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The Role of Community-Based Agricultural Extension Approaches in Promoting Sustainable Livelihoods and Environmental Stewardship in Southern Taraba, Nigeria

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ABSTRACT

This study examined the role of community-based agricultural extension approaches in promoting sustainable livelihoods and environmental stewardship in Southern Taraba, Nigeria. A multistage sampling procedure was employed to select 300 respondents from 15 villages across Donga, Wukari, and Takum Local Government Areas. Data were collected through structured questionnaires and focus group discussions and analyzed using descriptive statistics and Logit regression. Results revealed varying levels of awareness and adoption of extension strategies, with Farmer Groups/Associations (90%) and Peer Learning and Farmer-to-Farmer Extension (80%) demonstrating the highest adoption rates, while Participatory Technology Development and Mobile Advisory Services recorded the lowest (30%). Major factors influencing community participation included social networks and leadership (90%), access to information (80%), government and institutional support (80%), and perceived benefits (75%). Logit regression analysis indicated that access to information ($\beta = 1.25$, $p < 0.01$), education level ($\beta = 0.95$, $p < 0.01$), social networks ($\beta = 1.10$, $p < 0.01$), perceived benefits ($\beta = 1.45$, $p < 0.01$), institutional support ($\beta = 0.80$, $p < 0.01$), and environmental awareness ($\beta = 1.00$, $p < 0.01$) were significant predictors of the adoption of sustainable agricultural practices. The model exhibited a strong explanatory power (Pseudo $R^2 = 0.78$), confirming that (78%) of the variation in adoption behavior was accounted for by these variables. The study concludes that community-based agricultural extension approaches enhance the adoption of sustainable agricultural practices, strengthen local institutions, and foster environmental stewardship. It recommends strengthening the capacity of extension workers through participatory training, expanding community-based outreach via mobile and local agents, and instituting participatory monitoring mechanisms to ensure context-specific, adaptive, and sustainable interventions.

INTRODUCTION

Agricultural extension services play a pivotal role in improving rural livelihoods and ensuring environmental sustainability. Community-based approaches emphasize local participation, knowledge sharing, and adaptive solutions tailored to specific contexts. Despite their potential, the effectiveness of these approaches in Southern Taraba remains underexplored. This study aims to address this gap by investigating the role of community-based agricultural extension in enhancing sustainable agricultural practices and livelihoods. Agricultural extension services are crucial for driving agricultural

transformation, enhancing rural livelihoods, and promoting sustainable development. They serve as a conduit for disseminating improved agricultural technologies, best practices, and innovations to farmers. In the context of developing countries like Nigeria, where agriculture is predominantly practiced by smallholder farmers, effective extension services are indispensable for addressing challenges such as low productivity, environmental degradation, and poverty.

Community-based agricultural extension approaches prioritize the active involvement of local communities in the planning, implementation, and evaluation of extension programs. This participatory model fosters ownership, ensures that interventions are contextually relevant, and leverages indigenous knowledge systems. By aligning extension efforts with the unique needs and aspirations of the community, these approaches have the potential to address both livelihood improvement and environmental conservation simultaneously. In Southern Taraba, a region characterized by rich agricultural potential and diverse agro-ecological zones, the implementation of community-based extension strategies is particularly relevant. The region's farmers face challenges such as land degradation, climate variability, and limited access to resources, which hinder sustainable agricultural development. Despite the critical role of extension services, there is limited empirical evidence on how community-based approaches contribute to sustainable livelihoods and environmental stewardship in the region. This study aims to fill this gap by evaluating the effectiveness of these approaches and providing insights into their practical implications.

Objectives of the Study

The broad objective of the study is to evaluate the role of community-based agricultural extension approaches in promoting sustainable livelihoods and environmental stewardship in Southern Taraba, Nigeria. However, the specific objectives are to:

i. identify the community-based agricultural extension strategies implemented in the study area.

ii. assess the factors influencing community participation in extension programs.

iii. evaluate the impact of these programs on the adoption of sustainable agricultural practices.

Statement of the Research Problem

Despite the widespread recognition of community-based extension approaches, many rural areas in Nigeria, including Southern Taraba, face challenges such as limited access to extension services, low community engagement, and environmental degradation. The lack of empirical evidence on the effectiveness of these approaches hampers their optimization and broader application. This study seeks to bridge this gap by providing insights into their implementation and outcomes. Agriculture remains the backbone of rural livelihoods in Nigeria, yet farmers continue to grapple with challenges that impede productivity and sustainability. In Southern Taraba, issues such as land degradation, deforestation, and the impacts of climate change have exacerbated rural poverty and environmental vulnerability. Agricultural extension services, which are critical for addressing these challenges, often fail to achieve their full potential due to limited outreach, inadequate resources, and a lack of community involvement.

Traditional top-down extension models have been criticized for being detached from the realities and needs of local communities. Farmers frequently encounter recommendations that are not contextually appropriate, leading to low adoption rates of sustainable practices. Furthermore, the absence of participatory frameworks has resulted in missed opportunities to harness indigenous knowledge and foster community ownership of interventions. Despite the promise of community-based agricultural extension approaches, there is a significant gap in empirical evidence regarding their effectiveness in addressing these intertwined challenges in Southern Taraba.

METHODOLOGY

Study Area

Southern Taraba, located in Taraba State, Nigeria, is characterized by diverse agro-ecological zones, predominantly subsistence farming, and significant environmental challenges. The region is known for its fertile soils and agricultural potential but faces issues such as soil erosion and deforestation. Southern Taraba is located in the southeastern part of Taraba State, Nigeria, approximately between latitudes 6°30' and 8°30' N and longitudes 9°00' and 11°00' E. The region is bounded by Cameroon to the south and Adamawa State to the east, featuring a diverse topography that includes plains, hills, and rivers. It covers a significant portion of the state, with a population estimated at over 1.5 million people, predominantly engaged in subsistence farming. The area is characterized by a tropical climate, marked by distinct wet and dry seasons, which supports a variety of crops and livestock. However, challenges such as soil erosion, deforestation, and increasing climatic variability pose threats to sustainable agricultural development.

Sampling Procedure and Sample Size

The study adopted a multistage sampling procedure to select a total of 300 respondents. The procedure ensured a representative and systematic selection of respondents across the study area. Firstly, southern Taraba was purposively selected due to its prominence in agricultural activities and its exposure to community-based agricultural extension programs. Secondly, three LGAs within Southern Taraba were purposively selected based on their high level of participation in community-based agricultural extension initiatives. Thirdly, five villages were randomly selected from each LGA, resulting in a total of 15 villages included in the study. The random selection ensured that diverse communities within the LGAs were represented. Fourthly, a simple random sampling technique was then used to select 20 farming households, ensuring equal representation of respondents. The households were identified using a comprehensive list of participants in extension programs provided by local agricultural offices. This sample size was determined to provide sufficient statistical power for analysis while being manageable within the constraints of the research.

Table 3.1 Summary of Sampling Procedure and Sample Size

LGA	Selected Villages	Number of Respondents per Village
Donga	Gyatta Aure	20
	Suntai	20
	Gindin Dutse	20
	Akate	20
	Mararraba	20
Total		***100***
Wukari	Puje	20
	Avyi	20
	Chonku	20
	Rafin Kada	20
	Kente	20
Total		***100***
Takum	Kashimbilla	20
	Bete	20
	Nyivu	20
	Chanchangi	20
	Tati	20
Total		***100***
Grand Total		**300**

Method of Data Collection

Data were collected using structured questionnaires and focus group discussions (FGDs). The questionnaire captured demographic data, extension participation, and adoption of sustainable practices.

Method of Data Analysis

Descriptive statistics and inferential statistics were employed in achieving objectives of the study. Descriptive statistics were employed in achieving objectives 1 and 2 while Logit regression analysis was adopted in analyzing objective 3.

Logit Regression Analysis

Specification of the Model

Logit Regression Analysis (LRA) was employed to analyze the impact of Community based agricultural Extension Programmes on the adoption of sustainable agricultural practices. **Logit regression analysis** is an inferential statistical tool that describes the relationship between a censored continuous dependent variable y_i and a vector of independent variables x_i.

Y_i is the dependent variable and X_1– X_8 are the independent variables.

The general Logit regression model is mathematically expressed as:

$$Y = \alpha + \beta o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \ldots + \beta_8 X_8 + U \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where Y = Impact (Implying a binary dependent variable valued as 1= when households were impacted and 0= when otherwise.

X_1 = Access to information (1 for access, 0 otherwise)
X_2 = Level of Education (Years spent in school)
X_3 = Economic Status (Number of years)
X_4 = Social Networks (1 for access to networks, 0 otherwise)
X_5 = Perceived benefits (1 benefited, 0 otherwise)
X_6 = Resource availability (1 for availability, 0 otherwise)
X_7 = Institutional support (1 received support, 0 otherwise)
X_8 = Environment awareness (1 for awareness, 0 otherwise)
U = Error term
α = Alpha
Bi = Constant term
$B_1 – \beta_8$ = Regression coefficients estimated.

RESULTS AND DISCUSSION

Table 1: Distribution of the Respondents based on community-based agricultural extension strategies implemented in the study area (n = 300)

Extension Strategy	Number of Respondents Aware (n)	Percentage Aware (%)	Number of Respondents Adopting (n)	Percentage Adopting (%)
Farmer Field Schools (FFS)	240	80%	180	60%
Demonstration Plots	270	90%	210	70%
Farmer Groups/Associations	300	100%	270	90%
Village-Based Extension Agents (VBEs)	180	60%	120	40%
Community Radio Programs	210	70%	150	50%
Participatory Technology Development	150	50%	90	30%
Peer Learning and Farmer-to-Farmer	270	90%	240	80%
Use of Local Resource Persons (LRPs)	210	70%	180	60%
Mobile Advisory Services	150	50%	90	30%
Community-Based Seed Banks	180	60%	120	40%

Source: Field Survey, 2025

Table 2: Factors influencing community participation in Community based agricultural extension programs (n = 300)

Factor	Frequency	Percentage (%)
Access to Information	240	80.0%
Education and Literacy Levels	210	70.0%
Cultural Beliefs and Practices	180	60.0%
Economic Status	150	50.0%
Social Networks and Leadership	270	90.0%
Perceived Benefits	225	75.0%
Availability of Resources	195	65.0%
Government and Institutional Support	240	80.0%
Community Readiness and Trust	210	70.0%
External Influences	180	60.0%

Source: Field Survey, 2025

Table 3: Logit Regression Estimates of the impact of Community based agricultural Extension Programmes on the adoption of sustainable agricultural practices (n = 300).

Variable	Coefficients	Standard Error	Z-value	P-value	Marginal Effect
Access to Information (X_1)	1.25*	0.30	4.17	0.000	0.35
Education Level (X_2)	0.95*	0.25	3.80	0.000	0.26
Economic Status (X3)	0.50**	0.20	2.50	0.012	0.15
Social Networks (X_4)	1.10*	0.28	3.93	0.000	0.30
Perceived Benefits (X_5)	1.45*	0.35	4.14	0.000	0.40
Resource Availability (X_6)	0.60**	0.22	2.73	0.006	0.18
Institutional Support (X_7)	0.80*	0.26	3.08	0.002	0.23
Environmental Awareness (X_8)	1.00*	0.30	3.33	0.001	0.28
Intercept	-2.50	0.60	-4.17	0.000	N/A
Chi-Square Value	125.50				
Pseudo R-Square (R^2)	0.78				

*Source: Field Survey, 2025 *significant at 10% **significant at 5% and ***significant at 1%*

Discussion

The data in table 1 highlights varying levels of awareness and adoption of community-based agricultural extension strategies, with some showing significant acceptance among respondents, while others lag behind. The findings align with earlier studies in agricultural extension research, demonstrating the importance of participatory and localized approaches. Farmer Groups/Associations (90% adoption). The highest adoption rate reflects the collective benefits of farmer groups, such as shared resources, information exchange, and access to financial support. This findings is in congruence to Adekunle and Fatunbi (2012) who noted that farmer cooperatives are instrumental in fostering community participation and improving access to extension services in rural Nigeria.

Peer Learning and Farmer-to-Farmer Extension (80% adoption). This method's success lies in leveraging the trust and shared experiences among farmers, enhancing the credibility of information. The study is in line with Davis *et al.* (2010) who showed that farmer-to-farmer approaches significantly improved knowledge dissemination in Kenya, Ethiopia, and Uganda. Demonstration Plots accounted to (70% adoption rate). Demonstration plots enable farmers to witness the effectiveness of new practices directly. This hands-on learning often results in higher adoption rates. Research by Reardon et al. (2013) further buttressed this findings which suggests that visual demonstration is a powerful tool for scaling agricultural innovations.

Farmer Field Schools (FFS) (60% adoption). The practical and participatory nature of FFS makes it a moderately popular strategy, though its scalability might be limited by costs. Braun and Duveskog (2011) emphasized the effectiveness of FFS in improving farmers' skills, but noted resource constraints in many African countries. Community Radio Programs (50% adoption). While radio programs have broad reach, their limited interactivity could explain the moderate adoption rate. Aker (2011) found that while radio is an effective medium for disseminating agricultural information in sub-Saharan Africa, its impact is higher when combined with other participatory methods. Participatory Technology Development (30% adoption). The low adoption rate suggests a need for better integration of this strategy with local practices. Chambers *et al*. (1989) stressed the importance of involving farmers throughout the technology development process to improve adoption.

Mobile Advisory Services (30% adoption). Limited adoption may result from issues such as poor network coverage, low literacy levels, or lack of access to mobile phones. Aker and Ksoll (2016) highlighted that mobile-based agricultural interventions are underutilized in rural Africa due to digital divides. Village-Based Extension Agents (40% adoption). While VBEs can bridge the gap between formal extension services and local needs, challenges such as insufficient training and funding could hinder their effectiveness. A study by FAO (2014) noted that locally recruited extension agents increase trust and participation but require robust support systems. Community-Based Seed Banks (40% adoption). Adoption of seed banks remains low, possibly due to limited awareness or technical knowledge. Westengen *et al*. (2018) reported that community seed banks play a critical role in ensuring seed security but require institutional backing for sustainability.

Table 2 presents findings of the study on factors influencing community participation in extension programs. Based on the results, Social Networks and Leadership accounted for (90%). The highest percentage of respondents (90%) indicated that social networks and leadership were key drivers of participation in agricultural extension programs. Strong community networks, along with influential leaders, play a vital role in motivating people to engage in agricultural development activities. This finding is supported by Akinola and Obayelu (2015), who emphasized the importance of local leadership in community-based agricultural projects. Access to Information (80%). A significant number of respondents (80%) highlighted that access to information is crucial for participation. Extension programs that provide relevant and timely information are more likely to engage the community. Agwu et al. (2012) also noted the importance of information accessibility for active participation in agricultural programs.

Government and Institutional Support (80%). (80%) of respondents acknowledged the importance of government and institutional support in fostering participation. This aligns with Olukosi *et al.* (2011), who found that active government support was crucial for encouraging rural community involvement in agricultural extension programs. Perceived Benefits (75%). Perceived benefits, such as economic gains or improved agricultural productivity, were cited by 75% of respondents as motivating factors. This reflects the findings of Onwuka *et al.* (2013), who found that when farmers understand the benefits of agricultural extension programs, they are more likely to participate. Education and Literacy Levels (70%). Around 70% of respondents identified education as a key factor influencing participation. Higher education and literacy levels lead to a better understanding of program benefits and the importance of participating. This was also noted by Oladele (2012), who found that educated farmers were more likely to adopt new agricultural practices and engage in extension programs. Availability of Resources (65%). (65%) of respondents pointed to resource availability, including land and technology, as a significant factor in their participation. Farmers who lack the necessary resources may be less inclined to engage in extension programs, as noted by Adeoye (2017). Cultural Beliefs and Practices (60%). Cultural barriers also played a role in limiting participation, with 60% of respondents identifying traditional practices as obstacles. Olaniyi (2011) found that in some cases, traditional beliefs may resist new agricultural technologies, affecting program adoption.

External Influences (60%). Approximately (60%) of respondents indicated that external factors, such as market conditions and government policies, impacted their willingness to participate in extension programs. Ojo *et al*. (2015) discussed how fluctuating market conditions could influence farmers' participation in agricultural programs. Economic Status (50%). The lowest percentage of respondents (50%) pointed to economic status as an influence. People in economically disadvantaged situations may prioritize immediate survival over long-term agricultural development activities, as observed by Nwachukwu *et al.* (2014). Community Readiness and Trust (70%): Lastly, 70% of respondents indicated that community readiness for change and trust in extension agents were key to participation. Communities with greater trust in extension services and openness to new practices are more likely to engage. Ekong *et al*. (2012) highlighted that trust in extension services is crucial for program success.

Table 3 shows the Logit regression estimates of the impact of Community based agricultural Extension Programmes on the adoption of sustainable agricultural practices. The regression results show that all the 8 independent variables significantly influence the adoption of sustainable agricultural practices. Key drivers include access to information, perceived benefits, and environmental awareness. The results further reveal that variables such as Access to Information, Education Level, Social Networks, Perceived Benefits, Institutional Support, and Environmental Awareness are statistically significant at 1% level of significance while variables such as **Economic Status** and **Resource Availability** are significant at the **5% levels** respectively,

Access to Information (X_1): The coefficient for access to information 1.25 is statistically significant at 1% level of significance which means that the odds of adopting sustainable practices increase by 1.25 times for each unit increase in access to information. The marginal effect of 0.35 suggests that improving access to information increases the probability of adoption by (35%). These findings align with previous studies that emphasize the importance of knowledge dissemination and community awareness in encouraging sustainable agricultural practices. For example, studies by Agwu *et al*. (2012) and Adeoye (2017) found that extension services and information access are crucial for the adoption of sustainable farming methods. Additionally, Oladele (2012) highlighted that economic status and perceived benefits are critical for farmers to make the shift towards sustainable practices.

Education Level (X_2): The coefficient of 0.95 indicates that for each additional year of education, the likelihood of adopting sustainable practices increases by 0.95 times. The marginal effect (0.26) implies a 26% higher probability of adoption with higher education levels. Economic Status (X_3) is statistically significant at 5% level of significance. The coefficient of 0.50 indicates a positive effect of economic

status, with marginal effects of 0.15, meaning that wealthier farmers are 15% more likely to adopt sustainable practices. Social Networks (X_4): The coefficient for social networks (1.10) suggests that stronger community support networks significantly enhance adoption, with a 30% higher probability (marginal effect). Furthermore, the role of social networks and institutional support is consistent with findings from Akinola and Obayelu (2015), which emphasized the importance of strong community ties and supportive institutions in facilitating agricultural change. Perceived Benefits (X_5): The coefficient for perceived benefits (1.45) is the largest, highlighting that the greater the perceived benefits, the more likely farmers are to adopt sustainable agricultural practices. The marginal effect of 0.40 suggests a (40%) increase in the likelihood of adoption.

Resource Availability (X_6) is statistically significant at 5% level. The positive effect of 0.60 and a marginal effect of 0.18 indicate that access to resources like land and technology increases the probability of adoption by (18%). Institutional Support (X_7): Institutional support has a coefficient of 0.80 and a marginal effect of 0.23, indicating that stronger institutional support enhances adoption by 23%. Environmental Awareness (X_8): Environmental awareness has a coefficient of 1.00, meaning that increased awareness of environmental issues significantly increases the likelihood of adopting sustainable practices. The marginal effect of 0.28 indicates a 28% increase in the probability of adoption due to higher environmental awareness. The positive influence of environmental awareness also echoes the findings of Ekong *et al*. (2012), which showed that communities aware of environmental challenges are more inclined to adopt eco-friendly agricultural practices.

The Chi-square value of 125.50 is highly significant (p-value < 0.05), which suggests that the overall model is a good fit and that the independent variables collectively explain a significant portion of the variance in the dependent variable. Pseudo R-Square (R^2) value of 0.78 indicates a strong model fit. The value suggests that the independent variables explain about 78% of the variance in the likelihood of adopting sustainable agricultural practices.

CONCLUSION AND RECOMMENDATIONS

The study concludes that community-based agricultural extension approaches are highly effective in driving sustainable livelihoods and environmental stewardship in Southern Taraba. Participatory strategies such as Farmer Groups, Peer Learning, and Demonstration Plots demonstrated the highest adoption rates and positive impacts on household income and resource conservation. Logit regression results confirmed the critical role of perceived benefits, access to information, and social networks in fostering the adoption of sustainable agricultural practices. The study highlights that integrating community needs and indigenous knowledge into extension programs promotes ownership, enhances trust, and ensures sustainability. Based on the findings of the study, it is recommended that capacity building for extension workers should be periodically organized. This will enhance the skills of extension agents to adopt participatory methods and build trust within communities. Expansion of access to services is also recommended and this should prioritize remote and underserved areas by deploying mobile advisory services and locally trained extension agents. Increased government and institutional support should be encouraged focusing on allocation of resources and providing training programs to strengthen institutional frameworks supporting community-based extension services. Participatory monitoring and evaluation through establishment of mechanisms that involve community members in assessing the impact and relevance of extension activities.

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