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Contents

Impact Assessment of Mechanized Shelling on Maize Yield Efficiency and Farm Profit in Rural Bangladesh 1–16

Prianka Basak; Farhana Yeasmin; Jannatul Ferdous; Md. Nazmus Sadekin

Development Diplomacy in Changing Political Transition: Envisioning a Developed and Prosperous Bangladesh 17–39

Razia Sultana; Fahim Shahriar

Energy Transition and Carbon Emissions in Bangladesh: A Nonlinear Analysis of Renewable and Fossil Energy Consumption 40–65

Al Amin Al Abbasi

Climate Change, Biodiversity Loss, and Livelihood Adaptation: Perspectives from *Beel* Dependent Artisanal Fishers in Bangladesh 66–87

Md. Ariful Islam; Al-Amin Sarkar; Md. Firoz Hossain; Nahid Hasan; Fuad Hasan

Attaining SDG 13: Assessing Bangladesh Scenario 88–111

Segufta Hossain

Economic Participation Without Protection: A Systematic Literature Review on Women's Vulnerability in Bangladesh's Urban Economy 112–136

Maisha Akter Trina; Md. Ariful Islam

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Vol. 7, No. 1&2, June-December 2025, (Page 1–16) ISSN: 3078-6614 (Online)

Impact Assessment of Mechanized Shelling on Maize Yield Efficiency and Farm Profit in Rural Bangladesh

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Abstract

Maize has become the second most important cereal crop in Bangladesh after rice due to its high demand in poultry feed and food industries. Its adaptability to diverse agro-climate zones, shorter growing period, and higher profitability contributed to its rapid expansion nationwide. But post-harvest inefficiencies, such as manual shelling, still pose significant challenges for rural farmers. The main objectives of this study include: (i) assessing the economic impact of maize shellers on farmers' overall productivity (ii) evaluating the effect of sheller use on labor costs and post-harvest losses (iii) analyzing both benefits and barriers of adopting a maize sheller machine. Using primary data of 80 maize farmers collected through convenience sampling, the study results explore that high adoption of maize shellers increases efficiency of maize cultivation. Engine-operated maize shellers are highly preferred by adopters. Farmers who adopt the technology report increased maize productivity and higher profit due to reduced labor costs, easier and quicker shelling, good grain quality, and higher maize price. Efficiency challenges such as high rent, fuel prices, and maintenance costs make it difficult to get proper output. Moreover, absence of subsidies limits broader adoption. Financial support, advanced technology, and training programs can boost adoption and increase profitability among rural farmers.

Keywords: Maize production, maize sheller, rural farmers, mechanization, profitability

JEL Classification: Q12, Q16

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1. Introduction

Bangladesh, being a South Asian agrarian economy, is significantly dependent on agriculture, which remains crucial to the nation's advancement in both its economy and society. More than 70% of the population and around 45% of the labor force depend on agriculture, which constitutes about 11.19% of the national GDP. Maize represents one of the most significant and lucrative cereal crops in the country (Adnan et al., 2021). According to socioeconomic investigations, maize is more profitable than rice (Ali et al., 2009) and mustard (Uddin et al., 2021). Thus, maize production has exceeded wheat production in Bangladesh and has become an essential meal and commercial crop.

Maize is a very useful food that can be used for many things. People eat it as a main food in numerous forms, including cornmeal, tortillas, popcorn, and breakfast cereals. It additionally acts as a significant biofuel that is made from corn. Corn is turned into cornflour, corn syrup, and corn oil for use in industry. Corn starch is used to make plastics, fabrics, and other chemicals (Corn starch, 2016). In the biochemical business, maize waste is also used for cultivating microorganisms in culture media (Liggett and Koffler, 1948).

In Bangladesh, maize grows nationwide, especially in the Rangpur, Rajshahi, Bogura, and Tangail districts, predominantly during the Rabi season. Productivity has significantly risen over the past years—from 4.56 million tons in fiscal year 2022-23 to 4.87 million tons in 2023-24—attributed to advantageous climate conditions and escalating consumer demand. Nonetheless, domestic output continues to falter in satisfying the escalating demand from customers, highlighting the necessity for enhanced after-harvest supervision and mechanized manufacturing. Notwithstanding its significance, maize cultivation in Bangladesh continues to encounter substantial post-harvest difficulties. Over fifty percent of the maize shelling process is conducted using non-mechanized or substandard equipment, resulting in a significant incidence (7% to 8%) of fractured kernels (Milufarzana et al., 2015). These compromised kernels are particularly vulnerable to exposure to aflatoxin throughout preservation, presenting health hazards to both individuals and their animals.

The introduction of maize sheller devices in Bangladesh commenced in the 1990s, coinciding with the implementation of regulations aimed at facilitating both imports and domestic production of farming equipment, including shellers, to improve productivity (Ahmmed, 2014). Since that time, mechanization has assumed a growing importance in the nation's shift from conventional agriculture for survival to a more commercialized economy (MOA, 2020). Conventional shelling techniques were arduous and protracted, however the mechanized sheller provided an effective alternative by enhancing efficiency and reducing labor requirements. Power-operated maize shellers have gained popularity among farmers over time (Roy et al., 2007). The Division of Agricultural Extension (DAE), a subsection of the government's Ministry of Agriculture, has been instrumental in advancing maize shellers via

subsidies, policy assistance, and training initiatives (MOA, 2020).The Bangladesh Agricultural Research Institute (BARI) has created and evaluated maize sheller designs that are suitable for tiny and mid-sized farmers. These devices—manual and powered—are user-friendly, cost-effective, and necessitate low upkeep (Hossain et al., 2017). BARI initially created hand-powered shelling machines for small-scale applications, subsequently developing high-powered power shelling machines for massive scales (Hossain et al., 2017). To guarantee optimal yield and quality, corn cobs must be adequately dried prior to shelling (Hossain et al., 2017).

Mechanized agriculture has increased output, lowered expenses, and boosted productivity worldwide. A one percent improvement in agricultural mechanization in Hubei, China, enhanced crop production by almost 1% (Peng et al., 2022). Modern and environmentally friendly methods minimize post-harvest losses, worker shortages, efficiency of resources, and climate adaptation (FAO, 2025). Mechanization remains difficult for small-scale farmers due to high expenses, inadequate training, and restricted credit. Threshers, shelling machines, and combine harvesters boost efficiency in manufacturing and reduce labor. The process of shelling is one of the most laborious post-harvest tasks in maize farming. Maize shellers—manual, motorized, and gasoline-powered—efficiently separate kernels from cobs. Mechanized shellers prevent after-harvest damage, increase the quality of grains, and boost farmers' revenue (FAO, 2025).

Biswas et al. (2023) explore the cost-return structure and input efficiency in maize farming in Bangladesh using 80 selected respondents with Cobb-Douglas production function in Chuadanga

district. Where farmers are divided by three categories like marginal, small and medium and interestingly smaller farms are highly efficient. Most challenges identified like high input costs, lack of labor supply, declining soil fertility and less technology knowledge. Islam and Hoshain (2022**)** explain that maize is an income-generating crop in Bangladesh but it faces several challenges like poor seed access, lower extension services, and poor post-harvest system. They suggest that training, technology, and policy support can boost productivity. Adnan et al. (2021) led a thorough analysis on profit efficiency and reason behind inefficiency in hybrid maize production in Bangladesh done by using data of 350 farmers. Analysis explains that maize farming is highly profitable but factors like age, education, less access to extension service make it difficult to gain more profitable. Author suggests that efficiency can boost by improving in education, soil management, irrigation agricultural training. Adnan et al. (2021) led a thorough analysis on profit efficiency and reason behind inefficiency in hybrid maize production in Bangladesh done by using data of 350 farmers. Analysis explains that maize farming is highly profitable but factors like age, education, less access to extension service make it difficult to gain more profitable. Author suggests that efficiency can boost by improving in education, soil management, irrigation agricultural training. Hajong et al., (2023) analyzed the input intensity and profitability of maize production in major maize-

growing districts-Chuadanga, Jhenaidah, Meherpur and Khustia in Bangladesh with 160 respondents. Study reveals that the maize production is highly labor-intensive and highly depends on fertilizer. High price of fertilizer makes it difficult to gain more profit from maize production. According to Hunt (2022**)** Bangladesh's agriculture sector faces great transformation from manual to widespread use of mechanized tools. Government policy after 1988 and a great transformation increase the demand of machineries but there are several challenges hinder the full mechanization. Rahman et al., (2021) screening the mechanization of farm in Bangladesh and found that irrigation and tillage are mostly mechanized but huge tasks are still on manual labor. Study also found that the Government also takes initiatives during pandemic to raise the mechanization. Author suggests that youth engagement and precision tech for sustainable development. Similar findings were found by Akter et al. (2024).

Begum et al., (2012) found that late harvesting is the main reason for loss of production by the sample of Rangpur and Dinajpur districts of Bangladesh. Study explores notable losses during harvesting, threshing, drying, and storage are happening by the inefficiencies in primitive practices and a significant improved in post-harvest management needed to reduce food and economic losses. Hossain (2017), found that agricultural sector in Bangladesh is dominated by tiny farms with common and easy power tillers. For a vast production and lack of labor supply mechanization and management badly needed because mechanized systems give a huge return than traditional. Specially a mini combine harvester is urgent while maize shellers and rice-wheat threshers are widely used. Study also suggests for training, extension services and policy support in promoting mechanization. Haque et al. (2021), stress on the necessity of operating cost of machinery farm system in Bangladesh. Small -scale machineries are more viable than traditional farming. Vast production, low-cost make it efficient largely. Brown et al., (2024), investigate the adoption of harvest and post-harvest mechanization in Bangladesh across several districts by a non-binary analysis. Study reveals that mechanization rate is very poor to capture true adoption status because of several constraints issues like information gap, lack of training, few farmers satisfaction with extensive service. Author suggests that different strategies need for different district to recognize the need of mechanization. Hossain et al., (2017) conducts a study that develops a two-wheel tractor (2WT)-mounted and cost-effective mobile maize sheller. Unlike traditional shellers, this sheller eliminates transport delays. Moreover, the study highlights the mobile maize sheller as a cost-effective, efficient, and suitable solution for rural areas and useful for other countries using 2WTs. Das et al. (2023), traditional procedure limits the productivity because it very labors intensive, time consuming, low and while maize sheller is an efficient procedure. Along with maize sheller Output rate 5kg/hr compared to traditional procedure. Author claimed that manual shelling is a low-cost and efficient more than traditional method.

Jahan et al. (2019), addressed the traditional issues of maize shelling and tried the satisfaction level of the maize sheller, which was developed at BARI, Gazipur in

2016-2017. The author found that satisfactory performance of maize shellers with minimal grain damage. The study also suggests that machine offers an efficient way of improving the post-harvesting process. A study conducts by Milufarzana et al. (2015) provides a comprehensive analysis of the economic viability of maize shellers for custom hire services in Bangladesh. Study with primary and secondary data analyze operational costs and financial profitability through benefit-cost-ratio (BCR) analysis and break-even analysis. From the analysis, it is seen that maize sheller venture is highly profitable for an entrepreneur.

Roy et al. (2007) emphasize the growing need for mechanization in agriculture. Study analyzes regional variations and economic factors which affect the investment decisions of sheller and found that during peak harvesting seasons, power shellers significantly reduce labor requirements than traditional. Study suggests mechanization as a sustainable solution to labor shortages in rural farming. Lawal et al. (2020), emphasize that motorized mobile maize reduces the losses of post-harvest. Mounted on two-wheel tractors, they improve mobility, lower transport costs, and improve efficiency. The author suggests making them ideal for small-scale farmers in developing countries like Bangladesh.

Begum et al. (2022) analyze the result of adopting the BARI maize sheller in Mymensing by using data of 120 farmers and the propensity Score Matching method. Study finds production increase by maize sheller and adoption is influenced by farmer experience and training. That is benefit is clear but adoption remaining slow in this sector. Author stress on targeted training and institutional support to promote larger use of advance technology for better outcome. Overall studies show maize shellers improve the productivity, most of the studies focus on national level analysis. Few addresses regional adoption conditions, obstacles, necessities. Unfortunately lack of micro-level research especially in rural zone like Tangail. Our study aims to fill the gap by analyzing the economic impact of maize shellers on farmers in Baruha, Tangail.

2. Theoretical Framework

This study is based on many theoretical frameworks that clarify the intricate relationship among agricultural mechanization, productivity on farms, and economic results in a rural setting. These ideas offer a conceptual framework for comprehending the implementation, effects, and ramifications of mechanized shelling on maize agriculture in Bangladesh.

2.1 Production Theory

The production function theory, grounded in the study of economics, describes the highest output possible with given resources and technologies. It analyses how labor, capital, land, and technology affect the production of agriculture (Kurz and Salvadori, 1995). Developments in technology, along with intensive input utilization, should raise the production function, resulting in increased output with the same or fewer inputs (Kurz and Salvadori, 1995).

We expect that the effectiveness of the maize shelling will be enhanced by mechanized shelling because technology can lower the losses of the post-harvest operations and improve the quality of the maize (FAO, 2025). When the process of shelling is mechanized by technology, it enhances the efficiency of the maize production, because it maximizes the conversion of raw maize cobs into commercial grain.

2.2 Diffusion of Innovations Theory

This theory was first demonstrated by E.M. Rogers, sheds light on the propagation of fresh ideas, behaviors, and technological advancement of a community. There are factors that are believed to be the most important in determining relative benefits, its compatibility with conventional processes, the level of challenges, and accessibility (Hietala, 1983).

The rate of mechanized shelling implementation among Bangladeshi producers is critical in terms of its benefits. A better understanding of the factors that either facilitate or hinder the use of this technology is provided by this theory. It is anticipated that the increasing use of mechanized shelling would occur quickly if it is able to deliver economic advantages and can easily be integrated into existing agricultural processes (Straub, 2009).

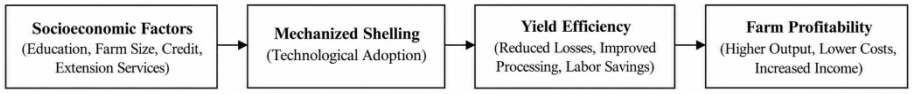
2.3 Efficiency and Profitability Model

Farrell's efficiency paradigm categorizes agricultural efficiency into technical efficiency and allocative efficiency (Farrell, 1957). Technical efficiency assesses a firm's ability to maximize yield with a defined set of inputs, whereas allocative efficiency utilizes the performance of the input via pricing (Farrell, 1957). By speeding up the process, reducing grain breakage, and lowering post-harvest losses, technical efficiency can be improved through mechanized shelling (FAO, 2025). These enhancements lead to increased profitability as unit costs diminish and marketable output rises. This improvement, then, results in higher revenue, as unit costs decrease and the suitable production increases.

This conceptual structure posits that mechanized shelling, a technological advancement in post-harvest processing, significantly improves maize yield and farm earnings by enhancing efficiency and decreasing costs. The extent of implementation in the rural production process is influenced by farmers' views, demographic and financial situations, and the accessibility of the resources required. This creates a link among technology, general efficiency, and profitability.

Study works on Baruha village in Tangail district and tries to assess the economic impact of sheller machine adoption on maize productivity, labor costs and post-harvest efficiency along with profitability, targeting to inform future policy and support to rural agriculture. Findings will contribute to policy recommendations to promote agricultural mechanization and increase the greater adoption of maize shellers in Bangladesh.

Figure 1: Conceptual framework linking mechanized shelling, yield efficiency, and farm profitability



Source: Authors' construction

The specific objective of the study is to assess the economic impact of maize sheller machines and the efficiency of maize production in rural areas in Bangladesh.

3. Research Method

This paper uses a descriptive research design to check how maize sheller machines impact maize production in rural areas, without manipulating any variables. The study focuses on Bahura village in the union of Silimpur at the Tangail Sadar Upazila in the district of Tangail, which is largely dependent on the agricultural sector, and most of its population lives in rural areas. Observing a vast growth of maize crop in Baruha offers an analysis of the impact and productivity of maize sheller machines. In this study used a mixed-method study to explore the impact of the sheller machine in maize crop productivity. Data is collected through structured questionnaires, and qualitative data also gathered through informal interviews for better observation in the practical experience of the respondents. Random sampling method also used to select 80 maize farmers from the village. Sample size is designed to focus various types of maize sheller users. Secondary and primary data were collected through open and closed-ended questions during March ,2025. Primary data was collected by Face-to-face interviews and structured questionnaire across various regions of Bahura village. Our survey also covered demographics information of respondents like land ownership, maize production tenure, rent period of sheller machines, and some economic indices like cost, labor, grain loss, and profit. Secondary data also gathered from reports, theses, news, and authentic websites like Google. These data have been summarized and presented using tables to examine the patterns, trends, and differences across several groups. The qualitative data are given narratively or in an organized table. Additionally, charts and tablature presentations are also used to reveal the findings of data graphically. The quantitative approach was used to determine the frequency of generalizing the respondents' data.

4. Research Analysis and Discussion

In this section, the findings of the study are explained with tables, graphs, and charts, which is the main purpose of the study. This chapter contains demographic information and both qualitative and quantitative analyses.

4.1 Demographic Information

Our survey explores that the maximum number of farmers (36.25%) are aged 50–59, followed by 22.5% in the 40–49 age group, and 21.25% in the 60–69 age

group. And the oldest, 13.75% are aged 70–80. The smallest number of farmers (6.25%) is aged 30–39 (Table 1). The level of education among farmers is faster than the adoption of agricultural technologies like the maize sheller.

Table 1: Distribution of the respondents according to their age group and education level

Category	Percentage
Distribution of age (years)	
30 to 49	28.75%
50 to 69	57.50%
70 above	13.75
Education Level	
No formal education	16.25%
Primary and secondary	67.50%
Higher secondary above	16.25%

Source: Field survey of the authors, 2025

As shown in Table 2, about 17.5% completed primary level education 50% have secondary education, and 16.25% have no formal education. Only 8.75% reached higher secondary, and 7.5% are graduates.

Table 2: Purpose of maize cultivation and maize farming years

Category	Percentage
Maize farming years	
1 to 3	65.00%
4 to 6	28.75%
7 to 9	6.25%
Purpose of maize farming	
High profit	65.00%
Animal feed	13.75%
Market demand	21.25%

Source: Field survey of the authors, 2025

4.2 Thematic Analysis

4.2.1 Technology adaptation and diffusion

Table 3 presents information about the adoption and use of the maize sheller in Baruha village. Out of the total surveyed farmers, 62 respondents (77.5%) use a maize sheller machine, while 6 respondents (7.5%) do not, and 12 respondents (15%) fall in the not applicable category. Among the adopters, the majority, around 27.5% adopted shellers for about 2 years. Then 20%, 21.25%, 7.5% and 1.25% farmers adopted for 3,4,5, and 6 years respectively. The collecting source of the sheller machine shows that only 3 adopters have their own sheller machine and rent users are 59.

Overall, the findings indicate positive technology diffusion and adaptation, though constrained by limited ownership and financial capacity. Strengthening access to affordable credit or cooperative ownership models could further enhance the adoption and sustainability of mechanized farming practices in the village.

Table 3: Distribution of sheller adoption and use among respondents

Category	Percentage
Sheller use	
Yes	77.50%
No	7.50%
N/A	15.00%
Years of Using	
2 to 4 years	68.75%
5 to 6 years	8.75%
N/A	22.50%
Machine Source	
Own	3.75%
Rent	73.75%
N/A	22.50%

Source: Field survey of the authors, 2025

4.2.2 Mechanization and agricultural productivity

In the Previous year, maize was mainly cultivated on smaller spaces, with 78.26% of farmers using shorter areas due to primitive production methods and lack of instruments. Only 4.35% cultivated bigger areas (105–154 decimals). Some of these farmers provided invalid responses, so data from 69 respondents were used. Now a days cultivation of maize has extended like 11.25% of respondents using 105–154 decimal land for maize, 1.25% cultivating 155–204 decimals and where remaining 1.25% of them using 255–304 decimals, which shows an upward production line.

Table 4: Land distribution of respondents based on their present and previous years' maize cultivation

Category	Percentage
Land (Decimals)	Previous
5-54	78.26%
55-104	17.39%
105-154	4.35%
Land (Decimals)	Current
5-54	60.00%
55-104	26.25%
105-154	11.25%
155-204	1.25%
205-304	1.25%

Source: Field survey of the authors, 2025

4.2.3 Enhanced production

Farmers who are the adopters of maize machines gather an experience of increase in production, and that is very important factor to analyze in this study shown in Table 5. Maize machines create a contribute to a faster harvesting, sound storage of crop with good quality and quantity, and led to quicker selling in the market. Among adopters, 39.58% claimed a 11–25% of production increase,

according to 22.92% adopters 26–50% production growth, 20.83% had a 5–10% rise, and 16.67% claimed over 50% increase.

Table 5: Distribution of increase in production among adopters

Category	Percentage (Adopters)
Production Growth	
5 to 10%	20.83%
11 to 25%	39.58%
26 to 50%	22.92%
Above 50%	16.67%

Source: Field survey of the authors, 2025

The data clearly indicates that the adoption of maize machinery has increased the production of the maize. Therefore, the result demonstrate that the mechanized shelling process are crucial for increasing agricultural productivity and profitability.

4.2.4 High-yield post-harvest practice

In this part of our study explores the efficiency of post-harvest by the maize sheller machine. By this technology grain loss and tenure of production period reach at minimum range. Also reduce labor dependency, and the charge of labor. A major portion of respondents about 62.9% recognized a decrease of 5% grain loss. About 40.32 % of adopters reported an 11-25% reduction in labor cost, while rest of them noted other reductions. Time savings also claimed by respondent with 87.1% noted highest benefits and 11.29% moderate savings.

Table 6: Distribution of post-harvest efficiency among sheller adopters

Category	Percentage
Respondent	Reduce Grain Loss
39	5%
16	10%
7	15%

Source: Field survey of the authors, 2025

Results indicate that reduced labor costs, time, and loss of grain, the shelling process has undoubtedly raised the post-harvest efficiency. It shows us how technology usage can improve productivity by executing effective strategies.

4.2.5 Optimal performance

Farmers who adopt maize sheller machines for maize production report many facilities over manual shelling. Approx. 62 adopters, 90.32% claimed it reduce time dependency, 62.90% reported lower labor costs, and 51.61% noted a few grain losses. And, 61.29% say shellers are very helpful to process and sell maize faster.

The result demonstrates that we can improve operational efficiency by lowering labor requirements, saving time, and reducing loss of grain. Overall, this indicates how the process of shelling mechanization can enhance productivity quickly and profitably.

Table 7: Distribution of benefits of maize sheller usage among adopters

Category	Percentage
Reduced timeframe	
Yes	90.32%
No	9.67%
Reduce manpower	
Yes	62.90%
No	37.10%
Minimize grain loss	
Yes	51.61%
No	48.38%
Fater shelling	
Yes	61.29%
No	38.70%

Source: Field survey of the authors, 2025

4.2.6 Cost reduction and increase in profit

Maize is labor intensive crop and requires a huge labor, but the sheller machine reduces this labor dependency and finally reduce cost of labor. Reduction of labor costs reduce the production costs and increase efficiency along with profit level, table 8 reflects the overall production cost reduction and profit gain among adopters. Around 70% adopters receive moderate production cost reduction and higher profit, while only 30% adopters gain slight production cost reduction and low profit.

Table 8: Distribution of production cost reduction and profit increases among adopters

Profit / Pr. cost	0-5% Increase		6-10% Increase		11-25% Increase		26-50% Increase		Total	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
Moderately	14	28%	10	20%	7	14%	4	8%	35	70%
Slightly	13	26%	2	4%	0	0%	0	0%	15	30%
Total	27	54%	12	24%	7	14%	4	8%	50	100%

Source: Field survey of the authors, 2025

The data indicate that the adoption of maize sheller machines has led to notable cost reductions and profit gains among farmers. Around 70% of adopters experienced moderate production cost reduction with higher profits, confirming that mechanization enhances production efficiency and overall farm profitability.

4.2.7 Advance marketing

Maize sheller machine adoption has notably developed market access and sales efficiency. According to the study, 90.38% of maize farmers sell to wholesale buyers, while only 9.62% use local markets. Among users, 94.23% reported quick sales, and 5.77% noted a price hike due to improved quality. New maize farmers, non-users, and those producing maize for animal feed were excluded from this analysis.

Table 9: Distribution of market and sales advantage among sheller adopters

Category	Percentage
Sales growth	
Local Market	9.62%
Wholesale buyers	90.38%
Advantages in Marketing	
Faster selling	94.23%
Higher price	5.77%

Source: Field survey of the authors, 2025

The data suggests that the use of maize sheller boosts farmer's profit by speeding sales. This enables the market competitiveness and also increases income opportunities for farmer.

4.2.8 New employment

Table 10 indicates that around 72.58% adopters agree that maize sheller adoption increases new employment opportunities, while 27.42% respond negatively.

Table 10: Distribution of the adopters based on the responses regarding new employment creation

Category	Percentage
New employment	
Yes	72.58%
No	27.42%

Source: Field survey of the authors, 2025

The results indicate that maize sheller adoption not only improves production efficiency but also generates new employment opportunities, particularly in operation, repair, and maintenance services, despite manual labor in shelling has decreased. This shows that mechanization contributes positively to rural livelihood diversification and local economic development.

4.3 Discussion

Our paper explored the impact and adoption of mechanization maize shelling on productivity, efficiency, and profitability based on a theoretical framework - production theory, diffusion, and efficiency model. Results explore that mechanized shelling has a positive impact on maize production, efficiency, market advantage, and new employment, and some barriers are also present. Our study strongly aligns with the production theory that technology can increase productivity. According to the paper, approximately. 78% respondents in Bahura village adopted shells, and 69% have been using them for 2 to 4 years. A large portion of adoption shows the ability to increase operational efficiency. The study also reveals that the cultivation area expands by reducing labor intensity and production tenure. Technology also contributes to yield improvement of about 40% claiming that 11.25% increase in productivity, while 26% production increase is claimed by 23% adopters. That means technology positive influence on production. According to the sample, 4%

adopters have their own machine, while 73% use a rented machine for production. It is clear that diffusion technology makes production easier.

Despite the vast use of there are some problems like high rent, high price of the machine, and maintenance cost. 91% users report that reduction in time, and 52% observed a decrease in grain loss. Our respondent also claimed that after mechanization, post-harvest loss also reduced by 5%. Findings show that mechanization reduces inefficiency, increases marketing advantages, creates new employment.

The adopters of the maize sheller are divided into two categories –sheller machine buyers and users through rent. Our analysis reveals that only 3 adopters have considered buying the machine worthwhile. The rest of the adopters (59) rent the machine from the owners because they find renting more preferable than buying. This is because the initial cost of purchasing the machine is very high. On the other hand, all machine owners generate profit by renting out their machines to other farmers besides their own use. Despite sheller machines, farmers face difficulties with this. About 65% renters reported high costs of rent, which is the main issue. On the other hand, owners face some major concerns like high fuel and maintenance costs. While maize farmers and non-users were excluded from this section.

5. Conclusion

The study found that producers with at least a higher secondary education are more conscious of the benefits of corn sheller machines. Diesel-fueled, engine-driven shellers are most popular since they may be rented. Few farmers own their machinery, but they lease them out. Therefore, it boosts innovation, efficiency in manufacturing, cost reduction, and raise profit. The use of maize shelling machine has increased maize output quality and created rural jobs for operators of machines and technicians. Multiple economic benefits were noted by farmers, including reduced grain loss, quicker harvesting, and better use of leftovers like cobs and husks for fuel.

Numerous obstacles remain in the production despite being these advantages. These may be high prices of sheller machine, maintenance costs, and so on. They can prevent small business holder from owning a sheller machine. However, several farmers can indirectly benefit from the rental sheller machine. Because it yields more product in less time than before, therefore raises profitability. Therefore, the mechanization can be viewed as a pathway to higher income.

This study, therefore, concludes that the mechanization process significantly improves productivity and profitability for rural farmers by rapid processing, better grain quality, and lower labor costs. But financial, technological and institutional obstacles limit the scope of this technology.

Several strategies are proposed to mitigate these obstacles. Initially, purchase subsidies and low-interest loans can enhance the accessibility of the maize sheller for

tiny and medium-sized farmers. Secondly, government organizations should implement structured training and create awareness programs to improve farmer's operational management and maintenance skills. Thirdly, the confidence of the farmers can be enhanced by local workshops and demonstration programs. Finally, ongoing technological advancement - better design, longevity, and reparability - would maximize optimal performance, and diminish long-term maintenance expenses, and therefore make maize sheller machine more adaptable to several agricultural operations in Bangladesh.

The mechanized shelling, therefore, offers a significant chance to boost yield of maize, profitable farming, and employment in the rural areas, dependent upon the efficient implementation of affordable funding, and supportive policies.

Reference

Adnan, K. M. M., Ying, L., Sarker, S. A., Yu, M., Eliw, M., Sultanuzzaman, M. R., & Huq, M. E. (2021). Simultaneous adoption of risk management strategies to manage the catastrophic risk of maize farmers in Bangladesh. *GeoJournal*, *86*(4), 1981–1998. https://doi.org/10.1007/s10708-020-10154-y

Ahmmed, S. (2014). Mechanization status and enabling environment for custom hiring of agricultural machinery in Bangladesh. *UN-CSAM Country Report – Bangladesh*. Available from http://www.un-csam.org/publication/Bangladesh. [23 January 2024].

Akter, J., Rahman, A., Akter, S., & Sadekin, M. N. (2024). Impact of microfinance on women's empowerment in Tangail district: a case study in 2024. *Jagannath University Journal of Economics, 6*(1&2), 113−132.

Ali, M. U, Waddington, S. R., Timsina, J., Hodson, D., & Dixon, J. (2009). Maize-rice cropping systems in Bangladesh: status and research needs. *Journal of Agricultural Science and Technology, 3*(6), 35–53.

Begum, E., Hossain, M. I., & Papanagiotou, E. (2012). Evaggelos papanagiotou economic analysis of post-harvest losses in food grains for strengthening food security in northern regions of Bangladesh. *International Journal of Applied Research in Business Administration & Economics*, *1*(3), 56–65.

Begum, M., Hasan, M., Khatun, M., & Hossain, M. (2022). Determinants and impact of the adoption of Bangladesh Agricultural Research Institute developed maize sheller in Mymensingh district of Bangladesh. *Journal of Bangladesh Agricultural University*, *20*(2), 187–196. https://doi.org/10.5455/jbau.141358

Biswas, R., Molla, M. M. U., Faisal-E-Alam, M., Zonayet, M., & Castanho, R. A. (2023). Profitability analysis and input use efficiency of maize cultivation in selected areas of Bangladesh. *Land*, *12*(1), 1–23. https://doi.org/10.3390/land12010023

Brown, B., Timsina, P., Sharma, A., Aravindakshan, S., & Krupnik, T. (2024). Stepwise methods for more nuanced adoption analysis : a case study of harvest and post - harvest mechanization in Bangladesh. *Discover Agriculture, 2,* 73.

https://doi.org/10.1007/s44279-024-00088-1

Corn starch. (2016). *Meyler's Side Effects of Drugs* (Sixteenth Edition). https://doi.org/10.1016/b978-0-444-53717-1.01716-9

Das, D., Routray, R., Das, P. P., Singh, S., & Swain, D. S. (2023). Design and development of maize sheller. *International Journal for Research in Applied Science and Engineering Technology*, *11*(6), 155–164. https://doi.org/10.22214/ijraset.2023.53621

FAO. (2025). Gross domestic product and agriculture value added 2012–2021: Global and regional trends. *FAOSTAT Analytical Brief 104*. Rome: Food and Agriculture Organization. https://doi.org/10.4060/cd5490en

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society*, *120*(3), 253–290. https://doi.org/10.2307/j.ctv5rdxd5.7

Hajong, P., Mondal, S., Islam, M. A., & Ghosh, A. (2023). Economics of maize cultivation at selected intensive areas of Bangladesh. *International Journal of Agricultural Research Innovation & Technology, 13*(2), 70–78. https://doi.org/10.3329/ijarit.v13i2.70859

Haque, M. A., Alam, M., & Sarker, T. R. (2014). Break-even analysis of farm machineries available in Bangladesh for selected farm operations, Journal of Agricultural Engineering, 41(2), 11–17.

Hietala, M. (1983). The diffusion of innovations: some examples of finnish civil servant's professional tours in Europe. *Scandinavian Journal of History*, *8*(1–4), 23–36. https://doi.org/10.1080/03468758308579015

Hossain, M. I. (2017). Present status and prospect of appropriate mechanization for wheat and maize cultivation in Bangladesh. The paper presented in the workshop of "Integration of maize in rice-wheat system with conservation agriculture and nutrient management for climate resilient sustainable productivity" held in Bangladesh Agricultural Research Institute (BARI), Gazipur on 22 August 2017.

Hossain, M. I., Hossain, M. A., Amin, M. N., Saha, K. K., Tasneem, N. J., & Rarna, N. (2017). *Introduction to BARI Developed Agricultural Machinery*. Bangladesh Agricultural Research Institute (BARI), Gazipur.

Hossain, M. I., Tiwari, T. P., Gullandaz, A., & Jahan, N. (2017). Development of a cost effective two wheel tractor mounted mobile maize sheller for small farmers in Bangladesh. *International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering, 11*(5), 995–999.

Hunt, F. (2022). Agricultural Mechanization in Bangladesh – The Future. *Workshop Report*, Cereal Systems Initiative for South Asia-Mechanization Extension Activity, The U.S. Government's Global Hunger & Food Security Initiative.

Islam, M. R., & Hoshain, S. (2022). A brief review on the present status, problems and prospects of maize production in Bangladesh. *Research in Agriculture Livestock*

and Fisheries, *9*(2), 89–96. https://doi.org/10.3329/ralf.v9i2.61613

Jahan, N., Hoque, M. A., Sheikh, S. I., & Gulandaz, M. A. (2019). Design and development of maize peeler for farmers in Bangladesh. *Agricultural Engineering International: CIGR Journal*, *21*(4), 195–200.

Kurz, H. D., & Salvadori, N. (1995). *Theory of Production: A Long-Period Analysis.* Cambridge University Press. https://doi.org/10.1017/cbo9780511625770

Lawal, M., Idris, M., & Obiyemi, O. (2020). Construction and performance evaluation of a solar powered maize sheller for rural farmers. *UNIOSUN Journal of Engineering and Environmental Sciences*, *2*(1) 47–52. https://doi.org/10.36108/ujees/0202.20.0170

Liggett, R. W., & Koffler, H. (1948). Corn steep liquor in microbiology. *Bacteriological Reviews*, *12*(4), 297–311. https://doi.org/10.1128/mmbr.12.4.297-311.1948

Milufarzana, M., Rahman, A., Alam, M., & Ahmed, R. (2015). Economic parameter of maize sheller for custom hire service in Bangladesh. *Agricultural Engineering International: CIGR Journal*, *17*(2), 146–150.

MOA. (2020). *National Agricultural Mechanization Policy 2020.* Ministry of Agriculture. Government of the Peoples Republic of Bangladesh, Dhaka.

Peng, J., Zhao, Z., & Liu, D. (2022). Impact of agricultural mechanization on agricultural production, income, and mechanism: evidence from hubei province, China. *Frontiers in Environmental Science*, *10*, 838686, 1–15. https://doi.org/10.3389/fenvs.2022.838686

Rahman, M. M., Ali, M. R., Oliver, M. M. H., Hanif, M. A., Uddin, M. Z., Tamim-Ul-Hasan, Saha, K. K., Islam, M. H., & Moniruzzaman, M. (2021). Farm mechanization in Bangladesh: a review of the status, roles, policy, and potentials. *Journal of Agriculture and Food Research, 6, 100225*. https://doi.org/https://doi.org/10.1016/j.jafr.2021.100225

Rahman, S., Kazal, M. M. H., Begum, I. A., & Alam, M. J. (2016). Competitiveness, profitability, input demand and output supply of maize production in Bangladesh. *Agriculture, 6*(2), 21. https://doi.org/10.3390/agriculture6020021

Roy, S. K., Mike, A., & Rob A. (2007). Business rationale for investment on power operated maize sheller in Bangladesh. *Agricultural Engineering International: CIGR Journal, 9*(3), 1–13.

Straub, E. T. (2009). Understanding technology adoption: theory and future directions for informal learning. *Review of Educational Research*, *79*(2), 625–649. https://doi.org/10.3102/0034654308325896

Uddin, I., Shah, S., Khan, S., & Khan, Z. (2021). An economic study on maize production in some selected areas of Swat District. *Economic Consultant, 33*(1), 25–39. https://doi.org/10.46224/ecoc.2021.1.4