information about the returns to scale that is in response of output to a proportionate change in all inputs. The sum of all the production coefficients of the equations for wheat production was 0.5685 (Table 6.1). This indicated that the production function showed diminishing returns to scale. That is, if all the variables specified in the model were increases by one percent, gross return would also be increased by 0.5685 percent respectively. That means gross return would be increased at a decreasing rate.

6.5 Resource use efficiency in wheat production

To determine the state of resource usage efficiency, it was determined that a ratio equal to unity represented the best use of that factor, while a ratio greater than unity showed that the yield could be raised by utilizing additional resources. A value less than one indicated an unprofitable level of resource consumption that should be reduced to prevent losses caused by farmers overusing this variable. The negative value of MVP denotes indiscriminate and wasteful resource utilization.

The ratio of MVP/MFC of labor (0.506) for wheat production was positive and smaller than one, indicating that labor was over-utilized in the study area (Table 6.2). Sometimes family labor was used frequently. As a result, labor were overutilized in the study area. So farmers should utilize less labor to achieve more efficiency.

Table 6.2 revealed that the ratio of MVP and MFC of land preparation (0.360) for wheat farming was positive and smaller than one, indicating that land preparation cost for wheat production was overutilized in the research area. As a result, farmers should reduce their usage of land preparation costs in order to achieve a higher degree of efficiency.

Table 6.2: Estimated resource use efficiency in wheat production

Variables	Geometric mean (GM)	Y(GM)/Xi (GM)	Coefficient	MVP (Xi)	MFC	r= MVP/MFC	Comment
Yield	113528						
Labor	38850	2.922	0.1732	0.506	1	0.506	Over utilized
Land preparation	6300	18.020	0.02	0.360	1	0.360	Over utilized
Seed	4720	24.053	0.1081	2.600	1	2.600	Under utilized
Manure	2845	39.904	0.0073	0.291	1	0.291	Over utilized
Fertilizer	9521	11.924	0.0873	1.041	1	1.041	Under utilized
Pesticide	1800	63.071	0.1503	9.480	1	9.480	Under utilized
Irrigation	3612	31.431	0.0223	0.701	1	0.701	Over utilized

Source: Field survey, 2020

The ratio of MVP and MFC of seed was found to be (2.600) for wheat cultivation, which was positive and more than one, indicating that seed was underutilized in the research area. As a result, farmers should increase their usage of seed in order to boost wheat production efficiency (Table 6.2).

Table 6.2 showed that the ratio of MVP and MFC of manure (0.291) for wheat farming was positive and less than one, which indicated that in the study area manure for wheat production was overused. So, farmers should decrease the use of manure to attain efficiency level.

Table 6.2 demonstrated that the MVP and MFC ratios of fertilizer used for wheat production were both positive and more than one (1.041), indicating that fertilizer use was underutilized. As a result, farmers should raise their fertilizer uses in order to boost wheat production efficiency.

According to Table 6.2, the ratio of MVP and MFC of pesticide (9.480) for wheat farming was positive and more than one, indicating that the use of pesticide for wheat farming was underutilized in the research region. As a result, farmers should raise their usage of pesticides in order to boost wheat production efficiency.

The irrigation MVP/MFC ratio (0.701) for wheat production was positive and less than one, indicating that irrigation for wheat production was overused in the study area. As a result, farmers should reduce their usage of irrigation in order to achieve a higher degree of efficiency (Table 6.2).

6.6 Concluding remarks

From the estimated value of the production function and the findings it may be suggested that the overall performances of the model for wheat producers were good as indicated by estimated R^2 and F-value. But all the explanatory variables included in the model were not significant as were generally expected. Form the findings of factors affecting and resource use efficiency in the study, it may be suggested that the farmers of the study area have scope to attain full efficiency by re-allocating the resources.

CHAPTER VII
CONSTRAINTS ASSOCIATED WITH PRODUCTION OF WHEAT

7.1 Introduction

Wheat farmers in the study area experienced a variety of challenges, including higher wheat input costs, a lack of quality seed, a lack of operating capital, a lack of storage facility, a lack of transportation facility, scarcity of fertilizer, disease and pest infestation, and wheat price volatility etc. Due to their limited capital basis, they are not economically capable of investing the needed amount for agricultural production. This chapter attempts to examine the limits that wheat producers face.

7.2 Problems Faced Index (PFI)

Table 7.1: Problems Faced Index (PFI)

Items	High (3)	Medium (2)	Low (1)	Index	Rank
Higher price of wheat inputs	45	25	10	195	4
Low market price of wheat product	60	15	5	215	1
Lack of operating capital	56	15	9	207	2
Disease and pest infestation	50	20	10	200	3
Lack of storage facility	41	27	12	189	7
Lack of quality seed	41	30	9	192	5
Scarcity of fertilizer	38	35	7	191	6
Lack of transportation facility	32	40	8	184	8

Source: Field survey, 2020

7.2.1 Low market price of wheat product at harvesting period

Wheat prices were found to be extremely low throughout the harvesting season. Table 7.1 shows that the index point for low wheat prices is 215 and ranks first, indicating that low wheat prices are the most critical concern in the wheat producers' study area. Many farmers are forced to make distress sales in order to meet the immediate demands of cash for their day-to-day family expenses, which resulted in an increase in supply of their

products in the village market during harvesting season, decreasing the per unit selling price of wheat.

7.2.2 Lack of operating capital

Wheat production requires adequate dosages of fertilizer, seeds, irrigation water, and pesticides, in addition to particular agronomic care, and wheat producers must have the money to purchase the essential inputs. In the research region, it ranks second among the difficulties, indicating that they did not have an acceptable quantity of operational capital (Table 7.1). Because most farmers were unable to get institutional credit, they were forced to borrow money from neighbors, relatives, banks, and money lenders at high interest rates.

7.2.3 Disease and pest infestation

With the expansion of modern variety adoption, pest management to 'seed to seed' is getting importance. Attack of diseases or pests is a problem of wheat in Bangladesh. In the research region, it ranks third among the difficulties. The important diseases in wheat are leaf rust, leaf spot complex, seedling blight, loose smut, black point and, foot and root rot etc. Therefore, farmers generally cannot differentiate between pests and predators. They are unskilled in using knowledge based pest management techniques in an economically optimal manner. As a result, the sustainable productivity of wheat is being threatened.

7.2.4 Higher price of wheat inputs

Non-availability of inputs like seeds, fertilizers, insecticides etc. at fair price was a problem in the way of producing enterprises. During the production period price of some inputs tend to rise due to their scarcity. In the study area, wheat growers reported that they had to purchase some inputs at a high price during the production period. It appears from Table 7.1 that the problem of higher price of wheat inputs is ranked fourth.

7.2.5 Lack of quality seeds

Good quality seeds play an important role in higher production. Farmers used seeds of different grades of wheat. They usually purchased seeds from the local markets which were not a good quality seed as their germination rate was very poor. They had lacking of good quality seeds in the market. This ranked fifth among the constraints (Table 7.1).

7.2.6 Scarcity of fertilizer

Fertilizer is indispensable for increasing crop productivity. Sometimes soil related constraints severely limit crop productivity or may even make a desired cropping pattern agronomical impractical (Ahmed *et al.*, 1996). Based on farmers' opinion, the sixth ranking constraint was scarcity of fertilizers (Table 7.1). Such problems led some of the farmers to apply fewer amounts of fertilizers which further aggravated the imbalanced use of chemical fertilizers. While the use of fertilizer per hectare is increasing over the years, still the farmers used less than recommended and imbalance doses, which reduced wheat yields.

7.2.7 Lack of storage facility

After harvesting of cereal crops, it needs space to dry for storage. Due to lack of proper knowledge, farmers could not store their produced wheat in proper place resulted storage loss. On the other hand, they could not keep grains for selling later on when market price would go up. It is indicated from Table 7.1 that wheat producing farmers stated lack of storage facility as the seventh ranked constraint in the study areas. For this constraint, they were bound to sell wheat just after harvesting. Therefore, they did not get the appropriate prices of their products.

7.2.8 Lack of transportation facility

Transport is a burning component of post-harvest crop management. After all, every harvested crop needs to be transported, either directly from the field to the market, or to the packing house and storage**.** In the study area transportation problem is also a major problem during post-harvest period of wheat production. Table 7.1 shows that, it ranked eighth indicating that farmers did not get proper transportation facility.

7.3 Concluding remarks

Wheat can play an important role in earning cash money. Since it is profitable and has huge domestic demand, its production should be expanded. Therefore, it may be concluded that wheat production per hectare as well as its commercial production could possibly be increased to a large extent if the above mentioned constraints could be solved. Then it could help farmers to increase their income as well as their living standard.

CHAPTER VIII
CONCLUSION AND POLICY RECOMMENDATIONS

8.1 Introduction

This chapter attempts to summarize the major findings of the study. Conclusion, policy recommendations, limitation and scope for the further study are given in sections 8.2, 8.3 and 8.4 respectively.

8.2 Conclusion of the study

Sustaining government investment in irrigation systems, rural infrastructure, agricultural research, and extension services has enabled Bangladeshi farmers to achieve remarkable improvements in food production since the early 1970s. Today, Bangladesh is on the verge of being self-sufficient in rice, the country's main grain. Wheat production, the country's second most important cereal crop, has also grown, albeit the government still imports substantial amounts of wheat to fulfill fast expanding domestic demand. While the Bangladeshi government continues to give considerable support to rice farmers, its commitment to wheat growers appears to be less firm. From the econometric model Cobb-Douglas production function, we saw that labor, fertilizer, pesticide, seed, and irrigation were statistically significant. These variables have strong effct on production of wheat in the study area. In the study area labor, land preparation, manure, and irrigation for wheat farming were over used as well as fertilizer, seed, and pesticide were under used. In analyzing socioeconomic characteristics, age structure, composition of family size, educational status, occupation, farm size, and land ownership pattern etc. were considered. In the study area, it reveals that the least family member of a household is four and the maximum member is ten, with an average family size of 6.63. According to the Household Income and Expenditure Survey (HIES, 2016), Bangladesh has a family size of 4.06. The family size is larger than the national average. Literacy status like 6% of farmers were illiterate, 58 percent had elementary education, 27 percent had finished J.S.C level schooling, and 9% had completed secondary level education. Bangladesh's adult literacy rate in 2019 was 74.7 percent (WB, 2019). It denotes that the educational level is greater than the national average. According to the data, 57 percent of farmers

were active in agriculture, while 21 percent were involved in wheateries. Only a few of them were also involved in business and other sectors. Findings shows that 19% of the sample were landless farmers, 58 percent were small farmers, 16 percent were medium farmers, and just 7% were large farmers. According to national data 2016-2017, 11.33 percent of households are landless, 57.60 percent are small farm households, 5.17 percent are medium farm households, and 0.34 percent are big farm households, indicating that the situation of the study area is better than the average level. In the study area, the average agricultural income and non-agricultural income of farmers were Tk. 84209 and Tk. 50837. According to the sample farmers, around 18% of farmers received loans from banks, 37% received credit from non-governmental organizations, and 17% received loans from relatives. In addition, 28% of farmers utilized their own funds. The average area held by the sample farmers was homestead area, own land, mortgage in, mortgage out, rent in, rent out, leased in, leased out, fellow land, and pond area (21 decimal, 49 decimal, 14 decimal, 12 decimal, 43 decimal, 8 decimal, 11 decimal, 5 decimal, 0.36 decimal, and 7.2 decimal respectively). The quantity of human labor utilized for wheat production was 111 man days per hectare. The total cost of human labor per hectare was Tk. 38850. The opportunity cost of family provided labor was calculated by using the average wage of hired labor as the opportunity cost of family-supplied labor. Wheat producers utilized an average of 111 man-days/ha total human labor, with an additional 20 man-days/ha contributed by family members. The average wage rate in the study region was Tk. 350 per man-day. As a result, the total cost of family-supplied labor for wheat was Tk. 7000 per hectare. Table 5.1 reveals that the majority of the human labor was required to operate the operations of harvesting and carrying, land preparation and threshing. The cost of land preparation was Tk. 6300, while the cost of weeding was Tk. 3150. The cost of harvesting and carrying was likewise Tk. 7700; this was the greatest labor cost. The total variable costs which were Tk. 66468 per hectare for wheat production. The interest on operating capital per hectare was Tk. 1994, while the rental value of one hectare land for wheat cultivation was Tk. 16000. As a result, the total fixed cost was Tk. 17994. Per hectare total cost of wheat production was Tk. 84462. Total value of by-products was Tk. 11778. The quantity of main product was 4625 Kg. The total value of wheat main product was Tk. 101750. So the gross return of the wheat

production was Tk. 113528. Net return was Tk. 29066. The study revealed that the benefit cost ratio of wheat cultivation was 1.34, suggesting that Tk. 1.34 would be returned by investing Tk. 1 in wheat production.

Wheat farmers in the study area experienced a variety of challenges, including higher wheat input costs, a lack of quality seed, a lack of operating capital, a lack of fertilizer, a lack of storage facility, disease and pest infestation, a lack of transportation facility, and wheat price volatility etc. The index point for low wheat prices is 215 and ranks first, indicating that low wheat prices are the most critical concern in the wheat producers' study area. In the research region, lack of capital ranks second among the difficulties, indicating that they did not have an acceptable quantity of operational capital. Because most farmers were unable to get institutional credit, they were forced to borrow money from neighbors, relatives, banks, and money lenders at high interest rates.

8.3 Recommendations

On the basis of the findings of the study, it was evident that wheat production was profitable and it can generate income earning and employment opportunity to the rural people of Bangladesh. But some constraints came out into the production of wheat. So, policy recommendations constitute important guidelines for overcoming these constraints and increasing wheat production in Bangladesh. Some policy recommendations based on the findings of the study are presented below:

*Low wheat prices during the harvesting season are also a common occurrence in our nation. Farmers did not receive a fair price, and each year they became poorer. Output price should be increased reasonably by ensuring government regulation. Government procurement center could be established to buy the wheat from farmers with guaranteed price.

*Determining that human labor, manure, and irrigation are overutilized in the study area, these should be utilized efficiently. Otherwise there will be an economic loss. Irrigation wastes a lot of money if it's utilized too much. On the other side, if fertilizer and pesticide are underutilized, it suggests that these variables are not being utilized appropriately.

Farmers should be given short term-training on proper application of inputs. It will help to increase the resource use efficiency of the farmers in wheat cultivation.

* Government should increase subsidy on fertilizer and seed.

*Department of Agricultural Extension should encourage the farmers to cultivate the high yielding variety and practice scientific system of wheat cultivation. DAE should also strengthen the field level service by the field workers (SAAOs) to give farmers proper information, suggestions and advice regarding cultivation of wheat.

*Farmers have expressed their dissatisfaction with the low quality of seed and the high cost of agricultural supplies. So, the government institution such as BADC can oversee the system and offer high-quality seed.

*The majority of the sample farmers do not have enough money to continue wheat farming. As a result, the government should issue institutional loans on favorable terms as a means of addressing the problem of capital scarcity. Banks and other sorts of financial institutions such as credit unions, savings and credit cooperatives, and microfinance groups etc. should make loans to farmers without delay.

*Transportation facilities for wheat products should be improved in the rural areas. On the basis of priority village roads should be developed at least brick bedded road should be made so that the rickshaw, van, truck and other vehicles could move easily. It would also help reducing the transportation cost of wheat products.

*Farmers in the study areas did not receive higher price due to lack of storage facility. The local government authority may develop low cost storage facilities at the primary and secondary markets. This would provide adequate storage facilitates to the wheat growing farmers.

*The present study was carried out in a small area of Naogaon district. Similar studies may be conducted in other parts of the country to get a clear picture of the whole country which will be helpful for effective policy formulation.

8.4 Limitation of the study

The current study has a number of limitations. The following are the research areas' limitations: Inadequate funding and time available for the investigation were significant constraints. Due to a lack of funding and time, the research was unable to cover a large region in order to collect essential information from the farmers; only 80 farmers were chosen for the purpose of the study. The researcher had to rely on farmers' memories to gather fundamental information because many of them did not retain any written records or only preserved fragmentary records. Despite a few limitations, the current study's findings may give farmers, extension workers, and academics useful information.

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