An Assessment of Socioeconomic Conditions, Technology Access, Institutional Support, and Livelihood Status among Rural Farmers in Jamalpur District, Bangladesh

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ABSTRACT

Bangladesh's rural livelihoods and food security are dependent on agriculture. This study assessed Jamalpur District rural farmers' socioeconomic conditions, technology access, institutional assistance, and livelihood issues. DAE Attachment and Village Study was part of the N-32nd Foundation Training Course of the National Agriculture Training Academy. Semi-structured questionnaires, face-to-face interviews, and focus group discussions were used to collect primary data from 100 farming households, while relevant reports and publications provided secondary data. Frequencies, percentages, tables, and graphs were used to analyse the data. Most responses were male (74%), and 73% were 26-50. 82% of farmers were married, and 61% lived in 4-6-person homes. Approximately 68% of recorded agricultural land was cultivated. All respondents had modern domestic technologies, but agriculture technologies were rarely used. Most farmers (42%) earned between BDT 10,000 and 15,000 per month. With 87% of farmers in agricultural organisations and 73% using agricultural loans, institutional support was common. Extension officers, input providers, and field visits provided agricultural information. Farmers still struggled with climate change, inadequate irrigation, fragmented land ownership, low machinery, unstable markets, and a lack of quality agricultural inputs. The study emphasises farmer-centered extension services, climate-smart agriculture, access to finance and modern machinery, market connections, and women and youth involvement in agriculture.

Keywords: Agricultural extension; farmers; Jamalpur District; rural livelihoods; technology access

INTRODUCTION

In Bangladesh, Agriculture still a vital pillar of food security, employment generation and rural livelihoods.

Although economic diversification has been rapid, many rural households associated with agriculture either directly (in terms of crop production, livestock rearing or fisheries) or indirectly via agricultural labor and related value chains. Improvements in agricultural productivity can be attributed to expansion of irrigation facilities, new improved crop varieties, fertilizer use, mechanization and strengthening public extension services. Sustainable agricultural development is hampered by a limited natural resources, increased production cost and unstable markets coupled with greater climate related risks (BBS, 2023; FAO, 2022; MoA, 2018; Timsina et al., 2018).

Climate change has become a concern for Bangladesh because of the high vulnerability to floods, river erosion, irregular rainfall patterns, droughts, salinity intrusion, and extreme temperatures. In this context, climate-smart agriculture has gained importance as an approach that aims to increase productivity, strengthen farmers' resilience, and minimize environmental impacts. Practices that can help farmers adapt to changing environments include climate-resilient crop varieties, efficient water and nutrient management, agricultural diversification, improved risk management and access to climate information. The research from Bangladesh indicates that with proper support from effective institutions and relevant services, climate-smart practices and farm-level adaptation measures can significantly improve the security of livelihoods (IPCC, 2022; World Bank, 2019, 2022; Islam et al., 2022; Islam & Farjana, 2024; Majumder et al., 2024).

The rise of agricultural technologies and information systems is also changing rural farming practices. Farmers are being helped to make better production decisions and reduce information gaps through modern machinery, mobile communication, digital advisory platforms, improved irrigation technologies and access to market information. According to prior research, farmers' decisions to adopt technology are influenced by a number of factors, including expected risks, credit facilities, institutional support, information access, and available resources (Feder et al., 1985; Anderson & Feder, 2007). In Bangladesh, studies have shown that machinery availability, extension services, market connectivity, household assets, and supportive service arrangements play significant roles in encouraging technology adoption among farmers (Mottaleb et al., 2016; Aryal et al., 2019; M. M. Rahman et al., 2021; M. S. Rahman et al., 2021; Alam et al., 2024). Digital platforms and mobile based agricultural services are expanding, simply having access to digital devices does not always ensure their effective use for farming (Islam & Grönlund, 2010; Asif et al., 2017; Ahsan et al., 2023; Ahmad et al., 2024).

Jamalpur District is one of the important agricultural districts of Bangladesh with fertile alluvial soil, diverse farming systems, river based environment and high dependence on agriculture. The district has a great potential for crop diversification, vegetable production, livestock development, fisheries and agricultural business. However, there are still a number of problems that farming households have to face, including frequent floods, river erosion, poor irrigation facilities, pest and disease problems, rising input prices, limited access to machinery, and unstable market conditions. These challenges match with national priorities for agricultural development which include building climate resilience, improving extension services, promoting mechanisation and strengthening market and institutional linkages (MoA, 2018, 2020a, 2020b).

In previous studies, Bangladesh has been studied for various aspects of agriculture, such as adoption of technology, extension services, mechanisation, access to digital information, gender participation, climate adaptation and livelihood improvement. However, these problems are often studied separately and not as a whole. Research on gender and agricultural development emphasises the need for access to resources, services, and decision-making opportunities to improve agricultural participation and outcomes. Research on extension and institutional support similarly highlights the essential function of inclusive and effective service delivery systems (Alkire et al., 2013; Seymour, 2017; Afrad et al., 2019; Quisumbing et al., 2022; Medendorp et al., 2022; Alam et al., 2024). A comprehensive assessment combining socioeconomic conditions, technology access, institutional support, and livelihood status can provide significant information for identifying practical development priorities in Jamalpur District.

The present study was carried out to identify the socioeconomic characteristics, agricultural technology adoption, institutional support systems and livelihood conditions of the farmers of Jamalpur District. The study specifically seeks the socioeconomic profile of the farmers in the study area, assess the contribution of agricultural technologies and extension services in improving rural livelihoods, determine the major challenges in

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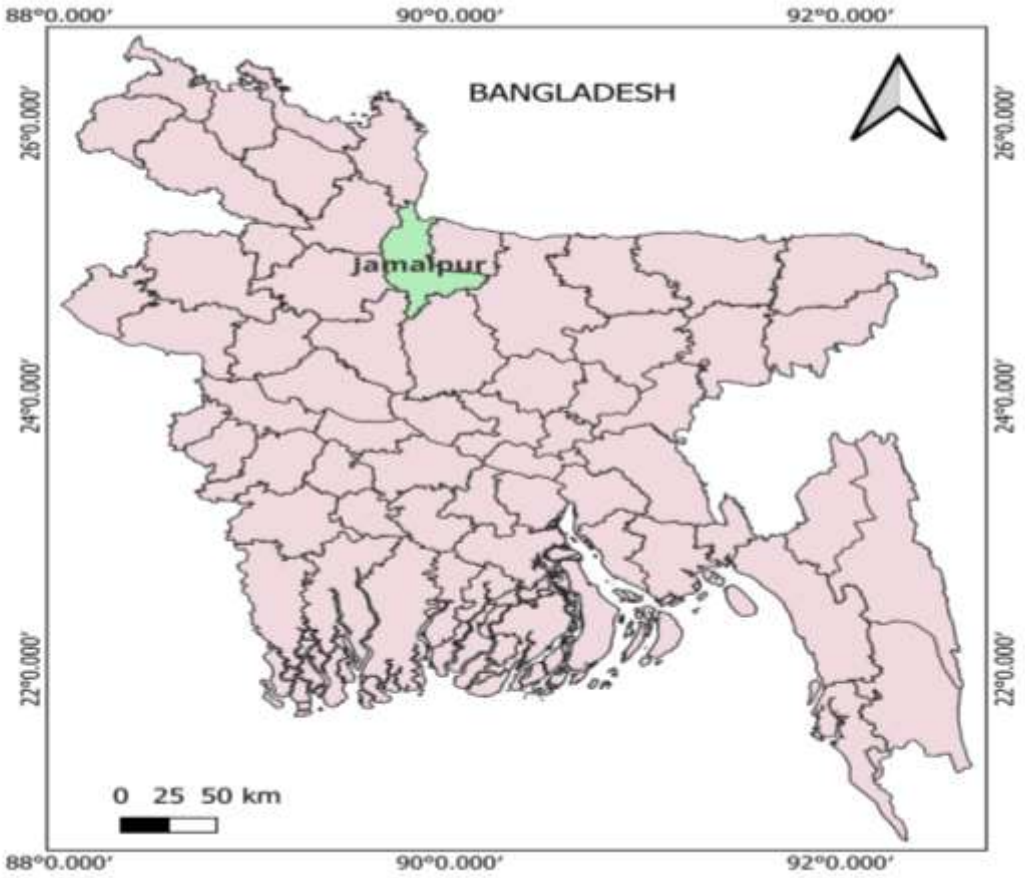
agricultural production and technology adoption, and suggest suitable strategies for promoting sustainable agricultural development in Jamalpur District.

MATERIALS AND METHODS

Study Area



The study was carried out in Jamalpur District of Bangladesh, focusing mainly on rural farming communities within the selected study areas. The study area was chosen because of its importance in agriculture and the dependence of the local households on farming for their livelihood.

Figure 1: Geographical location of the study area showing rural farming communities in Jamalpur District

Research Design

A descriptive cross-sectional research design was used to assess socioeconomic characteristics, technology access and use, institutional support, and livelihood conditions among farming households (Creswell & Creswell, 2023). Quantitative household survey data were combined with qualitative information from focus group discussions (FGDs) to provide contextual explanation for the descriptive patterns. The design was appropriate for documenting conditions at a specific point in time; however, it does not permit causal inference**.**

Sampling Strategy

The target population comprised farming households residing in the selected rural communities of Jamalpur District. A total of 100 households were included. Households were selected using a random sampling strategy. Eligibility criteria were: (i) residence in the selected village/union; (ii) active engagement in crop, livestock, fisheries, or mixed farming during the preceding; (iii) ownership or operational control of agricultural land through ownership, lease, sharecropping, or another locally relevant arrangement; (iv) age 18 years or older; and (v) willingness to provide informed consent.

Data Collection

Both primary and secondary sources of data were used in this study. Primary data were collected from selected farmers through a semi-structured questionnaire designed to capture information on demographic characteristics, household size, educational background, land ownership, agricultural technology use, income, access to credit facilities, membership in rural organizations, and contact with agricultural extension services. To household surveys, focus group discussions (FGDs) were conducted with selected farmers to gather deeper information into existing farming practices, production challenges, and potential opportunities. Secondary information was collected from various published sources, including government reports, statistical publications, agricultural research papers, journals, books, and relevant online resources.

Survey Instrument and Data Collection Period

A structured questionnaire developed by the National Agriculture Training Academy (NATA) was used as the main survey instrument for field data collection. The questionnaire was prepared based on the objectives of the study and included different socioeconomic, agricultural, technological, and institutional indicators. Field level data collection was conducted through direct visits and face-to-face interviews with farmers from 30 November 2025 to 4 December 2025.

Data Processing and Analytical Techniques

After collection, the data were carefully reviewed, edited, coded, organized, and entered into Microsoft Excel for analysis. Both quantitative and qualitative methods were applied to interpret the findings.

Ethical Considerations

The respondents were informed of the purpose and objectives of the study before the interviews. Participation was entirely voluntary, and the information provided by the farmers was used only for academic and research purposes. The privacy and confidentiality of the respondents' personal information was maintained throughout the whole research procedure.

RESULTS

Socio-demographic Characteristics of Respondents

The socioeconomic characteristics of farmers give valuable indication into their farming abilities, decision making processes, and overall livelihood conditions. Among the surveyed respondents, 74% were male and 26% were female (Figure 2). This lower level of female involvement may be due to household responsibilities, traditional gender roles, and fewer opportunities for women to engage directly in agricultural activities.

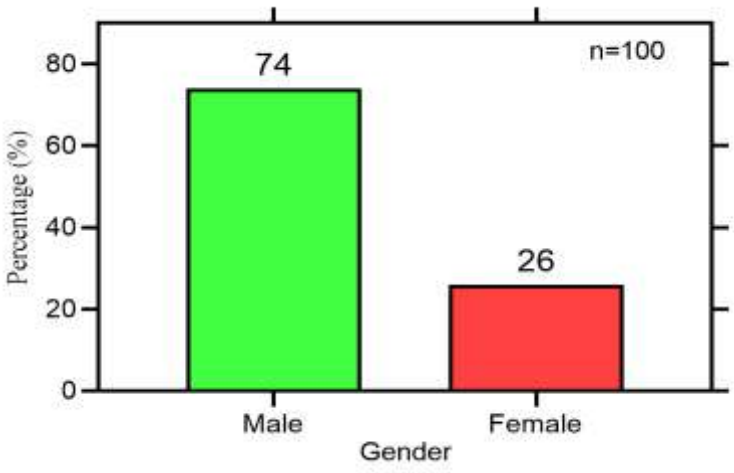


Figure 2. Gender distribution of surveyed farmers in Jamalpur District (n = 100).

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The age distribution among respondents indicates that agricultural activities in the study area are primarily conducted by middle-aged farmers. Around 73% of the surveyed farmers were between 26 and 50 years of age, while only 12% belonged to the younger age group (10–25 years) and 11% were above 50 years (Figure 3). This indicates that agricultural activities in the area depend on the experience and knowledge of farmers, the involvement of young people in farming remains relatively low.

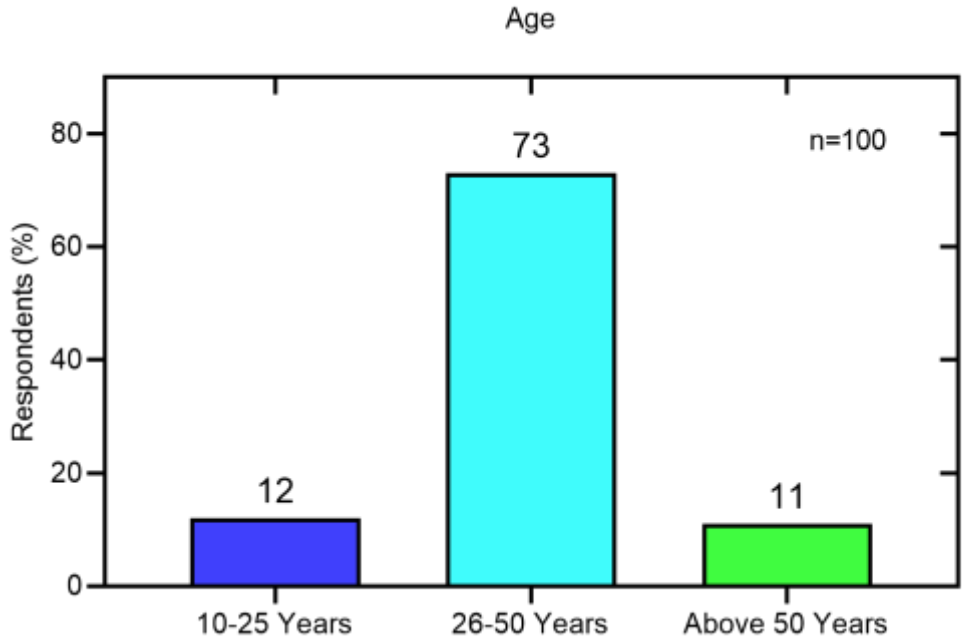

Figure 3. Reported age distribution of surveyed farmers in Jamalpur District.

The marital status revealed that the majority of respondents (82%) were married, while 18% were unmarried (Figure 4). The high percentage of married farmers highlights the importance of family-based farming systems in rural Bangladesh, where agricultural activities depend on the combined efforts and labor contributions of family members.

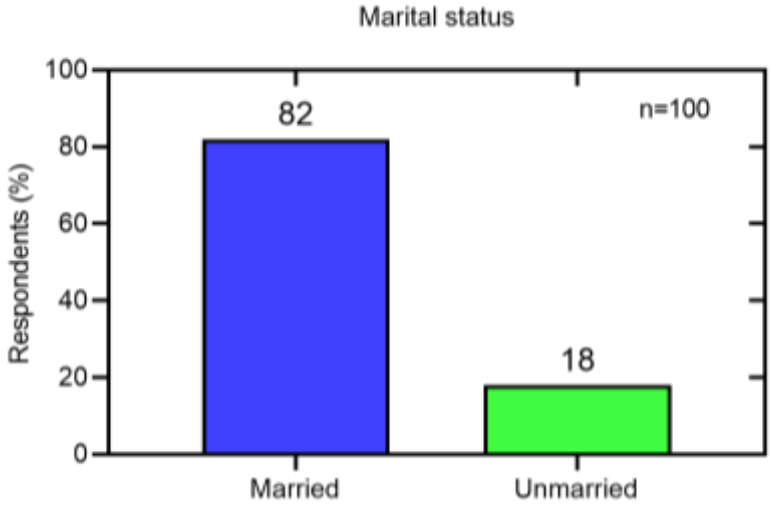

Figure 4. Marital status of surveyed farmers in Jamalpur District.

Family Structure and Educational Status

Family size plays an important role to determine the availability of household labor for agricultural practices. The study found that 61% of farmers belonged to medium sized families (4-6 members), while 21% came from small families (1-3 members) and 18% belonged to large families with more than 6 members (Figure 5).

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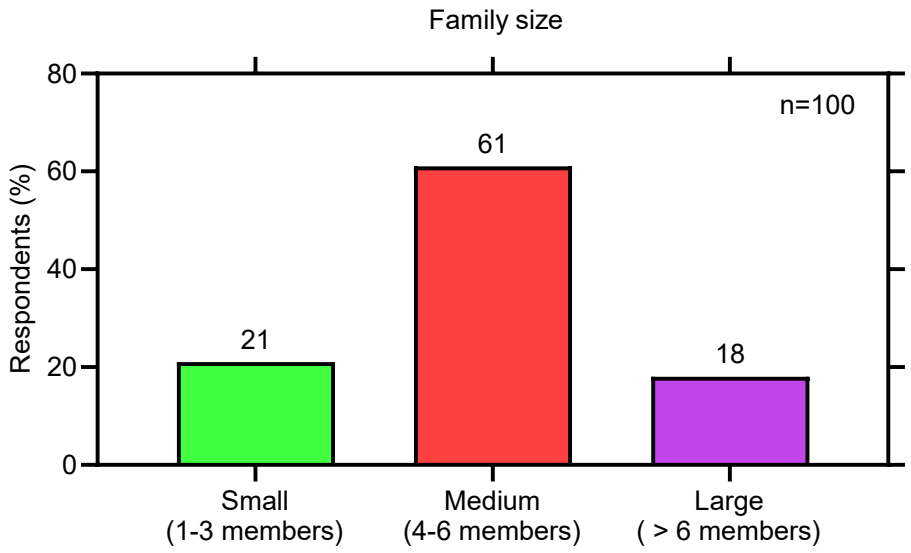

Figure 5. Family-size distribution of surveyed farmers (n = 100).

The educational background of the respondents indicates that most farmers had received basic education. Primary education was the most common level of education among the surveyed farmers, followed by secondary education. However, the number of farmers with higher levels of education was relatively low. Education plays an important role in enhancing farmers ability to adopt new technologies, access agricultural information, and make more effective decisions for farm management and production practices.

Land Ownership and Utilization Pattern

Land is one of the most important productive resources for rural farmers. It directly influences their agricultural activities and income opportunities. The study found that most of the agricultural land was used for farmers own cultivation. Around 68% of the land was under owned cultivation, indicating that farmers largely depend on their own land resources for production. Land used for household purposes accounted for 14%, while leased land, homestead gardening, and fallow land occupied relatively smaller percentage (Figure 4).

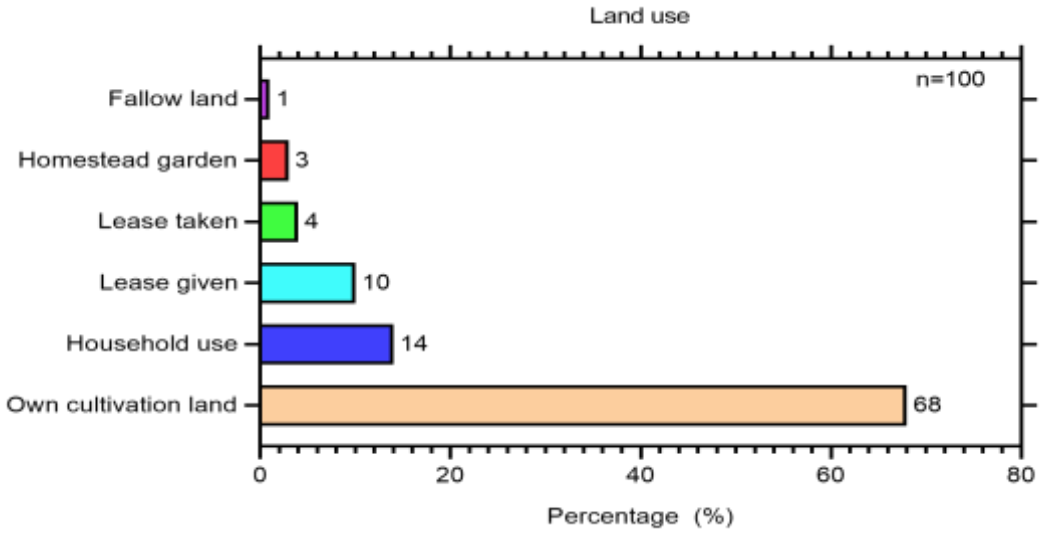

Figure 6. Land utilization pattern reported by surveyed farmers (n = 100).

Access to Modern Household and Communication Technologies

The study showed that high access to modern household and communication technology. Mobile phones, televisions and refrigerators were the modern household technologies used by most respondents. Mobile phones

has strengthened farmers ability to access agricultural information, contact with input suppliers and get market related updates. But farmers are not adopting modern agricultural technology such as precision farming, automated machinery and digital consulting platforms.

Income Status of Farmers

The income distribution of farming households showed noticeable variation among respondents. The most of farmers (42%) reported a monthly income between BDT 10,001 and 15,000, followed by 18% earning between BDT 5,000 and 10,000. Around 15% of respondents had a monthly income ranging from BDT 15,001 to 20,000, while only 14% earned more than BDT 20,000 per month (Figure 7). These findings indicate differences in income levels among farming households in the study area.

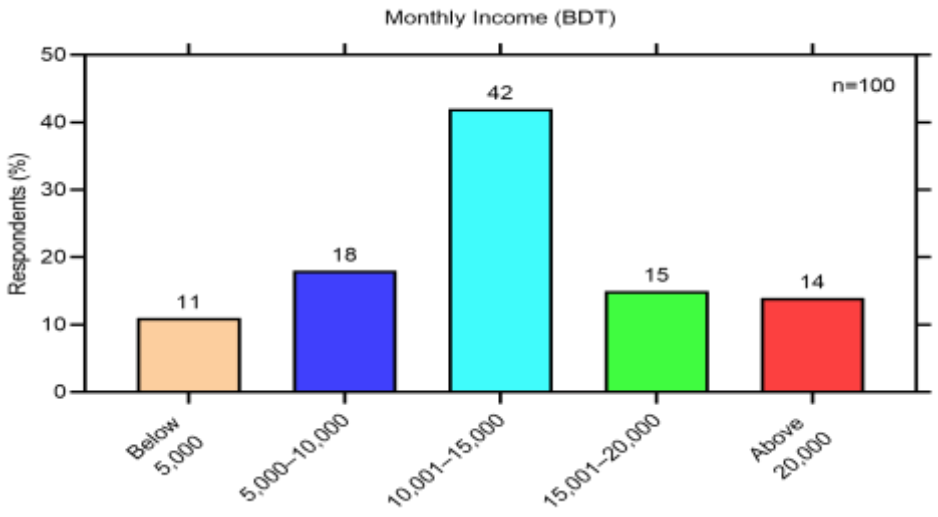

Figure 7. Monthly income distribution of surveyed farmers, in Bangladeshi taka (BDT) (n = 100).

Institutional Support and Extension Services

Institutional linkages are important in improving farmers access to knowledge, services and new agricultural technologies. The survey indicated that 87% of the respondents had connections with different organization mostly farmer groups formed by the DAE, and just 13% of the respondents had no organizational association (Figure 8). Agricultural extension officers were identified as the primary source of agricultural information, followed by input dealers and field visits. These support systems helped farmers acquire knowledge about improved crop varieties, fertilizer management, pest and disease control, and modern agricultural practices for better farm management decisions.

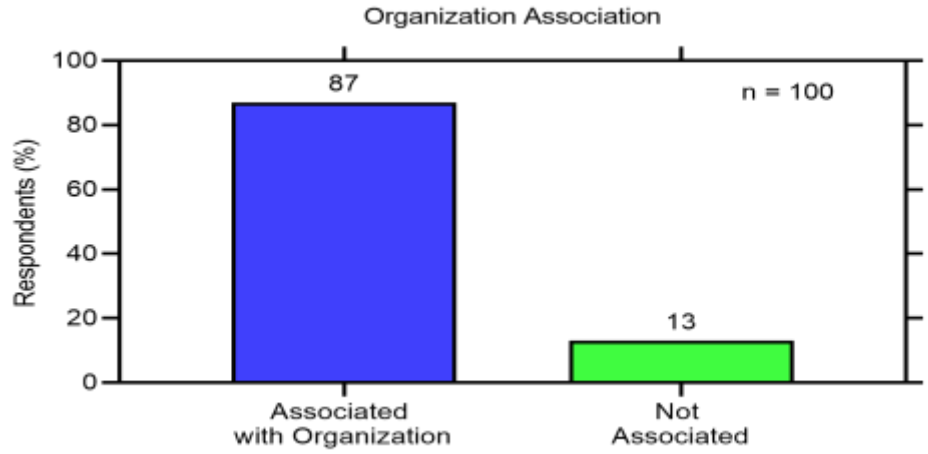

Figure 8. Organizational association among surveyed farmers (n = 100).

Access to Agricultural Credit

Access to credit is an important factor for farmers, it helps them to purchase agricultural inputs, invest in machinery, and manage seasonal production expenses. The study found that maximum farmers (73%) had access to agricultural credit facilities (Figure 9). Respondents gets loans from financial institutions and non-governmental organizations (NGOs), including agricultural banks and microfinance institutions.

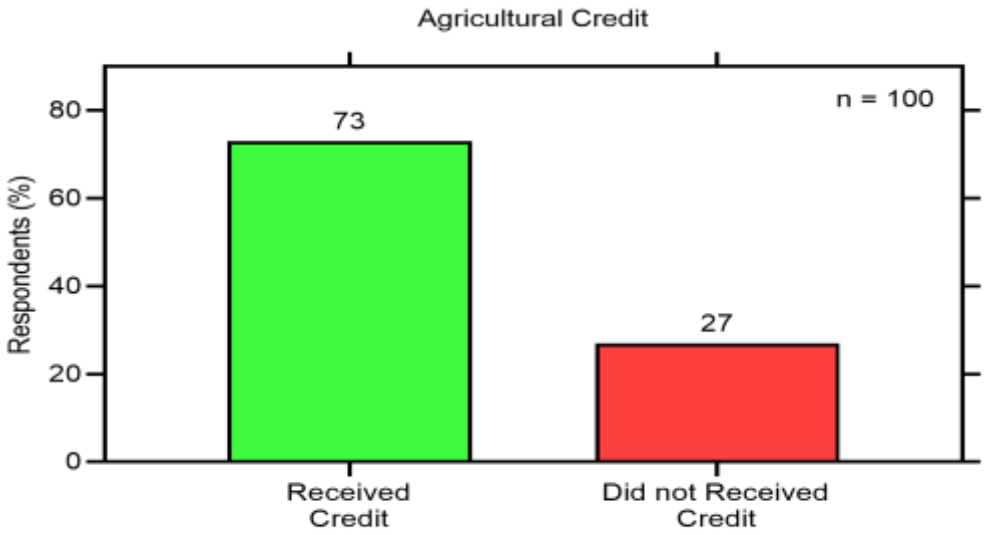

Figure 9. Reported access to agricultural credit among surveyed farmers (n = 100).

DISCUSSION

Results of this study gives a view of socioeconomic reality of the farmers, access to technology, institutional assistance and livelihood situations in the research area. The findings suggest that rural agricultural progress is not determined by access to technology. The effectiveness of transformation also depends on extension services, financial support, organisational engagement, gender inclusion, access to land and machinery, market access and the ability to cope with climate related risks (Feder et al., 1985; Anderson & Feder, 2007; Afrad et al., 2019; Alam et al., 2024).

The study found most farmers were male (74%) and female respondents were 26%. But that does not mean women do not engage in agriculture. In many rural places women are significant in agricultural productivity but their contributions are less visible in farm management, land ownership records, training participation and survey coverage. Studies on empowerment in agriculture in Bangladesh and South Asia indicate that women's access to productive resources, agricultural services, group participation and decision-making opportunities are important factors that significantly affect their ability to benefit from agricultural activities (Alkire et al., 2013; Seymour, 2017; FAO, 2023; Quisumbing et al., 2022). Gender-responsive extension efforts are vital, especially in places where social norms, mobility constraints and limited training options limit women's participation (Medendorp et al., 2022).

The majority of farmers belonged to the 26-50 years age group (73%), indicating that agricultural activities in the study area are largely managed by economically active and experienced farmers. The relatively low participation of younger farmers indicates the need to make agriculture more attractive through skill development, entrepreneurship opportunities, improved mechanization services, and digital agricultural tools. Prior studies on agricultural modernization in Bangladesh indicate that better access to machinery services, institutional support, and appropriate technologies can help to reduce barriers and improve farm efficiency (Mottaleb et al., 2016; Aryal et al., 2019; M. M. Rahman et al., 2021; Ministry of Agriculture, 2020b).

The study found that there was a wide supply of modern household goods like mobile phones, television and refrigerators. Mobile phone access is significant in agriculture since it provides farmers about market information, agricultural advice and engagement with service providers. But access to the digital is not enough to drive effective adoption of agricultural technologies. The value of digital services depends on the quality and relevancy of information, the digital capabilities of customers, the availability of networks and the institutional support (Islam & Grönlund, 2010; Asif et al., 2017; Ahsan et al., 2023; Ahmad et al., 2024). So, digital connectivity should be considered a foundation for agricultural improvement rather than an indicator of advanced technology adoption.

Institutional support and extension linkages were found a significant role in farmers agricultural activities. A large proportion of respondents (87%) were associated with different organizations, while agricultural extension officers, input dealers, and field visits were identified as major sources of farming information. Effective extension services help farmers access improved practices, reduce information gaps, and enhance their ability to make better production decisions. The impact of extension depends on service quality, accessibility, relevance, and inclusiveness (Anderson & Feder, 2007; Afrad et al., 2019). Recent evidence from Bangladesh also shows that extension access contributes to technology adoption and better management of production risks, supporting the need for demand based and farmer centered extension systems (MoA, 2020a; DAE, 2025; Alam et al., 2024). Climate-smart agriculture studies emphasize the importance of training and institutional support for strengthening farmers resilience (Islam & Farjana, 2024).

According to the study a large number (73%) of the respondents had access to agricultural loans. Access to finance allows farmers to purchase the seeds, fertilizers, herbicides, irrigation services, machinery and other inputs they need. But access to credit is not necessarily access to credit of sizeable amounts, at reasonable costs and in a timely manner. Studies have shown that the decisions of farmers to adopt technology are influenced by the joint effects of financial resources, household assets, availability of services and market conditions (Mottaleb et al., 2016; Aryal et al., 2019; M. S. Rahman et al., 2021; Alam et al., 2024).

The land-use pattern shows that 68% agricultural area was under private cultivation according to the study. This means that farmers are primarily dependent on their own land resources for agricultural production. But the smallness and the scattering of the land may make it difficult to use machinery and to develop commercial farming. Research on agricultural mechanization in Bangladesh shows that access to machines depends on farm size, ownership structure, rental services, availability of labour and institutional support. Problems of ownership of machinery to farmers can be solved by hiring services and farmer co-operation (Mottaleb et al., 2016; Aryal et al., 2019; M. M. Rahman et al., 2021; Ministry of Agriculture, 2020b).

Uneven rainfall, pest infestation and water management challenges of the research area are indicated the general vulnerability of the Bangladesh agriculture sector on a climate related basis. Climate smart agricultural strategies like stress tolerant crop varieties, irrigation and drainage systems, crop diversification, improved soil and nutrient management, climate forecasting services and livelihood diversification can play a vital role in resolving these challenges. Adaptation techniques can promote resilience, but their efficiency depends on local conditions, resources and institutional support (World Bank, 2019, 2022; IPCC, 2022; Islam et al., 2022; Islam & Farjana, 2024; Majumder et al., 2024).

Maximum involvement of farmers in organizations provides opportunities for collective learning, improved extension delivery, better access to inputs and loans, machinery services and market linkages. Farmer organizations can minimize the transaction cost and assist service providers reach out to farmers in a more effective manner. But their success depends on good management, active participation and ability to provide services that fulfil real needs of the farmers (Anderson & Feder, 2007; Afrad et al., 2019; Alam et al., 2024). Strengthening farmer groups could therefore support more inclusive and sustainable agricultural development.

The findings highlight the need for an integrated approach to rural agricultural development. Modern agricultural policies in Bangladesh increasingly focus on combining productivity improvement with extension strengthening, mechanization, social inclusion, climate resilience, and improved value chain connections (MoA, 2018, 2020a, 2020b; World Bank, 2019). In Jamalpur District, combining practical training, climate-resilient technologies, machinery support services, inclusive farmer organizations, digital information systems, accessible finance, and

stronger market linkages would likely provide greater benefits than promoting individual technologies in isolation.

Limitations

In this study, 100 farm houses in rural Jamalpur District have been used. The regional research results do not permit the establishment of causation. Home and communication technology were used more than advanced agricultural systems. Qualitative description of educational status and sources of agricultural expertise were carried out due to non-numerical dispersion of the dataset. Larger samples, more specific indicators of technology use, and better statistical methodologies could expose the links between the socioeconomic characteristics of farmers, institutional support, the adoption of technology, and livelihood outcomes.

CONCLUSION

Agriculture sustains rural communities in Jamalpur District. Farmers had communication, agricultural extension, organizational networks and financing. Climate change, fragmentation of landholdings, inadequate mechanization, irrigation problems, unpredictable markets, and cheap inputs impede sustainable agriculture. The recommendations include demand based extension services, climate-smart agriculture, improved finance and machinery, stronger market ties and increased involvement of women and youth in farming. As this is a descriptive study, these recommendations are evidence-based local agricultural development goals, not causative links. Farmers, government agencies, financial institutions, and other stakeholders may work together to strengthen study region agricultural resilience and livelihoods.

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