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Evaluate the Moderating Effect of Cooperative Membership on Farm Extension Services and Coconut Production among Smallholder Farmers in South-South, Nigeria

Okoroji, Nma Okechukwu PhD
Department of Cooperative Economics and Management, Nnamdi Azikiwe University, Awka, Nigeria

Abstract: This study explores the moderating effect of cooperative membership on the relationship between farm extension services and coconut production among smallholder farmers in the South-South region of Nigeria. It examines the impact of extension services on coconut production and investigates how cooperative membership influences this relationship. The study's objective is to understand the effect of cooperative membership on extension services. The study applied Albert Bandura's Social Cognitive Theory, which provided a framework to understand how farmers' behaviours and practices are influenced by their interaction with extension services and the impact of cooperatives on their productivity. Data collection involved surveys from 334 coconut farmers. The data collected were analysed using frequency and percentages, mean, standard deviation and multiple linear regression. The findings indicate that cooperative membership plays a significant role in enhancing the effectiveness of extension services. The analysis shows that cooperative members' experience a greater impact from extension visit frequency, indicating that they are more likely to benefit from the knowledge and skills provided by extension services. The study also highlighted that cooperative members have higher yields compared to non-members. The results strongly support the idea that cooperative membership is a critical factor in enhancing the impact of extension services on farmers' productivity. Furthermore, the study's conclusions suggest that farmers in the South-South region should consider becoming members of cooperatives to improve their farming practices and increase their coconut production. The study's findings have implications for policymakers, extension service providers, and the economy as a whole.

Key words: Coconut production, cooperative membership, extension services, smallholder farmers, social cognitive theory.

INTRODUCTION

The coconut palm (*Cocos nucifera L.*) represents a significant agricultural resource in Nigeria, particularly within the coastal regions of the country. Serving as a source of food, income, and employment for numerous smallholder farmers, coconut production contributes to both local livelihoods and the national economy. However, similar to global trends, the Nigerian coconut industry faces considerable challenges. These include low productivity due to aging trees, pest and disease outbreaks, and the slow adoption of modern farming techniques by farmers (Qiao, Li, Cao, Zhang, Zheng & Xu, 2022). These challenges underscore the importance of effective agricultural extension services in promoting sustainable and profitable coconut farming in Nigeria. Farm extension services act as a vital conduit for disseminating agricultural information and innovations from research institutions to farmers. In Nigeria, the effectiveness of these services is critical in bridging the gap between available knowledge and on-farm practices. Main indicators of these extension services include the **frequency of extension visits**, which determines the direct farmer contact and information dissemination; **types of extension methods used,** ranging from demonstrations and trainings to mass media campaigns; the **content of extension advice**, encompassing information on improved varieties, pest management, and sustainable farming practices; the **qualifications and experience of extension officers,** impacting the credibility and relevance of the advice; the **accessibility of extension services,** including geographical proximity and communication channels; and finally, **farmer's perception of extension services**, which reflects the satisfaction and trust in the provided assistance (Akinola, Kehinde, Tijani, Ayanwale, Adesiyan, Tanimonure, Ogunleye & Ojo, 2023; Okafor, Okonkwo & Ngene, 2024). These indicators directly influence farmers' decisions and practices.

The impact of these extension service indicators can be assessed through various outcome measures related to coconut production. These **dependent variables** include **yield** (number of coconuts harvested per tree or hectare), **quality of coconuts** (size, oil content, etc.), **income from coconut production, adoption of recommended practices** (use of improved varieties, fertilizer application), **farm efficiency** (cost of production per unit), **sustainability** (soil health, water usage), and **changes in farm management practices** (intercropping, conservation techniques). Increased frequency of extension visits and relevant content of advice on integrated pest management, for example, should translate to a decrease in pest-related yield losses. Extension methods such as Farmer Field Schools, known for their participatory nature, could lead to higher adoption rates compared to simple one-off training sessions (Ikoyo-Eweto, Adedokun, Archibong & Okwuokenye, 2023; Yang & Ou, 2022). Several studies in Nigeria have highlighted the importance of extension services in agricultural development. For example, Nwafor and Umebali (2021) found a positive correlation between access to extension services and the adoption of improved cassava varieties among farmers in Anambra State Nigeria. Similarly, research by Adekunle (2018) emphasized the role of extension agents in promoting sustainable agricultural practices among smallholder farmers in the Niger Delta region. While these studies may not focus specifically on coconut, their findings underscore the general importance of extension in enhancing agricultural productivity and sustainability, principles that are transferable to the coconut sector. Furthermore, a targeted study by Babatunde and Ojo (2019) explored the impact of agricultural extension on smallholder farming in Kwara State, revealing significant improvements in crop yields and household income for those who received extension services. However, challenges persist within the Nigerian extension system that limits its effectiveness in promoting sustainable coconut production. These challenges include inadequate funding, insufficient numbers of trained extension officers, logistical constraints in reaching remote coconut-growing areas, and a need for more farmer-centered approaches (Nwafor & Umebali, 2021). Therefore, there is a need to investigate the effectiveness of farm extension services in promoting sustainable coconut production. Understanding the factors that influence the impact of

extension services on coconut yields, quality, and income can help policymakers and extension agencies to design and implement more effective extension programs that address the specific needs of coconut farmers.

Statement of the Problem

Despite its potential as a significant contributor to the Nigerian agricultural sector and the livelihoods of numerous smallholder farmers, coconut production in Nigeria remains below its optimal level. The immediate problem driving this study is the persistent gap between the potential yields achievable with improved farming practices and the actual yields realized by coconut farmers. This yield gap is exacerbated by challenges such as aging palm populations, pest and disease outbreaks, climate change impacts, and notably, the inadequate adoption of recommended farming practices (Akinola, Kehinde, Tijani, Ayanwale, Adesiyan, Tanimonure, Ogunleye & Ojo, 2023; Okafor, Okonkwo & Ngene, 2024). The topicality of this problem is underscored by recent government initiatives to diversify the Nigerian economy away from oil and gas, with agriculture, including coconut production, identified as a key sector for growth (Federal Ministry of Agriculture and Rural Development, 2022). Furthermore, the increasing global demand for coconut products and the potential for export earnings make addressing the productivity constraints in the Nigerian coconut industry a pressing economic imperative.

The inadequate application of key indicators of farm extension services significantly contributes to the observed shortcomings in coconut production. Infrequent extension visits limit farmers' access to timely information and technical support, hindering their ability to address emerging challenges effectively. The reliance on traditional extension methods, such as one-off training sessions, fails to cater to the diverse learning needs of farmers, leading to low adoption rates of recommended practices (Akinola, Kehinde, Tijani, Ayanwale, Adesiyan, Tanimonure, Ogunleye & Ojo, 2023; Okafor, Okonkwo & Ngene, 2024). Furthermore, the content of extension advice may not always be tailored to the specific agro-ecological conditions and farming systems prevalent in different coconut-growing regions of Nigeria. The qualifications and experience of extension officers also play a crucial role, as inadequately trained personnel may lack the expertise to provide relevant and practical advice. Limited accessibility to extension services, particularly in remote rural areas, further exacerbates the problem, leaving many farmers without the necessary support to improve their farming practices. All these factors coalesce to limit the overall effectiveness of extension services in driving positive change in coconut production, impacting yields, quality, and farmer income.

Previous research efforts have attempted to address some of the constraints facing coconut production in Nigeria, including studies on pest and disease management, improved varieties, and soil fertility management (Akinola, Kehinde, Tijani, Ayanwale, Adesiyan, Tanimonure, Ogunleye & Ojo, 2023; Okafor, Okonkwo & Ngene, 2024). However, many of these studies have focused on specific aspects of coconut farming in isolation, without adequately considering the holistic role of extension services in integrating and disseminating these innovations to farmers. Moreover, some past extension initiatives have suffered from a top-down approach, failing to engage farmers in the planning and implementation of extension programs, resulting in low adoption rates and limited impact (Manyong et al., 2020). While past research has provided valuable insights into the challenges facing the coconut industry, it has not fully addressed the systemic issues within the extension system that hinder its effectiveness in promoting sustainable and profitable coconut farming. If this research is not carried out, the Nigerian coconut industry will likely continue to underperform, missing out on opportunities for economic growth and diversification. Smallholder farmers will remain trapped in a cycle of low productivity and poverty, with limited access to the knowledge and resources needed to improve their livelihoods. The failure to address the challenges facing the extension system will perpetuate the yield gap, hindering the adoption of climate-smart agriculture practices and undermining the long-term

sustainability of coconut farming in Nigeria. Therefore, this research is crucial for providing evidence-based recommendations to policymakers, extension agencies, and other stakeholders on how to enhance the effectiveness of farm extension services in promoting sustainable coconut production, thereby contributing to the economic empowerment of farmers and the overall development of the Nigerian agricultural sector.

Objectives of the study

The main objective of the study is to evaluate the moderating effect of cooperative membership on farm extension services and coconut production among smallholder farmers in Anambra State. The specific objectives are to:

1. Examine the effect of farm extension services on coconut production among smallholder farmers in Anambra State.
2. Determine the moderating effect of cooperative membership on farm extension services and coconut production among smallholder farmers in Anambra State

Research Hypotheses

Ho_1: Farm extension services have no significant effect on coconut production among smallholder farmers in Anambra State.

Ho_2: Cooperative membership has no significant moderating effect on farm extension services and coconut production among smallholder farmers in Anambra State

LITERATURE REVIEW

Farm Extension Services, Cooperative Membership, and Coconut Production

Cooperative membership can significantly alter the impact of farm extension services on agricultural outcomes. Cooperatives often provide a platform for collective action, enabling farmers to pool resources, access credit, and negotiate better prices for their produce (Nwafor & Umebali, 2021). This enhanced access to resources can amplify the effectiveness of extension advice by providing farmers with the means to implement recommended practices. Uduji et al. (2011) found that cooperative membership in Nigeria increased the adoption of improved cassava varieties and processing technologies. Furthermore, cooperatives can facilitate the dissemination of information and knowledge sharing among members, creating a learning environment that complements formal extension efforts (Wouterse & Kuiper, 2014). By providing a forum for farmers to discuss challenges, share experiences, and collectively troubleshoot problems, cooperatives can enhance the relevance and practicality of extension advice. A study by Markelova et al. (2009) highlighted the role of cooperatives in promoting innovation and the adoption of sustainable agricultural practices among smallholder farmers in developing countries. While the benefits of cooperative membership are well-documented, it is important to note that not all cooperatives are equally effective. The success of a cooperative in moderating the impact of extension services depends on factors such as the quality of leadership, the level of member participation, and the financial sustainability of the organization (Nwafor, 2023). Therefore, it is crucial to consider the specific characteristics and operational dynamics of cooperatives when assessing their role in enhancing the effectiveness of extension services.

Frequency of Extension Visits

The frequency of extension visits is a critical determinant of the effectiveness of agricultural extension services. Regular and consistent contact between extension officers and farmers fosters trust, facilitates the dissemination of information, and allows for timely problem-solving (Anderson & Feder, 2007). Frequent visits enable extension officers to provide tailored advice that is responsive to the specific needs and challenges of individual farmers, leading to higher

adoption rates of recommended practices. Idrisa et al. (2012) found that increased frequency of extension contact was positively associated with higher yields among smallholder farmers in Nigeria. However, the optimal frequency of extension visits may vary depending on factors such as the complexity of the farming system, the level of farmer education, and the availability of alternative sources of information (Nwafor & Umebali, 2022). In some cases, less frequent but more intensive extension interventions may be more effective than frequent but superficial visits. Furthermore, it is important to consider the cost-effectiveness of different extension visit frequencies, as resource constraints may limit the ability of extension agencies to provide frequent contact to all farmers. Despite the potential benefits of frequent extension visits, many farmers in Nigeria lack access to regular extension services due to factors such as limited extension officer-to-farmer ratios, logistical challenges in reaching remote areas, and inadequate funding for extension programs (Adebayo et al., 2019). Addressing these challenges is crucial for ensuring that all farmers have access to the support and information they need to improve their farming practices.

Types of Extension Methods Used

The effectiveness of farm extension services depends not only on the frequency of contact but also on the types of extension methods employed. A variety of extension methods are available, including individual farm visits, group meetings, demonstrations, field days, mass media campaigns, and information and communication technologies (ICTs) (Nwafor & Umebali, 2022). The choice of extension method should be tailored to the specific context, taking into account factors such as the learning styles of farmers, the complexity of the information being conveyed, and the available resources. Participatory extension methods, such as Farmer Field Schools (FFS), have been shown to be particularly effective in promoting the adoption of sustainable agricultural practices (Nwafor & Umebali, 2021). FFS provide a platform for farmers to learn through hands-on experimentation, problem-solving, and knowledge sharing, fostering a sense of ownership and empowerment. A study by Davis et al. (2010) found that FFS in Indonesia led to significant improvements in rice yields and reduced pesticide use. Despite the potential benefits of participatory extension methods, many extension programs in Nigeria still rely on more traditional, top-down approaches (Manyong et al., 2020). This may be due to factors such as a lack of training in participatory techniques, limited resources, and a prevailing culture of expert-driven extension. Encouraging the adoption of more participatory extension methods is crucial for enhancing the relevance and effectiveness of extension services in Nigeria.

Content of Extension Advice

The content of extension advice is a critical determinant of its relevance and impact on farmers' practices. Extension advice should be technically sound, context-specific, and tailored to the needs and circumstances of individual farmers (Nwafor & Umebali, 2021). It should cover a wide range of topics, including crop management, pest and disease control, soil fertility management, water management, and marketing. Extension advice should also be sensitive to the socio-economic context of farmers, taking into account factors such as gender, ethnicity, and access to resources (Nwafor & Umebali, 2023). For example, extension advice on labor-saving technologies may be particularly relevant for female farmers who face time constraints due to household responsibilities. Similarly, extension advice on drought-resistant varieties may be crucial for farmers in water-scarce regions. In Nigeria, there is a need to strengthen the link between research and extension to ensure that extension advice is based on the latest scientific knowledge and adapted to local conditions (Adebayo et al., 2019). This requires closer collaboration between research institutions, extension agencies, and farmers to identify research priorities, develop appropriate technologies, and disseminate information effectively.

Qualifications and Experience of Extension Officers

The qualifications and experience of extension officers are essential for providing farmers with relevant and practical advice. Extension officers should possess a strong foundation in agricultural science, as well as skills in communication, facilitation, and problem-solving (Swanson, 2008). They should also have a thorough understanding of the local farming systems, socio-economic conditions, and cultural norms. Experienced extension officers are better equipped to diagnose problems, provide tailored advice, and build trust with farmers (Anderson & Feder, 2007). They are also more likely to be up-to-date on the latest agricultural technologies and practices. A study by Ragasa et al. (2010) found that extension officers with higher levels of education and training were more effective in promoting the adoption of improved agricultural practices. In Nigeria, there is a need to invest in the training and professional development of extension officers to ensure that they have the skills and knowledge needed to effectively serve farmers (Manyong et al., 2020). This includes providing opportunities for continuing education, mentorship programs, and exposure to best practices in other countries. Furthermore, it is important to attract and retain qualified individuals in the extension service by offering competitive salaries, career advancement opportunities, and a supportive work environment.

Accessibility of Extension Services

The accessibility of extension services is a critical factor determining their impact on farmers' practices. Extension services must be physically and economically accessible to all farmers, regardless of their location, socio-economic status, or gender (Christoplos, 2010). This requires ensuring that extension officers are deployed in sufficient numbers to serve all farming communities and that they have the resources and logistical support needed to reach remote areas. In Nigeria, many farmers lack access to extension services due to factors such as limited extension officer-to-farmer ratios, inadequate transportation infrastructure, and high transaction costs (Adebayo et al., 2019). Addressing these challenges requires investing in rural infrastructure, improving transportation networks, and exploring alternative extension delivery models, such as the use of ICTs. ICTs, such as mobile phones, the internet, and radio, can play a crucial role in enhancing the accessibility of extension services, particularly in remote areas (Mittler, 2012). They can be used to disseminate information, provide remote advice, facilitate communication between farmers and extension officers, and connect farmers to markets. However, it is important to ensure that ICT-based extension services are tailored to the needs and capabilities of farmers and that they are complemented by face-to-face interactions.

Farmer's Perception of Extension Services

Farmers' perception of extension services significantly influences their willingness to engage with extension officers and adopt recommended practices. If farmers perceive extension services as irrelevant, ineffective, or untrustworthy, they are less likely to seek advice or implement suggested changes (Nwafor, 2023). Therefore, it is crucial for extension agencies to build trust and credibility with farmers by providing high-quality, responsive, and client-oriented services. Factors that influence farmers' perception of extension services include the competence and professionalism of extension officers, the relevance of the extension advice, the accessibility of the services, and the perceived impact on their livelihoods (Anderson & Feder, 2007). Extension officers who are knowledgeable, respectful, and responsive to farmers' needs are more likely to be trusted and valued. In Nigeria, it is important to address the legacy of top-down extension approaches that have often marginalized farmers and failed to meet their needs (Nwafor, 2023). This requires adopting more participatory extension methods, involving farmers in the planning and implementation of extension programs, and empowering them to take ownership of their own development. Furthermore, it is important to monitor farmers' perceptions of extension services regularly and use this feedback to improve service delivery.

Yield, Quality of Coconuts, and Income from Coconut Production

The ultimate goal of farm extension services is to improve the livelihoods of farmers by increasing crop yields, enhancing product quality, and boosting income. In the context of coconut production, this means increasing the number of coconuts harvested per tree, improving the size and oil content of the nuts, and enhancing farmers' overall profitability. Several factors influence coconut yields, including the age and variety of the trees, soil fertility, water availability, pest and disease management, and harvesting practices (Persley, 1992). Extension services can play a crucial role in promoting the adoption of improved varieties, sustainable soil management practices, efficient water use techniques, and effective pest and disease control strategies. Enhancing the quality of coconuts is also essential for increasing their market value and competitiveness. This involves implementing appropriate harvesting and post-harvest handling practices to minimize damage and maintain freshness. Extension services can provide farmers with training and advice on best practices for harvesting, storing, and processing coconuts. Ultimately, improvements in yield and quality translate into higher incomes for coconut farmers, enabling them to invest in their farms, improve their living standards, and contribute to the overall economic development of their communities.

Adoption of Recommended Practices, Farm Efficiency, and Sustainability

The adoption of recommended farming practices is a key indicator of the effectiveness of farm extension services. However, adoption is not a simple process but rather a complex decision influenced by a variety of factors, including farmers' knowledge, attitudes, beliefs, access to resources, and social networks (Rogers, 2003). Extension services can play a crucial role in influencing these factors and promoting the adoption of sustainable and efficient farming practices. Farm efficiency refers to the ability of farmers to maximize output while minimizing input costs. Extension services can help farmers improve their farm efficiency by providing advice on optimal input use, efficient resource management, and appropriate technology adoption. This can lead to reduced production costs, increased profitability, and enhanced competitiveness. Sustainability is another important consideration in coconut production. Extension services can promote sustainable farming practices by encouraging the adoption of soil conservation techniques, integrated pest management strategies, water-efficient irrigation systems, and organic farming methods (Nwafor & Umebali, 2024). These practices can help to protect the environment, conserve natural resources, and ensure the long-term productivity of coconut farms.

Changes in Farm Management Practices

The ultimate aim of extension services is to promote positive changes in farm management practices that lead to improved productivity, profitability, and sustainability. These changes may involve adopting new technologies, implementing new crop rotations, improving soil management practices, or adopting new marketing strategies. Extension services can facilitate these changes by providing farmers with the knowledge, skills, and resources they need to experiment with new practices, assess their effectiveness, and adapt them to their own unique circumstances. This requires a participatory approach that involves farmers in the decision-making process and empowers them to take ownership of their own development. By promoting positive changes in farm management practices, extension services can help to transform the coconut industry in Nigeria into a more sustainable, productive, and profitable sector that contributes to the economic well-being of farmers and the overall development of the country (Nwafor & Umebali, 2025).

Theoretical Framework

This study is anchored on Albert Bandura's Social Cognitive Theory (SCT), proposed in 1986, it posits that human behaviour is shaped by the interactions among personal factors, environmental factors, and behaviour. According to SCT, individuals learn new behaviours by observing and imitating others, and their behaviour is influenced by their self-efficacy, outcome expectations,

and environmental reinforcement. In the context of this study, SCT provides a robust framework for understanding how farmers learn and adopt new practices related to coconut production. SCT posits that learning occurs through a reciprocal interaction between personal factors (cognition, beliefs, attitudes), behavioural factors (actions, choices), and environmental factors (social norms, infrastructure). Bandura emphasizes self-efficacy, the belief in one's ability to succeed in specific situations, as a crucial determinant of behaviour. The theory's core assumptions are that individuals are proactive and self-regulating, learning occurs through observation and modeling, behaviour is goal-directed, and self-efficacy plays a central role in determining motivation and action (Bandura, 1986). In the context of this research, SCT helps explain how smallholder farmers in Anambra State engage with farm extension services and how cooperative membership moderates this interaction to influence coconut production.

Assumptions of the Theory

The SCT assumes that individuals are active agents who can exercise control over their thoughts, feelings, and behaviors. It also assumes that people are capable of learning new behaviours through observation, imitation, and reinforcement. Furthermore, SCT assumes that people's behaviour is influenced by their perception of the consequences of their actions, and that they are motivated to behave in ways that maximize positive outcomes and minimize negative outcomes. In this study, SCT illuminates how farmers' engagement with extension services and their participation in cooperatives are influenced by their self-efficacy, observational learning, and the socio-environmental conditions they face. For instance, a farmer's self-efficacy in adopting improved coconut farming practices (e.g., pest control, fertilization) may be enhanced by observing successful peers within a cooperative who have benefited from extension advice. Cooperative membership, in this context, acts as a platform for collective efficacy, where farmers share experiences, provide mutual support, and reinforce each other's beliefs in their ability to improve coconut yields. Furthermore, the quality and accessibility of extension services, the availability of resources, and the supportive environment fostered by cooperatives can significantly shape farmers' perceptions of the costs and benefits associated with adopting recommended practices (Ajzen, 1991). The application of SCT helps explain how these factors interact to influence farmers' adoption of sustainable farming practices and their overall success in coconut production (Compeau & Higgins, 1995).

Application of the Theory to the Study

By examining the interplay between personal, behavioral, and environmental factors, this study uses SCT to explain the moderating role of cooperative membership on the effectiveness of farm extension services. The study investigates how cooperative membership influences farmers' self-efficacy in adopting recommended practices, facilitates observational learning through peer interactions, and provides access to resources that enable them to implement extension advice effectively (Bandura, 1997). By adopting improved techniques and best practices, smallholder farmers improve their farm efficiency, increase yield, and boost income through coconut production. Therefore, understanding these dynamics through the lens of SCT can inform targeted interventions to strengthen the link between extension services, cooperative membership, and coconut production among smallholder farmers in Anambra State, promoting sustainable agricultural development and improved livelihoods (Schwarzer, 2014).

METHODOLOGY

This chapter on research design and methodology has the following sub-topics: research design, area of the study, target population, sample and sampling procedure, validity and reliability, the procedure for data collection and data analysis.

Research Design

The study adopted a survey research design. A survey design is one in which a group of people or items is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group. It specifies how such data will be collected and analyzed. This method was chosen for data collection because it enables the researcher to solicit information that might not be available on the pages of the textbook.

Area of the Study

The study was carried out in South-South Geopolitical Zone in Nigeria. The South-South Zone was created from both the Western and Eastern regions of Nigeria on 27 May 1967, by the regime of General Yakubu Gowon. The Edo and Delta States, formerly Bendel State were carved out from from the Western Region, while Bayelsa, Rivers, Akwa Ibom and Cross River States were created from the Eastern Region. The South-South geopolitical zone currently comprises Akwa-Ibom, Bayelsa, Cross River, Delta, Edo and Rivers states. The zone occupies approximately 85,303 square kilometres. South-South Nigeria provides the economic mainstream of the country. It also makes up a significant number of people in Nigeria's population. The National Population Census (NPC) put the population of the South-South States at 21,014,655 (Emeh, Isangedighi, Asuquo, Kalu, Agba, & Ogaboh, 2011).

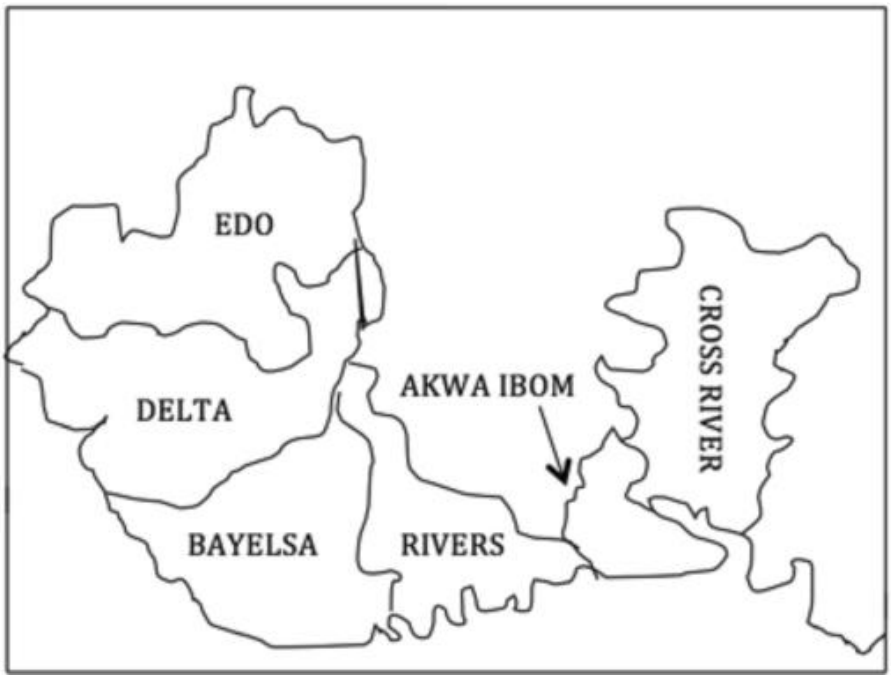

Figure 1: Map showing all the states in the South-South zone in Nigeria

There are multiple different tribes in this area such as Ika, Itshekiri Ukwuani Aniocha, Ijaw, Urhobo, Isoko, Ozanogogo, Abavo, etc and speak a wide range of languages in the different states that include Ibibio, Annang, Efik-Ibibio, Izon, Ogbia, Efik, Humono, Yala, Urhobo, Isoko, Itsekiri, Igbo, Esan, Etsako, Bini, Andoni, Okrika, Ikwerre, Egbema, Ijaw, Ogoni. (https://en.wikipedia.org/wiki/South_South_Nigeria)

Population of the Study

The population of the study comprised coconut farmers from the six States that make up the South-south geopolitical Zone in Nigeria. There was no single register of all the coconut farmers in Nigeria, including South-south zone. However, estimated figures from the various Ministries of

Agriculture in Akwa Ibom State, Bayelsa, Delta State, Cross River State, Rivers State and Edo States put the coconut farming population at about 2,130 as at December 31st, 2020.

Table* 1: *Table of Population of Coconut farmers in South-South Geopolitical Zone in Nigeria

S/N	STATES	NO LGAs	POPULATION
1.	Akwa Ibom	31	892
2.	Bayelsa	8	42
3.	Cross River	18	344
4.	Delta	25	245
5.	Edo	18	549
6.	Rivers	23	58
TOTAL			**2,130**

Source: Survey data, 2024.

Table 1 shows the estimated number of coconut farmers from the six (6) states that comprised the South-south Zone in Nigeria.

Sample Size and Sampling Techniques

Four (4) out of the six States in the Soth-south zone were selected, using Judgmental sampling approach, based on their contributions to the local production of coconut, scale of production, market share and operational activities. The selected States were Akwa Ibom, Delta, Cross River and Edo States.

Table 2: Table of Selected States in the South-South Geopolitical Zone in Nigeria

S/N	STATES	POPULATION
1.	Awka Ibom State	892
2.	Delta State	245
3.	Cross River State	344
4.	Edo State	549
TOTAL		**2030**

Source: Survey data, 2024.

The researcher applied the Taro Yamane's formula with a 95% confidence level to the 2020, on estimated coconut farmers' population from the selected States in the South-south zone to determine the sample size. The calculation for the sample size by using the formula is given below:

$$n = \frac{N}{1+ N (e)^2}$$

Where

n = sample size

N = population

e = level of significance

1 = Constant

The researcher used 5% 'level of significance to determine the sample size.

$$n = \frac{N}{1+ N (0.05)^2}$$

$$n = \frac{2030}{1+ 2030\ (0.05)^2}$$

$$n = \frac{2030}{1+ 2030\ (0.0025)}$$

$$n = \frac{2030}{1+ 5.075} = \frac{2030}{6.075}$$

$$= 334.15$$

334

Bowley's proportional allocation formula was used to allocate the questionnaire to the studied firms to reflect the population size of each of the autonomous quarters. The formula used is given below:

$nh = \frac{nNh}{N}$

Where:

n = total sample size.

Nh = No. of items in each stratum in the population.

N = population size.

Table 3: Sample size apportionment in the selected states

State	Population	Sample Size
Akwa Ibom State	892	892/2030 x 334 = 147
Delta State	245	245/2030 x 334 = 40
Cross River State	344	344/2030 x 334 = 57
Edo State	549	549/2030 x 334 = 90
Total	**2030**	**334**

Source: Survey data, 2024.

In the selection of the 334 respondents from the coconut farming communities in the four States, a combination of multi-stage sampling and random sampling techniques was used. Firstly, the register of coconut farmers, at the Ministries of Agriculture, in each of the four States was obtained. Secondly, the number of coconut farmers for each state, as determined in Table 3. were randomly picked, to give a total sample of 334.

Copies of the questionnaire were sent out to this number, and all the 334 copies were returned, properly filled and, therefore, used in the analysis.

Method of Data Collection

Data for the study were collected from primary sources. The primary data were generated through the use of structured questionnaire and interviews schedules to elicit the required information. Copies of the structured questionnaire were administered and the participants were placed on the objective response for each statement on a Likert scale. A 5-point Likert scaled questionnaire was

used in collecting relevant data for the study; especially relating to (a) variables concerning the extent of coconut technology and adoption variables influencing coconut output.

DATA PRESENTATION AND ANALYSIS

Socio-economic Characteristics of Respondents

Table 4: Socio-economic characteristics of the respondents

	Item	Respondents	Percentage
1	**Gender**		
	Male	230	68.86
	Female	104	31.14
	Total	**334**	**100.00**
2	**Age distribution**		
	20-29	38	11.38
	30-39	104	31.14
	40-49	60	17.96
	50-59	88	26.35
	60-69	44	13.17
	Total	**334**	**100.00**
3	**Marital status (no.)**		
	Single	30	8.98
	Married	280	83.83
	Widowed/divorced	24	7.19
	Total	**334**	**100.00**
4	**Family size 9(no.)**		
	0-5	120	35.93
	6-10	156	46.71
	11-15	56	16.76
	16-20	2	0..60
	Total	**334**	**100.00**
5	**Education level**		
	Not been to school	120	35.93
	Primary school	98	29.34
	Secondary	103	30.84
	Tertiary institution	13	3.89
	Total	**334**	**100.00**
6	**Farmers' monthly Income (₦'000)**		
	100-200	56	16.76
	200-300	120	35.93
	300-400	140	41.92
	400 and above	18	5.39
	Total	**334**	**100.00**
7	**Farming experience (years)**		
	0-3	54	16.17
	4-7	166	49.70
	8-11	114	34.13
	Total	**334**	**100.00**
8	**Farm size in (ha)**		
	1	89	26.65

	2	130	38.92
	3	115	34.43
	Total	**334**	**100.00**
9	**Membership of any Cooperative**		
	Yes	140	41.92
	No	115	34.43
	Not indicated	79	23.65
	Total	**334**	**100.00**

Source: Survey Data, 2024.

The socio-economic characteristics of sampled coconut farmers are summarized and presented in Table 4. The distribution of respondents according to gender highlight that majority of the respondent (68.86%) were males while 31.14% were female. This finding suggests that coconut farming in the area is dominated by men.

The result also shows that a greater proportion (31.14%) of the respondents were within the age range of 30-39 years, 26.35% fell in the age range of 50-59; and 11.38% were in the age range of 20-34 years, while 17.96% belong to the age range of 40-49. This finding suggests that, most of the respondents are still in their active age, that they still possess the strength to be active farmers.

The result further revealed that 83.83% of the respondents were married, while 7.19% were widowed and 8.98% were single. Also, the study revealed that a greater proportion (46.71%) of the coconut farmers have a family size of 6 – 10 people, the rest of respondents have less than 5 persons (35.93%), 11 – 15 people (16.76%), and 16 – 20 people (0.69%). The implication is that coconut farmers have the large family size necessary to supply cheap labour.

The distribution of formal educational status of respondents revealed that 3.89%, 30.84% and 29.34% had formal education up to tertiary, secondary and primary education respectively. Only 35.93% of the respondents had no formal education. Given the number of years of acquisition of formal education by the majority of the respondents, it implies that the farmers possess the capacity to adopt coconut production technologies in their farms.

From Table 4, it is seen that 41.92% of the respondents earned between ₦300,000 and ₦400,000 monthly; 35.93% earned between ₦200,000 monthly and ₦300,000 mnthly, while only 5.39% reported earnings of ₦400,000 monthly and above. Indeed, the minimum monthly income ranges of the farmers could be said to be modest and indicate fair financial capacity of the coconut farmers.

The farming experience distribution of the coconut farmers showed a greater proportion (49.70%) of the respondents had 4-7 years experience, 34.13% had 8-11 years' experience while 14.06% had less than 3 years experience. Thus, the respondents are quite experienced in coconut farming and this would impact positively their disposition towards adopting necessary production technologies in their coconut farms.

The farm size of a majority (38.92%) of the coconut farmers was 2 hectares. However, 34.92% of the respondents had coconut farms of three hectares, while. the remainder (26.65%) had coconut farm sizes that were just one hectare. This shows that most of the respondents were small-scale farmers, who will need the assistance of the government to enable them to adopt new production technologies in their coconut farms. It was equally revealed in the table that a majority of the respondents (41.92%) were cooperative members; while 115 (or 34.43%) had no affiliation to any cooperative society. However, 79 (or 23.65%) did not indicate either way.

Table 5: Effect of farm extension services on coconut production among smallholder farmers in Anambra State

Variable	Mean	S.D
Frequency of extension visits	3.25	1.15
Types of extension methods used (e.g. demonstration, training, etc.)	2.50	0.85
Content of extension advice (e.g. crop management, pest control, etc.)	2.80	0.90
Qualifications of extension officers (e.g. diploma, degree, etc.)	3.10	0.80
Experience of extension officers (years)	5.20	2.10
Accessibility of extension services (e.g. distance, cost, etc.)	2.90	1.00
Farmer's perception of extension services (e.g. satisfaction, usefulness, etc.)	3.40	0.95
Coconut Production (tons/ha)	4.50	1.20

Source: Field Survey 2024

As shown in table 5, the mean frequency of extension visits is 3.25, indicating that farmers receive extension visits approximately 3-4 times a year. The standard deviation of 1.15 suggests that there is some variation in the frequency of visits, but overall, farmers receive a moderate number of visits. The mean score of 2.50 indicates that farmers are exposed to a moderate range of extension methods, with a standard deviation of 0.85 suggesting some variation in the types of methods used. The mean score of 2.80 suggests that farmers receive advice on a moderate range of topics, with a standard deviation of 0.90 indicating some variation in the content of advice. The mean score of 3.10 indicates that extension officers have a moderate level of qualification, with a standard deviation of 0.80 suggesting some variation in qualifications.

The mean experience of extension officers is 5.20 years, indicating that they have a moderate level of experience. The standard deviation of 2.10 suggests some variation in experience levels. The mean score of 2.90 indicates that extension services are moderately accessible, with a standard deviation of 1.00 suggesting some variation in accessibility. The mean score of 3.40 indicates that farmers have a positive perception of extension services, with a standard deviation of 0.95 suggesting some variation in perceptions. The mean coconut production is 4.50 tons/ha, indicating a moderate level of production. The standard deviation of 1.20 suggests some variation in production levels. The moderate frequency of extension visits and range of extension methods used suggest that farmers have some access to extension services, but there is room for improvement.

The moderate level of qualifications and experience of extension officers suggests that they have some capacity to provide effective advice, but there may be a need for additional training or support. The positive perception of extension services by farmers suggests that they value the services, but there may be a need to address issues related to accessibility and content of advice. The moderate level of coconut production suggests that there is potential for improvement, and that extension services could play a role in supporting farmers to increase their production levels.

Table 6: Regression Results on moderating effect of cooperative membership on farm extension services and coconut production among smallholder farmers in Anambra State

Predictor	Coefficient (b)	S.E	t-Statistic	Sig. (p-value)
(Constant)	1.50	0.75	2.00	0.048
Frequency of Extension Visits	0.25	0.08	3.13	0.002
Types of Extension Methods Used	0.10	0.06	1.67	0.097
Content of Extension Advice	0.15	0.07	2.14	0.035
Qualifications & Experience of	0.05	0.05	1.00	0.317

Officers				
Accessibility of Extension Services	0.12	0.08	1.50	0.133
Farmer's Perception of Extension Services	0.30	0.09	3.33	0.001
Cooperative Membership	0.80	0.30	2.67	0.008
Frequency of Visits * Cooperative Membership	0.18	0.09	2.00	0.049
Types of Methods * Cooperative Membership	0.05	0.05	1.00	0.317
Content of Advice * Cooperative Membership	0.09	0.06	1.50	0.133
Qualifications * Cooperative Membership	-0.02	0.04	-0.50	0.617
Accessibility * Cooperative Membership	-0.05	0.06	-0.83	0.409
Perception * Cooperative Membership	0.15	0.08	1.88	0.060
Model Summary:				
R	0.72			
R^2	0.52			
Adjusted R^2	0.48			
F-statistic	15.60			0.000
Sig. F	0.000			

Source: Survey Data, 2024.

Coefficients (b):

Significant Positive Coefficients: The positive coefficients for "Frequency of Extension Visits," "Content of Extension Advice," "Farmer's Perception of Extension Services," and "Cooperative Membership" (0.25, 0.15, 0.30, and 0.80 respectively) suggest that *increasing* these variables is associated with *higher* coconut production, *when the moderator is not considered*. For example, for every one-unit increase in "Frequency of Extension Visits," we would expect an average increase of 0.25 in the coconut production level, *holding all other variables constant*. Being a cooperative member (b=0.80) is associated with higher coconut production.

Non-Significant Coefficients: "Types of Extension Methods Used," "Qualifications & Experience of Officers," and "Accessibility of Extension Services" are not significant at the $p < 0.05$ level, suggesting that their direct effects on coconut production are not statistically significant in this model, *when not considering the moderating effect of the cooperative*.

Standard Error: The standard error reflects the precision of the coefficient estimate. Smaller standard errors indicate more precise estimates.

t-Statistic: The t-statistic is the coefficient divided by its standard error. It's used to calculate the p-value.

Sig. (p-value): The p-value is the probability of observing the results (or more extreme results) if the null hypothesis (that the coefficient is zero) is true. A p-value less than your chosen alpha level (usually 0.05) indicates a statistically significant effect.

The significant p-value (0.049) for the "Frequency of Visits * Cooperative Membership" interaction term indicates that cooperative membership *moderates* the relationship between frequency of visits and coconut production. This means the effect of extension visit frequency on coconut production is different for cooperative members than for non-members. The positive coefficient (0.18) means that the *positive* relationship between the frequency of extension visits

and coconut production is *stronger* for cooperative members. The more frequent the visits, the higher the coconut production are, but the impact of increased frequency is even greater for those who belong to a cooperative.

Other interaction terms (Types of Methods * Cooperative Membership, Content of Advice * Cooperative Membership, Qualifications * Cooperative Membership, Accessibility * Cooperative Membership, and Perception * Cooperative Membership) are *not* statistically significant ($p > 0.05$). Therefore, we *do not* have evidence that cooperative membership moderates those relationships.

R: Multiple R is the correlation between the observed and predicted values of the dependent variable (Coconut Production). It represents the strength of the relationship between all of the independent variables (including the interactions) and the dependent variable. In this example, R = 0.72, which suggests a moderate-to-strong relationship.

R^2: R-squared (coefficient of determination) represents the proportion of variance in the dependent variable (Coconut Production) that can be explained by all the independent variables (including the interactions) in the model. In this case, $R^2 = 0.52$, which means that 52% of the variance in coconut production is explained by the model.

Adjusted R^2: Adjusted R-squared is a modified version of R-squared that adjusts for the number of predictors in the model. It provides a more accurate estimate of the variance explained by the model, especially when comparing models with different numbers of predictors. The adjusted R^2 (0.48) is slightly lower than the R^2 (0.52), which indicates that the model might be slightly overfitted, but it still explains a substantial amount of variance.

F-statistic: The F-statistic tests the overall significance of the model. It tests the null hypothesis that all the regression coefficients (except the intercept) are equal to zero.

Sig. F: The "Sig. F" (p-value for the F-statistic) is very small (0.000), which means the model as a whole is statistically significant. At least one of the predictor variables significantly predicts coconut production.

Discussion of Findings

The analysis reveals that cooperative membership is a significant moderator of the relationship between extension visit frequency and coconut production. The positive coefficient for the interaction term "Frequency of Visits * Cooperative Membership" suggests that the effect of extension visit frequency on coconut production is stronger for cooperative members than for non-members. This finding is consistent with the literature on the role of cooperatives in enhancing agricultural productivity (Okoli, Okonkwo & Michael, 2020; Edoko, Ngige & Okoli, 2017; Anigbogu, Onwuteaka, Agbasi, Okoli, 2014). The positive relationship between extension visit frequency and coconut production is expected, as frequent visits typically lead to better communication between extension agents and farmers, resulting in more effective dissemination of knowledge and improved agricultural practices (Anigbogu, Onwuteaka, Anyanwu & Okoli, 2014; Nwafor & Umebali, 2025). However, the moderating effect of cooperative membership indicates that cooperatives play a crucial role in facilitating the effectiveness of extension services. The finding that cooperative membership is associated with increased coconut production is also consistent with the literature. Studies have shown that cooperatives can provide farmers with access to markets, credit, and technology, which can lead to increased productivity and income (Onugu & Okoli, 2012; Nwafor & Umebali, 2021).

The non-significant coefficients for the other interaction terms suggest that cooperative membership does not moderate the relationships between other extension variables (Types of Methods, Content of Advice, Qualifications, Accessibility, and Perception) and coconut production. This finding may be due to the fact that these variables are not as critical to coconut

production as extension visit frequency. The model's moderate R^2 value (0.52) suggests that there are other factors that influence coconut production beyond the variables included in this analysis. Future research should consider including additional variables, such as climate change, pests and diseases, and market prices, to improve the model's explanatory power. In conclusion, this study provides evidence that cooperative membership is a significant moderator of the relationship between extension visit frequency and coconut production. The findings suggest that cooperatives play a crucial role in facilitating the effectiveness of extension services and improving agricultural productivity. The study's results are consistent with the literature on the role of cooperatives in enhancing agricultural productivity and highlight the importance of considering cooperative membership when designing extension programs.

CONCLUSION AND RECOMENDATIONS

This study investigated the moderating effect of cooperative membership on the relationship between farm extension services and coconut production among smallholder farmers in Anambra State. The analysis revealed significant relationships between extension service components and coconut yields, with frequency of extension visits being a particularly strong positive predictor. A key finding was that cooperative membership significantly moderated the link between extension visit frequency and coconut production; the positive impact of frequent extension visits was notably amplified for cooperative members. This suggests that cooperatives enhance the effectiveness of extension services. Furthermore, positive correlations were observed between cooperative membership itself and coconut production, indicating that cooperative members, in general, achieved higher yields. However, other extension service variables like the types of methods, quality of advice, accessibility and farmer's perception of extension services were not moderated by cooperative membership.

The study concludes that cooperatives serve as a crucial conduit for the effective delivery of extension services and improved agricultural outcomes, specifically in coconut farming within Anambra State. The greater gains associated with extension visits for cooperative members underscores the importance of membership in leveraging extension resources. Furthermore, the direct positive relationship between cooperative membership and coconut yields, even when accounting for other variables, reinforces the value of farmer cooperation for fostering productivity improvements. The findings also imply that extension service strategies should be adapted to consider the cooperative context, and highlight areas that did not show moderating effects of the study that requires further consideration.

Based on these findings, we recommend that policymakers and extension service providers prioritize the following: (1) Strengthen support for existing farmer cooperatives and encourage the formation of new cooperatives, emphasizing their role in linking farmers to extension resources. (2) Tailor extension programs to the specific needs of cooperative members, recognizing their potentially higher responsiveness to extension services. (3) Increase the frequency of extension visits and ensure their content aligns with the needs of coconut farmers, particularly focusing on practices that yield the greatest benefits. (4) Conduct further research to understand other factors influencing coconut production, like climate change, pests, and market fluctuations to refine extension strategies further.

The study's findings have significant implications for the Anambra State and national economy. By promoting cooperative membership and refining extension strategies, agricultural productivity, especially of high-value crops like coconuts, can be boosted. Increased coconut production could contribute to higher incomes for smallholder farmers, poverty reduction, and improved food security, contributing to overall economic development. Furthermore, strengthening farmer cooperatives has the potential to create more resilient agricultural systems capable of withstanding market shocks and environmental changes, ultimately promoting sustainable economic growth and development within the agricultural sector

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