



FACTORS INFLUENCING ADOPTION OF RICE PRODUCTION TECHNOLOGIES AMONG WOMEN RICE FARMERS IN BAUCHI STATE

Bawa, B. S., Abdullahi, S. and Garba, M.

Department of Agricultural Extension and Rural Development,
Abubakar Tafawa Balewa University, Bauchi.

Corresponding Author's Email: balkisuyari@gmail.com.

ABSTRACT

The study examined the factors influencing the adoption of rice production technologies among women rice farmers in Bauchi State, Nigeria. A multistage sampling technique was employed to select 161 respondents from the study area. Primary data were collected using structured questionnaires and analyzed using descriptive statistics and logistic regression. The results revealed that majority (59.0%) respondents cultivated between 0.5–1.5 hectares of land. Farming was the major occupation for majority (63.4%) of respondents, while 46% had access to credit facilities and more than half (54.7%) had access to extension service. The regression analysis indicated that education level, estimated income, and frequency of extension contact were statistically significant ($P < 0.01$) in influencing the adoption of rice production technologies. The major constraints identified were high cost of technology (57.8%), lack of technical skills (48.4%), and limited access to credit (34.2%), which hindered the ability of women farmers to invest in productivity-enhancing innovations. The study concludes that level of education, estimated income and frequency of extension contact were the factors influencing the adoption of rice production technologies among women in the study area. The study recommended the need for government and other stakeholders to strengthening women's access to extension services, affordable inputs, and credit toward enhancing rice productivity thereby contributing to food security and poverty reduction in study area.

Keywords: Adoption, Rice, Technologies, Women, Farmers,

INTRODUCTION

Nigeria, as the most populous country in Africa, has a diverse agricultural sector with significant potential for growth and development. Rice, being one of the staple foods, plays a crucial role in the country's food security strategy. The Nigerian government has implemented various programme and policies aimed at boosting rice production, including the promotion of improved rice technologies. Despite these efforts, the adoption of such technologies among smallholder farmers is still limited, especially among women. This disparity is influenced by factors such as limited access to resources, cultural norms, and inadequate support systems (Adeoye and Bello, 2018). Women play a critical role in Nigeria's agricultural sector, particularly in rice farming. They are involved in various stages of the rice value chain, from planting and weeding to harvesting and processing. Despite their significant contributions, women farmers often face challenges such as limited access to land, credit, and agricultural inputs, which hinder their productivity and capacity to adopt new technologies (Nwankwo and Ibekwe, 2021). Efforts to empower women farmers and enhance their access to resources and technologies are essential for improving agricultural productivity and sustainability in Nigeria (Olaniyi and Alabi, 2022).

A study by Kariyasa and Dewi (2019), indicate that the adoption of improved technologies increase productivity, which later results in socio-economic development. Adoption of improved agricultural technologies has been associated with higher earnings and a reduction in rural poverty among farm households; improved nutritional status; lower staple food prices; increased employment opportunities as well as earnings for landless laborers. Adoption of improved technologies is believed to be a major factor in the success of the green revolution experienced by Asian countries (Chen & Ravallion, 2018). A study by Jain *et al.* (2019) show that non-adopters of agriculture technologies can hardly maintain their marginal livelihood and are more prone to socio-economic stagnation which often results in deprivation. Technology adoption by farmers is an essential pre-requisite for economic



prosperity in developing countries. In many developing nations, a huge amount of resources have been devoted to extension service in order to educate farmers to new agricultural practices. In Nigeria, such initiatives have been undertaken through the Agricultural extension project (ADP) and Sasakawa Global 2000 (SG 2000) (Donye *et al.*, 2020). The efficiency of these programmes depends on the factors that influence technology adoption. Therefore, extension educators and technical assistants have to understand factors affecting technology adoption in order to target and deliver effective programmes.

Despite the availability of improved seeds, mechanization, irrigation systems and climate smart practices, many farmers continue to rely on traditional methods leading to low yields. Several factors influence the adoption of rice production technologies including socioeconomic, institutional and environmental. Farmers' awareness, perception, and accessibility are among key determinants of technology uptake. Similarly, policy constraints, cultural beliefs and infrastructural limitations may further hinder the adoption process. Furthermore, there little or no empirical studies on the factors influencing adoption of technologies among women rice farmers in Bauchi State. This study therefore, seeks to fill this gap in literatures in the study area.

The study will fill the research gap and add to the existing body of literature, it will serve as a guide to policy makers and farmers especially women in the study area. By addressing these objectives, this research aims to contribute to the broader discourse on agricultural development, gender equity, and sustainable farming practices in Nigeria and beyond. The findings are expected to inform policy makers, development agencies, farmers and other stakeholders involved in promoting agricultural innovation and empowering women in the agricultural sector.

The broad objective of the study is to examine the factors influencing adoption of rice production technologies among women rice farmers in Bauchi State, while the specific objectives were to;

- i. describe the socioeconomic characteristics of the respondents in the study area
- ii. determine the factors influencing adoption of rice production technologies by the respondents; and
- iii. identify the constraints to the adoption of rice production technologies in the study area

METHODOLOGY

The Study Area

The study was conducted in Western Agricultural Zone of Bauchi State, Nigeria. Bauchi State was created in 1976 and was divided into three (3) Agricultural Zone by the Bauchi State Agricultural Development Programme (BSADP). The Zones are Western, Central and Northern Zones. The Western Zone comprises of 7 LGAs; Alkaleri, Bauchi, Bogoro, Dass, Kirfi, Tafawa Balewa and Toro. The state is located between Latitudes 9°30' and 12°30' North of the Equator, and between Longitudes 8°45' and 11°0' East of the Green Which Meridian. It is bounded in a clockwise direction by Yobe, Gombe, Taraba, Plateau, Kaduna, Kano and Jigawa states. There are 20 Local Government Areas (LGAs) in the State. Bauchi State has a land mass of 49,259 Km² with a population of 4,653,066 according to National Population Commission (NPC, 2006) which is estimated to be 8,736,413 people in 2024 at 3.2% annual increase rate. The State is heterogeneous, with predominant tribes like Hausa, Fulani, Jarawa, Sayawa among others (Bauchi State Economic Empowerment and Development Strategies [BSEEDS], 2016). The State is one of the States in the north east of Nigeria that span two distinctive vegetation zones, namely, the Sudan savannah and the Sahel savannah. The Sudan savannah type of vegetation covers the Western part of the State. The vegetation types as described above are conditioned by the climatic factors, which in turn determine the amount of rainfall received in the area. For instance, the rainfall in Bauchi state ranges between 1,300 millimetres per annum in the south and only 700 millimetres per annum in the extreme north. The major economic activities of the Bauchi State were agriculture, which include both crop and livestock production. The major crop production activities include production of rice, maize, sorghum and soybean in western zone, while for central and northern is millet, sorghum, cowpea and sesame. The livestock production includes rearing of cattle, sheep, goat and poultry (BSEEDS, 2016).

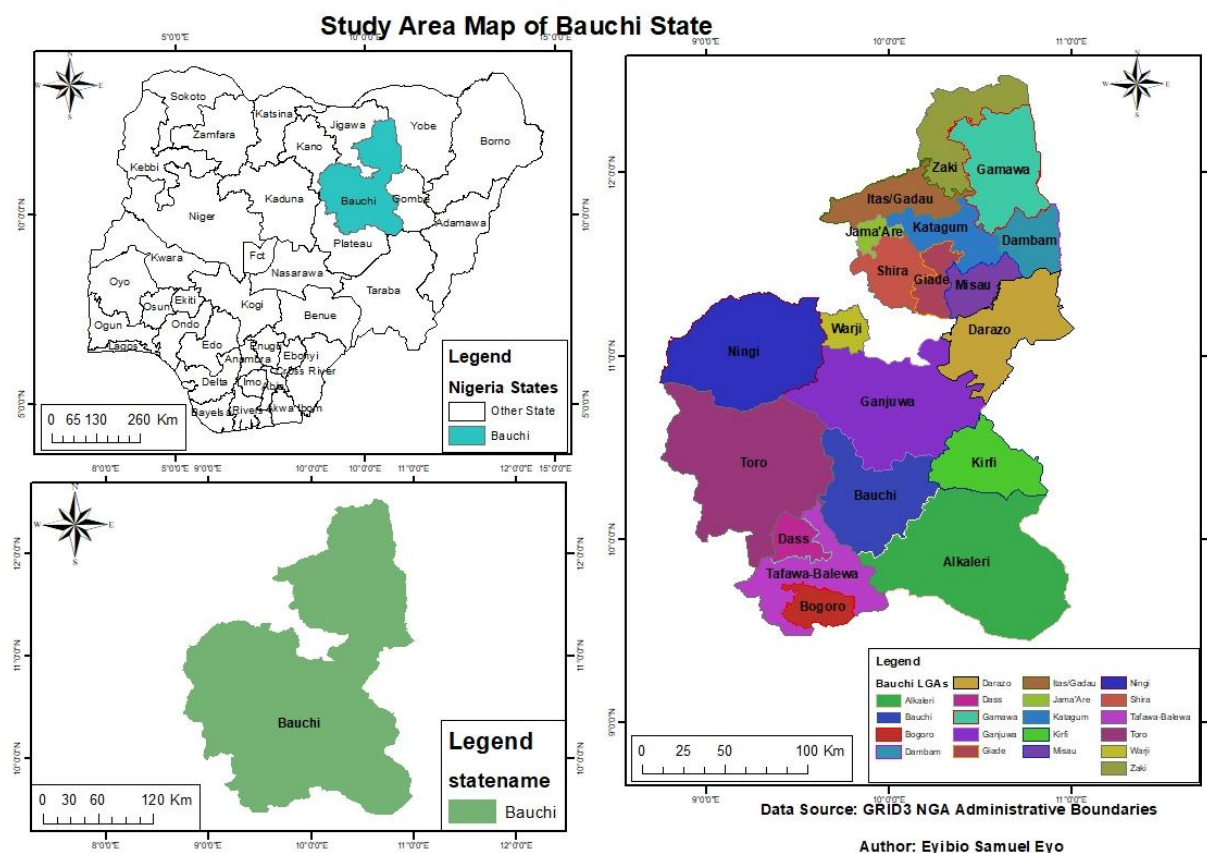


Figure 1: Map of Bauchi State

Sampling Technique and Sample Size

Multi-stage random sampling technique was employed in the selection of respondents for the study. In the first stage, two (2) Local Government Areas (LGAs) were randomly selected Bauchi and Toro out of the seven (7) Local Government Areas in the Western Zone of Bauchi State Agricultural Development Programme. In the second stage, five (5) communities were randomly selected from each of the selected LGAs, making a total of ten (10) communities. The last stage, a proportional sampling technic was employed in selecting respondents 161 respondents from a total sample frame of 1,997 households in the study area.

Table 1: Sampling Technique and Sampling Size

LGAs	Communities	Sample Frame	Sample size
Toro	Lame	256	20
	Nabordo	200	16
	Gumau	165	13
	Zaranda	228	18
	Geji	105	9
Bauchi	Kangere	294	24
	Bayara	125	10
	Inkil	223	18
	Piro	143	12
	Wuntin Dada	258	21
Total		1,997	161

Source: Authors' computations (2025)



Methods Data Collection

Data were collected through the administration of structured questionnaires to the respondents supplemented with interview using trained enumerators.

Methods of Data Analysis

Data were analyzed using both descriptive and inferential statistics. The descriptive was used in achieving objective i and iii, while inferential statistics was used in achieving objective ii. The descriptive statistics used includes frequency and percentage. In analyzing the factors influencing respondents' adoption of rice production technologies logistic regression was used. This model used for estimating the probability that an event occurs having a dichotomous dependent variables; 1 for adoption and 0 for non-adoption. The logistic regression model used is expressed as:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5 X_5 + b_6 X_6 + b_7X_7 + b_8X_8 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} + b_{14}X_{14} + U \quad \dots (1)$$

Where;

Y= Adoption (1=Adopted, 0=Not adopted)

X₁= Age of farmers (years)

X₂ = Sex (male=1, female=2)

X₃ = Marital Status (single=1, married =2, divorced =3 widowed =4)

X₄= Household size (Number)

X₅= Educational level of the farmers (Qur'anic=1, Primary=2, Secondary=3, Tertiary=4)

X₆= Occupation (crop farmers=1, civil servant=2, artisan=3, traders=4, livestock farmers=5, agro-dealers=6, agro-marketers=7)

X₇ = farm size (ha)

X₈=Years of farming experience (Number of Years)

X₉= Cooperative Membership (Yes=1, No=0)

X₁₀= Years of membership (years)

X₁₁= Annual income (in naira)

X₁₂=Technology adoption improves rice yield (Yes=1, No=0)

X₁₃=Extension contact (Yes=1, No=0)

X₁₄= Frequency of extension contacts (1=daily, 2=weekly, 3=monthly, 4=semi-annually, 5=annually)

X₁₄= Rice yield (bags)

a=Constant term of intercept

b_i(i=1...9) are regression coefficients.

u=Error term.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

The result from Table 2 revealed that majority (59.0%) of the respondents had a farm size of (0.5-1.5 hectares). The result also showed that 14.9% had 1.6-2.5ha, while 13% had 4.6ha and above, with 10.6% and 2.5% having 2.6ha-3.5ha and 3.6ha-4.5ha, respectively. This finding implies that small farm sizes limit the scale of technology adoption and the potential for mechanization. Technologies that are scale-neutral or suitable for small plots are more likely to be adopted (Okello *et al.*, 2021). Okello *et al.* (2021) found that farm size is a critical determinant, with smaller farms often facing constraints in adopting technologies that require significant land investment or large-scale operations. The findings also showed that majority (63.4%) of the respondents had farming as their primary occupation, while 18.6% engaged in livestock raising, 11.8% trading, 5.6% and 0.6% were engaged in civil service, fishery and agro-forestry, respectively. This finding implies that farming is the primary occupation for of respondents, underscoring its importance to their livelihoods. Adekunle *et al.* (2023) noted that farming as a primary occupation often signifies a higher commitment to agricultural activities and a greater incentive to invest in productivity-enhancing technologies.

The results also revealed that a good proportion 44.1% of the respondents had an estimated income of ₦70,000-₦370,000, while 23%, 13.7% and 3.1% had ₦371,000 - ₦671,000, ₦672,000 - ₦972,000, ₦1,274,000 and Above and ₦973,000 - ₦1,273,000, respectively. This finding implies that



higher income levels generally provide the financial capacity to purchase inputs and invest in new technologies. Low income can be a significant barrier to adoption, especially for capital-intensive technologies. Ogunniyi *et al.* (2020) consistently identified income as a key factor influencing the ability of farmers to adopt improved technologies, particularly those requiring significant upfront investment. The finding also showed that more than half (57.1%) of the respondents were not members of any association, while 42.9% belongs to one form of association or another in the study area. This finding implies that less than half of the respondents belong to one form of association or another. Akinola *et al.* (2021) highlighted that social capital, often fostered through group membership, significantly enhances information flow and collective adoption of agricultural innovations.

Table 2: Socioeconomic Characteristics of the Respondents

Variable	Frequency	Percentage
Farm size		
0.5 – 1.5	95	59.0
1.6 – 2.5	24	14.9
2.6 – 3.5	17	10.6
3.6 – 4.5	4	2.5
4.6 and Above	21	13.0
Primary occupation		
Farmer	102	63.4
Civil Servant	8	5.0
Trader	30	18.6
Livestock Raising	19	11.8
Fishery	1	0.6
Agro-Forestry	1	0.6
Estimated income		
70,000 - 370,000	71	44.1
371,000 - 671,000	37	23.0
672,000 - 972,000	26	16.1
973,000 - 1,273,000	5	3.1
1,274,000 and Above	22	13.7
Membership of association		
Yes	69	42.9
No	92	57.1
Years of membership		
0 - 4	125	77.6
5 - 8	29	18.0
9 - 12	3	1.9
13 - 16	2	1.2
17 and Aboves	2	1.2
Access to credit		
Yes	74	46.0
No	87	54.0
Access to extension		
Yes	88	54.7
No	73	45.3
Frequency of extension		
No access	73	45.3
Weekly	6	3.7
Fortnightly	21	13.0
Monthly	34	21.1
Quarterly	13	8.1
Annually	14	8.7

Source: Field Survey, 2025



The findings further showed that majority (77.4%) of the respondents had 0- 4 years of membership, while 18%, 1.9% and 1.2% had 5-8, and 9-12, 13-16 and 17 years and above, respectively. This finding implies that most of the respondents were not members of association and have less membership years of years of experience in the study area despite the role of association in increasing farmers access to market, inputs, information and technologies. The finding further depicted that more than half (54%) of the respondents had no access to credit, while good proportion 46% indicated access to credit in the study area. This finding shows limited access to credit, as many improved technologies require financial investment for inputs, labor, or equipment. Limited access to credit directly hinders the ability of farmers to adopt and sustain new practices. Lawal *et al.* (2020), in their comprehensive review, consistently identified lack of access to credit as one of the most significant barriers to technology adoption across various agricultural sectors in Africa. The findings also showed that more than half (54.7%) of the respondents had access to extension, while 45.3% did not. This finding implies that effective extension services are crucial for disseminating information, demonstrating technologies, and providing technical support. Low access and infrequent contact limit farmers' knowledge and confidence in adopting new practices. The results further showed that 45.3% had no contact with extension agents, while 21.1% had monthly contact, fortnight contact (13%), annual contact (8.7%), and quarterly (8.1%) and weekly (3.7%) contacts with extension agents. This finding shows infrequency of extension which is the bedrock of teaching and learning especially on technology transfer to farmers. This contradicts Idowu *et al.* (2020) who found that consistent and quality extension contact significantly influences the adoption of improved technologies, as it bridges the knowledge gap and builds trust between farmers and innovation sources.

Factors Influencing Adoption of the Technologies among Respondents

The results from Table 3, revealed the factors influencing the adoption of technologies among respondents. Level of education (2.55) and frequency of extension contact (3.22) were positive and significant ($P < 0.01$) in influencing adoption of technologies among respondents. This finding indicates that respondents with higher levels of education were more likely to adopt agricultural technologies than their less educated counterparts. This implies that education enhances farmers' ability to process and utilize information, evaluate innovations, and make rational decisions regarding adoption (Melesse, 2018; Tessema *et al.*, 2020). Therefore, investment in farmer education and training is critical in improving technology uptake.

Table 3: Factors Influencing Adoption of Technologies among Respondents

Variable	Odd ratio	Std Error	Z	P> Z
Age	.9644509	.0231619	-1.51	0.132
Sex	.8024113	.5183008	-0.34	0.733
Marital status	.7547896	.2967743	-0.72	0.474
Level of education	1.293974	.1307441	2.55	0.011***
Household size	1.046662	.0645092	0.74	0.459
Farming experience	.9831078	.0367336	-0.46	0.648
Farm size	1.235225	.1818432	1.44	0.151
Primary occupation	1.016173	.1438117	0.11	0.910
Estimated income	.9999988	3.68e-07	-3.35	0.001***
Membership of association	3.091847	2.303182	1.52	0.130
Years of membership	1.008678	.1095674	0.08	0.937
Access to credit	.3541111	.2040143	-1.80	0.072
Access to extension	4.101405	4.467359	1.30	0.195
Frequency of extension	3.767018	1.552671	3.22	0.001***
Cons.	.2229615	.4854199	-0.69	0.491

Source: Field Survey, 2025 ***Significant at 1%

The result further revealed that frequency of extension contact (3.22) was positive and significant ($P < 0.01$) in influencing adoption of improved technologies. This findings implies that the vital role of extension services in bridging knowledge gaps, disseminating innovations, and providing



technical support (Ali *et al.*, 2021). It also highlights that beyond mere access to extension, the frequency and intensity of contact matter significantly in driving behavioral change among farmers. Strengthening extension systems, increasing the ratio of extension agents to farmers, and enhancing the quality of advisory services could therefore accelerate adoption. Estimated income (-3.35) also showed a highly significant relationship with adoption at the 1% level although the odds ratio suggests a marginal effect due to the scaling of income values. The negative z-value indicates that respondents with lower income were less likely to adopt technologies. This finding underscores the importance of economic capacity in influencing adoption decisions, as financially constrained households may be unable to bear the costs associated with new technologies, such as inputs, equipment, or maintenance. Previous studies have similarly reported that income levels directly affect technology adoption by determining affordability and willingness to take financial risks (Abebe and Gebremedhin, 2021 and Choudhury *et al.*, 2022). Policies that improve farmers' access to affordable credit or subsidies can therefore enhance adoption rates.

Constraints to Adoption of Technologies

The result from Table 4 showed that the major constraint to adoption of technologies among respondents were high cost of technology (57.8%), lack of technical skills (48.4%), lack of credit facilities (34.2%), complexity (30.4%), and limited land (30.4%) which were ranked 1st, 2nd, 3rd and 4th by the respondents respectively.

Table 4: Distribution of Respondents According to their Constraints to Adoption of the Technologies

Variable	Frequency	Percentage	Ranking
High cost of technology	93	57.8	1 st
Lack of technical skills	78	48.4	2 nd
Lack of credit facilities	55	34.2	3 rd
Complexity	49	30.4	4 th
Limited land	49	30.4	4 th
Limited land	49	30.4	4 th
Heavy weed growth	44	27.3	6 th
Disease infestation	30	18.6	7 th
Low availability of seeds	26	16.1	8 th

Source: Field Survey, 2025

Other constraints to adoption of rice technologies by respondents were heavy weed growth (27.3%), disease infestation (18.6%) and low availability of seeds (16.1%) which were ranked 6th, 7th and 8th, respectively. This finding implies respondent highly needs subsidies, affordable credit, and cost-effective technologies. The lack of technical skills and complexity points to deficiencies in training and technology design. Limited land further restricts the scale of adoption Lawal *et al.* (2020) and Ogunniyi *et al.* (2020) consistently identified financial barriers (cost of inputs, lack of credit) as primary impediments to technology adoption among smallholder farmers across Africa. Similarly, skill gaps and land fragmentation are common challenges (Okello *et al.*, 2021).

CONCLUSION AND RECOMMENDATIONS

The study concluded that level of education, estimated income and access to extension were the factors influencing adoption of improved rice technologies among women farmers in the study area. In addition, adoption of rice production technologies are constrained by cost of technology, lack of technologies and lack of credit facilities.

Based on the findings, the following recommendations are made:

- i. Government and development agencies should recruit and train more extension agents to ensure frequent and gender-sensitive contact with women farmers.
- ii. Financial institutions and agricultural support programs should design affordable and accessible credit schemes tailored for women farmers to enable them to purchase inputs and adopt new technologies.



- iii. Government should provide subsidies or financial support on fertilizers, improved seeds, and mechanization services to reduce production costs and make technologies more affordable.
- iv. Women should be encouraged to join agricultural cooperatives to improve their bargaining power, access to inputs, and information sharing on best practices.
- v. Collaboration among agricultural research institutes, NGOs, and government agencies should be enhanced to ensure effective dissemination and sustainability of agricultural innovations among rural women.

REFERENCES

- Abebe, G., & Gebremedhin, B. (2021). Determinants of agricultural technology adoption in developing countries: A review. *Agricultural and Food Economics*, *9*(7): 1–18. <https://doi.org/10.1186/s40100-021-00190-2>
- Adekunle, A. O., Yusuf, T. M., & Lawal, R. A. (2023). The role of occupation in technology adoption and productivity among smallholder farmers in Nigeria. *Journal of Agricultural Extension*, *27*(2): 45–59.
- Adeoye, A. O., & Bello, M. (2018). Constraints to women's participation in agricultural development in Nigeria. *Nigerian Journal of Rural Sociology*, *18*(2): 1–11.
- Akinola, M. O., Ojo, J. A., & Musa, L. (2021). Social capital and collective action in smallholder farmers' adoption of agricultural innovations in Nigeria. *International Journal of Agricultural Policy and Research*, *9*(4): 60–70.
- Ali, A., Khan, M. J., & Hussain, S. (2021). Agricultural extension and farmers' technology adoption behavior in developing countries. *Journal of Agricultural Sciences*, *16*(3): 100–115.
- Bauchi State Economic Empowerment and Development Strategies (BSEEDS). (2016). *Bauchi State economic empowerment and development strategy document*. Bauchi: Government of Bauchi State.
- Chen, S., & Ravallion, M. (2018). The role of technology adoption in poverty reduction: Evidence from the Green Revolution. *World Bank Economic Review*, *32*(1): 125–144.
- Choudhury, A., Singh, R., & Sharma, K. (2022). Economic factors influencing the adoption of improved rice technologies among smallholder farmers in South Asia. *Asian Journal of Agriculture and Development*, *19*(1): 45–59.
- Donye, A. O., Audu, J., & Tashikalma, A. K. (2020). Assessment of agricultural extension services delivery in Nigeria: Achievements and challenges. *Nigerian Journal of Rural Extension and Development*, *5*(1): 40–52.
- Idowu, A. O., Adefalu, L. L., & Bello, M. (2020). Influence of extension contact on adoption of improved agricultural technologies among smallholder farmers in Nigeria. *Journal of Agricultural Extension*, *24*(3): 102–115.
- Jain, M., Singh, R., & Mehra, A. (2019). Technology adoption and livelihood outcomes among smallholder farmers in Africa. *African Journal of Agricultural Research*, *14*(12): 945–956.
- Kariyasa, K., & Dewi, Y. A. (2019). The impact of technology adoption on rice productivity and income of smallholder farmers. *International Journal of Agricultural Economics*, *4*(2): 87–94.
- Lawal, R. A., Adegbite, D. A., & Balogun, O. S. (2020). Financial inclusion and smallholder farmers' access to credit in Nigeria. *Journal of Development Policy and Practice*, *5*(1): 75–92.
- Melesse, B. (2018). A review on factors affecting adoption of agricultural new technologies in Ethiopia. *Journal of Agricultural Science and Food Research*, *9*(3): 1–5.
- Nwankwo, E. O., & Ibekwe, U. C. (2021). Gender disparities and access to agricultural resources in Nigeria. *African Development Review*, *33*(1): 143–156.
- Ogunniyi, A., Aremu, O., & Olayemi, O. (2020). Income diversification and technology adoption among smallholder farmers in Nigeria. *Journal of Agricultural Economics and Rural Development*, *6*(2): 95–106.
- Okello, J. J., Otieno, D., & Kirui, O. (2021). Farm size and agricultural technology adoption: Evidence from sub-Saharan Africa. *Food Policy*, *101*(3): 1–12.



Nigerian Journal of Agriculture and Agricultural Technology (NJAAT)
Volume 5, Number 4B, December, 2025
ISSN (Print): 2811-1885; ISSN (Online): 2811-1893



- Olaniyi, A. A., & Alabi, O. O. (2022). Empowering women farmers through access to agricultural innovations in Nigeria. *Journal of Gender Studies and Development*, 4(2): 34–48.
- Tessema, G., Meles, D., & Dadi, A. (2020). Socioeconomic determinants of agricultural technology adoption among smallholder farmers in Ethiopia. *Heliyon*, 6(9): 50-53.