

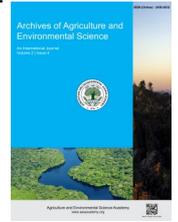


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ORIGINAL RESEARCH ARTICLE



Exploring the drivers of commercial farming adoption among farmers in Mymensingh, Bangladesh

Ismat Jerin Nishu¹, Md. Saidur Rahman², S. M. Mehedy Hasan Noman^{3,4} and Md. Tariquul Islam^{5*}

¹Lecturer, Haor and Char Development Institute, Bangladesh Agricultural University, Mymensingh, 2202, Bangladesh

²Professor, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh, 2202, Bangladesh

³Scientific Officer, Agricultural Economics Division, Bangladesh Rice Research Institute, Joydebpur, Gazipur, 1701, Bangladesh

⁴Department of Agricultural and Resource Economics, School of Agriculture and Environment, The University of Western Australia, Perth, Australia

⁵Assistant Professor, Haor and Char Development Institute, Bangladesh Agricultural University, Mymensingh, 2202, Bangladesh

*Corresponding author's E-mail: tariq.hcdi@bau.edu.bd

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ABSTRACT

This study investigates the drivers influencing the adoption of commercial farming as rice farms transition into diversified commercial enterprises. A sample of 120 respondents was randomly selected for primary data collection from Mymensingh Sadar and Muktagachha upazilas in the Mymensingh district of Bangladesh, and they were chosen for their notable adoption of commercial farming. Among the respondents, 40 were engaged in rice farming, while 80 were involved in commercial farming due to its higher prevalence. The analysis utilized both descriptive statistics and econometric methods, particularly binary logistic regression. The findings reveal that 98.8% of commercial farmers fell within the age range of 30 to 64 years, with only 1.2% exceeding 64 years. Moreover, commercial farmers exhibited a higher level of education compared to their rice farming counterparts. The econometric analysis indicated that education, access to extension services, and access to information significantly and positively influence the adoption of commercial farming. This underscored the critical importance of prioritizing education, extension services, and information accessibility to facilitate the swift adoption of commercial farming. This study proposing effective policy recommendations aimed at enhancing diversified commercial farming practices and optimizing land use for the increased profitability of rural farmers.

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INTRODUCTION

Agriculture plays a pivotal role in Bangladesh, acting as the primary food source for 165 million people (BBS, 2022). Approximately 84 percent of the country's rural population relies on agriculture for their livelihoods, either directly or indirectly (Uddin, 2015). Agriculture serves as the main source of income, sustenance, and food security for most rural residents. It also supplies raw materials to industries and contributes significantly to the country's thriving exports. Despite the heavy reliance on industrialization in the modern economy, agriculture persists as

the backbone of numerous economies, including Bangladesh. The relationship between agriculture and economic growth is well-recognized and it is widely established that agriculture has positive effect on economy (Wang *et al.*, 2010). Amidst the vast expanse of Bangladesh's agricultural domain, over 60% of the land is dedicated to cultivation, a stark contrast to the global average of 12%. Crops, livestock, and fisheries along with forest products collectively account for around 12.5% of the country's GDP, while approximately 40.6% of the population relies on agriculture for their livelihoods (BBS, 2021). Smallholder farming constitutes 96% of operational holdings and 69% of cultivat-

ed land. Global change studies focus primarily on changes in land use and land cover, which can affect regional and global climates by altering the Earth's properties and features (Brown *et al.*, 2013; Jain *et al.*, 2013; Xu *et al.*, 2016). The landscape of Bangladesh is undergoing transformation due to physiographic, socioeconomic, climatic changes, adaptability, population expansion, economic growth, and infrastructure development (Islam & Hassan, 2012). Threats such as soil salinity, decreasing productivity (Hossain *et al.*, 2015), and climatic hazards such as floods (Ruhul Amin *et al.*, 2015) pose challenges to Bangladesh's agricultural land, leading to local-scale land use and cover alterations (Béné *et al.*, 2015; Dasgupta *et al.*, 2015).

Smallholders have increasingly changed their land use decisions over time, influenced by various drivers like population growth and economic development. Small farmers, in response to evolving circumstances, have embraced a variety of land use decisions, moving away from traditional rice farming towards more commercially oriented ventures. This transformation is characterized by a diversified approach, with smallholders transitioning from cultivating traditional crop fields to engaging in fisheries, and converting rice farms into livestock and poultry enterprises. The motivation behind these changes extends beyond mere agricultural practices; it reflects a strategic response to meet the demands of population growth and economic development. The shift towards alternative land uses is driven not only by economic considerations but also by a quest for short-term food self-sufficiency. Small farmers are adapting and diversifying their land use decisions to meet evolving needs, demonstrating resilience and adaptability in the face of changing demographic and economic landscapes. This dynamic transition underscores the complex interplay between agricultural practices, demographic shifts, and economic dynamics, shaping the trajectory of land use decisions among smallholders (Anisuzzaman *et al.*, 2016; Sarker *et al.*, 2015).

Rice, covering 78% of the nation's 14.9 million hectares of cropland, is crucial to Bangladesh's agriculture, contributing 4.5% to GDP (BBS, 2020). It constitutes 50% of the agricultural GDP, contributes to one-sixth of household income in rural areas, and half of rural employment. Two-thirds of caloric and protein needs are met through daily rice consumption (Gurung *et al.*, 2016). The nation's food security, robust growth of the economy, and significant decrease in poverty have been supported by the increase in rice production more than threefold over the previous four decades, from 15 million tonnes in 1971 to 51 million tonnes in 2013 (Hossain *et al.*, 2007; Hossain & Bayes, 2009). In addition to rice production, Bangladeshi farmers engage in the cultivation of vegetables, as well as the rearing of livestock, poultry, and fisheries due to market demand and favourable profit rates. In Bangladesh, the demand for animal products has been on the rise, driven by factors such as income growth, population expansion, and urbanization. This growing market presents an opportunity for small-scale and economically disadvantaged livestock producers to generate income and employment by supplying sought-after products at competitive prices (Jabbar, 2005). Unpredictability in rice production and

low market prices have further facilitated this shift. Farmers predominantly engage in commercial fish, livestock, and poultry farming. Bangladesh's rice-based farming systems have become more diverse over the last few decades, shifting towards monoculture commercial aquaculture production, particularly for fish, prawns, and shrimp (Ahmed *et al.*, 2011; Mondal, 2008).

This transformation has led to changes in the patterns of land use in major cities, with poultry and dairy farms gaining prominence due to their advantages, such as requiring less acreage and being less affected by seasonality. Poultry farming, characterized by its brief production cycle, minimal initial investment, and rapid profitability, serves as a feasible income stream for rural farmers year-round (Bhende, 2006). This transition has not only been instrumental in elevating farmers' livelihoods but has also led to improved socio-economic circumstances and greater empowerment of women in rural areas of Bangladesh. The agricultural sector contributes 12.07% to Bangladesh's GDP, with livestock farming accounting for 2.94% and fisheries for 4.11% (BBS, 2021). Fish and animal husbandry generate larger profits than high-yielding potential rice varieties, making them attractive to young, educated individuals and contributing to economic prosperity (Hossain, 2004).

Various drivers such as farming experience, disaster damage, farmer education, annual income, financing availability, farmer age, and saltwater intrusion play significant roles in modifying land transformation. Consequently, the livelihood assets of farmers, including human, social, financial, natural, and physical capitals, undergo substantial changes. Population expansion, unplanned urbanization, industrialization, and agricultural modernization exert pressure on agricultural land, leading to a decline in per capita cropland. Various factors at local, regional, and global levels influence these transformations, presenting challenges that indirectly affect land management (Lambin *et al.*, 2001). Households differ in resources, operate within diverse biophysical contexts, and exhibit spatial dynamics in land use (Dixon *et al.*, 2001). Farm size, setting, resource allocations, land policies, and institutional factors influence land usage and transformation (Browder *et al.*, 2004; Ebanyat *et al.*, 2010; Perz, 2001).

Understanding the drivers influencing the transformation of rice farming to fish livestock and poultry farming is crucial. The core objective of this study is to identify these driven factors, with specific objectives including documenting the socioeconomic characteristics of respondent farmers. While existing literature has explored characteristics impacting land use transformation and the profitability of rice production in various seasons and areas, the unique comparative profitability of rice and commercial farms like livestock and aquaculture remains underexplored, especially in the context of Bangladesh. This research aims to explore the drivers influencing the adoption of commercial farming as rice farms transition into diversified commercial enterprises. Understanding the factors influencing farmers' adoption of diversified commercial farming in Mymensingh is crucial for formulating targeted policies and support systems that can enhance agricultural productivity, improve rural livelihoods, and

ensure sustainable economic development in the region

MATERIALS AND METHODS

Study areas, sample size, data collection, and technical analysis

The research was conducted in the Mymensingh Sadar and Muktagachha upazilas, situated within the broader Mymensingh district. These specific upazilas were deliberately chosen due to their status as prominent commercial hubs in the district, undergoing significant transformations in land use patterns over time (Figure 1). The rationale behind this intentional selection was the farmers' expressed interest in transitioning from traditional rice cultivation to alternative practices, such as converting rice fields into fish ponds and engaging in livestock and poultry farming, with the aim of enhancing overall agricultural productivity. The study specifically focused on farmers in the Mymensingh district who had undergone the transition from rice cultivation to the diversified practices of fish and livestock farming, as documented in previous studies (Anisuzzaman et al., 2016; Sarker et al., 2015). The choice of these upazilas was driven by their dynamic and evolving agricultural landscape, which stood out in comparison to other regions in Bangladesh. The researchers believed that studying these particular sites would yield valuable insights and results that could be instrumental for future generations in navigating the challenges and opportunities associated with agricultural transitions. The intentional selection of Mymensingh Sadar and Muktagachha aimed to capture the changing agricultural dynamics prevalent in these areas, providing a nuanced understanding that could inform future agricultural practices and policies.

Sampling and data management

A sampling frame is a critical tool for researchers, aiding in the delineation of the specific population under investigation (Figure 2). Given constraints in resources, such as funding and time, most studies opt for representative sample units rather than attempting to survey the entire population. In the present study, the sampling unit was defined as a single farm household, recognizing it as a comprehensive unit encapsulating various aspects of agricultural activities and decision-making. To create a representative sample, three villages were randomly selected from each upazila, encompassing both commercial farms and traditional rice farmers. A total of 120 respondents were chosen from each village, ensuring a diverse and inclusive representation of the agricultural landscape (Table 1). The selection of both commercial farms and rice farmers aimed to capture the distinct characteristics and practices prevalent in each subgroup. The collection of primary data was carried out through personal interviews, with the household identified as the primary unit of analysis. Given the well-established role of the household head as the primary decision-maker in the context of Bangladeshi farming and family operations, interviews were conducted with these individuals during the survey. This approach not only facilitated a comprehensive understanding of the agricultural dynamics but also ensured that key decision-makers were directly engaged, enhancing the reliability and relevance of the collected data. The detailed sampling strategy adopted in this study was designed to provide a robust representation of the population under investigation, balancing efficiency and accuracy within the constraints of available resources. Primary data was collected through a blend of qualitative and quantitative research methodologies. The primary data collection methods involved interviews with key informants and a questionnaire survey administered to farm households. The initial step involved gathering information directly from respondents, followed by a comprehensive household survey. Participants were provided with a concise overview of the study, research objectives, and data requirements.

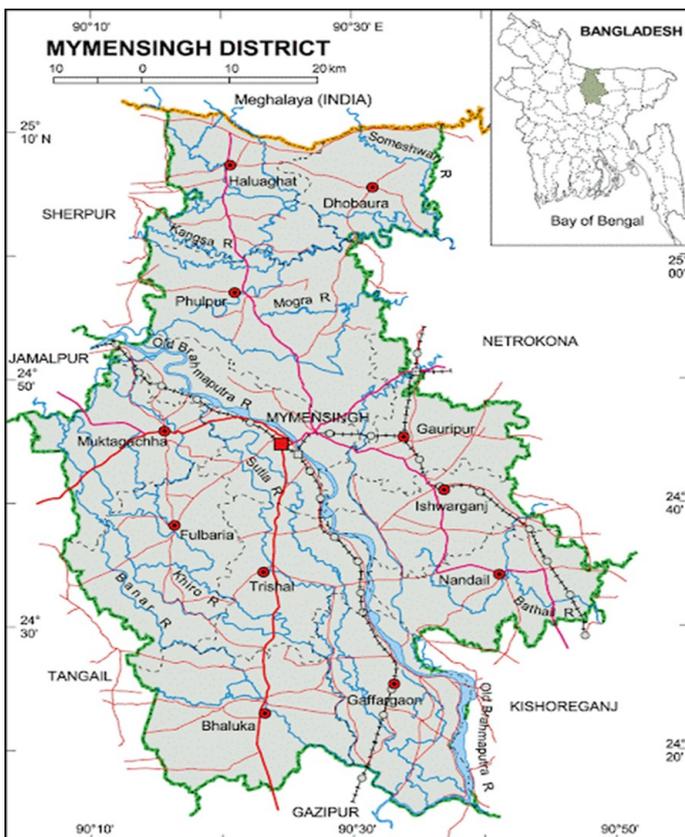


Figure 1. Map of Mymensingh district showing the selected upazila.

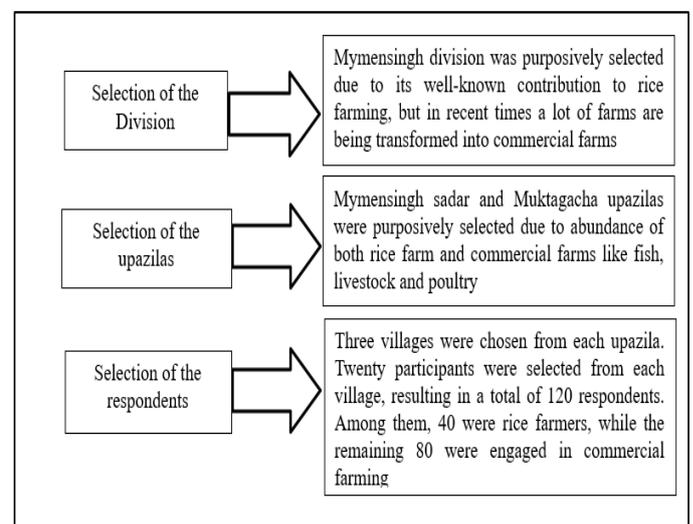


Figure 2. Sampling framework of the research.

Table 1. Study areas and sample size.

District	Upazila	Village	Number of Respondents
Mymensingh	Mymensingh Sadar	Churkhai	20
		Bhabkhali	20
		Barmila paar	20
	Muktagachha	Langalia	20
		Guwari	20
		Bonbangla	20
		Total sample	

To obtain information from the sampled households, a face-to-face interview approach was adopted, employing a structured questionnaire with closed-ended questions. The questionnaire was initially developed in collaboration with the supervisor and subsequently refined with input from academicians. Prior to finalization, the questionnaire underwent a pre-test through simulated farm home surveys. The ultimately redefined questionnaire was then used in the actual survey, with particular attention given to addressing farmers' perspectives and challenges. The comprehensive questionnaire covered a spectrum of topics, encompassing farmers' socioeconomic characteristics, farm profiles, details of high-yielding variety (HYV) rice, and specifics of fish, livestock (cattle), and poultry farming. It delved into inputs and outputs related to rice, fish, and livestock, factors influencing the adoption of commercial farming, major challenges faced by farmers, and included inquiries about policy-related information. This thorough questionnaire design aimed to capture an integrated view of the multifaceted aspects of farmers' practices and experiences, providing a rich dataset for a nuanced analysis of the drivers influencing the adoption of fish, livestock, and poultry farming in the study area.

Data analysis

Following the completion of the household survey, the collected data underwent systematic coding, and a master sheet was generated using MS Excel. Subsequently, the data cleaning process was executed on this MS Excel master sheet, ensuring accuracy and integrity. Descriptive statistical methods such as averages and percentages were employed to delineate the socioeconomic characteristics of the households. The results of the descriptive analysis were then presented in tables using MS Excel. To explore the influence of the agricultural transformation, a binary logistic regression model was applied. This model facilitated predictions regarding a categorical variable in relation to a continuous one, providing insights into the influential drivers shaping the transformation of agriculture.

Socioeconomic characteristics of farmers

The study primarily relied on tabular and graphical formats for presenting socioeconomic data, as these modes of representation are commonly employed and offer a straightforward means of comprehension. The utilization of such formats facilitates a clear and accessible presentation of complex socioeconomic information. To delve into the socioeconomic characteristics of the sampled farmers, descriptive statistics, including measures

such as sum, average, percentages, ratios, and more, were calculated. This analytical approach allowed for a comprehensive examination of the key features and trends within the dataset, offering significant insights into the socioeconomic profile of the farmers under study. The use of descriptive statistics not only aids in summarizing the data but also provides a foundation for a more detailed and nuanced understanding of the various drivers influencing the agricultural landscape in the research area.

Drivers influencing the adoption of commercial farming

For this purpose, the binary logistic regression, also known as the logit model, serves as an appropriate analytical tool for exploring the drivers influencing the shift towards commercial farming instead of rice farming. Binary logistic regression is specifically well-suited for analyzing survey data in widely utilized cross-sectional and case-control study designs (Barros & Hirakata, 2003; Labrecque et al., 2021). Binary logistic regression is differentiated from other generalized linear models primarily by the type of dependent (or outcome) variable it deals with (Harris, 2019). Specifically, in binary logistic regression, the dependent variable is characterized by having two levels. This entails a single binary dependent variable coded by an indicator variable, with the two values represented as "0" and "1". Meanwhile, the independent variables can each be either binary or continuous variables. The associated probability of the value labeled "1" can vary between 0 (representing certainty of the value "0") and 1 (representing certainty of the value "1"), providing the rationale behind the labeling (Hosmer et al., 2000).

Following logistic regression model was specified in order to explore the determining drivers of adopting commercial farming instead of rice farming.

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e_i$$

Where,

Y= Adopting diversified commercial farming (Adoption=1; Not adoption=0)

X₁= Age

X₂= Farming experience

X₃= Farm size

X₄= Education

X₅= Extension service

X₆= Land category

X₇= Information access

e_i= Error term

RESULTS AND DISCUSSION

Socioeconomic characteristics of the respondent farmers

Understanding the socio-demographic attributes of farmers is crucial as it shapes their decision-making capacity within various farming systems. This study considers variables like age distribution, educational status, occupational status, farm size, on-farm income distribution, and monthly expenditure of respondents for analysis. Table 1 presents a summary of the respondents' socio-demographic profile as outlined below:

Age distribution of the respondents

Respondents' age constitutes a significant factor in this research. The respondents' ages were scrutinized and categorized into four groups. The working-age population was classified into three categories: 15 to 29, 30 to 64, and above 64 (BBS, 2022). As per the survey findings, 95.5 percent of farmers fall within the 30-64 age group, with the lowest percentage (4.5 percent) belonging to the age group above 64 years. Likewise, the mean age of the farmers was 48 years (Akter et al., 2019) and 37 years (Islam et al., 2020). This cohort of respondents is anticipated to yield greater profits, attributed to their energy and productivity in the field (Akter et al., 2019). Among rice farmers, 90 percent of respondents are in the 30-64 age group, while 57.5 percent are above 64 years old. Conversely, for commercial farmers, most respondents (98.8%) were between 30 and 64 years, with only 1.2 percent being above 64 years old (Table 2).

Educational status of the respondents

The educational attainment of a farm operator plays a pivotal role in influencing not only the choices made in production but

also the overall management and administration of farm operations. Education serves as a catalyst for enhancing farming skills and augmenting the production capacity of farmers (Weir, 1999). Additionally, staying informed about contemporary agricultural technologies is crucial for empowering farmers to transition from traditional rice farming to more diversified and commercially oriented practices. To gauge the educational landscape of the respondents, the study categorized their educational levels into five groups: i) No formal education; ii) Primary education; iii) Secondary education; iv) Higher Secondary education; v) Graduate. Remarkably, only a minimal 5 percent of respondents were found to be illiterate in the study area. Specifically, within the subset of rice farmers, 15 individuals had no formal education, and interestingly, there were no uneducated farmers involved in commercial farming. Moreover, the survey disclosed that a mere 5 percent of rice farmers had attained a graduate degree. Conversely, when examining the educational profiles of commercial farmers, a noteworthy trend emerged. A substantial majority, constituting 55 percent, were found to be graduates (Table 2). The findings were quite similar with (Islam et al., 2020) where a significant portion of farmers in the research areas lacked formal education, with 49.7% being illiterate. Additionally, 28.7% could only write their signature, while 11.3% had completed secondary education. This disparity in educational levels between rice farmers and their counterparts engaged in commercial farming highlights the potential influence of education on the adoption of diversified agricultural practices. These findings suggest that a higher level of education may be a contributing factor to the inclination towards commercial farming, providing valuable insights for stakeholders and policymakers aiming to foster sustainable agricultural development.

Table 2. Socioeconomic characteristics of the respondents.

Socioeconomic characteristics	Categories	Rice Farmers		Commercial Farmers		All Farmers	
		No.	%	No.	%	No.	%
Age	15-29 Years	0	0	0	0	0	0
	30-64 Years	36	90	79	98.8	115	95.5
	More than 64 Years	4	10	1	1.2	5	4.5
Education level	No formal education	6	15	0	0	6	5
	Primary education	13	32.5	2	2.5	15	12.5
	Secondary	16	40	11	13.8	27	22.5
	Higher secondary	3	7.5	23	28.7	26	21.7
	Graduate	2	5	44	55	46	38.3
Occupational status	Agriculture as main occupation	36	90	65	81.2	101	84.2
	Agriculture as secondary occupation	4	10	15	18.8	19	15.8
Farm categories	Small	28	70	59	73.7	87	72.5
	Medium	12	30	20	25	32	26.7
	Large	0	0	1	1.3	1	0.8
On-farm income per month (US \$)	<350	21	52.5	2	2.5	23	19.2
	350-450	9	22.5	10	12.5	19	15.8
	451-550	7	17.5	22	27.5	29	24.1
	551-650	2	5	15	18.8	17	14.2
	651-750	0	0	15	18.8	15	12.5
Farm Household Expenditure (US \$)	>750	1	2.5	16	20	17	14.2
	Food	810		935		872	
	Clothing	75		86		82	
	Children's education	38		57		50	
	Medical	36		42		39	
	Tax	13		18		16	
Interest	81		107		98		

Occupational status of the respondents

The survey findings underscore the predominant role of agriculture as the primary occupation among respondents in the selected study areas. Alongside agriculture, some farmers were also found to be engaged in business, services, and employment as day laborers. Nearly all farmers were found to be primarily engaged in agriculture, which emerged as their inherent and sole major occupation (Kamal et al., 2014). Notably, a significant 84.2 percent of the surveyed individuals identified agriculture as their primary means of livelihood. Furthermore, when categorizing respondents into rice farmers and commercial farmers, the data revealed that 90 percent of rice farmers and 81.2 percent of commercial farmers were primarily involved in agriculture (Table 2). This insight highlights the overwhelming reliance on agriculture as the mainstay occupation in the surveyed community, with a substantial majority of individuals dedicating themselves primarily to farming activities. The additional involvement of some farmers in diverse economic sectors suggests a degree of economic diversification within the community. Understanding the distribution of occupations among rice farmers and those involved in commercial farming provides a nuanced perspective on the varied economic activities in the study area. Such insights are valuable for policymakers and researchers seeking to formulate targeted interventions that align with the predominant economic activities of the local population.

Farm size of the respondents

The term "farm size" refers to the total cultivated area on a farm, including fallow land, while excluding areas covered by trees, natural vegetation, or pasture. Farms are typically categorized into small, medium, and large based on their sizes. The average sizes of small, medium, and large farms were 0.83, 2.23, and 4.04 acres, respectively. The overall average farm size was 2.37 acre (Kamal et al., 2014). According to the findings of this study, a significant 72.5 percent of farms in the selected area were classified as small in terms of their size. When examining the specific distribution of farm sizes among rice farmers, it was revealed that 70 percent of them possessed less than 2.49 acres of land, with none of the respondents having more than 7.50 acres. Similarly, among commercial farmers, a substantial 72.5 percent of respondents operated farms with less than 2.50 acres of land, and notably, only one respondent managed a farm exceeding 7.50 acres (Table 2). These results underscore the prevalent small-scale nature of farming operations in the study area, with a majority falling within the small farm size category. The limited land holdings among both rice and commercial farmers suggest that agricultural activities in the region are characterized by a predominantly small-scale structure. Understanding the distribution of farm sizes is crucial for policymakers and agricultural development initiatives aiming to tailor interventions and support programs to the specific needs of small-scale farmers in the selected areas.

Top of Form

On farm-income distribution and expenditure per month of the

respondents

According to the study findings, a notable 24.2 percent of respondents reported monthly earnings falling within the range of \$451 to \$550. Delving into the specifics among rice farmers, a significant 52.5 percent earned less than \$350 per month, with a mere 2.5 percent surpassing the \$750 monthly income threshold from farming activities. In contrast, for commercial farmers, 27.5 percent reported monthly earnings between \$551 and \$650, while only 2.5 percent earned less than \$350, and a noteworthy 20 percent earned more than \$750 per month (Table 2). The examination of average annual expenditures revealed that rice farmers and commercial farmers spent an average of \$1050 and \$1195, respectively (Table 2). Interestingly, the study noted a distinctive trend in the study area, highlighting that annual expenditure on food items were comparatively higher for farmers compared to other expenditure categories. These findings provide valuable insights into the economic dynamics of farmers in the study area, shedding light on the variations in income and expenditure patterns among rice and commercial farmers. The prevalence of lower income brackets among rice farmers, coupled with the observed disparities in monthly earnings and annual expenditures, underscores the economic challenges faced by farmers. Policymakers and stakeholders can utilize this information to design targeted interventions and support programs aimed at enhancing the economic well-being of farmers in the region, particularly focusing on addressing income disparities and promoting sustainable financial practices.

Drivers influencing the adoption of diversified commercial farming

Regression analysis revealed that three specific drivers emerged as significant contributors to the farmers' adoption of commercial farming: the education level of respondents, access to extension services, and the access to information. These three variables were found to exert a substantial and statistically significant impact on the likelihood of farmers embracing commercial farming practices. By pinpointing these influential drivers, the study provides a more nuanced understanding of the key determinants driving the adoption of commercial farming among respondents. The results of the binary logistic regression have been shown in (Table 3). The educational levels of farmers exerted a positive significant influence on the adoption of commercial farming. With every one-unit increase in the years of schooling of respondent farmers, there is an anticipated 0.3425702 increase in the log-odds of adopting commercial farming, keeping all other independent variables constant (Table 3). Farmers in their youth exhibited the highest educational attainment levels among their peers. This finding underscores the prominence of education among the younger demographics engaged in farming activities. The emphasis on education could be indicative of various factors such as changing societal norms, increased access to educational opportunities, or a recognition of the importance of knowledge and skills in modern agriculture. It suggests a positive trend towards a more educated and potentially innovative generation of farmers, poised to contrib-

Table 3. Logistic regression estimates of the effects of different factors on adoption of commercial farming among the respondents of the study area.

Independent variable	Coefficient	Standard Error	p-value	Odds Ratio
Age of the respondent	-0.140397	0.1007118	0.163	0.8690132
Farming experience	-0.0313252	0.0913493	0.732	0.9691604
Farm size	0.5318258	0.7207911	0.461	1.702037
Education	0.3425702**	0.1508407	0.023	1.408563
Extension service	1.232614**	0.4765117	0.010	3.430185
Land category (r: own)	-2.568701	4.534382	0.571	0.076635
Rented both	1.393152	1.291971	0.281	4.027526
Information access (r: rarely Constantly)	3.293339**	1.283332	0.010	26.93264
Intercept	-0.6801699	3.808	0.858	0.5065309

Note: Level of Significance, a^{***} = 0.01; a^{**} = 0.05; a^{*} = 0.1

ute to the advancement and sustainability of the agricultural sector. Further exploration into the specific educational backgrounds and its correlation with farming practices could provide valuable insights into the evolving landscape of agriculture, especially among the younger generation.

Likewise, the engagement of farmers with extension services showed a noteworthy and positive influence on the adoption of commercial farming practices. The statistical analysis indicates that for each additional unit of access to extension services per year, there is a corresponding 1.232614 increase in the log-odds of adopting commercial farming, with all other independent variables held constant (Table 3). This finding underscores the vital role of extension services in promoting and facilitating the transition to commercial farming. Extension services, which typically involve the provision of agricultural knowledge, technology, and guidance to farmers, emerge as a significant factor influencing the process of decision-making towards more commercially oriented agricultural practices. The observed positive correlation suggests that enhanced access to extension services contributes positively to farmers' willingness and ability to adopt modern and commercially viable farming methods. Further exploration into the specific aspects of extension services that contribute most significantly to this positive impact could offer valuable insights for policymakers and agricultural development initiatives. Moreover, the study reveals that the information access of respondents played a crucial and statistically significant role in influencing the adoption of commercial farming practices. Specifically, for each incremental unit increase in information access, moving from rare to consistent information access, there is an anticipated 3.293339 rise in the log-odds of adopting commercial farming. This relationship holds true even when all other independent variables are held constant (Table 3). This finding underscores the importance of information access as a driving force behind the shift towards commercial farming. It implies that farmers with more regular and comprehensive access to relevant information are more likely to embrace and integrate modern and commercially viable agricultural methods into their practices. The positive correlation observed in this study suggests that efforts to enhance information dissemination and accessibility in agricultural communities could significantly contribute to the widespread adoption of innovative farming approaches. Further investigation into the specific types and sources of

information that have the most impact on commercial farming adoption could provide valuable insights for designing targeted interventions and support programs in the agricultural sector.

To sum up, the regression model employed in this study effectively highlights the significance of all incorporated variables in elucidating the determinants of transitioning from exclusive rice production to diversified commercial farming in the research area. Out of the seven variables considered, three exhibited statistical significance at the 5% level. This leads to the conclusive inference that the educational level, access to extension services, and information access are pivotal drivers influencing the adoption of commercial farming practices. The observed statistical significance of these three variables underscores their crucial roles in shaping farmers' decisions to embrace commercial farming over traditional rice-centric approaches. A higher educational level, increased access to extension services, and enhanced information access are identified as key drivers facilitating the shift towards diversified commercial farming. As these drivers continue to witness an upward trajectory in Bangladesh, it is anticipated that the trend of adopting commercial farming practices will likely persist and potentially expand in the future. This insight not only sheds light on the current dynamics in agricultural practices but also provides a forward-looking perspective, suggesting that the ongoing improvements in education, extension services, and information accessibility will likely contribute to the continued growth of commercial farming in the study area. Policymakers and stakeholders can use these findings to develop targeted strategies that foster the positive trends identified in education, extension services, and information access, thereby promoting sustainable agricultural practices and economic development in Bangladesh.

Conclusion and recommendations

The study was conducted to explore the influenced drivers of adoption diversified commercial farming which includes crop (rice), fisheries, livestock (cattle) and poultry on a commercial venture instead of only rice farming in Mymensingh district. From the analysis of the socioeconomic characteristics of the respondents, it can be concluded that 98.8 percent commercial farmers' age were between 30 to 64 years, and 55 percent of commercial farmers had completed their graduation. The binary

logistic regression carried out that education level of the farmers, access to extension services and information access had statistically significant and positive influence on the adoption of diversified commercial farming instead of only rice farming. Income derived from agricultural engagement often falls short of covering production costs and household expenses, posing challenges to both the production process and household food security. Given the enhanced profitability of commercial agriculture, it is imperative for the government to prioritize and facilitate diversified commercial farming. A dedicated government fund should be established to support commercial producers. The Ministry of Fisheries and Livestock, as the relevant authority, should conduct workshops, seminars, conferences, and live demonstrations to impart knowledge on the latest production and marketing techniques to grassroots commercial farmers and entrepreneurs. Improvements in the extension services are crucial to identifying potential commercial farmers, and the dissemination of books and pamphlets on modern commercial farming methods should be prioritized. Efforts should be made towards developing a suitable market infrastructure in the study area, encompassing swift transportation, proper storage, and other essential facilities to alleviate excessive marketing costs. Embracing new technologies, adopting improved farm management practices, and providing education and training are essential steps toward achieving the Sustainable Development Goals (SDGs).

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DECLARATIONS

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