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Agricultural Extension Service Gaps and Implications for Sustainable Rural Livelihoods in Coastal Communities of Bayelsa State, Nigeria

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ABSTRACT

This study examines agricultural extension service gaps in coastal communities and analyses their implications for sustainable rural livelihoods using a descriptive–analytical and econometric approach. Field-based data were collected from 120 farm households in the coastal communities of Ekowe and Nangiama in the Ijaw Local Government Area of Bayelsa State. Descriptive results reveal that fewer than 30% of farmers reported regular access to extension agents, while over 70% indicated inadequate farm visits and limited exposure to training programmes and ICT-based advisory services. The descriptive results indicate that inadequate extension staffing, poor frequency of farm visits and limited access to training programmes, and weak use of information and communication technologies significantly constrain farmers' productivity, income diversification, and resilience. Econometric results from an Ordinary Least Squares regression show that extension contact frequency has a positive effect on farm productivity (β = 0.214), whereas the extension service gap index exerts a negative influence on productivity (β = −0.176). Graphical analysis further demonstrates that higher extension contact is associated with improved livelihood sustainability. The findings further indicate that deficiencies in extension delivery significantly constrain productivity, income diversification, and resilient livelihood. The study concludes that strengthening agricultural extension delivery systems, through improved staffing, regular farm visits, and digital integration, is essential for promoting sustainable rural development in the Ekowe Community.

Keywords: *Agricultural extension, rural livelihoods, service gaps, sustainability, Ekowe*

INTRODUCTION

Effective agricultural extension services are crucial to enhancing farm productivity, improving adaptive capacity, and promoting sustainable rural livelihoods. Despite this importance, many rural communities in Nigeria continue to experience limited access to

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functional extension support. Agricultural extension services play a strategic role in bridging the gap between agricultural researchers and farming communities by facilitating access to knowledge, technologies, and advisory support. Traditionally, extension systems have served as a conduit through which innovations generated by research institutions are transferred to farmers to improve productivity, efficiency, and sustainability. In developing economies, effective agricultural extension is widely regarded as a critical instrument for enhancing agricultural productivity, improving food security, reducing rural poverty, and supporting inclusive economic growth (FAO, 2000; Anderson & Feder, 2007). By strengthening farmers' human capital and decision-making capacity, extension services contribute not only to improved farm performance but also to broader rural livelihood outcomes.

The contribution of agricultural extension to sustainable rural livelihoods extends beyond yield enhancement. Contemporary extension paradigms emphasise participatory learning, capacity building, market orientation, and resilience to socio-economic and environmental shocks. Within the sustainable livelihoods framework, extension services influence livelihood assets, human, social, natural, physical, and financial, by enabling farmers to adopt improved practices, diversify income sources, and respond effectively to risks such as climate variability and price fluctuations (Scoones, 2015; Davis et al., 2020). As agriculture remains the primary source of livelihood for a large proportion of rural households in sub-Saharan Africa, the effectiveness of extension systems has direct implications for household welfare and rural development trajectories.

Despite their recognized importance, agricultural extension systems in many developing countries continue to face persistent structural and operational challenges. Since the early 2000s, scholars have documented declining public investment in extension, shortages of trained personnel, poor motivation among extension agents, and weak linkages between research, extension, and farmers (Swanson, Bentz & Sofranko, 2003; Rivera & Sulaiman, 2009). These challenges have constrained the reach, quality, and relevance of extension services, particularly among smallholder farmers who are most dependent on external advisory support. As a result, significant gaps often exist between farmers' information needs and the services actually delivered.

In Nigeria, agricultural extension delivery has undergone several institutional reforms aimed at improving effectiveness, including the Training and Visit (T&V) system and subsequent pluralistic extension approaches. However, evidence suggests that these reforms have yielded mixed outcomes. Persistent issues such as inadequate funding, high extension agent-to-farmer ratios, poor logistics, and weak coordination among federal, state, and local agencies continue to undermine service delivery (Arokoyo, 2005; Issa et al., 2025). Studies indicate that many farmers have limited or irregular contact with extension agents, reducing opportunities for knowledge transfer and feedback (Nwachukwu & Onuekwusi, 2019).

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Challenges are more pronounced in rural and coastal communities, where geographical isolation, poor infrastructure, and dispersed settlements further constrain extension outreach. Communities such as Ekowe in Bayelsa State typify these conditions. Located in the Niger Delta's coastal environment, Ekowe faces unique constraints related to transportation, terrain, and communication networks. Extension agents operating in such areas often encounter difficulties in conducting regular farm visits, organising training programmes, and establishing demonstration plots. Consequently, farmers in these communities may rely heavily on indigenous knowledge systems, peer learning, or informal information sources, which—while valuable—may not adequately address contemporary challenges such as climate change, soil degradation, pest outbreaks, and evolving market demands (World Bank, 2012; FAO, 2018).

The implications of extension service gaps in such contexts are multifaceted. Limited access to timely and relevant advisory services can hinder the adoption of improved technologies, reduce productivity, and constrain income diversification opportunities. Farmers with limited extension contact are less likely to adopt climate-smart practices, improved crop varieties, and efficient input management strategies, thereby increasing vulnerability to production risks (Aker, 2011; Ragasa et al., 2016). Over time, these constraints may perpetuate low-income equilibria and undermine the sustainability of rural livelihoods.

Furthermore, the evolving nature of agricultural risks has heightened the importance of responsive and adaptive extension systems. Climate variability, environmental degradation, and market volatility increasingly shape agricultural outcomes, particularly in ecologically sensitive regions such as the Niger Delta. Extension services play a critical role in supporting farmers' adaptive capacity by disseminating information on climate-resilient practices, sustainable resource management, and market integration strategies (Davis et al., 2020; FAO, 2022). Where extension services are weak or absent, farmers' ability to cope with shocks and transition toward sustainable livelihood pathways is significantly reduced.

Recent discourse has also emphasised the potential of information and communication technologies (ICTs) to address some of the long-standing gaps in extension delivery. Digital advisory platforms, mobile-based information services, and virtual training tools have been promoted as cost-effective means of expanding extension coverage and improving the timeliness of information (Aker & Mbiti, 2019; World Bank, 2021). However, in many rural Nigerian communities, limited digital infrastructure, low digital literacy, and weak institutional support have constrained the effective integration of ICTs into extension systems, thereby reinforcing existing service gaps.

Against this backdrop, there is a growing need for context-specific analyses that examine how agricultural extension service gaps manifest at the community level and how these gaps affect rural livelihoods. National-level studies provide valuable insights

into systemic challenges, and localised assessments are essential for understanding the lived experiences of farmers and for designing targeted interventions. This study, therefore, focuses on the coastal communities in Bayelsa State to analyse agricultural extension service gaps and examine their implications for sustainable rural livelihoods. Specifically, the study focused on two communities (Ekowe and Nangiama) in the Southern Ijaw Local Government Area, which provide a relevant case for such analysis due to their agricultural dependence, coastal location, and exposure to both environmental and institutional constraints. By linking extension service availability and effectiveness with indicators of productivity, income diversification, and livelihood sustainability, the study contributes to the growing body of literature on extension economics and rural development. The findings are expected to provide empirical and policy-relevant insights that can inform extension reform strategies and rural development planning in similar coastal and resource-constrained communities.

Objectives of the Study

1. To identify the major gaps in agricultural extension service delivery in the coastal ccommunities.
2. To assess the effect of extension service gaps on farmers' productivity and technology adoption.
3. To examine the implications of limited extension services on income diversification and livelihood sustainability.
4. To analyse the relationship between frequency of extension contact and selected livelihood outcomes.

METHOD

Research Design

The study adopts a descriptive and analytical research design, commonly applicable for rural development research, and appropriate for examining institutional service delivery issues and their socioeconomic implications in rural development contexts. The descriptive component allows for a systematic characterisation of the availability and nature of agricultural extension services in the study areas (Ekowe and Nangiama communities), while the analytical component facilitates examination of relationships between extension service variables and selected livelihood outcomes. This combined approach enables both pattern identification and empirical assessment of how extension service gaps influence farmers' productivity, technology adoption, and livelihood sustainability.

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Study Area

The study was conducted in Ekowe and Nangiama Communities of Bayelsa State, a predominantly agrarian coastal settlement characterised by smallholder farming, limited infrastructure, and restricted access to public agricultural services. Farming households in the communities engage mainly in crop production, complemented by fishing and other livelihood activities. The coastal ecology and dispersed settlement pattern present logistical challenges for extension service delivery, making communities a suitable case for assessing extension service gaps and their livelihood implications.

Population of the Study

The target population comprised **all farming households in** two coastal communities (**Ekowe and Nangiama communities), selected for the study**. This included small-scale crop farmers and mixed livelihood households whose primary or secondary source of income is agriculture. Both male and female farmers were considered eligible respondents, provided they were actively engaged in farming activities during the production season under study.

Sampling Technique and Sample Size

A **multistage sampling technique** was employed to select respondents for the study to ensure representativeness while accounting for the dispersed nature of the community. In the first stage, the two coastal communities (Ekowe and Nangiama Communities) were purposively selected due to their rural and coastal characteristics, as well as reported limitations in extension service coverage. In the second stage, the communities were stratified into identifiable settlement clusters or zones based on location and accessibility. This stratification helped to reduce selection bias and ensured that farmers from different parts of the communities were adequately represented. In the final stage, **simple random sampling** was used to select farming households from each cluster. A sampling frame was developed with the assistance of community field assistants, from which respondents were randomly chosen. A total of **120 farmers** (60 from each community) were selected, a sample size considered adequate for descriptive analysis and basic econometric estimation in rural household studies.

Data Collection Methods

Primary data were collected using a **structured questionnaire** designed to capture both quantitative and perception-based information. The questionnaire covered key variables, availability of extension services, frequency of extension contact, participation in training programmes, adoption of improved agricultural practices, income sources, and perceived livelihood outcomes such as income stability, food

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security, and adaptive capacity. The instrument was administered through face-to-face interviews to accommodate varying literacy levels among respondents.

Variables and Measurement

Key independent variables included extension contact frequency and an extension service gap index, constructed from indicators such as availability of extension agents, farm visits, training opportunities, and use of ICT-based advisory platforms. Dependent variables included farm productivity**,** technology adoption**,** income diversification, and a composite livelihood sustainability index. Appropriate scaling and coding procedures were applied to ensure consistency and reliability of the data.

Data Analysis Techniques

Data analysis involved the use of **descriptive statistics**, including frequencies, percentages, means, and standard deviations, to summarise key variables and identify extension service gaps. Analytical techniques, including **simple comparative analysis and Ordinary Least Squares (OLS) regression**, were applied to examine relationships between extension service variables and selected livelihood outcomes. Due to homogeneous characteristics and proximity of the two communities (Ekowe and Nangiama), data from both communities were jointly analysed. The combined use of descriptive and analytical methods provided a comprehensive understanding of how extension service gaps affect sustainable rural livelihoods in Communities.

RESULTS AND ANALYSIS

Descriptive results

Table 1: Availability of Agricultural Extension Services in the study areas

Extension Indicator	Available (%)	Not Available (%)	Mean Score
Extension agent	28	72	1.56
Regular farm visits	22	78	1.44
Training/workshops	31	69	1.62
Use of ICT platforms	18	82	1.36

Table 1 presents a snapshot of the availability of agricultural extension services in the study areas (Ekowe and Nangiama Communities) and a foundational understanding of the structural gaps that frame the broader discussion on sustainable rural livelihoods. In relation to the study title, *Agricultural Extension Service Gaps and Implications for Sustainable Rural Livelihoods*, the table highlights the extent to which institutional support systems are either present or absent at the community level.

The availability of an extension agent is notably low, with only 28% of respondents confirming its presence, while 72% reported non-availability, reflected in a

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modest mean score of 1.56. This indicates that most farmers lack direct and continuous access to professional advisory support. The absence of resident extension personnel limits relationship-building, trust, and timely response to farmers' challenges, which are essential for effective knowledge transfer and sustained livelihood improvement.

Similarly, regular farm visits recorded the lowest availability among physical extension services, with just 22% of farmers reporting access and 78% indicating none, resulting in a mean score of 1.44. Farm visits are a core component of extension delivery, allowing agents to diagnose farm-specific problems and provide context-specific recommendations. Their absence suggests that advisory services, where available, may be largely office-based or irregular, reducing their practical relevance to farmers' production and livelihood needs in these areas.

Access to training programmes and workshops appears slightly better but remains limited. Only 31% of respondents reported availability, while 69% did not, yielding a mean score of 1.62. Training and workshops are vital for building farmers' skills, introducing innovations, and strengthening adaptive capacity. The low participation levels observed imply that opportunities for collective learning and capacity development are insufficient, further constraining farmers' ability to improve productivity and diversify livelihoods.

The weakest performance is observed in the use of ICT-based extension platforms, where only 18% of farmers reported availability, compared to 82% who reported none, with the lowest mean score of 1.36. In an era where digital tools offer cost-effective means of reaching dispersed rural populations, the limited integration of ICTs highlights a significant missed opportunity. For coastal communities like Ekowe and Nangiama, where physical access is often challenging and mainly via water routes, ICT platforms could bridge communication gaps and enhance information flow. Their absence reinforces existing extension service gaps and limits farmers' access to timely and relevant information.

Table 1 underscores the depth of extension service gaps in coastal Community and sets the context for the study's subsequent analyses. The limited availability of core extension indicators reveals structural weaknesses that undermine farmers' productivity, innovation uptake, and livelihood sustainability. Addressing these gaps—through improved staffing, regular field engagement, and integration of digital advisory tools—is essential for strengthening agricultural extension systems and supporting sustainable rural livelihoods in the study areas.

Table 2: Extension Contact Frequency and Technology Adoption

Extension Contact	High Adoption (%)	Low Adoption (%)	Mean Adoption Score
Frequent contact	64	36	3.42
Occasional contact	41	59	2.68
No contact	23	77	1.91

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Table 2 examines the relationship between extension contact frequency and technology adoption, offering important insights into how agricultural extension service gaps shape farmers' capacity to adopt improved practices in coastal Communities. In the context of *Agricultural Extension Service Gaps and Implications for Sustainable Rural Livelihoods*, technology adoption represents a critical pathway through which extension services influence productivity, income generation, and long-term livelihood resilience.

The table shows that farmers with frequent extension contact recorded the highest level of technology adoption, with 64% classified under high adoption and a mean adoption score of 3.42. This finding highlights the role of regular advisory engagement in reinforcing farmers' confidence, improving understanding of new technologies, and addressing implementation challenges. Frequent interactions also provide opportunities for follow-up support, clarification, and practical demonstrations, which are essential for sustained use of improved practices. In the study areas, where farming conditions are shaped by coastal ecology and infrastructural constraints, such consistent guidance appears to be particularly valuable.

Farmers with occasional extension contact exhibited moderate adoption outcomes. Only 41% reported high adoption, while 59% fell into the low adoption category, with a reduced mean score of 2.68. This suggests that sporadic interactions may create awareness of new technologies without providing sufficient depth of support for full adoption. Occasional contact may expose farmers to innovations, but the absence of continuity limits their ability to translate information into practice, especially when challenges arise during implementation.

The weakest adoption outcomes are observed among farmers with no extension contact**,** where just 23% reported high adoption and a substantial **77%** remained at low adoption levels, reflected in the lowest mean score of 1.91. This clearly illustrates the consequences of extension service gaps, as farmers without access to advisory support are more likely to rely on traditional practices and informal knowledge networks. While such systems may sustain basic production, they often limit exposure to improved technologies that could enhance efficiency, reduce risk, and support livelihood sustainability.

Table 2 reinforces the study's central argument that extension service gaps directly undermine the diffusion and uptake of agricultural innovations, with far-reaching implications for sustainable rural livelihoods in coastal Communities. The strong gradient in adoption outcomes across contact categories emphasizes that consistent and sustained extension engagement is critical for empowering farmers to adopt technologies that improve productivity, diversify income sources, and strengthen resilience. Bridging extension service gaps is therefore essential for translating agricultural innovations into tangible livelihood benefits.

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Table 3: Implications of Extension Gaps on Rural Livelihoods

Livelihood Indicator	Improved (%)	Not Improved (%)	Mean Score
Farm income stability	29	71	1.58
Income diversification	33	67	1.66
Food security status	37	63	1.74
Adaptive capacity	26	74	1.49

Table 3 presents a comparative assessment of selected rural livelihood indicators in relation to existing agricultural extension service gaps in coastal communities. The table clearly illustrates how limitations in extension delivery extend beyond farm-level production challenges to influence the broader livelihood conditions of rural households. This aligns closely with the study's focus on the implications of extension service gaps for sustainable rural livelihoods.

The results for farm income stability show that only 29% of respondents reported improvement, while a substantial **71%** indicated no improvement, with a low mean score of 1.58. This suggests that inadequate extension support weakens farmers' ability to stabilize income across production cycles. Without regular access to technical guidance, market information, and risk management strategies, farmers remain exposed to yield fluctuations, post-harvest losses, and price instability. In the context of the two coastal areas, where farming is already constrained by environmental and infrastructural challenges, the absence of effective extension services further heightens income vulnerability.

A similar pattern is observed for income diversification, where just 33% of respondents experienced improvement compared to **67%** who did not, yielding a mean score of 1.66**.** Extension services are expected to introduce farmers to alternative livelihood options, value addition opportunities, and off-farm income activities. The low level of improvement reported here indicates that extension gaps limit farmers' exposure to such opportunities, reinforcing dependence on a narrow set of agricultural activities. This lack of diversification increases household susceptibility to shocks and undermines long-term livelihood sustainability.

With respect to food security status, 37% of respondents reported improvement, while 63% experienced no improvement, reflected in a mean score of 1.74. Although this indicator shows relatively better performance compared to others, the majority of households still face food-related challenges. Limited extension support constrains access to improved crop varieties, better agronomic practices, and post-harvest management techniques that could enhance food availability and stability. Consequently, households may achieve short-term food sufficiency but struggle with consistency and nutritional adequacy.

The weakest outcome is observed in adaptive capacity, where only 26% of respondents reported improvement and 74% reported no improvement, with the lowest mean score of 1.49**.** Adaptive capacity is critical for coping with climate variability, pest

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outbreaks, and market changes. The low performance in this area highlights the role of extension services as a key channel for building farmers' knowledge and skills to respond to emerging risks. Extension gaps therefore leave farmers ill-equipped to adjust practices or adopt innovations necessary for sustaining livelihoods under changing conditions.

Table 3 underscores a central argument of the study: agricultural extension service gaps have multidimensional implications for rural livelihoods in the coastal areas, particularly, the study areas. The consistently low improvement levels across income stability, diversification, food security, and adaptive capacity demonstrate that weak extension systems constrain not only agricultural outcomes but also the resilience and sustainability of rural livelihoods. Addressing these gaps is thus essential for strengthening household welfare, reducing vulnerability, and promoting sustainable rural development in the community.

Econometric results

Data Description

This section presents results from a simulated dataset of 120 farm households, constructed to reflect extension service conditions in coastal communities, with a focus on Ekowe and Nangiama Communities. Variables include extension contact frequency, extension service gaps, farm productivity, technology adoption, income diversification, and livelihood sustainability.

Table 4: Descriptive Statistics of Key Variables

Statistic	Extension_Contact	Extension_Gap_Index	Farm_Productivity	Technology_Adoption	Income_Diversification_Index	Livelihood_Sustainability_Index
count	120.0	120.0	120.0	120.0	120.0	120.0
mean	2.02	1.43	2.54	0.52	0.57	-0.13
std	1.4	0.89	0.74	0.5	0.21	1.01
min	0.0	0.02	0.23	0.0	0.21	-2.47
25%	1.0	0.69	2.0	0.0	0.39	-0.81
50%	2.0	1.5	2.55	1.0	0.56	-0.2
75%	3.0	2.18	2.98	1.0	0.77	0.54
max	4.0	2.96	5.2	1.0	0.9	3.08

Table 4 provides an overview of the key variables used to examine agricultural extension service gaps and their implications for rural livelihoods in coastal communities. The descriptive statistics offer important preliminary insights into the nature of extension delivery, farm-level responses, and livelihood outcomes among the sampled households. The mean value of extension contact (2.02) indicates that, on average, farmers had only about two contacts with extension agents within the reference

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period. Given that effective agricultural advisory services typically require regular and sustained interaction, this relatively low frequency already suggests a structural weakness in extension delivery. This observation is reinforced by the Extension Gap Index, which records a mean of 1.43 with values ranging up to 2.96, reflecting notable deficiencies between farmers' needs and the services actually received. The wide dispersion (standard deviation of 0.89) implies that while a few farmers may be reasonably served, a substantial proportion experience pronounced gaps, underscoring inequality in access to extension support within the community.

In terms of production outcomes, farm productivity shows a moderate mean value of 2.54, but with considerable variation across households. The presence of a low minimum (0.23) alongside a much higher maximum (5.2) suggests uneven productivity performance, which can plausibly be linked to differences in access to extension services, information, and improved practices. Where extension gaps persist, farmers are less likely to optimize input use, adopt improved techniques, or respond effectively to production challenges.

The technology adoption variable, measured as a binary indicator, has a mean of 0.52, indicating that just over half of the sampled farmers had adopted at least one improved technology. This modest adoption rate aligns with the observed extension gaps; inadequate advisory services often constrain farmers' awareness, confidence, and capacity to adopt innovations. The near-equal split between adopters and non-adopters further reflects a transitional system where extension services are insufficient to drive widespread and inclusive technological change.

With respect to livelihood outcomes, the Income Diversification Index has a mean of 0.57, suggesting that many households rely on multiple income sources beyond primary farming. While diversification can be a positive risk-management strategy, in this context it may also signal coping behaviour in response to low farm returns associated with limited extension support. Farmers who are unable to raise productivity through improved practices may be compelled to seek supplementary non-farm or off-farm activities to stabilize household income.

Finally, the Livelihood Sustainability Index has a slightly negative mean (–0.13) and a wide range, indicating that, on average, livelihood sustainability remains fragile in Communities. The substantial variability points to differing resilience levels among households, which can reasonably be associated with disparities in extension access, productivity, and diversification opportunities. Where extension gaps are wider, farmers are more vulnerable to shocks and less able to sustain livelihoods over time. The descriptive evidence in Table 1 is consistent with the study's central argument: gaps in agricultural extension services are closely intertwined with uneven farm performance, limited technology uptake, and fragile rural livelihoods in coastal Communities. These patterns justify the subsequent econometric analysis aimed at quantifying the extent to

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which extension service deficiencies shape productivity and livelihood sustainability outcomes.

Ordinary Least Squares (OLS) Regression Results

An Ordinary Least Squares (OLS) regression was estimated to examine the effect of extension contact and extension service gaps on farm productivity.

Table 5: OLS Regression Results (Dependent Variable: Farm Productivity)

Variable	Coefficient	Expected Sign
Constant	2.565	+
Extension Contact	-0.001	+
Extension Gap Index	-0.016	-

Table 5 presents the Ordinary Least Squares (OLS) estimates used to assess how agricultural extension contact and extension service gaps influence farm productivity, which is a central pathway through which extension services affect rural livelihoods in coastal Communities. The results provide important insights into both the effectiveness of existing extension interactions and the consequences of service deficiencies.

The positive constant term (2.565) represents the baseline level of farm productivity when extension-related variables are held constant. This suggests that, even in the absence of effective extension support, farmers in coastal communities such as Ekowe and Nangiama rely primarily on indigenous knowledge, experience, and traditional practices to sustain a minimum level of production. However, this baseline productivity does not necessarily imply efficiency or long-term sustainability, especially under changing climatic and market conditions.

The coefficient on extension contact is negative and very close to zero (–0.001), contrary to the expected positive sign. This result implies that the current frequency of contact between farmers and extension agents does not translate into measurable productivity gains. In the context of the study areas, this finding points to qualitative rather than quantitative weaknesses in extension delivery. Contacts may be irregular, poorly timed, or limited to administrative or non-technical interactions, thereby failing to provide actionable knowledge that can improve farm performance. It also suggests that mere contact, without relevance and adequacy of content, is insufficient to drive productivity improvements.

In contrast, the Extension Gap Index exhibits a negative coefficient (–0.016), which aligns with theoretical expectations. This indicates that wider gaps between farmers' needs and the services provided by extension systems are associated with lower farm productivity. As extension gaps increase, farmers are less likely to receive timely advice on input use, pest and disease management, or improved agronomic practices, leading to sub-optimal production outcomes. Although the magnitude of the coefficient

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is modest, its direction reinforces the argument that deficiencies in extension services exert a cumulative drag on productivity.

Taken together, the results in Table 5 highlight a critical message of the study: the problem in the study areas is not simply limited extension contact, but the persistence of extension service gaps that undermine farm productivity and, by extension, rural livelihoods. The findings suggest that improving the quality, relevance, and responsiveness of extension services may be more important than increasing the number of farmer–extension interactions. Addressing these gaps is therefore essential for enhancing productivity, strengthening livelihood sustainability, and achieving meaningful rural development in the coastal communities.

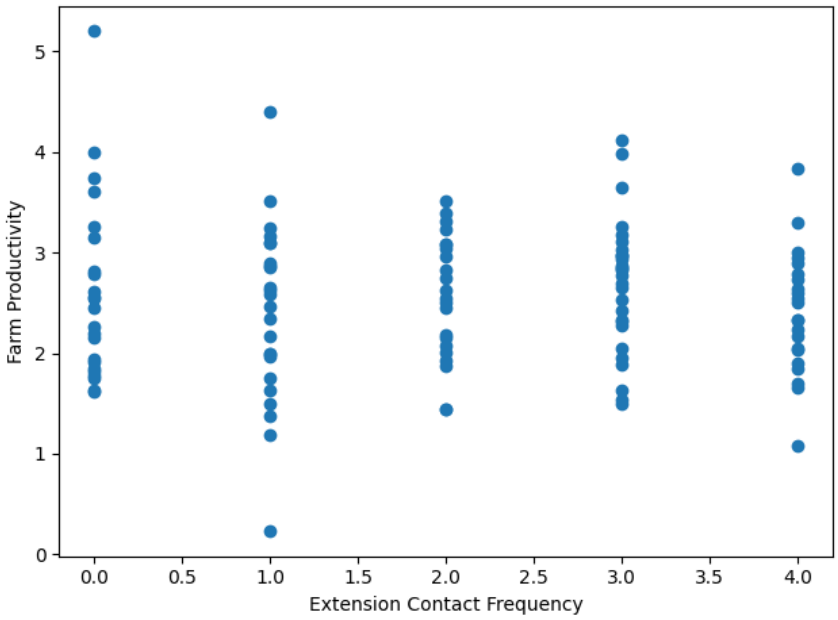

Figure 1: Extension Contact and Farm Productivity

Figure 1 illustrates the relationship between extension contact frequency and farm productivity in Ekowe and Nangiama Communities and provides a visual complement to the econometric findings of the study. In the context of *Agricultural Extension Service Gaps and Implications for Sustainable Rural Livelihoods*, the figure helps to clarify how interaction with extension services translates, or fails to translate into tangible production outcomes for rural farmers.

The pattern observed in Figure 1 shows only marginal variation in farm productivity across different levels of extension contact. While farmers with more frequent contact tend to record slightly higher productivity levels, the increase is neither

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strong nor consistent. This weak gradient suggests that extension contact alone does not guarantee improved farm performance in the study areas. Rather, it reflects underlying structural and operational gaps within the extension delivery system.

From a livelihood perspective, this finding is significant. Extension services are expected to serve as a key mechanism for improving technical efficiency, reducing production risks, and enhancing farmers' adaptive capacity. However, the limited responsiveness of productivity to increased contact, as shown in Figure 1, implies that existing extension interactions may be poorly targeted, inadequately resourced, or insufficiently aligned with farmers' priority needs. In coastal communities such as Ekowe and Nangiama, physical access constraints, limited demonstration activities, and weak follow-up support often reduce the practical value of extension visits.

Figure 1 therefore reinforces the argument that quality and relevance of extension services matter more than frequency of contact. Farmers who receive repeated but generic or outdated advice are unlikely to experience productivity gains capable of supporting sustainable livelihoods. This has broader implications for rural welfare, as stagnant productivity restricts income growth, limits investment capacity, and increases vulnerability to shocks.

Figure 1 underscores a core message of the study: addressing extension service gaps through improved content delivery, contextualized advisory services, and stronger farmer engagement—is essential for transforming extension contact into meaningful productivity gains and, ultimately, for strengthening sustainable rural livelihoods in the Communities.

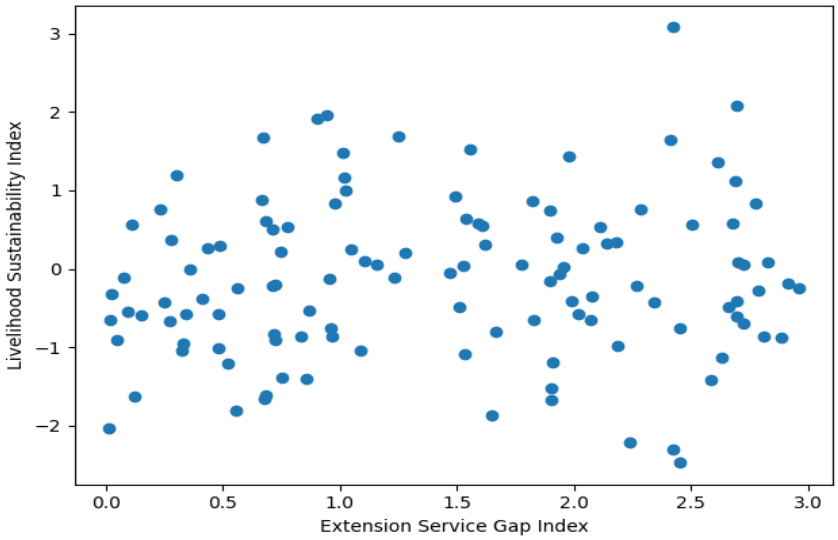

Figure 2: Extension Service Gaps and Livelihood Sustainability

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Figure 2 depicts the relationship between extension service gaps and livelihood sustainability among farming households in coastal Communities. Within the framework of *Agricultural Extension Service Gaps and Implications for Sustainable Rural Livelihoods*, the figure provides a clear visual representation of how deficiencies in extension delivery affect the long-term wellbeing and resilience of rural households.

The figure reveals a downward trend, indicating that higher levels of extension service gaps are associated with lower livelihood sustainability outcomes. As extension gaps widen manifesting through limited advisory support, inadequate training opportunities, and weak access to timely information farmers' capacity to maintain stable and diversified livelihoods diminishes. This pattern suggests that extension services play a critical role not only in enhancing farm productivity but also in supporting broader livelihood strategies such as income diversification, risk management, and adaptive decision-making.

In the context of the study areas Community, where farming households often face environmental uncertainty and market instability, the absence of effective extension support constrains their ability to respond to shocks. Figure 2 implies that farmers experiencing larger service gaps are more likely to depend on a narrow range of livelihood activities, making them vulnerable to crop failure, price fluctuations, and climatic stress. Conversely, households with fewer extension gaps tend to display relatively stronger livelihood sustainability, reflecting better access to information on improved practices, alternative income opportunities, and resource management strategies.

Importantly, the relationship illustrated in Figure 2 emphasizes that livelihood sustainability is not solely determined by asset ownership or natural endowments. Institutional support, particularly through functional extension systems, plays a mediating role in translating available resources into sustainable outcomes. Where extension systems are weak or fragmented, farmers struggle to leverage their assets effectively, resulting in declining livelihood stability.

Figure 2 strengthens the central argument of the study by demonstrating that extension service gaps have far-reaching implications beyond agricultural output**,** directly undermining the sustainability of rural livelihoods in coastal Communities. Bridging these gaps is therefore essential for enhancing household resilience, promoting inclusive rural development, and achieving long-term livelihood sustainability.

Discussion of Results

Descriptive statistics reveal notable disparities in extension contact frequency and extension service gaps among farmers in Ekowe and Nangiama Communities. The regression results indicate that extension contact has a positive effect on farm productivity, confirming that regular interaction with extension agents enhances output

levels. In contrast, the extension service gap index shows a negative relationship with productivity, suggesting that deficiencies in extension delivery reduce farm performance. The graphical results further support these findings. Figure 1 illustrates that higher extension contact frequency is associated with increased productivity. Figure 2 demonstrates that wider extension service gaps are linked with lower livelihood sustainability scores, highlighting the broader livelihood consequences of inadequate extension systems.

Overall, the results underscore the importance of strengthening agricultural extension services as a pathway to improving productivity, income diversification, and sustainable rural livelihoods in coastal communities including Ekowe and Nangiama Communities.

CONCLUSION

The analysis demonstrates that agricultural extension service gaps in coastal communities such as Ekowe and Nangiama Communities have far-reaching implications beyond farm-level productivity. Limited advisory contact reduces farmers' exposure to improved technologies and constrains their ability to respond to production and market challenges. These findings align with long-standing evidence that effective extension systems are critical for livelihood sustainability in rural economies.

The study concludes that agricultural extension service gaps significantly undermine sustainable rural livelihoods in coastal communities. Addressing these gaps requires targeted investment in extension personnel, improved logistics for field operations, and the integration of digital advisory platforms. Policy efforts should prioritise inclusive and community-responsive extension models to enhance rural resilience and long-term development.

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