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Adoption of Agroforestry Farming Practices among Rural Farmers in Shendam Local Government Area of Plateau State, Nigeria

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Abstract

This study examined the adoption of agroforestry farming practices among rural farmers in Shendam Local Government Area, Plateau State, Nigeria. A total of 120 farmers were selected using a multistage sampling technique from three out of the four districts within the Local Government Area. Primary data were collected through questionnaires and oral interviews, and the analysis involved both descriptive statistics and logit regression (inferential statistics). The findings indicated that the average age of the farmers was 39 years, with the majority being married men. Most respondents had attained some level of formal education, had an average of seven years of farming experience, and owned farms averaging 3.5 hectares in size. For most of the farmers, land acquisition was primarily through inheritance. A significant portion of the farmers reported being aware of agroforestry, and many had contact with extension personnel approximately three times annually. On average, farmers adopted about two agroforestry practices, with the home garden being the most commonly adopted practice. The results also showed that the farmers' mean annual income was ₦113,529. According to the logit regression analysis, factors such as income, education level, cooperative membership, and land tenure were significantly associated with the adoption of agroforestry practices at varying levels of probability. The main barriers to adoption reported by the farmers included a lack of knowledge and skills in agroforestry, limited awareness of agroforestry practices, the long gestation period required to realize benefits, and the high costs of implementation. The study recommended the development of a robust land-use policy to help farmers secure land titles and ensure land tenure security.

Key Words: *Adoption, agroforestry, farming practices, Shendam Local Government.*

Introduction: In sub-Saharan Africa, challenges related to agricultural land use and management are critical development issues. The expansion of cultivated areas and a shift from fallow-based cropping systems to continuous cultivation have become widespread (Jamala, Shehu, Yidau and Joel, 2013). These changes have also given rise to environmental concerns associated with agricultural production. The significant expansion and intensification of agricultural activities have led to the loss of 50 million hectares of forested area across Africa during the 1980s (Jamala *et al*., 2013). This deforestation has resulted in reduced availability of wood products for construction and fuel, degradation of rangeland resources, and increased soil vulnerability to erosion and other forms of degradation. Historically, crop farming and livestock rearing have been the primary occupations in many parts of sub-Saharan Africa, including Nigeria. However, rising human and livestock populations have intensified competition for limited land resources. Issues such as land ownership, accessibility, and management have further complicated these challenges. In recent years, Nigeria has experienced significant problems related to agriculture and animal husbandry. The nature and scale of these challenges vary across the country. In the southern and urban regions of Nigeria, land scarcity is a predominant issue, whereas the northern and rural regions face shortages of grazing resources and poor-quality pastures (Adewuyi and Olofin, 2018). One of Nigeria's pressing concerns is meeting the increasing demand for food and fiber for its rapidly growing population (Alao and Shuaibu, 2011). Population growth and intensified land use have drastically reduced natural fallows and shifting cultivation systems below the thresholds necessary for their sustainability (Jamala *et al*., 2013). This situation has led to the overuse of arable land without allowing adequate fallow periods for soil fertility restoration. While the application of chemical fertilizers has been used to address this issue, it has also resulted in soil toxicity and environmental pollution. In this context, sustainable intensification has been identified as a crucial approach to addressing issues such as low agricultural yields, environmental degradation, and climate change adaptation, especially in the face of growing populations, rising food demand, and limited agricultural land (Jamala *et al*., 2013). It is essential to implement practices that complement traditional land-use methods while ensuring long-term sustainability, environmental preservation, and societal acceptance Amonum, Babalola and Agera, 2009)
. Agroforestry represents one such land-use approach, offering a solution to Nigeria's high demand for land while addressing deforestation, soil erosion, and other environmental challenges. Agroforestry integrates principles of natural resource management to restore soil fertility, making it one of the key practices for sustainable soil management (**Glover, Jon, Harris, Greg, and Lewis** 2013). According to the International Centre for Research in Agroforestry (ICRAF, 1997), agroforestry is a dynamic, ecologically based system for managing natural resources that enhances and sustains production on farmland and rangeland, providing social, economic, and environmental benefits for land users at all levels. Agroforestry encompasses all land-use systems and practices that deliberately combine herbaceous plants (crops or pastures) with woody perennials (trees, shrubs, palms, and bamboos) within a single management unit (Olujide and Oladele, 2011). This approach integrates farming, forestry, and pastoralism into a cohesive system. Sangeetha, Rani and Thomas (2016) emphasized that incorporating trees into farming systems can help prevent soil erosion, mitigate extreme temperatures, and address various environmental issues. According to Owonubi and Otegbeye (2012), agroforestry is a versatile land-use system where agricultural crops and woody perennials are cultivated together on the same land. It includes both traditional and modern land-use methods in which trees are managed alongside agricultural crops or livestock systems. Agroforestry has immense potential

to address many of the challenges faced by farmers. Nitrogen-fixing trees, for instance, can act as alternatives to chemical fertilizers, increasing smallholder incomes, reducing reliance on foreign imports, and enhancing local food security. Agroforestry also eases pressure on forests and communal woodlands by providing fuelwood from farmed sources. Additionally, it offers farmers a range of products such as food, medicine, animal feed, and timber, which can be used domestically or sold for income. Although some tree-related benefits, such as boundary marking, windbreaks, erosion control, shade, and aesthetic value, may be challenging to quantify, they are vital for farm families and the preservation of natural resources. Agroforestry practices can enhance agricultural land-use systems, provide long-term benefits, and reduce negative environmental impacts locally and globally. The approach is rooted in using trees in production and conservation systems across farms, forests, ranches, and communities. The United States Department of Agriculture (USDA) defines the essence of agroforestry as planting the right species in the right location to achieve specific goals and purposes.

The future of Nigeria's forests and agricultural land is under significant threat due to the country's rapidly growing population, which increases pressure on land resources for socioeconomic, agricultural, and industrial expansion. This is compounded by heightened human interference with the environment and forest ecosystems (Bifarin, Folayan and Omoniyi, 2013). In developing nations like Nigeria, population growth has also intensified the reliance of both rural and urban poor populations on fuelwood, resulting in accelerated deforestation. The ongoing depletion of forest reserves and agricultural land significantly impacts Nigeria's agricultural sector. It leads to diminished soil productivity, increased erosion, loss of plant genetic diversity, climate change, landslides, soil degradation, and adverse hydrological changes, as well as the destruction of wildlife habitats. According to the Food and Agriculture Organization's 2010 report on global forest resources, Nigeria has a low forest cover, constituting less than 2.3% of the country's total land area. This alarming rate of forest and agricultural land loss underscores the urgent need to sustain and enhance soil fertility for global food security and environmental sustainability.

To ensure food security, it is crucial to develop ecologically friendly agricultural practices that prioritize long-term productivity over short-term gains (Bankole, Adekoya, Nwawe, 2012). Agroforestry holds significant promise for establishing sustainable land-use systems capable of addressing Nigeria's critical challenges of land degradation and food insecurity. However, despite its potential, agroforestry has not received adequate attention in the policy-making process or rural development strategies, nor has sufficient investment been directed toward its advancement (FAO, 2013). The lack of clear environmental and agricultural policies has disrupted agroforestry programs and exacerbated environmental degradation (Nwosu, 2014). The history of agroforestry adoption in Nigeria is marked by limited success. Many agroforestry initiatives have failed, partly because socioeconomic considerations were not adequately integrated into the design of systems and programs (Cerdán, 2012). According to Edinam, Hassan and Mawutor (2013), a major reason for these failures was the lack of focus on generating tangible benefits for farmers. Agricultural practices in Nigeria, particularly in rural areas, are characterized by unsustainable land use, leading to significant environmental degradation, deforestation, soil fertility loss, and declining agricultural productivity. Shendam Local Government Area of Plateau State, like many rural areas in Nigeria, faces these challenges. Farmers in the area often depend on traditional farming systems that prioritize short-term productivity at the expense of long-term sustainability. This has led to increased vulnerability to climate change, food insecurity, and reduced income for rural households. Despite its numerous benefits, the adoption of agroforestry practices among rural farmers remains low, attributed to factors such as limited awareness, inadequate access to extension services, cultural beliefs, and financial constraints. While previous studies have explored agroforestry adoption in other regions, there is limited empirical evidence on its adoption in Shendam Local Government Area. Understanding the extent of adoption, the factors influencing farmers' decisions, and the challenges they face is crucial for designing effective interventions to promote sustainable farming practices.

Materials and Methods: Shendam Local Government Area (LGA) is one of the seventeen LGAs in Plateau State, comprising four districts: Dorok, Derteng, Dokan Tofa, and Shendam. It covers an area of 2,477 km² and has a population of 208,017 in the 2006 population census (NPC, 2006) and a projected population of 293,797 (2.2% growth rate) in 2023. Located at latitude 8°53′N and longitude 9°32′E, Shendam experiences an average annual rainfall of 57 inches and a mean annual temperature of 22°C. The LGA is bordered by Mikang LGA to the north, Quan Pan LGA to the west, Langtang South to the east, and Taraba State to the south. March and September are typically the hottest months, while December and January are the coldest, with significant harmattan haze. The rainy season usually lasts from May to October, with the remaining months being dry. The local population is predominantly engaged in agriculture, with rice and yam being the major food crops grown in the lower Benue basin, characterized by soils ranging from rich silt deposits to sandy-loamy textures.

Sampling Technique: This study employed a multi-stage sampling technique. In the first stage, three out of the four districts in Shendam LGA; Dorok, Derteng, and Dokan Tofa were purposively selected due to their substantial involvement in agriculture. In the second stage, two villages were randomly chosen from each of the three selected districts, resulting in a total of six villages. In the final stage, twenty farmers were randomly selected from each village, bringing the total number of respondents to 120. Primary data was collected through questionnaires and oral interviews.

Method of Data Analysis: The data collected for this study were analyzed using descriptive statistics, including frequency distributions, percentages, means, and Binary Logit regression.

Logit Regression

The expressions of the equation in explicit and implicit forms are as follows:

$\text{Ln}(i) = \ln(Pi/1-Pi) = \beta 0+\beta_i X_i + \mu i$ (implicit form)

$Y = a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+b_6x_6+b_7x_7+e$ (explicit form)

Where:

Y = Adoption of agroforestry practices (1 if adopted, 0 if otherwise)

X_1 = Age (years)

X_2 = Education of respondents (years spent in school)

X_3 = Household size (Number of persons in the household)

X_4 = Annual income (naira)

X_5 = Membership of social groups (1 if yes, 0 otherwise)

X_6 = Land tenure (1 if own land through inheritance/ purchase, 0 if otherwise)

X_7 = Contact with extension agent (Number of visits)

a = constant term

U = error term (explicit)

e = Error term (implicit)

b_1 to b_7 = Regression coefficient

x_1 to x_7 = Independent variables as defined in the general and explicit equations above

Results and Discussion:Socio-economic Characteristics of Farmers.: The findings in Table 1 show that the average age of the farmers in the study area was 39 years. This suggests that a significant portion of the farmers are in their prime, active years, making them physically capable of engaging in farming activities. Age is a key determinant of a population's socio-economic position since older individuals tend to have less energy. This result is consistent with the findings of Vihi, Nguuma, Sadiku and Adedire, 2018) who reported an average age of 38 years in their study on the factors influencing access to credit for agricultural production among crop farmers in Bassa Local Government Area, Plateau State, Nigeria. Regarding gender, 78% of the farmers were male, and 22% were female. Men typically

have greater access to land as a productive resource, especially in agroforestry practices, which may explain the higher proportion of male farmers in the study area. This finding supports Orisakwe and Agomuo (2011) who observed that most agroforestry farmers were male in their study on the adoption of improved agroforestry technologies in Imo State, Nigeria.

According to Table 1, a large majority (92%) of the respondents were married, while 8% were unmarried. The high proportion of married farmers is likely linked to the labor-intensive nature of agricultural work, where family members often provide the necessary labor. Additionally, being married is associated with the ability to feed one's family, making it an appealing factor for farmers. This finding aligns with the work of Obasi, Henri-Ukoha, Ukewuihe, and Chidiebere (2013) who also found that most agroforestry farmers in Nigeria were married. The data in Table 1 also reveals that the typical household size of the farmers was ten members. Many farmers view having more children as an advantage, as they can contribute to farm labor, reducing the need for hired labor. In addition, the polygamous culture in some communities allows men to have multiple wives, further increasing household size. In terms of education, 41% of farmers had completed primary education, 25% had secondary education, 22% had tertiary education, and 12% had no formal education. This shows that most farmers in the area have at least some formal education. As noted by Obasi *et al*. (2013), a higher level of education not only boosts agricultural productivity but also enhances farmers' ability to understand and adopt new production technologies.

The results also reveal that 67% of the respondents identified farming as their primary occupation, with the remaining respondents working as civil servants or entrepreneurs. This is not surprising given the rural nature of the study area. The majority of these farmers depend on agriculture (such as yam, pumpkin, and cassava) and forest products (including fruits, timber, and herbs) both for their food supply and income.

According to Table 1, the average farming experience of the respondents was seven years. This suggests that many of the farmers are well-equipped to adopt agroforestry technologies, as they likely have prior experience with similar practices.

The average farm size was reported as 3.5 hectares, indicating that most of the farmers are small-scale landholders. This limitation may restrict their ability to cultivate permanent tree crops, as smaller plots are typically used for growing arable crops. The farmers' mean annual income was N113,529, which indicates that they have a reasonable income that could support the adoption of agroforestry practices. Income is a significant factor in the adoption of new technologies, and this finding suggests that the farmers are in a position to integrate agroforestry techniques into their practices. Regarding land tenure, 67% of the respondents reported acquiring their land through inheritance, 27% through renting, and 6% through purchase. Inheritance often leads to fragmented land ownership due to division among siblings, which reduces the available land for farming. In many traditional societies, farmland is not communally owned, resulting in further fragmentation, making it difficult for farmers to engage in agroforestry.

According to Table 1, 57% of the respondents were members of farmers' associations and cooperatives, while 43% were not. Membership in these groups allows farmers access to loans, inputs, and valuable, up-to-date information on farming practices. Many farmers join these organizations to meet basic needs, which are sometimes addressed through collective efforts. Finally, the results showed that, on average, farmers interacted with extension agents about three times a year, which is considered low. This suggests that agroforestry techniques and other advanced agricultural practices may not be effectively communicated to the farmers. Orisakwe and Agomuo (2011) emphasized that regular interaction with extension agents is crucial for encouraging the adoption of new technologies, providing necessary knowledge, and guiding farmers in their implementation.

Table 1: Socio-economic Characteristics of the Respondents (n=120)

Variable	Frequency	Percentage	Mean
Age			
21-30	28	23.0	
31-40	52	43.0	
41-50	20	17.0	
51-60	13	11.0	
>60	7	6.0	39
Sex			
Male	94	78.0	
Female	26	22.0	
Marital status			
Married	110	92.0	
Single	10	8.0	
Household size			
1-5	10	8.0	
6-10	78	65.0	
11-15	26	22.0	
>15	6	5.0	10
Educational status			
Primary	49	41.0	
Secondary	30	25.0	
Tertiary	27	22.0	
Non formal	14	12.0	
Major occupation			
Civil Servant	7	6.0	
Business	23	19.0	
Farming	80	67.0	
Others	10	8.0	
Farming experience			
1-5	24	20.0	
6-10	65	54.0	
11-15	20	17.0	
>15	11	9.0	7
Farm size			

0.1-2.0		6		5.0	
2.1-4.0		79		66.0	
>4		35		29.0	3.5
Annual income					
1000-50000		3		3.0	
51000-100000		52		43.0	
101000-150000	37		31.0		
151000-200000	27		23.0		
201000-250000	1		0.8	113529	
Land tenure					
Hired		33		27.0	
Inheritance	80		67.0		
Purchased	7		6.0		
Membership of Association					
Yes		68		57.0	
No		52		43.0	
Extension visits					
No visit	55		46.0		
1-3 times	48		40.0		
4-6 times	11		9.0		
7-9 times	6		5.0	3.0	

Source: Field survey, 2024

Table 2: Distribution of Respondents according to Awareness of Agroforestry

Awareness	**Frequency**	**Percentage**
Yes	71	59.0
No	49	41.0
Total	**120**	**100**

Source: Field survey, 2024

Table 3: Distribution of Respondents based on Agroforestry Practices adopted.

Agroforestry	***Frequency**	**Percentage**
Home garden	89	74.0
Taungya	77	64.0
Alley farming	68	57.0
Boarder planting	55	46.0
Multipurpose Trees	35	29.0
Shelter belt	17	14.0
Woodlot Establishment	11	9.0
Aquaforestry	4	3.0

Multiple responses

Table 6: Distribution of Respondents based on common trees integrated with arable crops.

Trees	**Frequency**	**Percentage**
Mango	89	74.0
Sugar cane	85	71.0
Neem	66	55.0
Guava	61	51.0
Locust bean	61	51.0
Cashew	58	48.0
Teak	41	34.0
Gmelina	35	29.0
Bitter leaf	35	29.0
Cocoa nut	28	23.0
Banana	20	16.0
Oil palm	20	16.0
Eucalyptus	18	15.0
Orange	5	4.0
Others	11	9.0

Multiple responses

Table 8**.** Factors Influencing Farmers Adoption of Agroforestry Practices

Variables	**Odds Ratio**	**Std. Err.**	**Z**
Constant	0.1386487	0.2092621	-1.31
Age	1.021845	0.0186933	1.18
Education	1.033388	0.1920734	3.15***
Household size	1.126462	0.3679022	0.36
Income	0.999994	2.190	2.89**
Membership	2.49749	1.030907	2.22**
Land tenure	2.52369	1.033833	2.26**
Extension visit	0.8102216	0.3362964	2.65**

Log likelihood: -71.516633
Pseudo R^2: 0.6866
LR chi^2: 23.56
Prob > chi^2: 0.0597

*** and ** represent 1% and 5% probability levels respectively.

Table 9: Distribution of Respondents based on Constraints to adoption of agroforestry

Constraint	Frequency	Percentage
Government policies	9	7.5
Land and tree tenure rights	86	71.0
Low awareness of agroforestry	50	42.0
Lack of knowledge and skills	55	46.0
Long gestation period to obtain benefits	65	54.0
High cost of involved in adoption	51	43.0
Increase demand for arable land	23	19.0
Traditional beliefs and taboos	13	11.0
Complexity	31	26.0

Multiple responses

Awareness of Agroforestry: Table 2 presents the distribution of respondents' awareness of agroforestry, revealing that 59% of the farmers (71 respondents) were aware of agroforestry practices, while 41% (49 respondents) were not. This indicates that a majority of the farmers in the study area have some level of awareness of agroforestry, which is promising for the potential adoption and implementation of agroforestry practices. The high level of awareness could be attributed to the influence of extension services, exposure to agroforestry training programs, or the integration of agroforestry into the broader agricultural practices in the area. The findings of this study align with similar research in other regions that have explored farmers' awareness of agroforestry. For instance, Orisakwe and Agomuo (2011) found that a significant portion of farmers in Imo State, Nigeria, was aware of agroforestry technologies. In their study, 65% of respondents were aware of agroforestry, which is somewhat higher than the 59% awareness rate in the current study but still within a similar range. This suggests that awareness levels of agroforestry in rural farming communities can vary, but they are generally quite high, particularly when extension services or education programs are available. In contrast, studies in other parts of Africa have shown lower levels of awareness. For example, a study by **Glover, Jon, Harris, Greg, and Lewis** (2013a) on agroforestry adoption in parts of East Africa found that only about 45% of farmers were aware of agroforestry practices. This difference can be attributed to the availability of extension services, education, and the overall agricultural development programs in the region. Additionally, awareness is often closely tied to farmers' access to information and their exposure to new technologies. A study by Amonum *et al.* (2009) in northern Nigeria indicated that a relatively small percentage of farmers (about 30%) were aware of agroforestry systems, mainly due to limited access to extension services and insufficient exposure to agroforestry-related knowledge. In regions with limited agricultural development programs or extension outreach, awareness tends to be lower, highlighting the importance of outreach programs in raising awareness about sustainable agricultural practices like agroforestry.

Extent of Adoption of Agroforestry: Table 3 presents the distribution of respondents based on the agroforestry practices they adopted. The findings show that the most widely adopted agroforestry practice in the study area is the **home garden,** with 74% of the respondents incorporating it into their farming systems. **Taungya,** a system that combines tree planting with agricultural crops in the same plot, was adopted by 64% (77 respondents), followed by **alley farming** (57%) and **border planting** (46%). Other practices such as **multipurpose trees** (29%), **shelter belts** (14%), **woodlot establishment** (9%), and **aquaforestry** (3%) were adopted by fewer farmers. The dominance of home gardens as the most adopted practice reflects its accessibility and suitability for smallholder farmers, particularly in areas with limited land. Home gardens allow farmers to grow a variety of crops and trees, which can improve food security and provide additional income from both plant and tree products. Taungya farming and alley farming, which integrate tree planting with crop cultivation, also received significant adoption, indicating that farmers in the region recognize the potential benefits of diversifying their farming practices. The results of this study align with similar research conducted in other parts of sub-Saharan Africa and Asia. For instance, a study by **Olujide and Oladele** (2011) in Nigeria found that **home gardens** were widely adopted due to their flexibility and ability to enhance food security and income generation. Similarly, **taungya farming** has been reported as a common agroforestry practice in various parts of Africa and Southeast Asia, as it allows farmers to cultivate crops alongside newly planted trees, improving both land productivity and soil conservation (Glover *et al*., 2013). In contrast, practices such as **shelter belts** and **woodlot establishment** had relatively low adoption in the study area. This is consistent with findings from other studies, such as Orisakwe and Agomuo (2011) which highlighted that farmers often prefer practices that provide immediate and direct benefits, such as food crops in home gardens, rather than those that require a longer waiting period, like shelter belts or woodlots. These practices often necessitate substantial investment in terms of time, land, and resources, with returns typically realized over a longer period, which could deter farmers from adopting them. The adoption of **multipurpose trees** (29%) and **aquaforestry** (3%) reflects a growing awareness of the environmental and economic benefits of integrating trees into farming systems. However, the relatively low adoption of these practices suggests that while farmers acknowledge the value of trees in enhancing biodiversity, providing timber, and improving soil health, the barriers to adoption may include a lack of technical knowledge, financial constraints, or insufficient extension services to support these practices (Amonum *et al.*, 2009). Moreover, **alley farming** and **border planting** (57% and 46%, respectively) are practices that have been widely adopted in areas with limited space or where land degradation is a concern. These practices help to control soil erosion, improve soil fertility, and provide a sustainable form of agriculture by incorporating trees and crops into the same farming system. Studies by Sangeetha, Rani, Thomas (2016) and **Kosheri (2016)** found that alley farming is an effective means of promoting sustainable agriculture, especially in regions facing land degradation.

Common Trees integrated with Arable crops: Table 6 highlights the species of trees and shrubs planted or preserved on farmlands by respondents. The most commonly integrated trees include mango (74%), sugar cane (71%), neem (55%), guava (51%), locust bean (51%), cashew (48%), teak (34%), gmelina (29%), bitter leaf (29%), coconut (23%), banana (16%), oil palm (16%), and other species (9%). The majority of these trees belong to the fruit category, as indicated by the widespread presence of mango, citrus, cashew, guava, and other fruit trees on farmlands and within homesteads across the study area. This preference for fruit trees reflects their versatility, with farmers cultivating them

for various benefits. According to Henri-Ukoha, Orebiyi, Obasi, Oguoma, Ohajianya, Ibekwe and Ukoha (2011), fruit trees are favored because they provide income, construction wood, fuel, and livestock fodder. The findings suggest that the primary drivers of tree selection in agroforestry practices are the potential for food production, fuelwood supply, and revenue generation.

Factors Influencing Farmers' Adoption of Agroforestry Practices: The logistic regression analysis in Table 8 provides insights into the factors affecting farmers' adoption of agroforestry practices. The odds ratios, standard errors, and significance levels reveal the relative influence of each variable. The independent variables (X_1, X_2, ..., X_7) collectively accounted for 68.66% of the variation in the dependent variable (Y), as indicated by the coefficient of multiple determination (R^2 = 0.6866). The regression model was statistically significant at the 10% level, meaning that the independent variables had a considerable impact on farmers' adoption of agroforestry practices. Among the eight predictors, five—educational attainment, income, cooperative membership, land tenure system, and access to extension visits—were statistically significant, while age and household size did not show significant effects.

Level of Education (X_2): The positive coefficient of 1.0334 and the significant level at the 1% probability level suggest that farmers with higher education are more likely to adopt agroforestry practices compared to those with lower or no education. This finding is consistent with Sale and Olujobi (2014) who also found a positive and strong relationship between education and the use of risk management techniques among maize farmers in Lere Local Government Area, Kaduna State, Nigeria. The level of formal education a person attains significantly influences their personality, attitude, and openness to adopting more effective farming practices.

Annual Income (X_4): The positive coefficient of 0.9999 for income, which is significant at the 5% level, indicates that as farmers' income increases, their likelihood of adopting agroforestry practices also increases. This is because wealthier farmers are generally more willing to take risks, which facilitates their adoption of innovative agricultural practices.

Membership in Cooperative (X_5): The data revealed a positive coefficient of 2.4975 for cooperative membership, which is significant at the 5% level. This suggests that farmers who are members of cooperatives are more likely to adopt agroforestry techniques, highlighting the supportive role that cooperatives play in encouraging the adoption of sustainable farming practices.

Land Tenure (X_6): The land tenure coefficient of 2.5237, which is significant at the 5% level, suggests that farmers with more secure land ownership are more likely to engage in agroforestry practices compared to those with less secure land tenure. This indicates that farmers with stronger claims to land are more inclined to invest in long-term agricultural practices like agroforestry.

Extension Access (X_7): The positive coefficient of 0.8102 for extension access, significant at the 5% level, shows that farmers who have more frequent interactions with extension agents are more likely to adopt agroforestry practices. This suggests that regular contact with extension agents facilitates the adoption of new farming techniques and technologies among farmers

Constraints to Adoption of Agroforestry: Table 9 highlights the major constraints faced by farmers in adopting agroforestry practices. The data is based on multiple responses, indicating that individual respondents could identify more than one challenge.

Land and Tree Tenure Rights: Land and tree tenure issues were identified as the most significant constraint, cited by 71% of respondents. This reflects the challenges farmers face in regions where land is communally owned or governed by traditional tenure systems. Such arrangements often discourage long-term investments like agroforestry due to uncertainty about ownership and benefits. Addressing tenure rights is crucial for promoting agroforestry adoption.

Long Gestation Period: Over half of the respondents (54%) cited the lengthy period required to realize the benefits of agroforestry as a major obstacle. The slow growth of trees reduces the appeal of agroforestry, especially for farmers focused on short-term gains. This underscores the need for interventions that either provide interim benefits or reduce the wait time, such as fast-growing species or complementary income-generating activities.

Lack of Knowledge and Skills: A lack of technical expertise was reported by 46% of respondents. This highlights the need for capacity-building initiatives, including training on nursery establishment, seed preparation, and agroforestry management practices.

Low Awareness of Agroforestry: Awareness is a key driver of adoption, and 42% of respondents cited its deficiency as a constraint. This suggests a gap in extension services and outreach programs to inform farmers about the benefits and methods of agroforestry.

High Costs of Adoption: Financial constraints were reported by 43% of respondents, emphasizing the need for affordable access to inputs and incentives to offset initial costs.

Complexity (26.0%): About 26% of respondents identified the complexity of agroforestry practices as a barrier. Simplifying agroforestry systems and tailoring them to local contexts could help reduce this challenge.

Increase in Demand for Arable Land: Competing land use priorities for food crop production hinder the allocation of land for agroforestry.

Traditional Beliefs and Taboos: Cultural practices and superstitions may limit tree planting in some communities.

Government Policies: Unfavorable or poorly implemented policies were the least cited constraint, suggesting that while policies matter, other barriers are more pressing for farmers.

Conclusion: The study revealed that most respondents were married and within their prime working age. They generally had some level of education and substantial farming experience, with an average annual income of ₦113,529. The logit regression analysis indicated that factors such as education, income, cooperative membership, and land tenure were significantly associated with the likelihood of adopting agroforestry practices. Farmers primarily implemented agroforestry on a small scale, often in groups of two or fewer, with home gardens being the most common approach. However, the adoption of agroforestry in the study area remains unsatisfactory. The key challenges identified include issues related to land and tree tenure rights, the extended gestation period required to realize benefits, limited knowledge and skills in agroforestry, and low awareness of agroforestry practices among farmers.

Recommendations Based on the study's findings, the following recommendations are proposed: **Land Use Policy Development**: A comprehensive land use policy should be established to provide farmers with secure land titles. This is particularly crucial in Africa, where women often face limited land rights due to traditional land tenure systems that favor adult males in owning and managing land. Harmonizing existing laws and policies is essential to enhance women's access to land and promote gender equity in agroforestry adoption. **Awareness Campaigns**: With a yearly decline in the number of trees planted or preserved, extension agents should initiate awareness campaigns to encourage tree planting in homesteads. This effort should leverage both direct communication and mass media. Collaboration with farmers' organizations, government agencies, and other stakeholders in rural areas can further amplify these campaigns and increase awareness about the benefits of agroforestry. **Enhanced Extension Services**: The limited number of extension visits to farmers hampers the dissemination of agroforestry techniques. To address this, all levels of government should increase the extension-to-farmer ratio. This will ensure wider outreach, more frequent interactions, and sustained support for farmers, ultimately fostering the adoption of agroforestry practices.

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