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Access to agricultural technologies by rural women in Nakla upazila under Sherpur district

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ABSTRACT

The study was conducted to assess rural women's access to agricultural technologies in two villages of Nakla Upazila in Sherpur District, Bangladesh. Data were collected from 110 respondents by face-to-face interviews using a pre-tested structured interview schedule. Findings revealed that 61.8% of the respondents had medium access to agricultural technologies, with crop sector technologies being the most widely adopted. In the crop sector, water pumps, power tillers, and threshers were the most commonly accessed technologies. In fisheries, water pumps and improved feed ranked highest, while in livestock, water pumps and grass cutters were the most frequently used technologies. Despite moderate access, significant barriers included lack of credit facilities and insufficient training opportunities. Correlation analysis showed that land ownership, knowledge of agricultural technologies, extension media contact, and cosmopoliteness had a significant positive influence on access to agricultural technologies. Specific policy implications include the need for targeted interventions that improve women's access to credit, enhance training programs, and increase availability and affordability of technologies. Additionally, policies should focus on increasing women's participation in decision-making and ensuring that extension services are more accessible to them. Addressing these issues can help close the gender gap in agricultural technology access, empowering rural women and contributing to sustainable agricultural development.

Introduction

Agriculture is the cornerstone of Bangladesh's economy, employing a significant portion of the population and contributing notably to the nation's GDP. Within this sector, rural women are indispensable, actively participating in a wide range of agricultural activities, including crop production, livestock management, and post-harvest processing (Rahman 2010). Despite their

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substantial contributions, rural women in Bangladesh often face significant socio-economic challenges that impede their access to agricultural technologies. These challenges are exacerbated by entrenched gender norms that marginalize women in decision-making processes and limit their access to resources and opportunities (Nazneen, Hossain & Sultan 2011). Addressing these gender disparities is crucial not only for the empowerment of rural women but also for the overall development of the agricultural sector and the economy at large (Mandal 2013).

Rural women in Bangladesh encounter a variety of challenges that hinder their access to agricultural technologies. These challenges can be categorized into socio-cultural, economic, and institutional barriers. Socio-cultural norms, such as restrictions on women's mobility and decision-making power, often limit their ability to participate in agricultural training programs and access agricultural inputs (Mason & Smith 2003). Economic barriers, such as limited access to credit and land, further restrict their ability to purchase and utilize new technologies (Rahman & Routray 1998). Additionally, institutional barriers, such as the lack of gender-sensitive agricultural extension services, exacerbate these challenges, making it difficult for women to access the information and support they need to adopt new technologies (Ruzzante, Labarta, & Bilton 2021). By identifying and analyzing these problems, this study aims to provide recommendations for improving rural women's access to agricultural technologies in Bangladesh.

A review of the existing literature (Rahman 2000; Saha et al. 2021; Shajahan et al. 2022; Sraboni *et al.* 2014; Theis *et al.* 2019) reveals a significant body of research on gender and agricultural technology in developing countries. Rahman and Routray (1998) provide a comprehensive analysis of gender issues in agricultural technology adoption in Bangladesh, highlighting the various barriers that women face in accessing and utilizing these technologies. Similarly, Quisumbing and Kumar (2011) discuss the role of social capital in building women's assets and its long-term impact on the adoption of agricultural technologies. In the context of Bangladesh, Rahman (2010) has conducted studies that explore the specific challenges faced by rural women in accessing agricultural technologies, emphasizing the importance of addressing socio-cultural norms and economic barriers. Rola-Rubzen *et al.* (2020) highlight the need for practical action to improve gender participation in agricultural technology adoption, moving beyond rhetoric to implement effective strategies. While these studies offer valuable insights, they often generalize findings across diverse contexts, leaving gaps in understanding the specific challenges rural women face in Bangladesh's agricultural sector. Furthermore, while gender-sensitive technologies and programs have been proposed, their practical implementation and effectiveness in rural settings remain underexplored.

This study aims to address these gaps by providing a detailed analysis of the socio-economic factors influencing rural women's access to agricultural technologies. Specifically, it seeks to assess their access to agricultural technologies, examine the relationship between socio-economic status and technology adoption, and identify the barriers women face. Unlike prior studies, this research emphasizes the cultural and institutional contexts unique to rural Bangladesh, offering a nuanced understanding of gender dynamics in agriculture. The study's novelty lies in its focus on integrating feminist technology perspectives to critically assess the factors affecting women's access to agricultural technologies. Its contribution lies in offering insights for policymakers and stakeholders to empower women, promote gender equality, and enhance agricultural productivity. By addressing these issues, the study not only advances academic knowledge but also supports the development of sustainable and equitable agricultural practices.

Methodology

Locale of the study

The study was conducted in Nakla upazila of Sherpur district in Bangladesh. Nakla Upazila is located between latitudes 24°53' to 25°02' North and longitudes 90°07' to 90°15' East. It is bordered by Nalitabari Upazila to the north, Fulbaria and Haluaghat Upazilas to the east, Jamalpur Sadar and Mymensingh Kotwali Upazilas to the south, and Sherpur Sadar Upazila to the west. Nakla Upazila covers an area of 174.80 square kilometers and has a population of 198,081 people. Nakla Upazila has a population distribution where approximately 51.5% are male and 48.5% are female. In terms of residence, about 80.6% of the population lives in rural areas, while 19.4% reside in urban areas (Bangladesh National Portal, 2024). Two villages namely Bausha and Baneshwardi of Baneshwardi Union of Nakla upazila were selected randomly as a specific study location. A map of Nakla upazila has been presented in Figure 1 highlighting the specific study location.

Research design sampling technique

The study employs a mixed-methods research design, combining both quantitative and qualitative approaches. It involves surveys and interviews with rural women to gather data on socio-economic status, access to agricultural technologies, and challenges faced. Statistical analysis and thematic content analysis are used to explore relationships and draw meaningful conclusions. All the women farmers of the selected two villages were the population of this study. There are approximately 470 households where

Fig. 1. Map of Nakla upazila of Sherpur district showing the study area

women are actively engaged in agriculture related activities who constituted population of the study. Out of the population, 110 (23% of total) households were selected as sample households following simple random sampling technique. One women from each selected household were considered as sample respondents for conducting household survey.

Data collection

Data collection for this study was conducted using a combination of face-to-face interviews, Focus Group Discussions (FGDs), and Key Informant Interviews (KIIs). Face-to-face interviews allowed for detailed, personalized responses from individual participants, with an interview schedule ensuring consistency across respondents. FGDs facilitated group interaction, revealing collective views and social dynamics related to agricultural technology access. KIIs provided expert insights from knowledgeable individuals such as local leaders and agricultural officers. Before the full data collection, a pre-test of the interview schedule was conducted to refine questions and improve the reliability and validity of the data-gathering process.

Variables and their measurement

In order to explore the socio-economic characteristics of the respondents, information on several variables such as age, family size, land ownership, educational attainment, knowledge on agricultural technology, extension media contact and cosmopoliteness were collected following standard procedure through structured interview schedule. Age of a respondent was assessed based on the actual age of her life and expressed in years. Family size was measured by the total number of members, including the respondent herself, spouse, children and other members who jointly lived together. Land ownership was measured by the total land area owned by the respondents. The education was measured by the number of classes completed in formal educational system. To measure the overall knowledge of respondents on agricultural technology each respondent was asked to answer eight questions. Each of the questions was assigned a score of '2' irrespective of their hardness or difficulties to answer by the respondents. Answer of each question was given a score depending on the correctness and wrongness of the answers. The extension media exposure was determined against a five-point scale as daily, weekly, monthly, yearly and not at all and a score of 4, 3, 2, 1, and 0 was assigned, respectively. Cosmopoliteness of the woman of study area was determined against a five-point scale as daily, weekly, monthly, yearly and not at all and a score of 4, 3, 2, 1, and 0 was assigned, respectively.

Status of rural women's access to agricultural technology was the major focus of the study. The level of access to agricultural technology was measured on a four-point continuum such as full access, moderate access, partial access, and no access at all and a score of 3, 2, 1 and 0 was assigned, respectively. Rural women's access to agricultural technology was measured in three sub-sector such as crop, fisheries, and livestock sector. Hence, an index of the access score for the crop, fisheries and livestock sectors were calculated following the equation 1. After that, the overall access score was calculated following the equation 2.

$$TAI_{crop\,fisheries,\,livestock} = T_n \times 0 + T_p \times 1 + T_m \times 2 + T_f \times 3 \quad \text{..... (1)}$$

Where, $TAI_{crop,\ fisheries,\ livesock}$ is Technology Access Index score of crop, fisheries, and livestock sector; T_n = Number of respondents who have no access to a technology; T_p = Number of respondents who partial access to a technology; T_m = Number of respondents who have moderate access to a technology; T_f = Number of respondents who have full access to a technology.

Overall access score

$$Overall\ Technology\ Access = \sum_{i=1}^{n} T_i \times A_i \quad \text{..... (2)}$$

Where, overall technology access denotes the total technology access score of a respondent based on her opinion on the level of access under crop, fisheries and livestock technologies; T_i means a specific technology, and A_i means level of access to a specific technology by the respondents. There are altogether 24 agricultural technologies were considered in this study to make the analysis manageable. So, the overall technology access score of a respondent may vary from 0-72.

Collected data were edited, coded and input in computer software namely Statistical Package for Social Sciences (SPSS). Statistical tests like frequency count, percentage, mean, standard deviations were performed to perform the descriptive nature of the findings. To explore the relationship between socio-economic characteristics and overall access to agricultural technology, co-efficient of correlation (r) test was performed.

Table 1. Socio-demographic profile of the respondent women

Selected Characteristics (Measuring units)	Observed ranges	Respondents (n=110)		Percent	Mean	SD
		Categories	Number			
Age (year)	28-60	Young	30	27.3	45.09	7.97
		Middle	59	53.6		
		Old	21	19.1		
Educational attainment (actual level)	0-15	No	21	19.1	4.28	2.96
		Primary	55	50		
		Secondary	32	29.1		
		Higher	2	1.8		
Family size (No. of member)	2-9	Small	15	13.63	4.92	1.36
		Medium	83	75.45		
		Large	12	10.92		
Land ownership (Acre)	0.09-6	Landless	0	0	1.63	1.15
		Marginal	12	10.9		
		Small	72	65.5		
		Medium	26	23.6		
		Large	0	0		
Knowledge on agricultural technology (Scores)	2-15	Low	31	28.2	8.30	3.35
		Medium	53	48.2		
		High	26	23.6		
Extension media contact (Scores)	8-18	Low	26	23.6	12.63	2.07
		Medium	66	60.0		
		High	18	16.4		
Cosmopoliteness (Scores)	1-13	Low	25	22.5	7.52	2.68
		Medium	71	64.9		
		High	14	12.6		

Results and Discussion

Socio-economic characteristics of the respondent rural women

Table 1 presents the socio-demographic profile of the 110 respondent women involved in the study, offering a comprehensive view of various selected characteristics such as age, educational attainment, family size, land ownership, knowledge of agricultural technology, extension media contact, and cosmopoliteness. These characteristics were measured and categorized to provide insights into the respondents' backgrounds and their potential influence on access to agricultural technologies.

The age of the respondents ranged from 28 to 60 years. The table categorizes the respondents into three age groups: young (27.3% of respondents), middle-aged (53.6%), and old (19.1%). The mean age was 45.09 years, with a standard deviation of 7.97, indicating a moderate age spread within the sample. This distribution suggests a predominance of middle-aged women in the study, which could be significant in understanding the experience and knowledge levels among the participants. The educational levels of the respondents ranged from 0 to 15 years of schooling, divided into four categories: no education (19.1%), primary education (50%), secondary education (29.1%), and higher education (1.8%). The mean level of education was 4.28 years, with a standard deviation of 2.96, showing a relatively low overall educational attainment. The majority of women had completed primary education, which might impact their understanding and adoption of agricultural technologies.

Family size among respondents ranged from 2 to 9 members. It was categorized into small (13.63%), medium (75.45%), and large (10.92%) families. The mean family size was 4.92 members, with a standard deviation of 1.36, indicating a tendency towards medium-sized families. It is evident that the average family size of 4.92 in the study area exceeded the national average of 3.93 in Bangladesh (BBS, 2023). Family size could influence labor availability and economic decisions related to agriculture. Land ownership varied from 0.09 to 6 acres, categorized into landless (0%), marginal (10.9%), small (65.5%), medium (23.6%), and large (0%) landowners. The mean land ownership was 1.63 acres, with a standard deviation of 1.15. It's noteworthy that the average farm size of 1.63 acres in the study area exceeded the national average of 1.46 acres in Bangladesh (BBS, 2016). This suggests that the majority of respondents were small landowners, which is typical in rural Bangladesh, and this could impact their access to and investment in agricultural technologies. The respondents' knowledge of agricultural technology was assessed with scores ranging from 2 to 15, classified as low (28.2%), medium (48.2%), and high (23.6%). The mean score was 8.30, with a standard deviation of 3.35, indicating varied levels of awareness and understanding of agricultural technologies among the women. This variation may reflect differences in educational background, access to information, and experience in farming. Contact with extension media was measured with scores between 8 and 18, categorized into low (23.6%), medium (60%), and high (16.4%) levels of contact. The mean score was 12.63, with a standard deviation of 2.07. The majority of respondents had medium-level contact with extension services, which could play a crucial role in their adoption of agricultural technologies. Cosmopoliteness, indicating the respondents' exposure to the outside world, was scored from 1 to 13, with categories of low (22.5%), medium (64.9%), and high (12.6%). The mean score was 7.52, with a standard deviation of 2.68. This measure suggests that most women had moderate exposure beyond their immediate environment, which might influence their openness to new agricultural practices and technologies.

Rural women's access to agricultural technologies

In case of crop-based technology, the scores ranged from 6 to 35 against the possible range from 0 to 39 with a mean value of 16.96 and standard deviation of 6.06. The respondents were classified into four categories according to their access to agricultural technologies such as no access, low access (1-10),

Table 2. Distribution of the respondents according to their access to agricultural technology based on crop sector

Sl.	Category	Frequency	Percentage	Mean	SD
1.	No	0	0	16.96	6.06
2	Low (1-10)	19	17.3		
3.	Medium (11-22)	69	62.7		
4.	High (above 22)	22	20.0		

moderate access (11-22) and full access (more than 22) that are presented in Table 2.

Table 2 revealed that none of the respondents reported having no access to agricultural technology (0%), indicating that all participants had at least some level of exposure to agricultural technologies in the crop sector. A small portion of respondents (17.3%) fell into the Low access category, with access levels ranging from 1 to 10 on a standardized scale. This suggests that while these women had some engagement with agricultural technologies, their exposure was limited. The majority of respondents (62.7%) were categorized under Medium access, with scores ranging from 11 to 22. This indicates that most of the women had a moderate level of access to agricultural technologies, reflecting more regular use and familiarity with innovations in the crop sector. Finally, 20% of the respondents were classified as having High access to agricultural technologies, with scores above 22. These women demonstrated significant engagement with advanced agricultural practices and tools, likely reflecting greater opportunities and resources. The mean access score across all respondents was 16.96, with a standard deviation of 6.06, indicating variability in access levels. This distribution highlights the disparity in access to agricultural technology among rural women, emphasizing the need for targeted interventions to support those with lower access levels and enhance technology adoption in the crop sector. Shajahan and Mirjana (2022) found in their study that rural women have limited access to agricultural technologies compared to men. Furthermore, it has been confirmed by the study that rural women face physical and economic constraints in terms of access to agricultural technologies.

Rural women's access to fish farming technologies increases their social and economic empowerment. In case of access to fish farming technology, the scores ranged from 0-11 against the possible range from 0 to 15 with mean value of 4.76 and standard deviation of 3.56. The respondents were classified into four categories according to their access to fish farming-related technologies such as no access, low access (1-4), medium access (5-9) and high access (above 9) that are presented in Table 3.

The Table 3 shows that 18.2% of the respondents reported having no access to agricultural technology in the fisheries sector. This indicates that nearly one-fifth of the women engaged in fisheries lacked any exposure to modern technologies, likely due to barriers such as financial constraints, lack of awareness, or limited availability of technology. A significant proportion of respondents (36.4%) fell into the low access category, with access scores ranging from 1 to 4. These women had some involvement with agricultural technologies in the fisheries sector but to a minimal extent. The medium access group comprised 29.1% of the respondents, with scores ranging from 5 to 9. These women demonstrated moderate use of fisheries-related technologies, suggesting a more frequent and consistent application of modern practices in their aquaculture activities. Lastly, 16.4% of the respondents were classified under high access, indicating that these women had a substantial engagement with advanced technologies in the fisheries sector, with scores above 9. The overall mean access score in the fisheries sector was 4.76, with a standard deviation of 3.56, highlighting

a wide range of access levels among the respondents. The variability underscores the need for targeted efforts to improve access to fisheries technologies, particularly for those in the low and no-access categories. Similar incidents were also observed in the study of Aregu et al. (2018), reported that women are less benefited from new technologies in aquaculture, fisheries and agricultural systems compared to men.

The major activities related to livestock farming are normally performed by rural women in Bangladesh. In case of access to livestock farming technologies, the scores ranged from 0-15 against the possible range from 0-18 with mean value of 5.75 and standard deviation of 3.97. The respondents were classified into four categories according to their access to livestock farming-related technologies such as no access, low access (1-4), medium access (5-10) and high access (above 10) that are presented in Table 4.

The data reveals that 14.5% of the respondents reported no access to agricultural technology in the livestock sector, indicating that these women had not engaged with or utilized any modern livestock-related technologies. This highlights a portion of the population that remains disconnected from innovations that could potentially enhance their livestock farming productivity. A further 20.0% of the respondents were classified under low access, with access scores ranging from 1 to 4. These women had minimal interaction with livestock technologies, likely utilizing only basic or limited technological tools in their livestock activities. The majority of respondents (52.7%) fell into the medium access category, with access scores ranging from 5 to 10. This indicates that over half of the women had moderate engagement with livestock technologies, reflecting a more consistent application of innovations and modern practices within the sector. Lastly, 12.7% of respondents reported high access to agricultural technology in the livestock sector, with access scores above 10. These women demonstrated significant utilization of advanced technologies in their livestock farming activities. The mean access score for the livestock sector was 5.75, with a standard deviation of 3.97, indicating considerable variability in access levels. This suggests that while many rural women are moderately involved with livestock technologies, a notable portion still faces challenges in accessing and fully utilizing these innovations. These findings are in line with the findings of Saha et al. (2021), found that more than half of the respondents had medium level of technological empowerment which indicates that women gained medium level of technological access related to livestock farming.

For better understanding, regarding the item-wise access to agricultural technologies, Technology Access Index (TAI) and rank order were computed and presented below.

Table 5 illustrates the rank order of access to various agricultural technologies in the crop sector among the respondents, based on the Total Access Index (TAI). The technologies are ranked according to the level of access reported by respondents, categorized into four levels: Full access, Moderate access, Partial access, and No access with a potential TAI score of 0-330.

The highest-ranked technology, with a TAI of 279, is the water pump, which received the most widespread

Table 4. Distribution of the respondents according to their access to agricultural technology based on livestock sector

Sl.	Category	Frequency	Percentage	Mean	SD
1.	No	16	14.5	5.75	3.97
2.	Low (1-4)	22	20.0		
3.	Medium (5-10)	58	52.7		
4.	High (above 10)	14	12.7		

usage, with 62 respondents having full access and 45 reporting moderate access. This reflects the critical role of water pumps in irrigation and water management for crop production. Following closely is the power tiller, ranked second with a TAI of 258. A significant number of respondents (57) reported full access, while 34 had moderate access, indicating its importance for land preparation and cultivation. The thresher ranks third with a TAI of 251, with 57 respondents having full access and 31 having moderate access. Threshers are essential for post-harvest processing, particularly in grain production, which explains their widespread use. Farm machinery, including various equipment types, holds the fourth rank with a TAI of 205, with 20 respondents reporting full access and 55 reporting moderate access. Its relatively high usage indicates the growing mechanization in farming practices. Lower-ranked technologies include sprayers (TAI 164), seed production and storage technology (TAI 159), and pest control through IPM (TAI 133). These technologies are moderately accessed but still reflect important aspects of crop production. Technologies such as reapers, dragon fruit cultivation, and vermicompost production are less accessible, with many respondents reporting no access. The drum seeder ranks lowest with a TAI of 24, reflecting limited usage, with 87 respondents reporting no access at all. These lower-ranked items suggest areas where technology adoption is lagging and where targeted interventions could enhance access and utilization. The overall distribution of access levels highlights the critical role of certain technologies in the crop sector, while also emphasizing the need for improved access to less commonly used innovations.

In order to quantify the TAI in fisheries sector, five fisheries-related technologies such as improved feed, water pump, aerator, egg-hatching equipment, and generator were considered. Based on the opinion of the respondents regarding their level of access to selected fisheries-related technologies, TAI was calculated and ranked (Table 6).

The highest-ranked technology in the fisheries sector is the water pump, with a TAI of 158. It is widely used, with 22 respondents reporting full access, 25 reporting moderate access, and 42 reporting partial access. The water pump's importance lies in its role in water management for fish farming, making it a critical technology in aquaculture practices. Ranked second is improved feed with a TAI of 132. Although

Table 5. Rank order of access to agricultural technology in crop sector

Sl.	Items	Number of responses				TAI	Rank
		Full	Moderate	Partial	No		
1.	Water pump	62	45	3	0	279	1st
2.	Thresher	57	31	18	4	251	3rd
3.	Power tiller	57	34	19	0	258	2nd
4.	Farm machinery	20	55	35	0	205	4th
5.	Sprayer	24	29	34	23	164	5th
6.	Seed production & storage technology	2	45	63	0	159	6th
7.	Pest control through IPM	28	15	9	55	133	7th
8.	Reaper	3	17	30	60	73	9th
9.	Dragon fruit cultivation	12	8	20	70	72	10th
10.	Vermicompost production	18	21	28	43	124	8th
11.	Transplanter	2	13	19	76	51	11th
12.	Tractor	2	13	41	54	73	9th
13.	Drum seeder	0	1	22	87	24	12th

fewer respondents (7) reported full access, a significant number had moderate (34) and partial (43) access. Improved feed is vital for enhancing fish growth and productivity, which explains its widespread adoption. The aerator ranks third with a TAI of 129, with 17 respondents having full access, 22 having moderate access, and 34 having partial access. Aerators are essential for maintaining oxygen levels in water, which is crucial for fish health and growth, making it another significant technology in aquaculture. Generators and egg-hatching equipment rank fourth and fifth, respectively. Although these technologies have relatively lower TAIs (56 and 49), they still play critical roles in specific fish farming processes. For instance, generators are used to power various equipment during power outages, while egg-hatching equipment is specialized for breeding purposes. Overall, the table highlights that while essential technologies like water pumps and improved feed are widely adopted, there is room to improve access to other critical tools like aerators, generators, and egg-hatching equipment to optimize fish farming outcomes.

In order to quantify the TAI in the livestock sector, six livestock-related technologies such as grass cutter, improved feed, vaccine, milking machine, water pump, and artificial insemination were considered. Based on the opinion of the respondents regarding their level of access to selected fisheries-related technologies, TAI was calculated and ranked (Table 7).

The highest-ranked technology is the water pump, with a TAI of 162. A significant number of respondents reported access to this technology, with 25 having full access, 28 moderate access, and 31 partial access. Water pumps are crucial in livestock farming for providing water to animals and maintaining hygiene standards, explaining their high usage. Ranking second is the grass cutter, with a TAI of 137. Grass cutters are essential for harvesting fodder, and 12 respondents reported full access, 29 moderate access, and 43 partial access. This technology's adoption reflects the importance of efficient fodder management in livestock farming. The improved feed ranks third with a TAI of 129. Improved feed is vital for enhancing livestock productivity, and 13 respondents had full access, 20 had moderate access,

Table 6. Rank order of access to agricultural technology in fisheries sector

Sl.	Items	Number of responses				TAI	Rank
		Full	Moderate	Partial	No		
1.	Improved feed	7	34	43	26	132	2nd
2.	Water PUMP	22	25	42	21	158	1st
3.	Aerator	17	22	34	37	129	3rd
4.	Egg-hatching equipment	0	8	33	69	49	5th
5.	Generator	0	10	36	64	56	4th

Table 7. Rank order of access to agricultural technology in livestock sector

Sl.	Items	Number of responses				TAI	Rank
		Full	Moderate	Partial	No		
1.	Vaccine	15	15	48	32	123	4th
2.	Improved feed	13	20	50	27	129	3rd
3.	Grass cutter	12	29	43	26	137	2nd
4.	Water pump	25	28	31	26	162	1st
5.	Artificial insemination	0	9	36	65	54	5th
6.	Milking machine	0	2	24	84	28	6th

and 50 had partial access, indicating a widespread but varied level of adoption among farmers. Vaccines rank fourth with a TAI of 123. Vaccination is crucial for disease prevention in livestock, and 15 respondents had full access, 15 had moderate access, and 48 had partial access. The moderate level of access suggests that while vaccination is recognized as important, there are still barriers to full adoption. Lower-ranked technologies include artificial insemination (TAI of 54) and the milking machine (TAI of 28). Artificial insemination, which enhances breeding practices, is less accessible, with no respondents reporting full access and most (65) having no access at all. Similarly, milking machines, which can improve efficiency in milk production, are underutilized, with only 2 respondents reporting moderate access and 84 having no access. The table highlights that while essential technologies like water pumps, grass cutters, and improved feed are relatively accessible, there is a significant gap in access to more advanced tools such as artificial insemination and milking machines. This indicates the need for targeted interventions to improve access to these technologies, which could enhance livestock productivity and efficiency.

The scores of overall accesses to agricultural technology of rural women ranged from 8-50 against the possible range from 0-72 with mean value of 27.48 and standard deviation of 9.57. The respondents were classified into three categories according to their access to agricultural technologies as low access (<18), medium access (18-36) and high access (>36) that are presented in Table 8.

The low-access category, which includes respondents with a total score of less than 18, represents 21.8% of the sample. These 24 respondents face significant challenges in accessing agricultural technology, which may limit their ability to adopt improved farming practices and optimize productivity. The barriers to access in this group could be due to several factors, such as limited financial resources, lack of information, and infrastructural constraints. This finding underscores the need for targeted interventions to address the technological gaps faced by these women and to provide them with the necessary support to integrate modern agricultural technologies into their farming activities. The majority of respondents, 61.8%, fall into the medium-access category, with scores ranging from 18 to 36. These 68 respondents have a moderate level of access to agricultural technology, indicating that they have access to some essential tools and practices but may still face limitations in fully adopting advanced technologies. This group likely benefits from certain technologies that have been disseminated more widely but still encounters obstacles in expanding their access further. Policymakers and development agencies should focus on enhancing the capacity of these women by improving access to a broader range of technologies and ensuring that they are well-equipped to make the most of the available tools. The high-access category includes respondents with scores greater than 36, representing 16.4% of the sample. These 18 women have extensive access to agricultural technology, which likely contributes to higher productivity and greater efficiency in their farming operations. The relatively small size of this group suggests that there is a significant portion of the population that still lacks comprehensive access to the full spectrum of agricultural technologies. Efforts should be made to understand the factors enabling access for this group and to replicate those conditions

Table 8. Distribution of the respondents according to their overall access to agricultural technology

Sl.	Category	Frequency	Percentage	Mean	SD
1.	Low (<18)	24	21.8	27.48	9.57
2.	Medium (18-36)	68	61.8		
3.	High (>36)	18	16.4		

for others. The overall mean score of 27.48 with a standard deviation of 9.57 indicates a wide range of access levels across the sample. The significant variation reflects unequal access to technology among rural women, which can be influenced by factors such as socio-economic status, education, and geographic location.

Relationship between socio-economic characteristics and access to agricultural technology

The relationship between the respondent's selected characteristics and the dependent variable which is women's access to agricultural technology has been described in this section. The relationship was measured by using Pearson's product-moment correlation co-efficient. The summary of the result of correlation analysis between dependent and independent variables has been presented in Table 9.

Table 9 explores the correlation between various socio-economic characteristics of rural women and their access to agricultural technology, providing insights into how these factors influence their ability to adopt and utilize technological innovations in agriculture. The correlation coefficients revealed the strength and direction of the relationships between the selected characteristics and access to agricultural technology. Age has a negative correlation with access to agricultural technology, though the relationship is weak ($r = -0.102$) and not statistically significant. This suggests that older rural women may have slightly less access to agricultural technology than younger women, possibly due to differences in technological adaptability or access to resources. However, the weak correlation implies that age alone is not a major determining factor. Educational attainment shows a positive correlation with access to agricultural technology ($r = 0.145$), although this relationship is not statistically significant. This indicates that women with higher levels of education tend to have better access to agricultural technology. Education likely enhances women's ability to comprehend and utilize technology, though other factors might play a more significant role in determining access. Family size also has a positive but weak correlation with access to agricultural technology ($r = 0.154$), suggesting that women from larger families may have slightly better access. This could be due to greater labor availability within the household, allowing for more involvement in agricultural activities that require technology. However, the weak correlation indicates that family size is not a major factor. Land ownership exhibits a strong and statistically significant positive correlation with access to agricultural technology ($r = 0.559$, $p < 0.01$). This suggests that women who own more land have significantly better access to agricultural technology. Land ownership often provides the financial stability and resources necessary to invest in agricultural

Table 9. Correlation between socio-economic characteristics and access to agricultural technology

Sl.	Selected characteristics of the rural women	Co-efficient of correlation with access to agricultural technology
1.	Age	-0.102
2.	Educational attainment	0.145
3.	Family size	0.154
4.	Land ownership	0.559**
5.	Knowledge on agricultural technology	0.457**
6.	Extension media contact	0.531**
7.	Cosmopoliteness	0.422**

**= Significant at 0.01 level of probability

innovations, making it a key factor in determining access. Knowledge of agricultural technology also has a strong and significant positive correlation with access ($r = 0.457$, $p < 0.01$). This implies that women who possess more knowledge about agricultural technology are better able to access and utilize it. Knowledge is a critical enabler, as it allows women to make informed decisions about adopting and applying technological advancements in their farming practices. Extension media contact, which refers to women's engagement with agricultural extension services and media, has a strong and significant positive correlation with access to agricultural technology ($r = 0.531$, $p < 0.01$). This finding underscores the importance of extension services in facilitating access to technology. Women who are more connected to these services are better equipped with information and support to adopt new technologies. Finally, cosmopoliteness, which measures the extent to which women are exposed to and influenced by external ideas and innovations, shows a strong and significant positive correlation with access to agricultural technology ($r = 0.422$, $p < 0.01$). This suggests that women who are more outward-looking and engaged with broader social networks are more likely to adopt agricultural technologies, possibly due to greater exposure to new ideas and practices.

Problems faced by the respondents in access to agricultural technologies

To identify the problems faced in access to selected agricultural technologies, each respondent was asked to indicate the level of problems she faced. The opinion of the respondents was collected on a four-point continuum such as high, moderate, low, and not at all, and a score of 3, 2, 1, and 0 was assigned, respectively. Since there were no respondents who didn't opine not at all response, information has been presented on a three-point continuum such as high, moderate, and low. The observed score was 8-27 with a mean 19.56 and the standard deviation 3.62. Based on the overall problem score, the respondents were classified into three categories as depicted in Table 10.

The less category, which includes respondents facing fewer challenges (up to a score of 15), accounts for 20.9% of the sample, representing 23 women. These respondents experience relatively fewer obstacles in accessing agricultural technology, which might suggest that they have better resources, support systems, or fewer socio-economic constraints compared to others. However, even within this group, access is not without difficulties, indicating that issues such as limited knowledge or infrastructural gaps may still exist, albeit at a lower intensity. The moderate category comprises the largest group, with 66.4% of respondents (73 women) reporting a moderate level of problems, with scores ranging from 16 to 23. This significant proportion of respondents faces considerable challenges in accessing agricultural technologies. Barriers for this group might include financial limitations, lack of access to training, gender-related constraints, or inadequate extension services. The prominence of this category suggests that systemic issues are widespread, requiring concerted efforts to address them through targeted policies and support programs. The high category includes 12.7% of respondents (14 women) who face severe barriers, with scores above 23. These women experience significant challenges, likely compounded by factors such as extreme poverty, remote locations, or severe gender discrimination. The high level of problems in this group indicates a critical need for interventions to mitigate these barriers and ensure that these women are not left behind in technological advancements in agriculture. The overall mean score of 19.56 with a standard deviation of 3.62 suggests a moderate level of difficulty across the sample, with some variability in the intensity of problems faced. The relatively high concentration of women in the moderate category underscores the need for systemic improvements to make agricultural technologies more accessible, particularly for rural women who are integral to farming but face numerous obstacles in optimizing their productivity.

Table 11 provides a detailed analysis of the various challenges that rural women face in accessing agricultural technology, using a Problem Confrontation Index (PCI) to rank these challenges based on

Table 10. Distribution of the respondents based on their problems faced in access to agricultural technology

Sl.	Category	Frequency	Percentage	Mean	SD
1.	Less (up to 15)	23	20.9	19.56	3.62
2.	Moderate (16-23)	73	66.4		
3.	High (above 23)	14	12.7		

the responses of the study participants. The table categorizes respondents' experiences into four levels of confrontation: High, Moderate, Low, or Not at all, and the PCI scores reflect the overall intensity of each problem. This ranking system highlights the most critical barriers to agricultural technology access for rural women. The most significant issue identified by the respondents is the lack of credit facilities, which ranks first with a PCI score of 396. A substantial 74 respondents rated this as a high-level problem, indicating that financial constraints are a major barrier to adopting agricultural technologies. Without access to credit, rural women struggle to invest in necessary resources such as equipment, inputs, and tools. This finding underscores the need for financial interventions, such as microcredit programs or government subsidies, to make agricultural technologies more accessible to women in rural areas. The lack of training facilities is another major concern, ranking second with a PCI score of 365. 60 respondents identified this as a high-level issue, emphasizing that many women lack the knowledge and skills to use new agricultural technologies effectively. Training is crucial for ensuring that women can fully benefit from technological innovations. The absence of adequate training programs limits their ability to increase productivity and improve their livelihoods. Therefore, expanding training opportunities tailored to rural women's needs is essential for enhancing their participation in the agricultural sector.

The lack of motivation from government and NGO agencies ranks third with a PCI of 346. 50 respondents reported this as a significant barrier. This highlights the institutional challenges that hinder women's access to agricultural technology. Support and encouragement from these agencies are critical for motivating women to engage in agriculture and adopt new technologies. The findings suggest that greater efforts are needed from both government and non-governmental organizations to promote women's participation and ensure they receive the necessary support. The fourth-ranked issue is the less priority given to women in decision-making, with a PCI score of 328. 43 respondents identified this as a high-level problem, pointing to ongoing gender disparities in agricultural decision-making processes. Women's limited involvement in decision-making affects their access to resources and technology, reinforcing existing inequalities. Addressing this

Table 11. Problem confrontation index (PCI) in access to agricultural technology

Sl.	Problem statements	Number of respondents				PCI	Rank
		High	Moderate	Low	Not at all		
1.	Lack of training facilities	60	26	23	1	365	2nd
2.	No credit facilities	74	28	8	0	396	1st
3.	Equipments are costly	5	41	49	15	256	5th
4.	Lack of motivation from GO and NGO agencies	50	28	30	2	346	3rd
5.	Less priority to women in decision making	43	31	27	9	328	4th
6.	Lack of knowledge	5	51	49	15	240	6th
7.	Equipments are not available in nearby market	6	27	47	30	229	7th

issue requires promoting gender equity in agricultural governance and ensuring that women's voices are heard in decision-making spaces.

The cost of agricultural equipment also presents a significant challenge, ranking fifth with a PCI score of 256. 41 respondents reported this as a moderate issue. The high cost of equipment makes it difficult for many rural women to adopt agricultural technologies, particularly in contexts where financial resources are already limited. To address this, there is a need for affordable technology solutions, as well as financial assistance programs that can help women purchase necessary equipment. The lack of knowledge ranks sixth with a PCI score of 240, with 51 respondents identifying this as a moderate problem. Knowledge gaps among rural women can be attributed to limited access to education and information, making it harder for them to adopt and use new technologies effectively. Bridging this knowledge gap requires targeted educational initiatives and the dissemination of information through accessible channels, such as community workshops or mobile-based learning platforms. Finally, the unavailability of equipment in nearby markets is ranked seventh with a PCI score of 229. 47 respondents identified this as a moderate issue. The logistical challenges posed by the lack of access to equipment in local markets further hinder women's ability to adopt new technologies. Improving the distribution and availability of agricultural tools in rural areas is essential for overcoming this barrier.

Conclusions

The study findings revealed that majority of the respondents were middle-aged (53.6%) and had received primary-level education (50%), with an average of 4.92 family members, indicating medium family size. Most of the respondents (65.5%) were smallholders, owning an average of 1.63 acres of farmland. An overwhelming majority of the respondents had a medium level of knowledge about agricultural technologies (48.2%), contact with extension media (60%), and cosmopoliteness (64.9%). The overall assessment of access to agricultural technologies shows that a majority (61.8%) of respondents have medium access, while a significant portion (21.8%) has low access. High access was reported by only 16.4% of the respondents. This indicates a need for targeted interventions to improve technology accessibility across the board, especially for those in the low-access category. The study finds that land ownership, knowledge of agricultural technologies, extension media contact, and cosmopoliteness have a significant positive correlation with access to agricultural technology at a 0.01 level of significance. This reinforces the importance of improving socio-economic conditions and strengthening institutional support mechanisms to enhance technology access for rural women. Respondents highlighted several challenges in accessing agricultural technologies, including the lack of credit facilities, limited training opportunities, and high costs of equipment. Lack of motivation from government and non-government organizations also emerged as a significant barrier. These issues need to be addressed to enhance rural women's ability to adopt and benefit from agricultural innovations.

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