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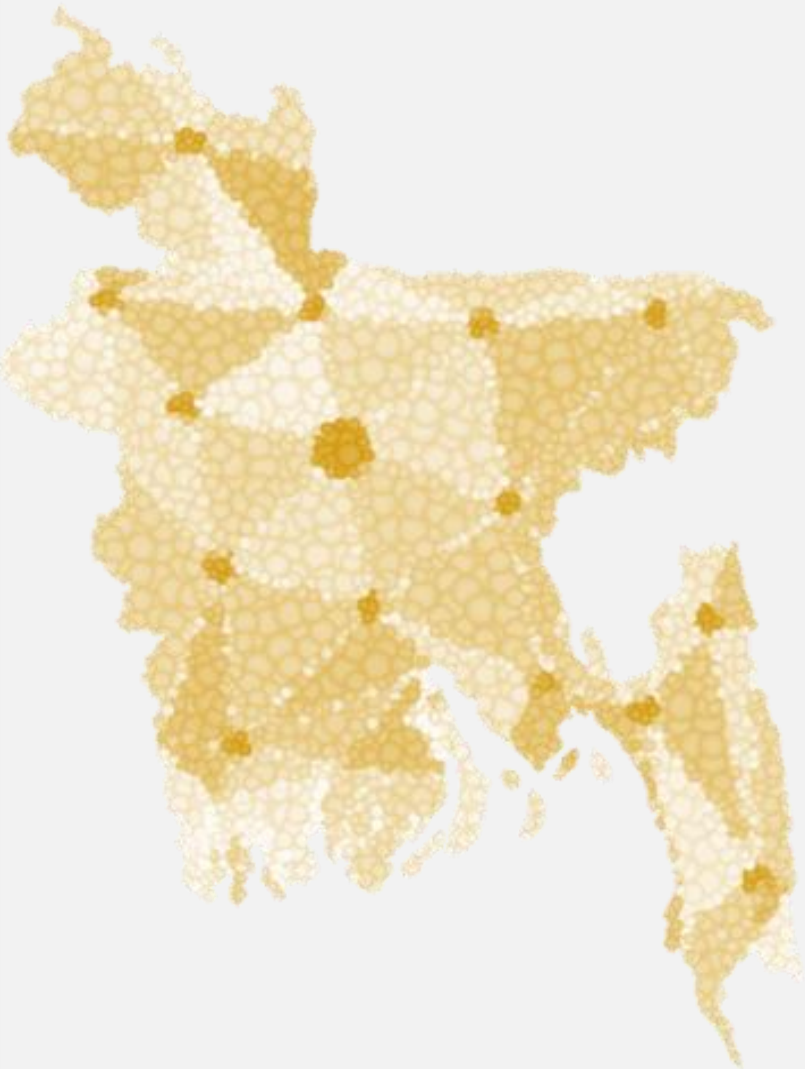
Assessing the Current State of the Rice Processing Industry in Bangladesh: A Comprehensive Review and Analysis of Empirical Evidence in 2023



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April 2023

EMERGING
Credit Rating Ltd
an independent house of risk assessment

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Abstract

This study presents a comprehensive analysis of various aspects of the rice processing industry in Bangladesh, such as rice cultivation, rice market, rice milling, competitiveness, future outlook, socio-economic condition, and profitability. Both primary and secondary data sources have been employed for this study. The preliminary data from 50 rice mills in five districts have been collected through the convenience sampling method. However, the study first provides a detailed discourse on rice cultivation in Bangladesh, which includes agroclimatic conditions, rice growing season and crop calendar, rice cultivars, factors affecting rice cultivation, and strategies to overcome problems associated with rice cultivation. Then, the study analyzes the rice market in Bangladesh, including rice production and consumption, growth, demand, import-export, and price trend. Next, the study focuses on rice milling in Bangladesh, which includes the type of rice mills, establishment and operational cost, production process, global supply chain, marketing channel, and related aspects. Moreover, competitive analysis is conducted using Porter's Five Forces Model, PESTEL analysis, and SWOT analysis. The study also predicts the industry's future, including opportunities and challenges, and provides a socio-economic profile of owners. Furthermore, the study summarizes the total cost, revenue, current asset, fixed asset, insurance, mortgage, and loan and discusses the problems and prospects the owners face in operating the business. The study reveals that the average total revenue for micro firms is Tk.172.04 million, for small firms is Tk.509.44 million, for medium firms, is Tk.968.53 million, and for large firms, Tk.1819.01 million. The benefit-cost ratio is 1.05, 1.11, 1.08, and 1.03 for micro, small, medium, and large firms, respectively. The average total benefit-cost ratio for the rice processing industry is 1.07. Finally, the study concludes by discussing some policy implications of the rice processing industry in Bangladesh.

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

Rice is the staple food of about 169 million people in Bangladesh (Worldometer, 2023), and the country produces about 36 million tons of rice annually using 11.5 million hectares of land (USDA, 2022). It accounts for over 70% of the country's total calorie intake, with per capita consumption averaging around 181.3kg per year, making it one of the highest in the world (The Business Standard, 2020; Zaman et al., 2001). Rice cultivation dominates about 75% of the total cropped area, and over 80% of the total irrigated area is planted for rice in Bangladesh (BRKB, 2022). Three primary types of rice, namely Aus (summer), Aman (winter), and Boro (spring) are cultivated in the country. According to Bangladesh Bank estimation, during FY2022, the combined production of Aus (3 million metric tons), Aman (14.96 million metric tons), and Boro (20.19 million metric tons) paddies can exceed 38.14 million metric tons by using 28.89 million acres of land (Bangladesh Bank, 2023).

Upon harvesting paddy from fields, it must undergo processing before it can be consumed. The process of rice processing comprises parboiling, drying, and milling and can be carried out both on a small scale at home and on a large scale at rice mills. Processing paddy at home, considered the non-commercial milling sector, represents Bangladesh's oldest and nearly obsolete form of rice processing. After the paddy has been parboiled and dried, this method involves processing it using Dheki.[1]

In Bangladesh, rice mills are the primary location for paddy processing and milling, classified as commercial milling centers.[2] Commercial mills are of two types, one of which purchases paddy directly or through agents from local marketplaces or 'hats' and supplies the finished rice to wholesalers and assemblers in major cities. On the other hand, paddy processed at home is milled into finished rice using small husking machines in nearby village marketplaces, which also provide husking services to small itinerant traders. Additionally, vendor-husking machines are now available in rural areas, where these vendors travel from house to house in the villages, offering husk paddy for the villagers at a set price right in the farmyards of their customers.

The rice mill industry in Bangladesh is a significant sector that plays a crucial role in the country's economy (Rahman et al., 2017). Bangladesh is one of the largest rice-producing countries in the world, and the rice mill industry is the backbone of the agriculture sector, employing millions of people (48% of rural employment). The number of commercial rice millers in Bangladesh has been growing steadily. An increasing trend of mechanical process units in the market has gradually replaced the traditional method of rice processing. These commercial processing units have significantly contributed to the rice marketing system, and it has become a vital part of the country's agricultural sector. The industry comprises thousands of small and large rice mills, and it is estimated that there are over 18,700 rice mills in the country (IDLC, 2021). However, the purpose of this industry analysis is to provide an in-depth understanding of the rice processing industry of Bangladesh. This study aims to analyze the various facets of rice farming, production, consumption, demand, growth, import-export, and pricing. Besides, this study aims to analyze step-by-step rice milling, including by-products, marketing channels, and government policies. Moreover, the purpose of this analysis is to discuss the competitiveness and future outlook of the industry. Lastly, an essential purpose of this study lies in evaluating the socio-economic status of the industry's proprietors.

[1] The Dheki is a wooden tool, approximately 2.5 meters in length and 20 centimeters in width, that is balanced on a bamboo fulcrum like a seesaw. Villagers widely use it in rice husking. During the process, women push down on one end of the Dheki with their foot, causing the other end, fitted with a wooden peg, to rise and fall on the rice grains placed in a hole scooped out of the earthen floor of the kitchen. This pounding action removes the outer husks, leaving the inner kernels intact (Rahman et al., 2017).

[2] Commercial milling systems mill the paddy in stages and consequently are called multi-stage or multi-pass rice mills. Commercial rice milling aims to diminish mechanical pressures and heat buildup in the grain, thereby decreasing grain breakage and producing uniformly polished grain (Rice Knowledge Bank, 2017).

Following the introduction in Section 1, the paper is organized as follows: Section 2 presents the methodology, Section 3 discusses rice cultivation, while Section 4 discusses the rice market. Section 5 discusses rice milling, Section 6 competitive analysis, Section 7 future outlook, Section 8 socio-economic analysis, and Section 9 concludes the study.

Chapter 2

Data and Methodology

The present investigation employed a combination of primary and secondary data sources. The secondary data was sourced from various open repositories, including BBS, Statista, Rice Knowledge Bank, Index Mundi, FAO, BRRI, and Bangladesh Bank. This study conducted a detailed analysis of rice cultivation, production, consumption, production-consumption growth, rice demand, import-export scenario, price trend, and rice milling analysis, utilizing the available secondary data.

In contrast, the primary data utilized in this study was obtained through a comprehensive questionnaire administered in April 2023. The study employed a convenient sampling method to collect data from 50 rice mills. The samples were collected from five Divisions in Bangladesh, namely Chittagong, Dhaka, Khulna, Rajshahi, and Rangpur. The size of the firms was classified into four categories: Micro, Small, Medium, and Large, based on the number of employees.[3] This study employed the graphical method, tabulated method, summary statistics, and Benefit-Cost Ratio (BCR)[4] to analyze the rice processing industry in Bangladesh.

[3] The classifications have been made taking a range of 10 to 24 employees for Micro Firms, 25 to 99 employees for Small Firms, 100 to 250 employees for Medium Firms, and above 250 employees for Large Firms (BBS 2013).

[4] BCR= TR/TC; where TR= Total Revenue and TC= Total Cost.

Chapter 3

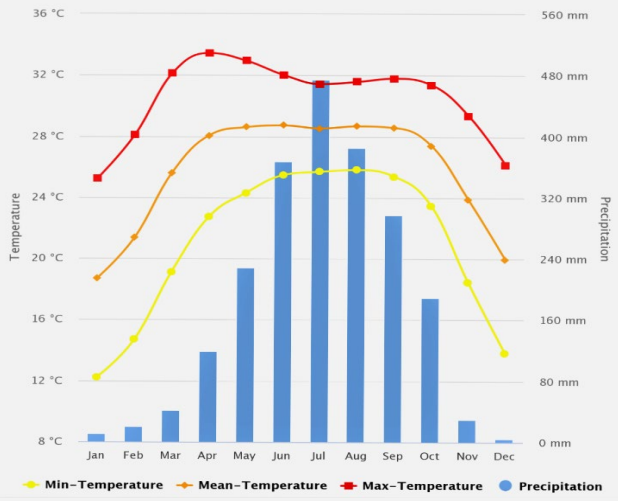
Analysis of Rice Cultivation in Bangladesh

3.1 Agroclimatic Condition

Bangladesh experiences a tropical climate characterized by significant fluctuations in climatic variables, particularly temperature, and rainfall. The nation's land area covers 14.86 million hectares (147,570 square kilometers), with arable land amounting to 8 million hectares in 2020, reflecting a 0.41% growth from 2019 (macrotrends, 2023). Moreover, the cropping intensity in the country is 191% (Shelley et al., 2016).

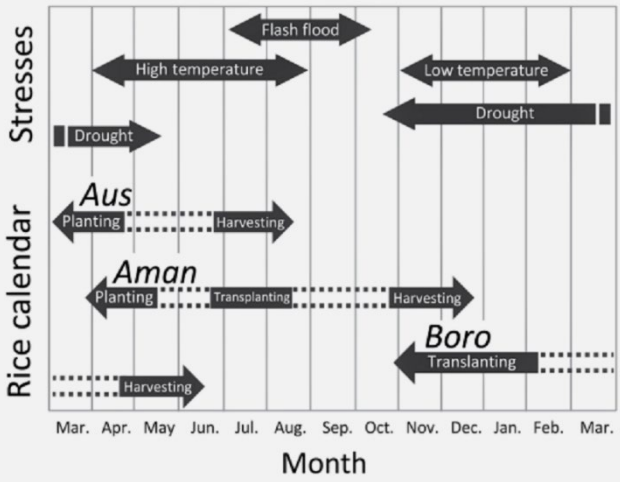
Bangladesh experiences a warm and humid climate influenced by pre-monsoon, monsoon, and post-monsoon circulations, resulting in heavy rainfall and tropical cyclones. Although Bangladesh receives a copious amount of rain, its distribution is not uniform across regions or seasons. The country receives approximately 2,200 millimeters (mm) of rainfall annually, with most areas receiving at least 1,500 mm (World Bank, 2023). However, some areas, particularly those in the northeastern border regions, receive up to 5,000 mm of rainfall annually (World Bank, 2023). The monsoon season occurs between mid-June and September, when most precipitation occurs (Figure 1). Conversely, the period between November and March experiences very little rainfall, while the pre-monsoon season between April and May brings rain accompanied by thunderstorms.

Figure 1. Monthly Agroclimatic Conditions in Bangladesh



Source: World Bank Climate Change Knowledge Portal (World Bank, 2023).

Figure 2. Rice Calendar of Bangladesh



Source: Journal of International Cooperation for Agricultural Development (Shelley et al., 2016).

Bangladesh experiences two distinctive seasons: summer and winter. April and May are summer seasons, with maximum temperatures between 35–41°C, and the winter season is between December to February, with daily average temperatures hovering around 15–20°C and nighttime temperatures of 10–12°C. However, in the northern regions, temperatures can drop below 10°C. Bangladesh has historically recorded an average temperature of approximately 26ºC, with yearly temperature variations ranging from 15ºC to 34ºC. The country registered a peak temperature of 42.5°C in May 2014, the highest recorded temperature in sixty years. However, the red line graph in Figure 1 shows the monthly

maximum temperature (°C), the yellow line shows the monthly minimum temperature (°C), and the orange line graph shows the mean temperature (°C).

3.2 Rice Growing Season and Crop Calendar

Bangladesh has three distinct rice-growing seasons: Aus, Aman, and Boro. The Aus season, characterized by upland rice cultivation under rainfed conditions, precedes the monsoon season. During March and April, the Aus rice is either directly or broadcast-seeded following the pre-monsoon showers, and its harvesting takes place between July and August (Figure 2). Although some areas traditionally used for Aus cultivation have shifted to irrigated Boro rice due to the latter's high yield potential.

Aman rice, a rainfed rice variety, is the primary rice crop during the monsoon season and is widely grown, particularly in coastal regions. Aman rice cultivation occurs in two methods: direct seeding along with Aus during March and April and transplantation between July and August. The harvesting of both types takes place between November and December. However, late flooding can impact the Aman rice area, while the absence of rain during summer reduces the Aus rice growing area.

Boro rice is cultivated during the dry season, typically between December and early February. The harvesting period for Boro rice falls between April and June. Historically, Boro rice was grown in low-lying areas that retained water from the wet season. During water scarcity, manual irrigation using surface water is used (Koichi, 2011; Shelley et al., 2016). Traditionally, Boro rice was transplanted after floodwaters receded in November and harvested from April to May. However, in the 1960s, modern high-yielding rice varieties like IR-8 were introduced in Bangladesh agriculture specifically for Boro cultivation with irrigation.

Similarly, another type named IR-20 was introduced for the Aman season in 1970. Since 1973, the Bangladesh Rice Research Institute (BRRI) has collaborated with the International Rice Research Institute (IRRI) to carry out adaptive research aimed at evaluating elite genetic lines under the IRRI-managed International Network for Genetic Evaluation of Rice (INGER). BRRI has developed rice varieties such as BR and later BRRI Dhan, which are tailored to suit the agroecological conditions in Bangladesh (Hossain et al., 2013; Shelley et al., 2016). Although many IRRI lines have proven successful in Bangladesh for the Boro season, such as BR1, BR3, BR14, BRRI dhan28, and BRRI dhan29, they have not performed well in the Aman season (Shelley et al., 2016). Due to this issue, BRRI scientists crossed international elite lines with traditional landraces to create several dependable varieties, among which BR11 has become one of the most widely used.

Since the 1960s, irrigation systems have been gradually developed in Bangladesh. Low-lift pumps were used for surface-water irrigation from the mid-1960s to the mid-1970s. After this period, the use of tube wells for groundwater irrigation accelerated, and the rapid diffusion of shallow tube wells throughout the 1980s led to a significant increase in the cropped area and yield of dry-season boro rice (Koichi, 2011). With the introduction of groundwater irrigation systems and modern high-yielding varieties, dry-season boro rice became more popular, and the rice cropping pattern of Bangladesh changed significantly. Areas previously occupied by rainfed Aus shifted to boro cultivation, making boro rice the major contributor to total rice production in the country despite Aman rice having a greater coverage area (Shelley et al., 2016). In FY2022, Bangladesh produced 38.144 million MT of rice, whereas Aus 3.001 million MT (8%), Aman 14.958 million MT (39%), and Boro 20.185 million MT (53%) (Bangladesh Bank, 2023). Bangladesh has made significant progress in maintaining good growth in rice production, and this production increase originated mainly from the shift from low-yielding traditional to high-yielding modern varieties when irrigation facilities were developed.

One contributing factor to the rise in overall rice production through the implementation of irrigation and modern rice varieties is the transformation of the rural economy. While the Green Revolution occurred in neighboring countries during the 1960s and 1970s, Bangladesh's own Green Revolution was realized during the 1980s, mainly due to the rapid proliferation of shallow tube wells for dry-season boro irrigation

and modern rice varieties. The development of the rural economy, spurred by the widespread adoption of the Green Revolution, increased agricultural wages (Koichi, 2011). However, as of 2001-2002, Hossain et al. (2006) demonstrated that the coverage of modern rice varieties had only reached 65% of the total rice-cropped area (with 80% coverage during the dry season and 51% coverage during the wet season), indicating that the Green Revolution in rice cultivation has yet to materialize in Bangladesh fully (Shelley et al., 2016).

3.3 Rice Cultivars

Several institutions, including the BRRI, BINA, BAU, and other universities, are working to develop rice cultivars that have high yield potential and resistance to various biotic and abiotic stresses (Table 1).[5] The BRRI has developed 69 rice varieties, BINA has developed 17, and BAU has developed 2. While traditional rice cultivars in Bangladesh have unique qualities, such as wide adaptability, superior grain quality, and resistance to abiotic and biotic stresses, their yields are meager (less than 2.0 t/ha). They are mainly grown in less suitable areas, such as coastal areas, lands without irrigation systems, and deep-water conditions (Shelley et al., 2016). However, with the increasing population, modern high-yielding rice cultivars need to replace wide traditional varieties to meet the demand for rice.

Various irrigation systems are used in Bangladesh, such as deep-tube well, shallow-tube well, low-lift pumps, and traditional irrigation systems. Irrigation is widely practiced in Bangladesh except in areas affected by salt. Proper water management is necessary for cultivating high-yielding rice varieties in the boro season. In suitable ecological regions, 92% of farmers use irrigation, of which only 28% own irrigation equipment, while 62% buy irrigation water (Hossain et al., 2013). According to the Ministry of Agriculture, the Net Cultivable Area in Bangladesh is about 8.59 million ha. In contrast, the Total Irrigated Area is 5.59 million ha, approximately 65.08% of the Net Cultivable Area in FY2019, with 73.09% of the total irrigated area covered by groundwater and the remaining 26.91% area covered by surface water (BRRI, 2019).

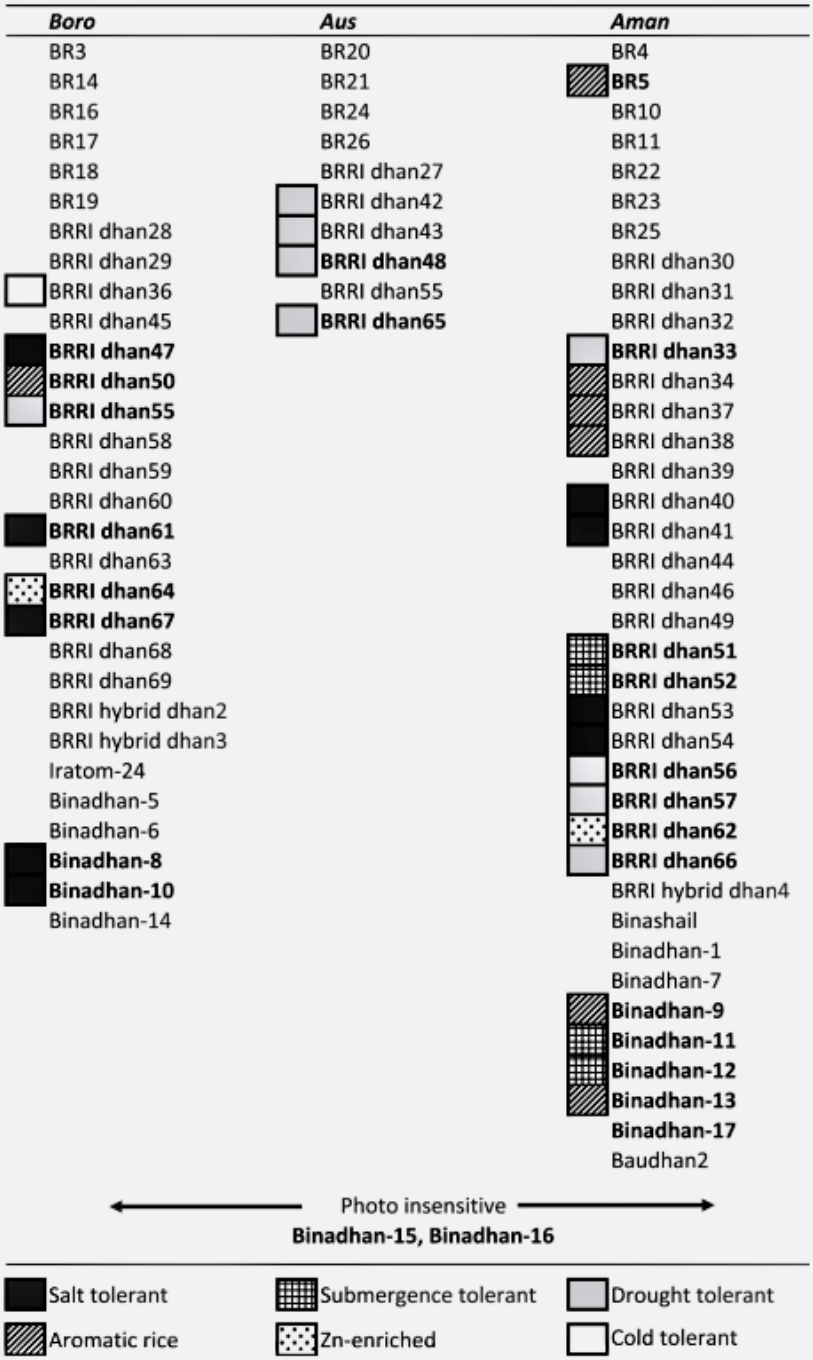
However, increasing irrigated areas for rice production is limited by salinity and land elevation constraints, and farmers in salinity-affected regions prefer traditional rice varieties. The majority of farm holdings in Bangladesh are small, but this did not impede the adoption of modern rice varieties, which were mainly hindered by logistical factors such as lack of irrigation facilities and topography affecting flood depth and soil salinity.

3.4 Factors Affecting Rice Cultivation

Various factors can impact the cultivation of rice, including climatic conditions, soil quality, water availability, pest and disease management, seed selection, and farming techniques. According to Shelley et al. (2016), various abiotic factors affect rice production in Bangladesh. For example: first, drought is a significant constraint for rice cultivation, particularly during the reproductive stage, and can cause a substantial reduction in yield. Second, depending on the rice variety, floods affect rice at different stages and can cause partial or complete crop losses. Third, salinity is a challenge in coastal areas, where traditional rice varieties are used but with poor yields. Forth, extremely low and high-temperature stresses can cause spikelet sterility and reduced yield. Fifth, soil fertility is declining due to intensive agriculture and the imbalanced use of chemical fertilizers, with N being the limiting factor. Finally, rice plants are often infested with various pests, including insects, pathogens, and weeds, which can significantly impact rice yield.

[5] Bangladesh Rice Research Institute (BRRI), Bangladesh Institute of Nuclear Agriculture (BINA), and the Bangladesh Agricultural University (BAU).

Table 1. Modern Rice Varieties of Bangladesh



Source: Journal of International Cooperation for Agricultural Development (Shelley et al., 2016)

3.5 Strategies to Overcome Problems Associated with Rice Cultivation

Several strategies can be employed to overcome challenges in rice cultivation, including improving irrigation and drainage systems, using high-quality seeds, implementing integrated pest and disease management practices, adopting sustainable farming techniques, and conducting regular monitoring and evaluation of crop performance. However, Shelley et al. (2016) discuss strategies to overcome problems associated with rice cultivation in Bangladesh. These strategies include improving crop management

practices such as using quality seeds, balanced fertilizers, and controlling weeds and pests. Besides, they have emphasized incorporating water-saving technologies such as alternate wet and dry irrigation methods and surface water management. Additionally, they have suggested combining genetic approaches to improve rice cultivars and recommend using organic and inorganic fertilizers in a balanced manner. Finally, they have discussed the need for improved post-harvest technology and the challenges small farmers face in accessing quality seeds.

Chapter 4

Analysis of the Rice Market in Bangladesh

4.1 Rice Production and Consumption in Bangladesh

Bangladesh is the third-largest rice-producing country globally, with an annual production of around 36 million metric tons (Statista, 2023). The country has made significant progress in rice production over the past few decades, thanks to improved seed varieties, irrigation systems, and agricultural practices. The government has also supported farmers through various initiatives, such as providing subsidies for inputs like fertilizers, seeds, and irrigation equipment. The country's rice production is concentrated in the northern and southern regions, with the significant rice-growing areas being the districts of Rangpur, Dinajpur, Bogra, Jessore, and Khulna. Bangladesh's two main rice varieties are Aus and Aman, while Boro is cultivated during the dry season.

However, Figure 3 illustrates Bangladesh's rice production and consumption trends from FY1971 to FY2022. Since gaining independence, the country has achieved remarkable rice production and consumption growth, aligning with population growth. In FY1971, rice production was 10,090 thousand MT, which increased to 35,650 thousand MT in 2022, exceeding 3.5 times the production from FY1971. This growth can be attributed to the developing of rice cultivation methods and research efforts to boost production to meet domestic demand.

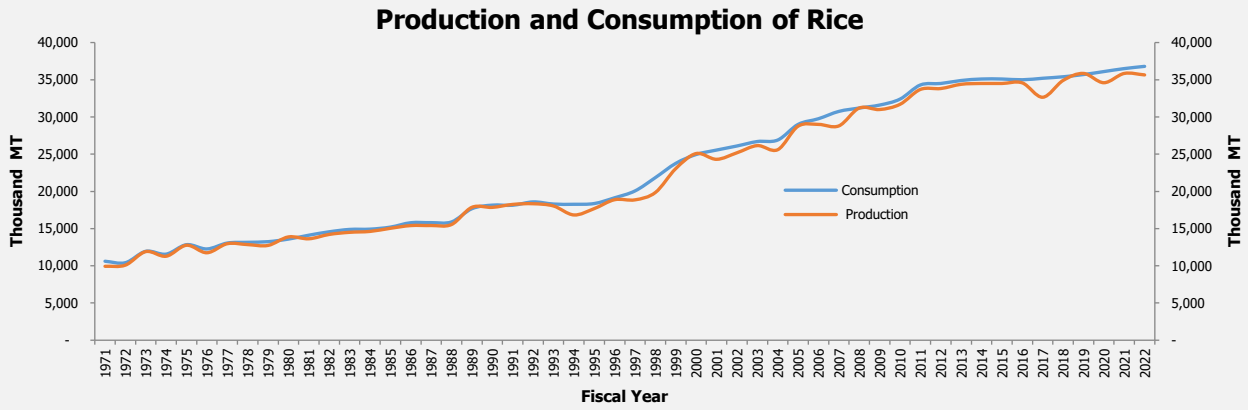
On the other hand, rice is a staple food in Bangladesh, consumed by almost all households in the country. Bangladesh's average per capita rice consumption is estimated to be around 181.3 kg per year, among the world's highest (The Business Standard, 2020). However, as shown in Figure 3, rice consumption has surpassed production levels, and Bangladesh has yet to attain self-sufficiency in rice production. This may be attributed to various factors, including natural calamities during rice harvesting, declining cultivable land, and farmers switching to alternative crops like Maize and Onion. Despite these challenges, the government has increased rice production by promoting research, developing new rice varieties, supporting farmers in adopting modern farming techniques, and expanding cultivable land and irrigation facilities.

Overall, while Bangladesh has made significant strides in rice production and consumption, there is still a need for continued efforts to achieve self-sufficiency in rice production and meet the rising demand for rice.

4.2 Consumption and Production Growth of Rice

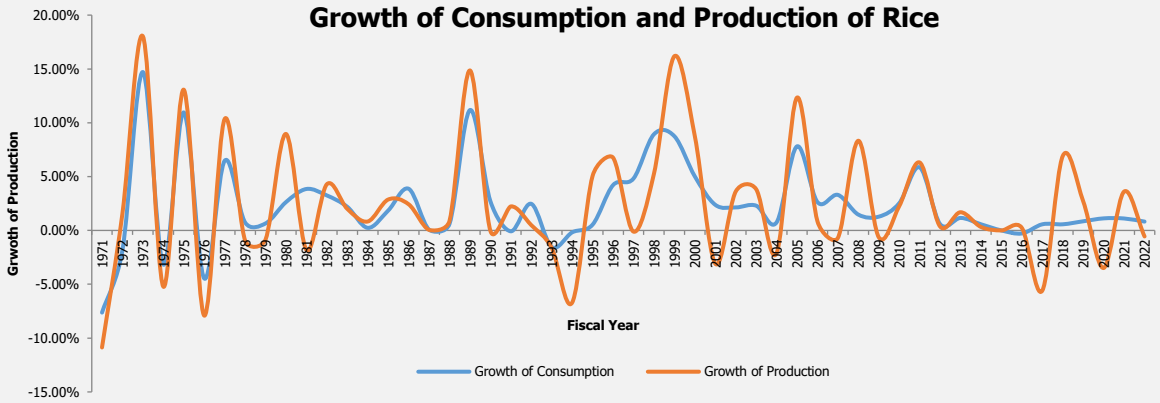
According to recent statistics, Bangladesh has experienced significant rice production and consumption growth (Index Mundi, 2022). However, Figure 4 displays Bangladesh's rice consumption and production growth from FY1971 to FY2022 (Index Mundi, 2022). The data reveals that the country's rice production growth has not been consistent over the years. One of the reasons behind this inconsistency is natural calamities such as floods and cyclones, which can damage crops and reduce production. Additionally, farmers may not always receive a fair price for their crops, discouraging them from investing in their farms and limiting their ability to increase production. Despite these challenges, rice consumption in Bangladesh has continued to grow. This suggests that the demand for rice is consistently high in the country, and efforts are being made to increase production to meet this demand.

Figure 3. Production and Consumption of Rice



Source: Index Mundi (2022)

Figure 4. Growth of Consumption and Production of Rice



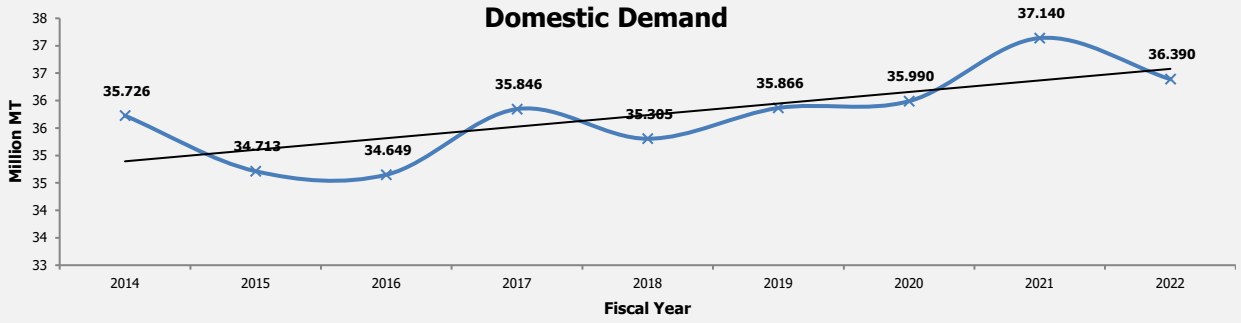
Source: Index Mundi (2022)

4.3 Rice Demand in Bangladesh

The demand for rice in Bangladesh is very high due to its population size and dietary preferences. The annual average demand for rice in Bangladesh is approximately 36 million MT. Both domestic production and imports meet this demand. However, Figure 5 depicts the demand for rice in Bangladesh from 2014 to 2022. In FY2022, the rice demand was 36.39 million MT, whereas rice demand was 35.73 million MT in FY2014. Demand for rice has been experiencing an ups and downs trend from FY2014 to FY2022. However, rice demand peaked in 2021, and the quantity stood at 37.14 million MT.

The government of Bangladesh has implemented several policies to ensure that the country's rice demand is met. These policies include increasing rice production through improved technologies, providing subsidies to farmers, and importing rice during times of shortage. Despite these efforts, there have been concerns about the country's ability to meet its rice demand in the long run due to climate change, land degradation, and population growth. As such, the government of Bangladesh is continually working to improve rice production and ensure food security for its citizens.

Figure 5. Domestic Demand



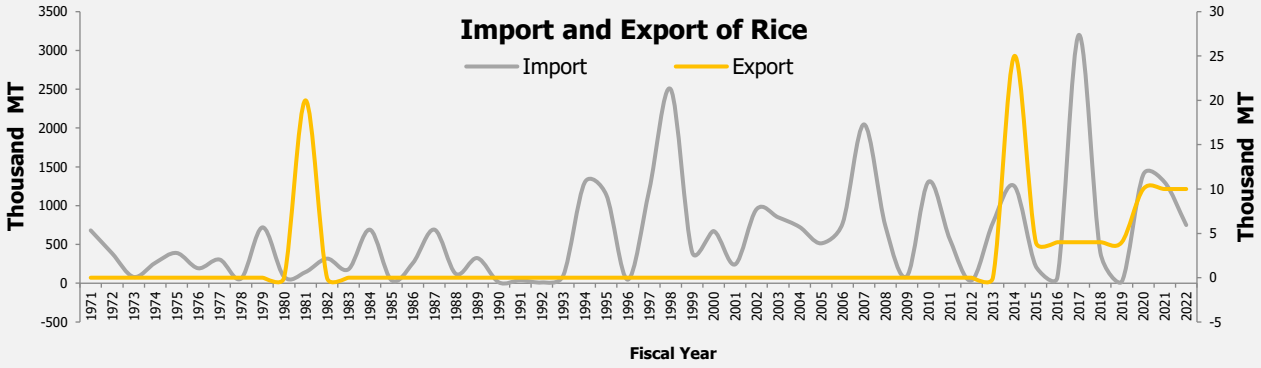
Source: ECRL Calculation
Note: Demand = (Production + Import) – Export

4.4 Rice Import and Export

Bangladesh is one of the major rice-producing countries in the world. Although, the government mainly imports rice rather than export due to several reasons, such as natural disasters, inadequate infrastructure, insufficient production, and high demand compared to production. In the current year, due to high demand, the Bangladesh government banned exporting aromatic rice due to the price control policy. However, Figure 6 provides an overview of the import and export scenario of rice in Bangladesh from 1971 to 2022 (Index Mundi, 2022). The figure shows Bangladesh mainly imports rice annually due to meet the domestic demand. On the other hand, the figure shows that Bangladesh has exported an insignificant amount of aromatic rice since FY 2014, mainly to the Middle East and Western countries.

The government of Bangladesh has taken several initiatives to increase rice production in the country, including providing subsidies to farmers, improving irrigation facilities, and introducing high-yielding rice varieties. These efforts have increased rice production in recent years, but the country still faces challenges in meeting the demand for its growing population.

Figure 6. Import and Export of Rice



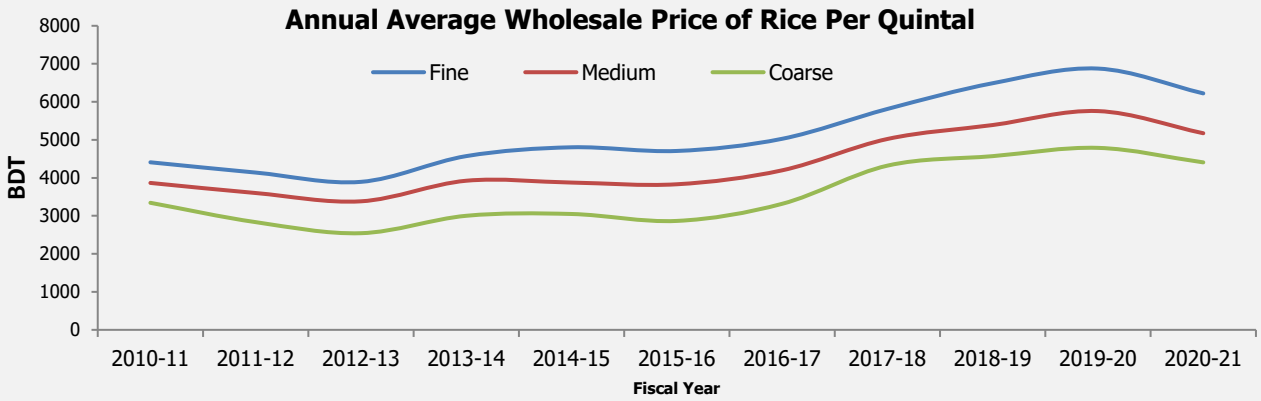
Source: Index Mundi

4.5 Price Trend of Rice

Finally, we have seen the price variation of three different crops over the year (FY2011 to FY2021) in Figure 7. The figure shows that the average price of all types of rice (fine, medium, and coarse) has increased since FY2014. In FY2021, rice prices fell slightly due to supply interruption for the countrywide lockdown. Although, now the price is growing again due to external and internal factors. However, the

rice price change depends on the rice supply and the production season. Rice prices fluctuate with the variability of production. Generally, Aus, Aman, and Boro rice harvesting season is July, December, and May. As paddy price is relatively low in the harvesting season, rice millers' collect paddy from the farmers during the harvesting season.

Figure 7. Annual Average Wholesale Price of Rice Per Quintal



Source: BBS (2021)

Chapter 5

Analysis of Rice Milling in Bangladesh

5.1 Types of Rice Mills

In Bangladesh, rice mills are classified based on their manufacturing processes into three primary types: Automatic Rice Mills, Semi-Auto Rice Mills, and Traditional Husking Mills. This categorization is contingent on the degree of automation and mechanization applied during the rice milling procedure. Automatic Rice Mills leverage cutting-edge machinery and technology to process paddy efficiently. The process commences with paddy preparation and soaking in hot water, followed by parboiling through steam pressure. Subsequently, the steamed paddy undergoes drying in a specialized dryer and husking using a rubber roll or disc huller. A paddy separator is employed to segregate unhusked paddy from the brown rice, with the latter being recycled back to the huller for further processing. Brown rice is then meticulously polished utilizing a Cone and an Engleberg roller polisher. The entire process is fully automated, employing advanced equipment to ensure optimal and high-quality rice production.

5.1.1 Automatic Rice Mill

An Automatic Rice Mill incorporates state-of-the-art technology to process paddy. The procedure begins with preparing paddy and its immersion in hot water, followed by pressurized parboiling through steam. Subsequently, the steamed paddy is dried using a specialized dryer and husked using a rubber roll or disc huller. A paddy separator segregates unhusked paddy from the brown rice, which is then cycled back into the huller for further processing. Further refinement of the brown rice is achieved through polishing with a Cone and an Engleberg roller polisher. This entire process is automated, using advanced machinery and equipment to ensure efficiency and rice production with high-quality standards.

5.1.2 Semi-Automatic Rice Mill

A Semi-Automatic Rice Mill operates with mechanical processes and omits the drying step. In this type of mill, parboiled paddy is manually dried on the floor under sunlight, involving spreading and stirring, before being fed into the mill. The process encompasses paddy storage, cleaning, parboiling, natural drying, milling using a rubber-roll huller, rubber polishing, paddy separation, stone separation, black rice sorting, cracked and discolored grain sorting, sifting for broken rice, aerating, bagging, and weighing. The outcome is high-quality rice that undergoes precise grading. Additionally, the process yields separate husk and bran, which can be utilized for producing briquette rice husk and extracting edible oil from bran, exemplifying a resourceful approach. Despite being Semi-Automatic, the process integrates modern machinery to achieve efficient rice production with consistent quality.

5.1.3 Husking Mill

The Husking Rice Mill adheres to traditional rice milling methods, wherein rice is manually boiled and dried, similar to the Semi-Automatic approach. In Husking Rice Mills, some polishing is performed in addition to husking, generally accomplished by passing the rice through hullers multiple times to remove some of the bran after husking. These mills typically produce four products: milled rice, broken rice, rice bran, and husks. Although the process is manual and traditional, it still yields usable rice products with varying degrees of polishing and bran content.

5.2 Establishment and Operational Cost of a Rice Mill

The section examines the capital investment and operational expenses of setting up and running an Automatic and Semi-Automatic Rice Mill. The establishment costs encompass land acquisition,

construction of buildings, and procurement of machinery, with the total expenditure varying based on the scale and nature of the mill.

5.2.1 Automatic Rice Mill

5.2.1.1 Establishment Cost

5.2.1.1.1 Land

Establishing a rice mill with a production capacity of 50 tons necessitates a land area of 100 decimal, while a production capacity of 100 tons requires a land area of 150 decimal. Expanding the land area may enhance operational efficiency, thereby increasing production capacity (CBECL 2012). However, the cost of land acquisition may fluctuate depending on location and other pertinent factors.

5.2.1.2 Infrastructure Development

5.2.1.2.1 Building Structure Development

An Automatic Rice Mill structure can be constructed using materials such as bricks, steel, or a combination thereof, employing automated methods. Prevailing market prices and the quality of the raw materials employed predominantly influence the overall construction cost. Moreover, the cost of establishing the structure may vary based on geographical location and regional factors. Consequently, meticulous calculation of all material expenses beforehand is imperative for entrepreneurs initiating the rice mill construction. A comprehensive analysis of raw material costs is also essential for effective planning and proficient execution of the mill construction project.

5.2.1.2.2 Setup Cost of Machinery

An Automatic Rice Mill plant consists of four distinct sections: the Parboiling Section, Drying Section, Milling Section, and Bagging Section. Each of these sections necessitates specific types of machinery customized to perform their respective stages of operation. Moreover, the cost of these machines is contingent upon the particular stages of production for which they are intended. A comprehensive overview of the machinery types associated with each production stage is presented in Table 2.

The standard boiler machine used in the rice mill plant has an average price range varying from BDT 6.3 million to BDT 10.5 million, with a daily capacity of boiling 50 tons to 100 tons of paddy for approximately 16 hours. It is noteworthy that Japanese and Chinese brands are relatively more affordable than Korean ones. Consequently, most (around 90 percent) of Bangladesh's parboiling rice milling machinery is imported from India (CBECL 2012). While machinery from Japan and Germany is renowned for its higher quality, it also comes with a higher price tag than Indian machinery. For instance, the average cost of an Indian machine designed for the parboiling section is approximately BDT 15.7 million, with a daily capacity of 100 tons.

Table 2. Machinery Cost (Taka in a million) of the Automatic Rice Mill

Particular	Japanese Brand	Chinese Brand	Indian Brand	Korean Brand
Boiler	6.29-6.55	6.29-6.55	0	6.6-10.5
Dryer	17.83	5.5	15.7	9.4
Parboiling	19.66-24.90	10.22-11.8	15.7	4.2
Milling	45.87-52.43	19.66-26.11		13.1-26.2
Color Sorter	14.42	6.55-7.86	5.9-7.9	9.2
Power station	2.88	2.88	2.9	3.9-5.2

Source: Bangladesh Rice Research Institute and ECRL primary survey (April 2023)

In contrast, the drying section machine from India, with the same capacity, is also priced at BDT 15.7 million, while a Chinese brand costs only BDT 5.5 million. Additionally, 90 percent of the milling and bagging machinery in Bangladesh is imported from China, with the price of a Chinese milling machine ranging from BDT 20 million to BDT 26 million for a daily capacity of 100 tons. Furthermore, the color sorter machines are considered expensive as well. The Indian color sorter machine is priced between BDT 6.55 million to BDT 7.86 million, and it is primarily employed to separate black and weak rice. This machine operates with the assistance of cameras, and the number of cameras required depends on the number of channels employed.

5.2.1.2 Operational Cost

5.2.1.2.1 Labor Cost

The labor cost constitutes a pivotal element of variable expenses within an organization. In a typical Automatic Rice Mill, the required workforce consists of approximately 20 to 25 individuals, encompassing both Permanent (10 to 15) and Temporary (10 to 12) employees. The exact number of laborers necessary is contingent upon the size and production capacity of the mill. Permanent workers are remunerated with a monthly salary ranging from BDT 15,000 to BDT 20,000, while temporary workers receive an average daily wage ranging from approximately BDT 500 to BDT 700. Notably, temporary workers may earn higher daily wages than permanent workers but encounter relatively less job security. It is essential to acknowledge that wage rates in an Automatic Rice Mill vary based on diverse factors, such as the mill's geographical location, prevailing labor demand, and laborer availability.

5.2.1.2.2 Utility Cost

The utility cost constitutes an essential variable expense that is contingent upon the production unit's operations. Specifically, in the case of an Automatic Rice Mill, the utility cost is influenced by the monthly production volume and other related factors, encompassing expenditures associated with electricity, fuel, gas, water, and various utility bills.

5.2.2 Husking and Semi-Automatic Rice Mills

5.2.2.1 Establishment Cost

As per the statements provided by Husking Mill proprietors, establishing such mills entails a mean capital investment ranging from BDT 5.0 million to BDT 7.0 million, alongside the necessity of 100-decimal land. A significant portion of this land is allocated for the paddy drying process. Conversely, the cost of setting up a Semi-Automatic Rice Mill in Bangladesh varies based on location, mill size, and machinery quality, typically demanding an investment exceeding BDT 7.0 million. The land area requirements depend on the production capacity, ranging from 100 to 150 decimals for small-scale mills and up to 300 decimals for larger mills.

The primary fixed costs are the land and machinery costs for Husking and Semi-Automatic Mills. The machinery cost varies depending on the location and region. In the context of a Semi-Automatic Rice Mill, the requisite machinery includes a paddy cleaner, de-stoner, husker, separator, polisher, color sorter, and packaging machine, with the average machinery costs ranging from BDT 3.0 million to BDT 4.0 million. Further information on the prices of Husking and Semi-Automatic Mills' machinery is provided in Table 3.

Table 3. Machinery Cost (Taka in a million) of Husking and Semi-Automatic Rice Mills

Particular item	Price
Saddler	0.13
Rice filter	0.13-.2
Garden polisher	0.1
Milling	0.2
Power station	0.65-0.91

Source: ECRL primary survey (April 2023)

3.2.2.2 Operational Cost

In general, Husking Mills exhibit a labor-intensive nature, signifying their reliance on a larger workforce than Automatic and Semi-Automatic Rice Mills. Precisely, an average of 30 workers is essential for the functioning of a Husking Mill, with the corresponding daily wage rate averaging BDT 500. It is worth noting that the wage rate for Husking Mills closely aligns with that of Automatic Rice Mills, although variations may arise based on factors such as geographical location, market demands, and the availability of laborers.

In contrast, Semi-Automatic Mills require a reduced workforce compared to traditional mills, with small-scale operations typically employing 5 to 10 permanent laborers, while larger mills necessitate 10 to 20

permanent laborers. Additionally, Husking Mills enjoy lower utility costs relative to Automatic Rice Mills due to their lower production output, primarily attributed to the manual operating system.

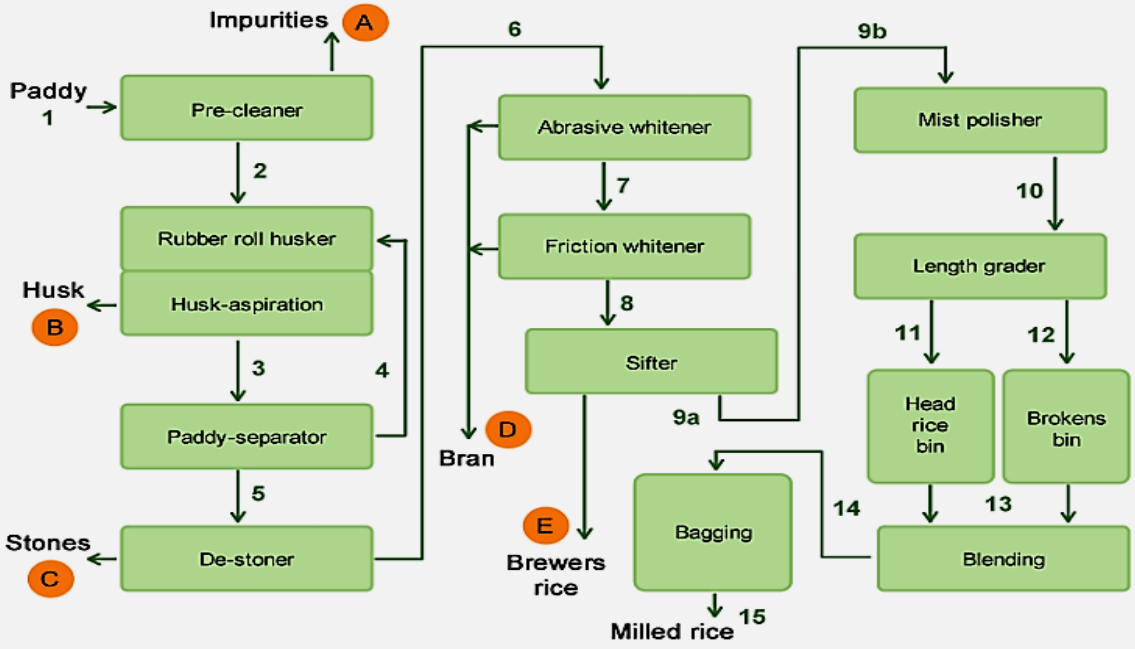
5.3 Production Process

5.3.1 Production Process of Automatic Rice Mills

The contemporary rice milling facility is available in various configurations, characterized by diverse designs and performance capabilities of the milling components. A modern rice mill typically consists of three primary stages: the husking stage, the whitening-polishing stage, and the grading, blending, and packaging stage. Modern rice mills employ automated adjustments such as rubber roll clearance, separator bed inclination, and feed rates to achieve maximum efficiency and facilitate ease of operation. Furthermore, whitener polishers are equipped with gauges that assess the current load on the motor drives, providing valuable insights into the grain's operating pressure. This integration of gauges offers a more objective approach to setting milling pressures on the grain, as detailed in the Rice Knowledge Bank (2017). A comprehensive overview of the various processes involved in modern rice milling is provided in Table 4.

A diverse range of configurations is employed in the production process of modern rice mills. The layout and flow of a typical modern rice mill can be visualized through the flow diagram presented in Figure 8.

Figure 8. Flow Chart of Auto Rice Milling



Source: Rice Knowledge Bank

According to the Rice Knowledge Bank, the description of the flow of materials and processes is given below:

1 - Paddy is dumped in the intake pit feeding the pre-cleaner
A - straw, chaff, and empty grains are removed
2 - pre-cleaned paddy moves to the rubber roll husker:
B - husk removed by the aspirator
3 - a mixture of brown rice and unhusked paddy moves to the separator
4 - unhusked paddy is separated and returned to the rubber roll husker

5 - brown rice moves to the de-stoner
C - small stones, mud balls, etc., removed by de-stoner
6 - de-stoned brown rice moves to the 1st stage (abrasive) whitener
7 - partially milled rice moves to the 2nd stage (friction) whitener
D - Coarse (from the first whitener) and fine (from the second whitener) bran removed from the rice grain during the whitening process
8 - milled rice moves to the sifter
E - Small broken/brewer's rice removed by the sifter
9a - (for simple rice mill) ungraded, milled rice moves to the bagging station
9b - (for more sophisticated mill) milled rice moves to the polisher1
10 - Polished rice will move to the length grader
11 - Head rice moves to head rice bin
12 - Broken rice move to broken rice bin
13 - The pre-selected amount of head rice and broken rice move to the blending station
14 - Custom-made blend of head rice and broken rice moves to the bagging station
15 - Bagged Rice moves to the market

Table 4. The Modern Rice Milling Process

Stage	Function
Pre-cleaning	removing all impurities and unfilled grains from the paddy.
Husking	removing the husk from the paddy.
Husk Aspiration	separating the husk from the brown rice/unhusked paddy.
Paddy separation	separating the unhusked paddy from the brown rice.
De-stoning	separating small stones from the brown rice.
Whitening	removing all or part of the bran layer and germ from the brown rice.
Polishing	Improving milled rice's appearance by removing remaining bran particles and polishing the milled kernel's exterior.
Sifting	separating small impurities or chips from the milled rice.
Length grading	separating small and large broken from the head rice.
Blending	mix head rice with a predetermined amount of broken, as the customers require.
Weighing and bagging	preparing milled rice for transport to the customer.

Source: Rice Knowledge Bank

5.3.2 Production Process of Husking Mills

Like an Automatic Rice Mill, a Husking Mill's production process comprises various stages. However, unlike an Automatic Rice Mill, most of the work involved in a Husking Mill is carried out manually. A typical flow diagram of the stages involved in a Husking Mill's production process is depicted in Figure 9.

After harvesting, the crops are brought for threshing to separate the grains from the straws. It can be done through machines or manually by farmers. The next step is cleaning. Cleaning grains after harvesting is essential as it removes unwanted materials from the grains. Drying rice grains as soon as possible after cleaning (ideally within 24 hours) (RKB) is vital. Farmers dry grains manually under the sun in the Chatal or open field. Then, farmers boil rice grain. Then again, the farmers dry the boiled grains under the sun. The last process includes milling, sorting (de-stoning), and packaging the milled rice.

5.4 Difference between Traditional and Modern Mill

The milling process in traditional and Automatic Rice Mills exhibits significant differences, as outlined in Table 5. Comparatively, the Automatic Rice Mill system surpasses the traditional method regarding rice processing efficiency, cleanliness, and overall output quality. The automated process involves fewer

impurities, such as stones, than the traditional process. Additionally, Automatic Rice Processing Mills can produce more than twice the amount of processed rice compared to conventional mills, processing over 2 tons per hour, while traditional mills are limited to 0.6 to 1 ton per hour. However, it is worth noting that Automatic Rice Mills require higher power consumption, typically ranging from 65 to 100 horsepower, while traditional mills suffice with 30 to 40 horsepower.

Figure 9. Husking Mill Flow Chart

Source: ECRL Primary Survey (Rahman et al., 2017)

Table 5. Major Differences between Husking and Automatic Rice Mill

Types of Mills	Major Components	Capacity of Production	Power Requirement	Hulling/ Polishing	Bran Separation and Grading
Husking	Soaking Tank Steam Parboiled Drying Floor Engle berg Huller	0.6 to 1 ton/hour	30-40 HP	2 to 3 operations	Manually
Automatic	Pre-cleaner Soaking Tank Boiler, Steam Pressure Parboiled Dryer, Rubber Roll Sheller, Paddy Separator Polisher, Bran Separator, etc.	2 tons/hour	65-100 HP	Separately by different devices	All Activities Mechanically

Source: The Review of Agricultural Economics (Zaman et al., 2001)

Moreover, traditional rice mills necessitate separate operations for cutting and drying processed rice, whereas Automatic Rice Processing Mills can accomplish these tasks in a single integrated process. In Husking Mills, grading and brand separation are manually performed, whereas in Automatic Mills, these processes are automated (Table 4). Furthermore, Automatic Rice Mills offers the advantage of cutting rice into various sizes, such as Miniket, Najir Shail, Pajam, Katari Bhog, Chinigura, etc., which is not feasible with traditional rice mills. The cooking time for rice milled in automated machines is significantly reduced to 12-15 minutes, whereas traditionally, milled rice takes 20-25 minutes to cook. Additionally, by-products from the Automatic Rice Mill, such as bran and oil, are generated after processing and can

be utilized for poultry feed, whereas traditional rice mills produce by-products suitable solely for poultry feed (Zaman et al. 2001).

5.5 By Product Generation

Rice mills can yield three main by-products: husk, bran, and broken rice. The proportions of head rice, rice husk, rice bran, and broken rice vary depending on the mill type. As per the survey findings, the average output of head rice, rice husk, rice bran, and broken rice from the examined Automatic Rice Mills accounts for approximately 65.0%, 22.75%, 8.25%, and 5.0%, respectively. In contrast, Husking Mills produces fewer quantities of these by-products than Automatic Rice Mills (Table 6).

Nonetheless, the prices of these by-products are detailed in Table 7. Additionally, it is worth noting that the by-products from an Automatic Rice Mill are generally in greater demand due to their superior quality. Consequently, the number of by-products and raw products generated by a rice mill, along with their market demand, can significantly impact the profit margin of the millers.

Table 6. Milling Outturn and Production of By-Products for 40 KG Paddy

Mill Type	Milling Outturn (Kg)	Husk (Kg)	Rice Bran (kg)	Broken Rice (Kg)
Husky	25	9.3	3.5	2.2
	(62.5)	(23.25)	(8.75)	(5.5)
Automatic	26	8.7	3.3	2
	(65.0)	(22.75)	(8.25)	(5.0)

Source: ECRL Primary Survey (Rahman et al., 2017)

Table 7. By-Product Selling Prices for both Husking, Semi-Automatic, and Automatic Rice Mills

Particular	Husk	Rice Bran	Broken Rice	
	(Per kg)	(Per kg)	(Per kg)	
			Medium	Small
Selling price	Tk.39	Tk.35	Tk.37-Tk.39	Tk.32

Source: ECRL primary survey (April 2023)

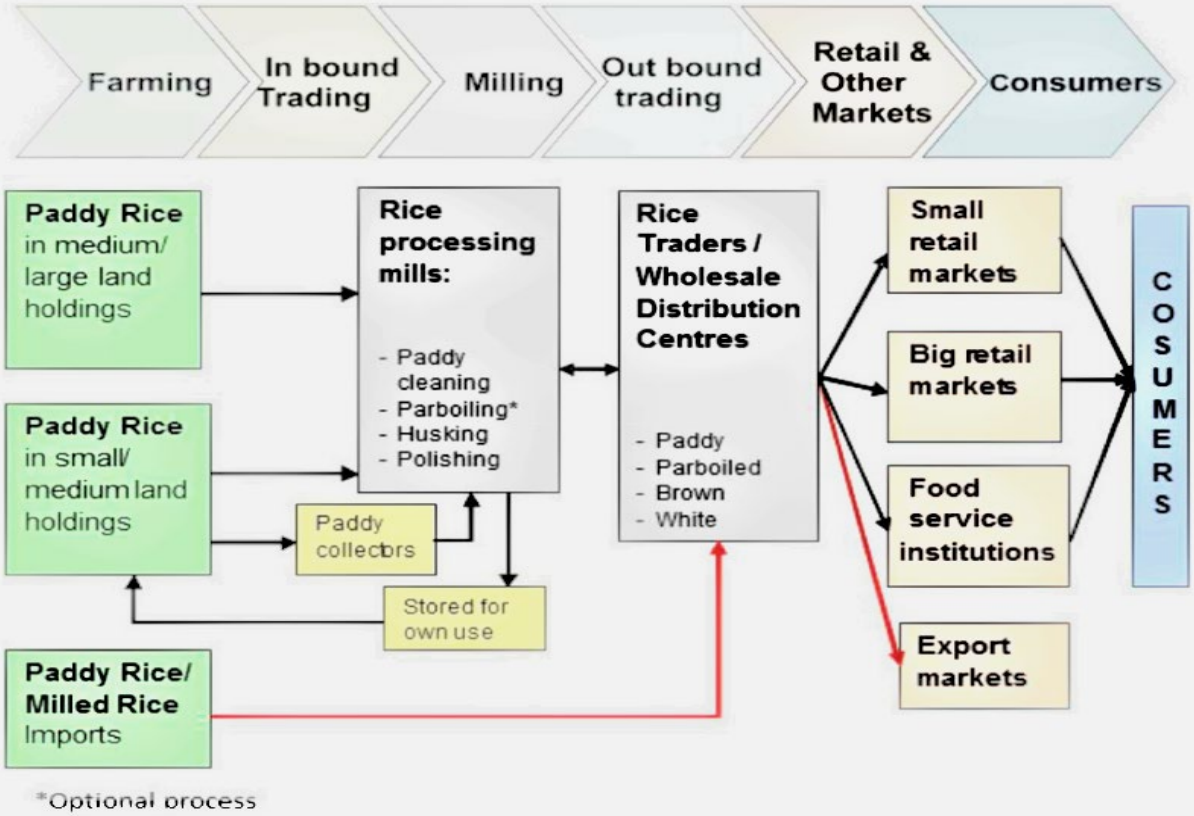
All the by-products produced by rice mills offer alternative uses. For instance, rice bran and broken rice are valuable feed sources for cattle, poultry, and fish, while rice bran is further utilized to produce natural oil. Rice husks, on the other hand, serve as fuel for millers and the rural community, and their ash finds application in cement factories as silica. In the case of Husking Mill owners, they commonly employ husks as fuel for the boiling process. A miller typically requires approximately 7200 kg of husks to boil 40,000 kg of paddy (Zaman et al. 2001). Millers often acquire husks from other millers or the market, transform them into charcoal sticks, and subsequently sell them for various purposes.

5.6 Global Rice Supply Chain

In a particular country, a customary rice supply chain is a complex system of public and private entities that interconnect rice producers, such as farmers, rice millers, collectors, traders, wholesalers, retailers, and food processors, with the ultimate consumers (Figure 10). The supply chain also includes other key stakeholders such as transporters, entities providing seeds, agrochemicals, and agricultural equipment, irrigation companies, inspection agencies, and various government departments, including those for commerce, tax, and agriculture. Additionally, other state agencies regulate the prices of paddy by governmental policies.

Small land-holding farmers residing in villages can produce sufficient rice to meet their yearly consumption needs. Typically, the village miller will process the small quantity of paddy rice without charge in exchange for the rice bran. As a result of the limited working capital and capacity of the mill, this activity represents a relatively small enterprise. Farmers with medium-sized holdings with access to local mills generally sell their rice directly to those mills. However, if transportation costs are high or road conditions are poor, access to mills may be limited, and farmers may be compelled to sell their crops to paddy collectors or traders at market prices. The collectors or traders then profit by selling the paddy to the millers or the export market. In many countries, fair trade programs have been established to connect farmers with consumers willing to pay a premium that covers production and investment expenses. These programs have successfully improved the lives of small-scale farmers. Large land-holding farmers, on the other hand, usually supply their paddy rice directly to rice-processing mills, thereby eliminating the middlemen and increasing their earnings. Rice-processing companies also benefit from sourcing directly from farmers, lowering procurement, logistics, and other intermediary and supply-chain expenses. Medium and large-scale rice-processing mills are increasingly located in large rice-producing regions, and they perform two primary functions: (1) cleaning, de-husking, and polishing rice, and (2) supplying rice (parboiled, brown, or milled white) to markets where demand is high and where rice can be sold at better prices, specifically urban and densely populated areas. Both paddy and milled rice are directly exported to neighboring countries during and after the harvesting season. Private rice companies are becoming more involved in the rice market by procuring paddy, processing, milling, and storage, and establishing retail outlets (Muthayya et al. 2014).

Figure 10. Conceptual Diagram of the Rice Supply Chain in a Rice-Growing Country



Source: The New York Academy of Sciences (Muthayya et al., 2014)

However, the rice supply chain trends are shifting, with small farmers increasingly selling their cultivated rice for higher prices. This has been facilitated through various government initiatives, including schemes that assist farmers, an increase in contract farming that promotes the consolidation of grain production,

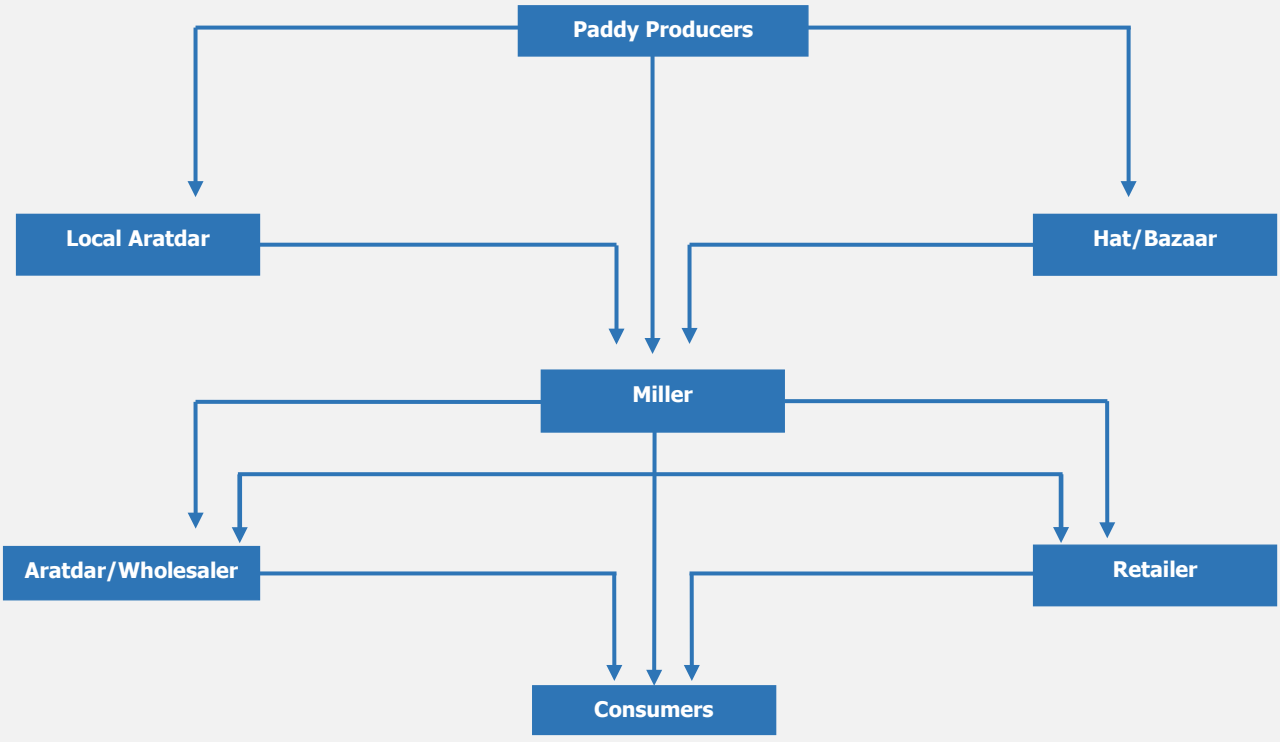
the adoption of the farm-to-fork concept in emerging corporate farms, and the integration of better traceability and control of operations into the rice supply chain. The forward linkages in the supply chain, which involve the relationships that move rice toward end consumers, are also anticipated to become more efficient, with greater organization in the retailing and branding processes leading to the consolidation of the volume of rice traded. In countries where the government subsidizes rice production, there is improved regulation and influence to support farmers and provide consumers with a low-cost purchasing option (Muthayya et al. 2014).

5.7 Marketing Channel of Rice in Bangladesh

A marketing or distribution channel refers to a group of interdependent entities that work together to facilitate the transfer of ownership of goods or services from the producer to the ultimate consumer. In the case of agricultural products, intermediaries within the marketing system ensure the efficient movement of goods from farmers to end customers.

The marketing channels utilized by rice mills are depicted in Figure 11. The channel involves four primary groups: rice producers, aratdar/bazaar, mills, and wholesalers/retailers. Initially, paddy producers sell their harvest to nearby bazaars or hats. Local aratdar then purchase the paddy from the bazaar or hat, and occasionally from the producers before selling it to the millers. The rice millers may also purchase paddy directly from the producers. After processing the paddy, the millers sell the resulting rice to wholesalers or retailers and sometimes to consumers. Finally, retailers purchase rice from wholesalers or directly from the mill and sell it to end consumers.

Figure 11. Marketing Channel of the Rice Processing Industry



Source: ECRL Primary Survey (Rahman et al., 2017)

5.8 Legal Issues

Before establishing a rice mill, the entrepreneur must obtain the requisite approvals and licenses from relevant authorities per various Acts and Rules. These authorizations grant clearance to establish the rice mill.

The following licenses and approvals are required (Rahman et al., 2017):

1. License from the Ministry of Land Office: The initial steps require a permit for establishing the industry.
2. Local Chairman Trade License: Trade license is required before starting any business.
3. Ministry of Food License (Upazila Food Controller, District Food Controller): The rice mill setup requires a license to be acquired for manufacturing rice or food items.
4. Approval from the Ministry of Power: The electricity or power supply is significant in rice manufacturing, especially in auto rice mills. The Ministry of Power needs to be informed about the required quantity and power supply. The ministry would provide the approval and power supply as required.
5. Ministry of Environment and Forests Approval: The rice mill emits husks while manufacturing the rice, which has created a health hazard for the local people living near the mills. So, an environmental certificate must be collected, which requires following some rules or precautions to be taken to reduce the impact. Then, it approves the mill owners to mill the rice.
6. Fire Service: The mill has to meet the safety measures for fire hazards by taking necessary steps or buying fire extinguishing equipment, etc.
7. Ministry of Labor and Employment: Millers have to abide by all the rules or laws of labor.

5.9 Government Policies

Many government policies are in effect to support the rice industry and contribute to its growth. The regulations in the domestic rice industry support farmers and rice manufacturers in terms of paddy prices and rice release mechanisms**.**

The Government of Bangladesh (GoB) adopted the Seventh Five Year Plan (7FYP/SFYP 2016-2020), accepted by the end of 2015, focusing on raising rural income and generating employment opportunities for rural people by developing the crop sub-sector. In addition, the 7FYP aims to diversify climate-resilient agricultural production with increased commercialization and income improvement through technological innovations and usage and connect the farming community nationally and internationally (FAO, 2016).

The Government of Bangladesh (GoB) directly assists farmers by enhancing inputs, increasing credit facilities, and guaranteeing support prices through public procurement. The government is helping by increasing fertilizer subsidies, credit provisions to smallholder farmers, continual price stabilization, domestic procurement, promoting food and agricultural diversification, etc. (FAO, 2016). This might positively impact the price of paddy, making the price cheaper for the millers.

Although the Government of Bangladesh (GoB) is providing subsidies for various inputs such as seed and fertilizer (20 kg of urea, 10 kg of Di-Ammonium Phosphate, and 10 kg of Muriate of Potash) to incentivize farmers to grow more Aus rice, many farmers prefer to grow jute because of higher profit margins (Lagos & Hossain, 2016). Therefore, this might lower the amount of paddy supplied to the millers.

During a natural calamity, like a flood, the paddy prices rise, making it expensive for the millers, again increasing the price of the rice. Thus, it harms the millers as well as the consumers. During the flood in 2016, the Ministry of Agriculture reported 0.75 million hectares (ha) of waterlogged cropland and damaged cropland of 1.6 million hectares (ha). Later in the season, the Aman rice crop was recovered through replanting, but the Aus rice affected by flooding was destroyed. The government of Bangladesh

supported farmers by spending TK.421 million ($5.32 million) on an agriculture rehabilitation and incentive program for the Kharif-2 (autumn) and Robi (winter) seasons. The government distributed rice seeds, rice seedlings, and fertilizer to 0.75 million lower-income farmers to make up for lost crops and boost production (Hossain & K.Singh, 2016). This government incentive is needed as a shortage of paddy will cause a rise in the price of paddy.

Additionally, the imposing tariff on imported rice also supports the millers of Bangladesh. The tariff has been raised, and other taxes have been added to stop cheaper Indian rice imports, which constitute the largest import market share. The GoB imposed a 20% import tariff, on December 8 (2015), on husked (brown) rice, fortified rice kernels, and other semi-milled or wholly milled rice to prevent less expensive imports from competing with domestic rice (Lagos & Hossain, 2016).

As of June 2, 2016, the tariffs have been increased by GoB, amounting from 10% to 25%, and a 10% regulatory duty on rice imports has been removed. The GoB also imposed a value-added tax (VAT) of 15% in addition to an advance income tax (AIT) of 5% and an additional advanced trade VAT (ATV) of 4%. As a result, rice imports have been lowered to 0.22 MMT for the marketing year (MY) 2015/16 based on the latest customs data (Hossain & K.Singh, 2016). On its annual budget for FY2016/17, GoB imposed 25% import tariffs on husked (brown) rice, fortified ice kernels, and other semi-milled or wholly milled rice to protect domestic rice producers. Slowed imports likely will result in lower ending stocks (Hossain, 2017).

Chapter 6

Competitive Analysis

6.1 Porter's Five Forces Model for the Rice Processing Industry of Bangladesh

Porter's Five Forces Model is a framework for analyzing the competitive environment of an industry. The model identifies five key forces that shape the competition within an industry and helps businesses understand the level of competition, potential profitability, and attractiveness of a particular industry (Table 8).

Table 8. Porter's Five Forces Analysis

The threat of New Entrants	**Bargaining Power of Suppliers**
High	**Low**
The threat of new entrants in the rice processing industry in Bangladesh is relatively high. This is because the industry has relatively low barriers to entry due to the availability of raw materials and the lack of government regulations. As per the research of ECRL establishment cost of the Husking Mill is TK.5.00 to 7.00 million, and the machinery of the Husking Mill is locally available. Additionally, rice processing can be done on a small scale with low initial investments, which makes it easier for new entrants to compete.	Suppliers' bargaining power in Bangladesh's rice processing industry is relatively low. This is because there are many suppliers of raw rice in Bangladesh, which reduces the bargaining power of any one supplier. Additionally, rice is a commodity product, meaning suppliers do not have a unique product to leverage to increase their bargaining power.
Bargaining Power of Buyers	**Threat of Substitutes**
High	**Low**
The buyers' bargaining power in Bangladesh's rice processing industry is relatively high. This is because there are many rice processing companies in Bangladesh, which means that buyers have many options to choose from. Additionally, rice is a commodity product, which means that buyers can easily switch between different brands and suppliers based on price and quality.	The threat of substitutes in the rice processing industry in Bangladesh is relatively low. This is because rice is a staple food in Bangladesh and is not easily replaced by other food products. However, there is a growing trend towards healthy eating and a shift towards non-rice-based foods, potentially threatening the industry in the long run.
Rivalry Among Existing Competitors	
High	
The rivalry among existing competitors in the rice processing industry in Bangladesh is relatively intense. This is because there are many rice processing companies in Bangladesh, all competing for market share. Additionally, the industry is highly competitive in price and quality, putting pressure on companies to constantly innovate and improve their products. However, large conglomerates like Meghna and TK groups are recently entering the rice processing industry, increasing competition among local firms.	

6.2 PESTEL Analysis of the Rice Processing Industry in Bangladesh

PESTEL analysis is a strategic tool used to analyze the macro-environmental factors that can affect an organization or industry. The acronym stands for Political, Economic, Sociocultural, Technological, Environmental, and Legal factors (Table 9).

Table 9. PESTEL Analysis

Political	**Economical**
1. There is a lack of incentives for the millers and a tax rate, which could have helped boost this industry. Political instability and unrest in the country can create uncertainty and disrupt business operations. 2. Political syndicate influencing the distributional cost.	1. The rice sector contributes one-half of the agricultural GDP and one-sixth of the national income in Bangladesh. 2. The government has imposed an interest rate ceiling for SMEs and other industries to facilitate rice mill growth. 3. Bangladesh Bank has imposed a cap on agriculture's interest rate; the highest rate for agriculture is 8.00%.
Social	**Technological**
1. The culture and customs of the people in Bangladesh can influence their consumption patterns and preferences for rice. 2. Changes in population demographics, including age distribution and urbanization, can impact the demand for rice and the auto rice mill's target market.	1. Changes in agricultural technology, including the development of new seed varieties, can impact the quality and quantity of rice production. 2. Technology can be a threat as labor is reduced every time specialized machinery is improved or developed.
Environmental	**Legal**
1. Change and natural disasters, such as floods and droughts, can impact the supply and quality of paddy. 2. 'Tush' in the air creates breathing problems for people in that area. For instance, a similar case happened in Dinajpur.	1. Compliance with labor laws, including minimum wages and working conditions, can improve the operations and reputation of auto rice mills. 2. According to the proposed law, a person who violates or overstocks government guidelines on foodgrain stocking can be jailed (maximum 14 years rigorous imprisonment) or fined (The Daily Star, 2023).

6.3 SWOT Analysis of the Rice Processing Industry in Bangladesh

SWOT analysis is a strategic tool used to assess an organization or project's strengths, weaknesses, opportunities, and threats (Table 10).

Table 10. SWOT analysis

Strengths	Weakness
1. The demand does not change significantly with price and low sales uncertainties, as all rice products are saleable. 2. Auto rice mills are entitled to rice allotment or incentives from the government (Bangladesh Grain and Feed Annual, 2013), and even banks provide financial support to the mills through overdraft limits, working capital limits, etc. (IFIC Bank & ICB, 2017)	1. The increasing import cost of machinery for depreciation of taka. 2. Intermediaries' commission inflated rice prices and consumers, increasing the rice miller's production price. 3. Seasonal fluctuation of paddy production creates a shortage of raw materials for rice millers.
Opportunity	**Threats**
1. Expansion into related industries, such as rice bran oil production or rice-based snack manufacturing. 2. Rice millers have the opportunity for vertical integration with the farmers. 3. Labor or technician availability according to area or location.	1. The climate factors are omitted in the rice processing for auto rice mills. Fluctuations in the exchange rate can affect the cost of imported equipment and supplies. 2. Farmers switching to more profitable crops like maize, potato, jute, pulses, and oilseeds might increase paddy prices.

Chapter 7

Future Outlook

The rice processing industry in Bangladesh is an important sector of the country's economy. It has been a significant source of employment and income for millions of people, particularly in rural areas. The industry has experienced substantial growth in recent years and is expected to expand. Here are some predictions for the industry's future, potential opportunities and challenges, and innovations and trends that could shape its future.

7.1 Predictions for the Future of the Industry

Bangladesh's rice processing industry is expected to continue to grow due to several factors, such as the country's increasing population and demand for rice, rising income levels, and government initiatives to support the sector. The increasing demand for rice due to a growing population is expected to drive the industry's growth in the coming years. Additionally, the government of Bangladesh has been implementing several policies and initiatives to support the industry, such as providing subsidies and incentives for rice millers, enhancing infrastructure and logistics, and improving access to finance. These initiatives are expected to boost the industry's growth potential. However, this industry is projected to grow at a CAGR of 4.1% by 2028, driven by increasing investments in modernization, technology, and infrastructure (MordorIntelligence, 2023).

7.2 Potential Opportunities and Challenges Facing the Industry

7.2.1 Opportunities

Increasing Demand for Rice: The growing population of Bangladesh supports the rising demand for rice, leading to more industry opportunities. The increasing income levels and changing dietary habits, especially among urban consumers, are also likely to create more opportunities for the industry.

Government Support: The government of Bangladesh has been implementing several policies and initiatives to support the industry, such as providing subsidies and incentives for rice millers, enhancing infrastructure and logistics, and improving access to finance. These initiatives are expected to create more opportunities for the industry and make it more competitive globally.

Export Potential: Bangladesh has the potential to become a major rice exporting country, especially to the United Arab Emirates, Saudi Arabia, Australia, Brunei, Bhutan, Canada, Switzerland, the UK, France, Germany, Finland, Greece, Hong Kong, Ireland, Italy, Jordan, Japan, Lebanon, the Maldives, Nepal, New Zealand, Myanmar, Mauritius, Malaysia, Kuwait, Liberia, and South Africa. Private firms, including Ispahani, Square, and Pran, export an estimated 10,000-16,000 tonnes of packaged aromatic rice to more than 135 countries annually. Besides, 4,500-10,000 tonnes are exported for expatriate Bangladeshis working and living in different countries (The Financial Express, 2023). However, the government has tried to increase exports by improving quality and reducing trade barriers.

Expanding into Related Industries: Expanding into related industries, such as rice bran oil production or rice-based snack manufacturing, can be a promising opportunity for the rice mill industry in Bangladesh. Rice bran oil production is a potential industry as Bangladesh produces a significant amount of rice bran, and rice-based snack manufacturing can capitalize on the growing trend for healthy snack options. However, expanding into related industries requires significant investment and involves additional risk. Rice millers would need to acquire new knowledge and skills and establish new distribution channels and marketing strategies. The decision to expand into related industries should be carefully considered and planned.

Vertical Integration Opportunity: Vertical integration is a potential opportunity for Bangladeshi rice millers to improve their competitiveness by ensuring a consistent supply of high-quality rice, reducing costs, and having greater control over the production process. Rice millers can pursue vertical integration by establishing direct relationships with farmers, investing in rice cultivation, and diversifying into related industries such as rice bran oil production or rice-based snack manufacturing. However, vertical integration involves significant investment in terms of capital and resources and requires a long-term commitment, and rice millers must carefully consider and plan before pursuing this opportunity

7.2.2 Challenges

Competition from Imported Rice: Despite being a major rice-producing country, Bangladesh still imports rice from other countries. Imported rice, which is often cheaper, could challenge the local industry. This could affect the industry's growth potential and competitiveness in the global market.

Infrastructure and Logistics: The industry requires significant investments in infrastructure and logistics, such as road networks, transportation, and storage facilities, to reach its full potential. A lack of proper infrastructure and logistics could affect the industry's efficiency and productivity.

Lack of Modernization: Most rice mills in Bangladesh still use traditional methods and equipment, which could limit the industry's growth potential. The industry needs to invest in modernization, such as adopting mechanization and automation, to improve efficiency and productivity.

7.3 Innovations and Trends in the Industry that Could Shape its Future

Mechanization and Automation: The industry is gradually shifting towards mechanization and automation, with more rice mills adopting modern equipment and technology to improve efficiency and productivity. Mechanization and automation can reduce labor costs, increase production efficiency, and enhance the quality of rice.

Value Addition: There is a growing trend towards value addition in the industry, with rice millers producing processed rice products such as parboiled rice, bran oil, and rice flour to cater to changing consumer preferences. Value-added products can increase revenue and profitability for rice millers.

Sustainability: The industry is becoming more environmentally conscious, with rice millers adopting sustainable practices such as using renewable energy sources and reducing water usage. Sustainable practices can help reduce costs, improve brand reputation, and contribute to a better environment.

In conclusion, the future outlook for the rice processing industry in Bangladesh is positive, with significant opportunities for growth and expansion. However, the industry also faces several challenges that need to be addressed, such as competition from imported rice, infrastructure, logistics issues, and modernization. Innovations and trends such as mechanization and automation, value addition, and sustainability will significantly shape the industry's future.

Chapter 8

Socio-Economic Analysis

We have already mentioned in Section 2 that this study has taken 50 samples from five Divisions in Bangladesh, namely Chittagong, Dhaka, Khulna, Rajshahi, and Rangpur, where more than half of the firms are located in Rajshahi Division (as depicted in Figure 12). All the firms in the study were locally owned, with 84% solely owned, while the remainder comprised partnership businesses and private limited companies (as illustrated in Figure 13). The size of the firms was classified into four categories: Micro, Small, Medium, and Large, based on the number of employees, where 38% are micro, and 40% are small firms (as shown in Figure 14).

Figure 12. Distribution of Firms by Division

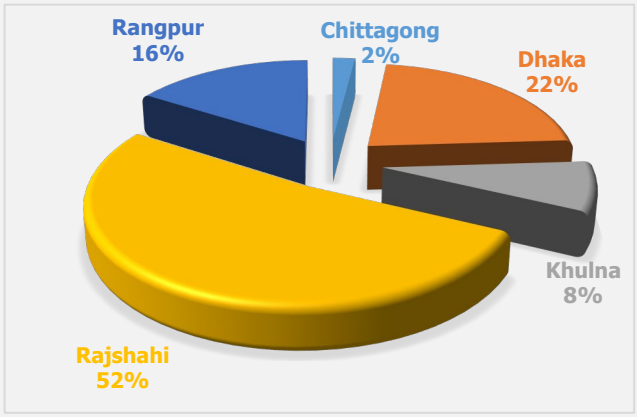


Figure 13. Distribution of Firms by Types of the Organization

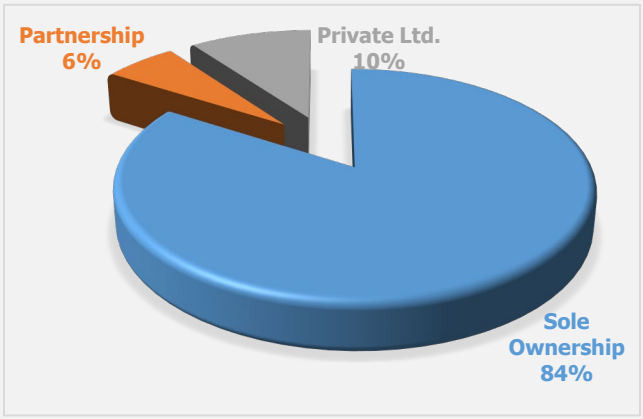
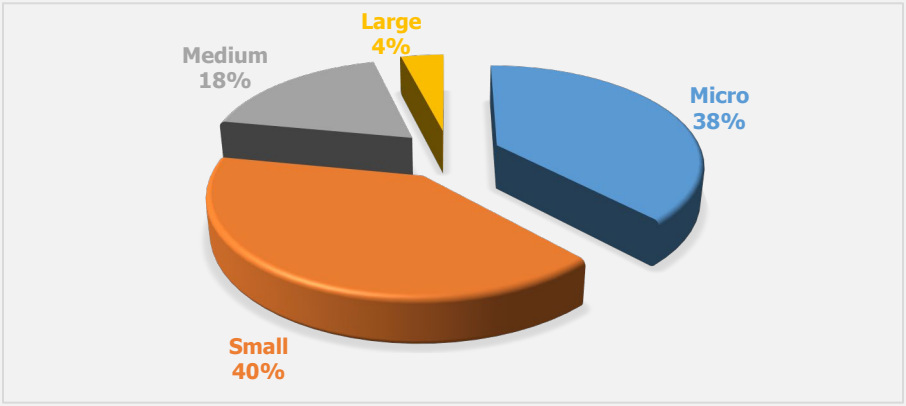


Figure 14. Distribution of Firms by the Size of the Organization



8.1 Socio-Economic Profile of Owners

Socio-economic factors such as age, education, and experience are crucial in determining an entrepreneur's ability to efficiently and effectively operate a business and impact their income (Barmon et al., 2012; Mamun et al., 2018; Mamun & Arfanuzzaman, 2020). Considering this importance, this study focused on the owners' age, education, and experience. The analysis reveals that, on average, the owners of rice mills in Bangladesh are 47.52 years old and possess 17.84 years of experience (Table 11), indicating they have great maturity and expertise to manage their businesses effectively. Moreover, the owner's education level is relatively high, ranging from higher secondary to graduate and above. Among

the sample respondents, 48% have completed a graduation degree, 24% HSC, 18% SSC, and only 10% have passed high school (Table 11). These findings also suggest that a significant portion of the respondents have higher educated, which is crucial for the future growth of this industry.

Table 11. Socio-Economic Profile of Rice Mill Owners

Characteristics	Results
Age (Mean & SD)	47.52 (8.95)
Experience (Mean & SD)	17.84 (9.35)
Education of the Owners (%)	
High School	10
SSC	18
HSC	24
Graduate & above	48
N	**50**

8.2 Summary of Total Cost, Revenue, Current Asset, Fixed Asset, Insurance, Mortgage, and Loan

Table 12 presents an overview of the statistical data categorized by the organization's size for various variables of interest. The total cost of firms includes all types of fixed and variable costs associated with operating a rice mill. On average, micro firms incur a total yearly cost of Tk.164.19 million, while small firms have a total cost of Tk.458.51 million, medium firms have a total cost of Tk.894.59 million, and large firms have a total cost of Tk.1765.20 million. Table 14, located in the appendix, provides a breakdown of the total cost, with the cost of goods sold being the main expense, accounting for over 90% of the total cost of a rice mill. On average, micro firms have a yearly cost of goods sold of Tk.158.51 million, small firms have a cost of Tk.424.61 million, medium firms have a cost of Tk.841.93 million, and large firms have a cost of Tk.1685.22 million. In addition to the cost of goods sold, the second essential cost is financial services, including bank charges and transaction fees. The average yearly cost of financial services for micro firms is Tk.2.24 million; for small firms, it is Tk.12.60 million; for medium firms, it is Tk.25.81 million; and for large firms, it is Tk.31.20 million. Moreover, the wages seem to be another highest cost of the rice mill, where the lowest cost (Tk.1.76 million) belongs to micro firms, and the highest cost (Tk.15.93 million) belongs to medium firms.

Alternatively, in terms of average yearly revenue, micro-firms earned Tk.172.04 million, small firms earned Tk.509.44 million, medium firms earned Tk.968.53 million, and large firms earned Tk.1819.01 million, as shown in Table 12. Regarding average yearly net profit, micro firms had an average of Tk.7.85 million, while small firms earned Tk.50.92 million and large firms earned Tk.53.80 million. However, medium firms generated the highest average net profit of Tk.73.93 million, as detailed in Appendix (Table 14).

Table 12 presents the summary statistics of total current and total fixed assets, demonstrating that large firms possess higher levels of total current and fixed assets, valued at Tk.465.99 million and Tk.451.63 million, respectively. In comparison, micro firms have comparatively low levels of these assets, valued at Tk.54.57 million and Tk.54.68 million, respectively. This pattern is also observed in the total insurance value, mortgage amount, and loan amount. However, Table 15 in the appendix shows that land and buildings, followed by machines and vehicles, are the primary fixed assets for all firms. Another table in the appendix (Table 16) illustrates the classified summary statistics of current assets, highlighting that closing inventories are the primary current asset, followed by A/C receivables. Furthermore, large firms tend to have higher average loan amounts, mortgages, and insurance amounts than firms of smaller

sizes. Despite this, Table 12 demonstrates that as firms grow, their revenue, assets, and costs increase, even though the average level of experience among employees is comparatively low.

Table 12. Summary Statistics

In a million BDT

Variables	Micro		Small		Medium		Large	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Total Cost (Million, Taka)	164.19	158.59	458.51	729.49	894.59	768.49	1765.20	1202.53
Total Revenue (Million, Taka)	172.04	165.05	509.44	851.42	968.53	842.79	1819.01	1241.13
Total Current Asset (Million, Taka)	54.57	58.33	203.49	350.42	392.93	385.33	465.99	161.47
Total Fixed Asset (Million, Taka)	54.68	67.03	158.32	127.99	322.78	159.35	451.63	229.17
Total Insurance (Million, Taka)	18.81	22.04	32.34	18.95	83.18	53.98	197.69	101.42
Total Mortgage (Million, Taka)	53.04	50.11	147.08	190.71	381.42	241.89	390.85	186.65
Total Loan (Million, Taka)	34.78	51.29	104.26	146.95	284.45	282.52	331.23	148.31

Table 13 represents the Benefit-Cost Ratio (BCR) by the organization's size. The BCR is higher for small firms (Tk.1.11) and lower for large firms (Tk.1.03). The average total BCR is Tk.1.07, which means that a firm has received a return of Tk.1.07 for every Tk.1.00 investment. The BCR is higher than the previous study by Rahman et al. (2017). Finally, it can be concluded that the business is profitable for each size of the organization, and a firm can earn a profit by spending each taka.

Table 13. Benefit-Cost Ratio (BCR) by the Size of the Organization

Micro	Small	Medium	Large	Total
1.05	1.11	1.08	1.03	1.07

8.3 Problems and Prospects

8.3.1 Prospects

Bangladesh is the third-largest rice-producing country in the world (Statista, 2023). The demand for rice is inelastic as it is the primary food grain of Bangladesh (Alam, 2010-2011). The demand does not change significantly with price, and low sales uncertainties as all rice products are saleable:

- Stone-feed
- Rice-plain
- Bran-Oil
- Tush-Mill
- Broken Rice-poor people buy them and are also used as feed

Moreover, auto rice mills are entitled to rice allotment or incentives from the government (Bangladesh Grain and Feed Annual, 2013), and even banks provide financial support to the mills through overdraft limits, working capital limits, etc. (IFIC Bank & ICB, 2017). Moreover, demand for rice increases with the population; the income is fixed with low leverage risk. All these factors make the rice mill industry an area of possibility and future investments. Several factors can enhance the possibilities for the rice industry.[6] These include:

- Eliminating intermediary or mediators' commission costs to reduce overall costs.
- Implementing machine-intensive mills, particularly for husking, to decrease labor costs and monitoring expenses.
- Obtaining export permission for manufacturers, which can be advantageous in light of surplus rice production.

[6] Information was gathered based on interviews with Financial Analysts of Emerging Credit Rating Limited and rice mill owners during surveys. Moreover, analysis had been further conducted by the Research Department of Emerging Credit Rating Limited.

- Establishing good relationships with suppliers to promote flexible and robust supply chain management.
- Automating production processes through conversion to auto rice mills to ensure market survival and credibility.
- Omitting climate factors during rice processing in auto rice mills.
- Leveraging the extensive experience of proprietors to maintain a strong presence in the local area and preserve market share.
- Utilizing labor or technician availability depending on the location or area.
- Implementing a sound marketing strategy, such as using small packaging to facilitate easier consumer storage and the purchase of smaller quantities as needed.

8.3.2 Problems

The rice industry is susceptible to intense competition, which may pose challenges for small firms. Additionally, different types of mills may pose challenges, with Husking Rice Mills being lengthier and more labor-intensive than automated rice mills and the drying process taking longer. Other factors that could potentially cause problems include:[7]

- Large firms are entering the paddy grain market, which would intensify competition and potentially drive small millers and traders out of the market.
- Inadequate electricity supply in remote areas and labor shortages could hinder production.
- Technological advancements could reduce the need for labor every time specialized machinery is developed or improved.
- Some mills may not produce certain by-products, such as Husking Mills not producing bran.
- The lack of government incentives and tax rates could boost the industry.
- Paddy price volatility is caused by crop damage, lower rice production, and import impacts.
- The export ban of aromatic rice from Bangladesh by the commerce ministry in July 2022 to control market volatility, which has already affected the export of overall agricultural products.
- Environmental hazards, such as the occurrence of "tush" in the air, cause breathing problems in certain areas. An "Environmental Clearance Certificate" is required for production.
- Political syndicates are influencing distributional costs.
- Climate-related issues, such as floods, can destroy paddy and raise prices.
- Management issues, including misalignment of managers' goals with the firm's objectives and maintenance problems resulting from unskilled or untrained technicians operating machinery.
- Farmers switched to more profitable crops like maize, potato, jute, pulses, and oilseeds, which could increase paddy prices.

In addition, negative sentiments among rice manufacturers are arising due to delayed crop planting caused by less rain this season and a low supply of urea, leading to concerns about potential increases in paddy prices.

[7] Information was gathered based on interviews with Financial Analysts of Emerging Credit Rating Limited and rice mill owners during surveys. Moreover, analysis had been further conducted by the Research Department of Emerging Credit Rating Limited.

Chapter 9

Conclusion

The fundamental aim of this study is to acquire a comprehensive comprehension of the rice processing industry in Bangladesh. To fulfill this objective, the study endeavors to comprehensively analyze diverse facets of the industry, encompassing rice farming, production, consumption, demand, growth, import-export, and pricing. Additionally, the study seeks to provide a step-by-step analysis of rice milling, encompassing by-products, marketing channels, and government policies. The other aim of this analysis is to evaluate the industry's competitiveness and future prospects. Furthermore, the study aims to assess the socio-economic status of industry owners. To accomplish these objectives, the research methodology utilized both primary and secondary data, including the tabular method, summary statistics, and benefit-cost ratio analysis.

The study revealed that the rice processing industry in Bangladesh attracts relatively young, educated, and experienced entrepreneurs. Furthermore, the industry exhibits economic profitability across all organizational sizes. The average annual net profit for micro, small, medium, and large firms is Tk.7.85 million, Tk.50.92 million, Tk.73.93 million, and Tk.53.80 million, respectively. Additionally, the benefit-cost ratios for micro, small, medium, and large firms are 1.05, 1.11, 1.08, and 1.03, respectively. The average benefit-cost ratio for the rice processing industry overall is 1.07. Ultimately, the study concludes by outlining certain policy implications of the rice processing industry in Bangladesh. However, notwithstanding the industry's profitability, business owners encounter various operational challenges.

Ultimately, our analysis leads us to conclude that the profit margin of rice millers may not be significantly high when their contribution to employment generation is considered. However, it is essential to note that our study did not utilize probability sampling with large sample size and did not incorporate an assessment of the efficiency of rice mills. Therefore, drawing any definitive conclusions regarding the profit margins of millers would be premature at this juncture. As a result, we recommend conducting an extensive investigation that employs probability sampling with a large sample size and encompasses a range of factors such as mill efficiency measurement, storage practices, trading challenges, and the profit margins of other intermediaries to gain a comprehensive understanding of the role of rice milling industries in the economy of Bangladesh.

References

Bangladesh Bank. (2023). *Monthly Economic Trends*. https://www.bb.org.bd/en/index.php/publication/publictn/3/10

Barmon, B. K., Sharmin, I., Abbasi, P. K., & Mamun, A. (2012). Economics of Mushroom (Agaricus bisporus) Production in a Selected Upazila of Bangladesh. *The Agriculturists*, *10*(2), Article 2. https://doi.org/10.3329/agric.v10i2.13144

BBS. (2021). *বাংলাদেশ পরিসংখ্যান ব্যুরো-গণপ্রজাতন্ত্রী বাংলাদেশ সরকার*. http://www.bbs.gov.bd/

BRKB. (2022). *Rice in Bangladesh*. https://www.knowledgebank-brri.org/riceinban.php

BRRI. (2019). *Bangladesh Rice Research Institute-Government of the People |'s Republic of Bangladesh*. https://badc.portal.gov.bd/sites/default/files/files/badc.portal.gov.bd/page/c23bdffd_22fd_4f15_8fc4_b1fc7a91a36a/2020-09-01-14-15-bbb411c861df9a62fdafcccbd8025192.pdf

CBECL. (2012). *Auto Rice Milling Machinery*. https://www.cbecl.info/2012/09/auto-rice-mill-machines.html

FAO. (2016). *Country fact sheet on food and agriculture policy trends—Bangladesh*. https://www.fao.org/3/i5890e/i5890e.pdf

Hossain, M., Bose, M. L., & Mustafi, B. A. A. (2006). Adoption and Productivity Impact of Modern Rice Varieties in Bangladesh. *The Developing Economies*, *44*(2), 149–166. https://doi.org/10.1111/j.1746-1049.2006.00011.x

Hossain, M., Jaim, W. M. H., Alam, M. S., & Rahman, A. M. (2013). *Rice biodiversity in Bangladesh: Adoption, diffusion and disappearance of varieties: a statistical report from farm survey in 2005*. http://dspace.bracu.ac.bd/xmlui/handle/10361/13271

IDLC. (2021). *RICE MILL INDUSTRY OF BANGLADESH*. https://idlc.com/mbr/article.php?id=367

Index Mundi. (2022). *Bangladesh Milled Rice Production by Year (1000 MT)*. https://www.indexmundi.com/agriculture/?country=bd&commodity=milled-rice&graph=production

Koichi, F. (2011). Re-thinking Economic Development: The Green Revolution, Agrarian Science, and Transformation in Bangladesh. *Agricultural History*, *85*(2), 284–285. https://doi.org/10.3098/ah.2011.85.2.284

macrotrends. (2023). *Bangladesh Arable Land 1961-2023*. https://www.macrotrends.net/countries/BGD/bangladesh/arable-land

Mamun, A., & Arfanuzzaman, MD. (2020). The Effects of Human Capital and Social Factors on the Household Income of Bangladesh: An Econometric Analysis. *Journal of Economic Development*, *45*(3), 29–49. https://doi.org/10.35866/caujed.2020.45.3.002

Mamun, A., Rahman, A., & Afrooz, N. (2018). A Socio-economic Analysis of Private Plant Nursery Business in Bangladesh. *The Agriculturists*, *16*(02), Article 02. https://doi.org/10.3329/agric.v16i02.40348

MordorIntelligence. (2023). *Bangladesh Rice Market Size & Share Analysis—Industry Research Report—Growth Trends*. https://www.mordorintelligence.com/industry-reports/bangladesh-rice-market

Muthayya, S., Sugimoto, J. D., Montgomery, S., & Maberly, G. F. (2014). An overview of global rice production, supply, trade, and consumption. *Annals of the New York Academy of Sciences*, *1324*(1), 7–14. https://doi.org/10.1111/nyas.12540

Rahman, A., Mamun, A., Afrooz, N., Howlader, S., & Khuda, A. (2017). Rice Processing Industry of Bangladesh: An Economic Analysis. *Department of Research| Emerging Credit Rating Limited, Dhaka, Bangladesh*, *Working Paper 01*, 1–34.

Rice Knowledge Bank. (2017). *Commercial rice milling systems*. http://www.knowledgebank.irri.org/index.php?option=com_zoo&view=item&layout=item&Itemid=1030

Shelley, I. J., Takahashi-Nosaka, M., Kano-Nakata, M., Haque, M. S., & Inukai, Y. (2016). Rice Cultivation in Bangladesh: Present Scenario, Problems, and Prospects. 農学国際協力, *14*, 20–29. https://doi.org/10.50907/jicad.14.0_20

Statista. (2023). *Leading countries based on production of milled rice 2022*. Statista. https://www.statista.com/statistics/255945/top-countries-of-destination-for-us-rice-exports-2011/

The Business Standard. (2020, November 12). *Per capita rice consumption in Bangladesh to be highest in Asia in 2021: FAO*. The Business Standard. https://www.tbsnews.net/bangladesh/capita-rice-consumption-bangladesh-be-highest-asia-2021-fao-157333

The Daily Star. (2023). *Hoarding food Illegally: Culprits to face sentence up to life term*. The Daily Star. https://www.thedailystar.net/news/bangladesh/news/hoarding-food-illegally-culprits-face-sentence-life-term-3293916

The Financial Express. (2023). *Exporters fear losing aromatic rice market due to export ban*. The Financial Express. https://thefinancialexpress.com.bd/trade/exporters-fear-losing-aromatic-rice-market-due-to-export-ban-1661829886

USDA. (2022, July 25). *Bangladesh: Grain and Feed Update*. USDA Foreign Agricultural Service. https://www.fas.usda.gov/data/bangladesh-grain-and-feed-update-23

World Bank. (2023). *World Bank Climate Change Knowledge Portal*. https://climateknowledgeportal.worldbank.org/

Worldometer. (2023). *Bangladesh Population (2023)*. https://www.worldometers.info/world-population/bangladesh-population/

Zaman, Z. U., Mishima, T., Hisano, S., & Moha'sci, G. (2001). The role of rice processing industries in Bangladesh: A case study of the Sherpur district. *Review of Agricultural Economics - Hokkaido University (Japan)*. https://scholar.google.com/scholar_lookup?title=The+role+of+rice+processing+industries+in+Bangladesh%3A+A+case+study+of+the+Sherpur+district&author=Zaman%2C+Z.U.+%28Hokkaido+Univ.%2C+Sapporo+%28Japan%29%29&publication_year=2001

Appendix

Table 14. Net Profit by Size of the Organization

In a million BDT

Particular	Micro		Small		Medium		Large	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Total Cost of Goods Sold	158.51	154.41	424.61	498.81	841.93	731.21	1685.22	1091.45
Total expenditures on wages in the last 12 months	1.76	2.81	10.51	31.39	15.93	24.59	7.01	6.78
Professional and business fees	0.05	0.12	0.03	0.01	0.05	0.00	0.01	0.00
Utilities	0.05	0.04	0.08	0.09	2.96	6.67	0.62	0.79
Office and computer-related expenses	0.08	0.09	0.12	0.09	0.17	0.15	10.22	14.21
Telephone, Internet, and others telecommunication	0.05	0.03	0.07	0.01	0.11	0.04	0.24	0.25
Business taxes, licenses, and permits	0.03	0.03	16.35	50.00	12.74	17.80	-	-
Rental and leasing	0.27	0.19	0.05	0.01	0.09	0.09	0.63	0.80
Repair and maintenance	0.15	0.11	0.23	0.17	0.17	0.07	0.75	0.87
Amortization and depreciation	2.36	2.10	5.48	6.53	7.69	13.20	25.86	22.58
Insurance	0.08	0.08	0.15	0.11	0.34	0.39	1.02	1.22
Advertising, marketing, promotion, meals, and entertainment	0.09	0.12	0.28	0.39	0.16	0.16	1.25	0.13
Travel, meetings, and conventions	0.11	0.09	0.15	0.11	0.21	0.11	0.74	0.51
Financial services	2.40	2.98	12.60	35.00	25.81	36.83	31.20	24.68
Interest expense	3.08	1.21	0.72	0.94	-	-	-	-
Other non-production related costs and expenses	0.66	1.25	0.15	0.09	0.20	0.11	0.32	0.25
All other costs and expenses	0.50	0.62	3.87	9.29	5.31	8.15	1.53	0.16
Total Expenses	**164.19**	**158.59**	**458.51**	**729.49**	**894.59**	**768.41**	**1765.20**	**1202.53**
Total Revenue	**172.04**	**165.05**	**509.44**	**851.42**	**968.53**	**842.79**	**1819.01**	**1241.13**
Net Profit	**7.85**	**6.46**	**50.92**	**121.92**	**73.93**	**74.38**	**53.80**	**38.59**

Table 15. Breakdown of the Fixed Assets by Size of the Organization

In a million BDT

Fixed Assets	Micro Firm		Small Firm		Medium Firm		Large Firm	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Land and Building	52.28	63.55	139.01	93.78	266.01	91.76	256.31	40.10
Machine and Vehicles	6.77	10.29	34.04	51.35	129.77	148.52	183.91	175.11
Office Equipment	0.72	0.64	-	-	-	-	-	-
Electric Goods and Fittings	-	-	5.39	6.83	0.52	0.36	-	-
Others Fixed Assets	0.84	0.92	6.46	18.92	0.55	0.31	1.17	-
Total Fixed Assets	**54.68**	**67.03**	**158.32**	**127.99**	**322.78**	**159.35**	**451.63**	**229.17**

Table 16. Breakdown of the Current Assets by Size of the Organization

In a million BDT

Current Assets	Micro Firm		Small Firm		Medium Firm		Large Firm	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Inventories/ Stock (Closing)	41.58	49.88	116.33	161.75	265.85	229.60	382.60	238.11
Cash in Hand	1.22	1.59	7.57	15.52	4.86	8.56	1.11	0.63
Cash at Bank	0.87	1.15	22.61	76.37	4.76	10.09	0.50	0.29
A/C Receivables	10.35	12.73	53.55	91.45	90.78	130.73	80.04	75.51
Advance, Deposit, and Repayments	1.63	1.15	12.84	27.70	55.14	123.46	1.74	0.79
Total Current Assets	**54.57**	**58.33**	**203.49**	**350.42**	**392.93**	**385.33**	**465.99**	**161.47**

About us

Emerging Credit Rating Limited (hereinafter referred to as ECRL) began its journey in the year 2009 with the motive to deliver credible superior & quality credit rating opinion in various industry segments around Bangladesh. ECRL obtained credit rating license from Bangladesh Securities and Exchange Commission (BSEC) in June 2010 as per Credit Rating Companies Rules 1996 and also received Bangladesh Bank Recognition as an External Credit Assessment Institutions (ECAI) in October 2010 to do the rating of Banks, Financial Institutions and their borrowers and also from Insurance Development & Regulatory Authority (IDRA) in 2015 to do the rating of Insurance Companies & affiliated with Malaysian Rating Corporation Berhad.

Emerging Credit Rating Limited's team is oriented towards the continuous improvement of processes, striving for an important role in the leadership of the business world. Every individual in ECRL is committed to providing topmost ingenious Credit Rating Services and Comprehensive Research Services in Bangladesh. ECRL's rating services and solutions reflect independence, professional, transparency and impartial opinions, which assist businesses in enhancing the quality of their decisions and helping issuers access a broader investor base and even smaller known companies approach the money and capital markets. The Credit Rating process is an informed, well-researched and intended opinion of rating agencies on the creditworthiness of issuers or issues in terms of their/ its ability and willingness of discharging its financial obligations in a timely manner. Issuers, lenders, fixed-income investors use these risk assessments for the purpose of lending to or investment in a corporation (such as a financial institution, an insurance company, a non-banking corporation or a corporate entity) as well as evaluating the risk of default of an organization's financial obligations in terms of loan or debt.

Find out more about our work on our website
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Editorial Overview

ECRL Research *provides insights, opinions and analysis on Bangladesh and International Economies and Business. ECRL Research conducts surveys and produces working papers and reports on Bangladesh's different socio economic and business issues, industries and capital market. It also provides training programs to professionals from financial and economic sectors on a wide array of technical issues.*

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