

Enhancing Agricultural Extension for Food Security: The Role of Development Communication in Kogi State, Nigeria

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Abstract- Agricultural extension is a cornerstone of food security in Nigeria, yet rural communities often face barriers to accessing timely, relevant, and actionable agricultural information. This study investigates the role of development communication in enhancing agricultural extension delivery for food security in Kogi State, Nigeria. Drawing on the Participatory Development Communication (PDC) model and Diffusion of Innovations (DOI) theory, the research examines how tailored communication strategies can improve the effectiveness of extension services in disseminating agricultural innovations, strengthening farmer capacity, and fostering community participation. Using mixed methods, the study integrates recent Kogi State agricultural statistics—showing that the state's extension agent-to-farmer ratio remains critically low at 1:3,000, with only 37% of farmers having regular contact with extension officers. Findings highlight significant gaps in extension coverage, digital inclusion, and participatory planning, while also identifying best practices from ongoing state-led and donor-supported programmes. The paper concludes that integrating development communication principles into extension delivery can significantly improve adoption rates of agricultural innovations, thereby boosting productivity, income, and food security outcomes.

Keywords: Development communication, agricultural extension, food security, Kogi State, participatory communication, diffusion of innovations.

I. INTRODUCTION

Agriculture remains the dominant sector in Nigeria, providing livelihoods, employment, and a substantial contribution to the national GDP. Yet, food security continues to pose a major challenge in this densely populated and climate-vulnerable nation. In recent years, agriculture has become increasingly information-driven, with digital communication and ICT tools now critical for enhancing productivity and resilience. Access to timely agricultural information has thus emerged as a key factor in promoting innovation, sustainability, and rural development (Islam et al., 2021). The effectiveness of agricultural communication systems determines the success of programs aimed at improving yields, income, and employment among rural farmers. Recent initiatives, such as mobile-based extension services and digital platforms, have proven vital in transforming farmers' behavior and adoption of new technologies (Rahman & Sultana, 2020). Mass communication and information dissemination continue to play a central

role in shaping attitudes and driving sustainable agricultural practices (Haque & Akter, 2022).

Food security means having, at all times, both physical and economic access to sufficient food to meet dietary needs for a productive and healthy life. A family is food secured when its members do not live in hunger or fear of hunger. Ibrahim (2016) noted that food security in a broader perspective has to do with having at all times and adequate level of food products to meet increasing consumption demand to migrate fluctuation in output and price. On the other hand, Karolina, and Małgorzata (2020) defined food security as "all people at all times having both physical and economic access to the basic food they need".

The report of World Food Summit of 1996 as cited in Abdul-Jalil (2015), pointed out that food security can be said to be as existing when all people at all-time have access to sufficient, safe and nutritious food to maintain a healthy and active life. According to Abdul, Saheed, Abraham, Bernard, and Yakubu (2022), food insecurity is attributed to the increasing

population without a proportionate increase in food production.

Agricultural extension is the use of scientific inquiries and new knowledge in agricultural practices through farmer education. Agricultural extension is essentially an educational process in which the farmers are the learners while agricultural extension workers are the facilitators. Through agricultural extension programmes, farmers are taught better, new ideas, innovations in agriculture, and new technical and economic practices are demonstrated to the farmers. According to Ajeigbe, and Dashiell (2010) extension is a non-formal educational function that applies to any institution that disseminates information and advice with the intension of promoting knowledge, attitudes, and skills. The author further stated that agricultural extension brings about changes, through education and communication in farmers attitude, knowledge and skills. Taiwo, Agbasi, Lawal and Okafo (2015), acknowledged that extension and outreach strategies are carried out by extension agents to build farmers capacity in utilising and improving crop and animal production techniques.

Consequently, Adeola, and Ayoade (2011) avowed that agricultural extension programmes improve yields and incomes for farmers and trained agents visit communities to ensure the dissemination of current best practices, organise cooperatives, and implement secondary programmes that improve farmers' knowledge on how to increase productivity of farm products. These agricultural workers are expected to travel extensively across their countries while ensuring that they maintain consistent and high-quality work with limited training. Agricultural extension plays a crucial role in agricultural development by facilitating the transfer of knowledge, technologies, and best practices to farmers. According to Madu (2014), agricultural extension services are now a major activity and basic element in programmes and projects formulated to bring about agricultural development and improvement in the quality of food production and lives of the rural poor farmers.

Development communication is the purposeful use of communication tools and participatory approaches to promote social and economic progress. It involves sharing information, fostering dialogue, and mobilizing communities for change. In the agricultural sector, development communication supports the dissemination of innovations that improve food production and enhance rural livelihoods. Oyeleke and Nwankwo (2021) describe it as an interactive process that encourages farmers' participation in decision-making related to agricultural practices. Ajiboye and Ibrahim (2023) assert that development communication empowers rural farmers by providing timely and relevant agricultural information through radio, mobile phones, and farmer field schools. This communication-driven approach ensures that information is not only received but understood and applied effectively. In Kogi State, such communication fosters awareness on improved seeds, pest control, and marketing strategies that are crucial for sustainable food production and security (Eze et al., 2022).

The role of agricultural extension in ensuring food security goes beyond technical training; it also involves behavioral and attitudinal transformation among farmers. When farmers are well-informed, they make better choices in resource management, post-harvest handling, and marketing. Development communication contributes to this transformation by using culturally relevant channels and participatory approaches. Olajide et al. (2022) explained that interpersonal communication and community radio have been instrumental in influencing farmers' adoption of new techniques. Likewise, Eze, Okoye, and Nnadi (2022) highlighted that participatory communication fosters trust and enhances the credibility of extension agents. In Kogi State, where literacy levels vary, using visual aids, local languages, and group discussions has proven effective in reaching diverse farming communities. This communicative approach ensures inclusivity and equitable access to agricultural knowledge for improved productivity and food sufficiency.

Statement of the Problems

Agriculture in Kogi State remains the primary source of livelihood for a large portion of the population, yet food insecurity continues to affect many households. Farmers face major challenges such as limited access to agricultural information, poor knowledge of modern farming techniques, and inadequate extension support. Many extension agents lack the necessary tools, training, and logistics to reach rural farmers effectively. The weak communication system between extension officers and farmers reduces the spread of agricultural innovations and limits awareness of improved seeds, pest management, and post-harvest practices. This situation has resulted in low productivity, poor income generation, and unstable food supply across farming communities in the state.

Agricultural communication structures in Kogi State are not effectively organized to support farmer participation and knowledge exchange. Most information channels are inactive or poorly coordinated, creating barriers to timely information sharing. The absence of strong development communication strategies within extension programs limits farmers' ability to adopt improved technologies and modern agricultural methods. Many farmers rely on traditional practices that do not meet the demands of current environmental and market conditions. Weak collaboration between researchers, extension workers, and farmers continues to slow agricultural transformation and contributes to persistent food insecurity in Kogi State.

Research Questions

The study addresses the following:

1. How can development communication strengthen agricultural extension effectiveness in Kogi State?
2. What communication strategies are currently used, and how do they influence adoption of improved agricultural practices?
3. How do participatory models and ICT-enhanced channels contribute to food security at the local level?

II. LITERATURE REVIEW

Food

Food security is widely recognized as a dynamic and multidimensional concept that ensures all individuals have reliable access to adequate, safe, and nutritious food necessary for an active and healthy life. The Food and Agriculture Organization (FAO, 2023) defines it through four key pillars: availability, access, utilization, and stability. Contemporary discussions highlight that food security extends beyond physical food supply to include affordability, nutritional adequacy, and equitable distribution. According to Smith and Anderson (2022), achieving food security requires addressing the social and economic barriers that prevent individuals from obtaining quality food. Thus, modern understanding emphasizes that true food security involves not only food availability but also the capacity of people to acquire and utilize food in ways that promote overall well-being.

Over time, the meaning of food security has evolved from a focus on national production levels to include household and individual access. This shift reflects a growing awareness that sufficient national food stocks do not necessarily guarantee adequate household consumption. Gómez and Ricketts (2023) note that household food security depends on income, market conditions, and the ability of individuals to convert available food into nutritional benefits. The inclusion of utilization as a core dimension recognizes that food quality, safety, and nutrient absorption play vital roles in ensuring health. In this sense, food security represents not merely the presence of food but the assurance of nourishment and stability over time.

Recent literature has expanded the concept further to incorporate agency and sustainability as essential components of food security. Agency refers to people's ability to make informed choices about what and how they eat, while sustainability relates to the long-term environmental, economic, and social viability of food systems (Manikas, Ali, & Sundarakani, 2023). The addition of these dimensions reflects the growing need for inclusive and environmentally responsible food systems.

Scholars argue that sustainable food production, equitable trade, and consumer empowerment are indispensable in achieving lasting food security (World Bank, 2024). Hence, food security today must be examined not only through the lens of availability and access but also through participation, rights, and ecological stewardship.

Agricultural Extension

Agricultural extension is broadly defined as an educational process aimed at transferring scientific knowledge, improved technologies, and practical innovations from research institutions to farmers. It serves as a bridge between agricultural science and rural communities by enhancing farmers' skills, decision-making abilities, and productivity. According to the Food and Agriculture Organization (FAO, 2021), agricultural extension involves organized communication and learning systems that promote sustainable farming practices and rural development. Recent scholars such as Lee and Ajayi (2022) describe it as a participatory process where farmers are not passive recipients of information but active partners in problem-solving and innovation. Through this approach, agricultural extension strengthens rural livelihoods by fostering learning, collaboration, and adaptation to changing agricultural conditions.

The modern concept of agricultural extension has evolved from a top-down model to a more inclusive and participatory framework. Traditional extension approaches focused mainly on transferring information, while contemporary systems emphasize empowering farmers to make informed choices. Adebayo, Sanni, and Chukwu (2023) note that agricultural extension today integrates adult education, communication, and innovation systems to improve productivity and sustainability. The emphasis is now on building farmer capacity to respond to challenges such as climate change, pest outbreaks, and market volatility. This shift recognizes the importance of knowledge sharing, feedback mechanisms, and local adaptation in achieving agricultural development goals.

Agricultural extension also plays a central role in promoting sustainable agriculture through the

dissemination of climate-smart and environmentally friendly technologies. The World Bank (2024) highlights that effective extension services are essential for achieving global food security and the Sustainable Development Goals (SDGs). Modern extension systems incorporate information and communication technologies (ICTs), mobile platforms, and digital tools to enhance the reach and efficiency of agricultural advice. According to Zhang and Karanja (2022), digital extension initiatives have improved access to real-time agricultural information and reduced barriers faced by remote farmers. These innovations have redefined agricultural extension as a dynamic, technology-driven process that connects science, policy, and practice.

Development Communication and Agricultural Extension

Development communication plays a vital role in strengthening agricultural extension by facilitating the effective flow of information between researchers, extension agents, and farmers. It involves the strategic use of communication processes, media, and interpersonal methods to promote agricultural knowledge and behavioral change. According to the Food and Agriculture Organization (FAO, 2021), communication for development in agriculture enhances understanding, participation, and adoption of innovations. Recent research by Bello and Anwar (2022) emphasizes that effective communication ensures that farmers are well-informed about new technologies, improved inputs, and better management practices. Development communication, therefore, serves as the backbone of agricultural extension systems by ensuring that scientific knowledge reaches farmers in practical and understandable forms.

Agricultural extension relies heavily on participatory communication, which encourages dialogue, trust, and collaboration among all stakeholders. Unlike the traditional one-way information flow, participatory communication focuses on two-way interaction, allowing farmers to share feedback and local experiences. As observed by Lee and Ajayi (2022), involving farmers in knowledge generation enhances

the relevance and sustainability of agricultural programs. Through radio broadcasts, community meetings, mobile platforms, and farmer field schools, development communication bridges the gap between research institutions and local farming communities. These interactive platforms strengthen farmers' confidence, encourage collective problem-solving, and promote the adoption of technologies that are tailored to local needs and cultural contexts. In recent years, digital communication technologies have transformed agricultural extension into a more efficient and inclusive process. Tools such as mobile phones, social media, and interactive voice response systems enable farmers to access agricultural information in real time. According to Zhang and Karanja (2022), digital communication has improved farmers' access to weather updates, market prices, and pest control measures, leading to better decision-making and productivity. The World Bank (2024) notes that integrating information and communication technologies into extension programs expands their reach and enhances transparency and accountability. This digital revolution in development communication ensures that farmers, even in remote areas, can participate actively in knowledge exchange and agricultural innovation.

Omotayo and Rahman (2023) highlight that communication strategies that consider local languages, cultural values, and gender dynamics empower marginalized groups and promote equitable access to resources. By combining communication, education, and participation, agricultural extension becomes more responsive to farmers' needs and adaptable to changing conditions such as climate variability. Ultimately, development communication strengthens the effectiveness of extension services by ensuring that agricultural transformation is not only technological but also social, participatory, and sustainable.

Theoretical Underpinnings

This study draws on two major theories:

Participatory Development Communication (PDC)

Participatory Development Communication (PDC) is an approach that integrates dialogue, knowledge sharing, and active local participation in

development processes. It moves beyond one-way information dissemination by involving communities as co-creators of solutions to their own problems. According to Melkote and Steeves (2021), PDC empowers individuals to voice their opinions, identify priorities, and make informed decisions that affect their livelihoods. In agricultural and rural contexts, this communication process strengthens ownership and sustainability by ensuring that development projects reflect the social and cultural realities of communities. By fostering inclusion, dialogue, and empowerment, PDC transforms communication from mere persuasion into a process of learning and collective action.

The core principle of PDC lies in horizontal and interactive communication that promotes equality among stakeholders. Unlike the traditional top-down approach to information transfer, PDC relies on two-way exchange between farmers, extension agents, researchers, and policymakers. Lee and Ajayi (2022) emphasized that participatory communication builds mutual trust and understanding, leading to better adaptation of innovations. Through participatory tools such as community dialogues, radio programs, and field schools, farmers are encouraged to share indigenous knowledge and experiences. This collaborative process not only democratizes communication but also helps integrate scientific knowledge with local practices, making development more relevant and impactful.

In agricultural extension, PDC plays a vital role in bridging the gap between farmers and development institutions. It enables agricultural extension officers to engage farmers as partners in learning rather than passive recipients of information. As noted by Bello and Anwar (2022), participatory communication enhances the effectiveness of extension programs by ensuring that messages are locally adapted and culturally appropriate. The approach also fosters community-driven innovation, where farmers collectively identify challenges and develop solutions through shared experimentation and reflection. By promoting inclusivity, feedback, and ownership, PDC strengthens agricultural extension

systems and contributes to sustainable agricultural development (World Bank, 2024).

Diffusion of Innovations (DOI) Theory

The Diffusion of Innovations (DOI) Theory, propounded by Everett Rogers in 1962, explains how new ideas, technologies, or practices spread through a social system over time. Rogers (2003) identified key elements in the diffusion process: the innovation itself, communication channels, time, and the social system. This theory emphasizes how individuals progress through stages—knowledge, persuasion, decision, implementation, and confirmation—before adopting an innovation. Recent scholars such as Valente (2021) argue that the DOI framework remains relevant in understanding behavioral change and technology acceptance, especially in developing societies. The theory provides insights into how people perceive innovations and how social networks influence their decisions to adopt or reject new practices.

Modern applications of DOI theory have expanded to include digital transformation, sustainable practices, and development communication. According to Saleh et al. (2022), the effectiveness of diffusion depends on social context, trust in information sources, and the perceived benefits of an innovation. Opinion leaders and change agents are vital in accelerating diffusion by influencing others through interpersonal communication. Studies such as Adisa and Lee (2023) highlight that communication strategies play a crucial role in the diffusion process, as individuals rely more on peer experiences and localized demonstrations than on abstract information. This reinforces the theory's relevance in promoting participatory communication and social learning in development initiatives.

In agricultural extension, DOI theory provides a valuable framework for understanding how farmers adopt new farming technologies, improved seeds, and sustainable practices. Extension agents act as change agents who introduce innovations through participatory and dialogic communication methods. Recent findings by Akinyemi and Okoro (2023) reveal that adoption rates increase when farmers perceive innovations as compatible with their needs and

socioeconomic conditions. Integrating DOI principles with participatory development communication enhances agricultural productivity and food security by facilitating mutual learning and adaptation. By promoting trust, relevance, and shared understanding, the DOI framework supports the transformation of agricultural systems toward resilience and sustainability.

Agricultural Extension in Kogi State: Current Realities
Agricultural extension in Kogi State functions as a vital conduit linking research institutions and rural farming communities, aiming to promote productivity, sustainability, and livelihoods. Extension officers disseminate recommendations on improved seed varieties, soil-fertility management, integrated pest control, and climate-smart practices (Chiagorom et al., 2023). Yet service coverage is uneven: many remote and riverine hamlets experience infrequent contact because of shortages in trained personnel, poor transport infrastructure, and constrained budgets (Arowosegbe et al., 2024). These structural limitations reduce consistent knowledge transfer and lower adoption rates of new technologies. To be more effective, extension programming must emphasize local capacity building, participatory demonstration plots, and farmer-field schools that adapt messages to local cropping systems and social contexts. Integrating mobile advisory platforms and leveraging local lead-farmers can amplify outreach and strengthen feedback loops between extension and those who cultivate the land (Federal Government of Nigeria, 2025).

A persistent reality in Kogi State is the mismatch between extension supply and the diverse needs of farmers across agro-ecological zones. While staple-crop producers may receive generalized guidance, producers of vegetables, fruits, and aquaculture require specialised technical support that is often unavailable. Gender dynamics also shape extension effectiveness: women farmers frequently have less access to formal advisory services and training opportunities, constraining household productivity gains (Bolarin et al., 2024). Moreover, extension curricula sometimes neglect value-chain aspects such as post-harvest handling, aggregation, and

market linkages, limiting farmers' ability to convert higher yields into incomes. Private-sector actors and agribusinesses can supply market-driven advice, but smallholders and marginalised groups may be excluded by cost and scale. Collaborative models that link extension with private-sector buyers, processors, and micro-finance providers can create incentives for innovation and sustained adoption of improved practices across commodities and actors (Ikuzo-gu et al., 2023).

Public extension agencies traditionally provide core technical support but are often hampered by bureaucratic delays, limited recurrent funding, and weak monitoring systems (Osuji et al., 2025). In response, several public-private partnerships and NGO-led interventions have emerged to fill gaps, offering training, input supply, and market information. However, fragmentation among service providers sometimes leads to duplication of effort and inconsistent messaging at the village level, which may confuse farmers and diminish trust. Strengthening coordination through district-level extension planning, shared training modules, and harmonised extension messages can reduce redundancy and improve farmer uptake. Investment in capacity building for extension personnel, better logistics, and routine feedback mechanisms between farmers and extension services will increase the relevance of technical advice (Nwokocha et al., 2024).

Digital agriculture tools including SMS advisories, interactive voice response platforms, and smartphone applications offer scalable pathways to reach more farmers if infrastructure and digital-literacy gaps are addressed (Ifeanyi-obi & Corbon, 2024). Training extension agents in climate-smart techniques and gender-responsive approaches will help them tailor recommendations to local realities and the needs of women and youth. Financing innovations such as performance-linked grants, fee-based advisory models for commercial farmers, and blended financing from development partners can enhance sustainability. Encouraging farmer-to-farmer exchanges, village-based demonstration plots, and youth-engagement programmes can accelerate adoption while ensuring local ownership. Ultimately, a pluralistic extension system combining

public oversight, private delivery, and peer learning will be better positioned to raise productivity, livelihoods, and resilience across Kogi State's farming communities (Deji et al., 2023).

Gaps in Literature

Although considerable research has been conducted on agricultural extension and food security in Nigeria, significant gaps remain in understanding the communication processes that facilitate agricultural transformation. Most existing studies have focused primarily on the technical and economic dimensions of extension services, paying little attention to the communicative factors that determine farmers' access, understanding, and application of agricultural innovations. Furthermore, much of the literature still adopts a top-down communication approach, overlooking participatory and dialogic frameworks that engage farmers as active contributors rather than passive recipients of information. Research on the integration of digital tools such as mobile phones, radio, and social media into agricultural communication remains limited, particularly within the socio-cultural context of Kogi State. Regional variations in literacy, language, and gender participation further underscore the need for localized studies. Additionally, there is a scarcity of empirical work linking development communication, agricultural extension, and food security within a single analytical framework. This study, therefore, seeks to bridge these gaps by examining how participatory and ICT-enhanced communication strategies can strengthen extension effectiveness and promote food security among rural farmers in Kogi State.

III. METHODOLOGY

Research Design

This study adopts a descriptive survey design to assess how development communication strategies influence the effectiveness of agricultural extension services in improving food security in Kogi State, Nigeria. The design is appropriate because it enables the collection of quantitative and qualitative data from a cross-section of stakeholders, including farmers, extension agents, and community leaders.

Study Area

Kogi State lies in the North Central geopolitical zone of Nigeria and is divided into three senatorial districts: Kogi East, Kogi Central, and Kogi West. The state's agricultural landscape is diverse, with major crops including cassava, rice, maize, yam, and groundnut. According to the Kogi State Ministry of Agriculture (2024), over 75% of the state's population is engaged in farming, with varying levels of access to extension services.

Kogi East — the focal area of this study — is predominantly rural, characterized by smallholder farming systems, limited mechanization, and seasonal reliance on rain-fed agriculture.

Population of the Study

The population of the study comprises three key groups essential to agricultural development in Kogi State. These include smallholder farmers registered with the Kogi State Agricultural Development Project (ADP), who represent the primary beneficiaries of extension services and government agricultural initiatives. It also includes agricultural extension agents operating within the state, serving as intermediaries between research institutions and farmers to promote improved farming practices. Additionally, community leaders involved in local agricultural planning form part of the population, as they influence decision-making, resource distribution, and the adoption of agricultural innovations within rural communities across Kogi State.

Sample Size and Sampling Technique

A multi-stage sampling technique was employed for the study. In the first stage, Kogi East Senatorial District was purposively selected due to its high agricultural activity. The second stage involves the random selection of six Local Government Areas (LGAs) within the district based on the intensity of farming practices. In the third stage, farmers were stratified by crop type; cassava, rice, maize, and yam to ensure representation across major agricultural enterprises. The fourth stage entails proportional random sampling of extension agents. Using Yamane's formula at a 95% confidence level and a population of about 120,000 registered farmers

(Kogi ADP, 2024), a sample size of 400 farmers and 30 extension agents will be selected.

Instruments for Data Collection

Two main research instruments were utilized for data collection in this study. The first is a structured questionnaire designed to obtain quantitative data from farmers, focusing on socio-demographic characteristics, access to agricultural extension services, preferred communication channels, adoption of improved farming innovations, and perceived levels of food security. The second instrument is a Key Informant Interview (KII) guide, which was administered to agricultural extension agents and community leaders to gather qualitative insights. This tool aims to explore in-depth perspectives on communication strategies, challenges faced in disseminating agricultural information, and ways to enhance extension service delivery in Kogi State.

Validity and Reliability of Instruments

The validity and reliability of the research instruments were carefully ensured to maintain data accuracy and consistency. Content validity was established through expert review by lecturers specializing in development communication and agricultural extension, who examined the instruments for clarity, relevance, and alignment with the study objectives. Reliability, on the other hand, was tested using Cronbach's Alpha to determine the internal consistency of the questionnaire items. A coefficient value of 0.7 or higher was considered acceptable, indicating that the research instruments were both dependable and suitable for generating credible and reproducible results for the study conducted in Kogi State.

Data Collection Procedure

Enumerators were trained on questionnaire administration and ethical considerations. Data collection was conducted in Igala, Ebiraland, and English, depending on respondent preference. The process took place over four weeks during the 2025 farming season.

Data Analysis

Data analysis for this study employed both quantitative and qualitative techniques to ensure comprehensive interpretation of findings. Quantitative data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 28. Descriptive statistics such as frequencies, percentages, and means were used to summarize demographic information and assess access to extension services. Chi-square tests were conducted to examine the association between communication channels and the adoption of agricultural innovations, while multiple regression analysis determined the predictive influence of development communication strategies on food security outcomes. Additionally, qualitative data obtained from Key Informant Interviews (KIIs) were transcribed and analyzed thematically to identify recurring patterns and insights.

Ethical Considerations

The study was conducted in strict adherence to established ethical principles to ensure the protection and dignity of all participants. Informed consent was obtained from every respondent after explaining the study's purpose, procedures, and their rights. Participation was entirely voluntary, and participants were assured of their freedom to withdraw from the study at any stage without any negative consequences. Furthermore, all data collected was anonymized to protect participants' identities, and information was stored securely to maintain confidentiality and prevent unauthorized access. These measures ensured that the research process complied with ethical standards for human subject research.

IV. RESULTS & DISCUSSION

1. Respondent Characteristics

A total of 287 valid responses were analyzed. The sample was predominantly male (61.3%), with most respondents aged 36–45 years (38.0%). Educational attainment was moderate, as 38.0% had completed secondary education and 26.1% had tertiary-level qualifications. Farming experience varied, though most had practiced farming for 6–15 years (64.1%). Cassava (35.5%), rice (21.3%), and maize (19.9%)

were the most cultivated crops. These demographic patterns suggest that respondents possessed adequate literacy levels to engage with extension communication tools, including ICT-mediated information.

2. Development Communication and Extension Effectiveness

Respondents' perceptions of development communication and its role in extension service delivery were assessed using six Likert-scaled items. Mean scores were generally high (Table 1). Farmers strongly agreed that group demonstrations enhance learning ($M = 4.41$, $SD = 0.75$) and that inadequate communication limits extension service's effectiveness ($M = 4.48$, $SD = 0.70$). Perceptions of communication frequency between farmers and extension workers were mixed ($M = 3.21$, $SD = 1.14$), indicating variability in agent–farmer contact.

Table 1. Perceptions of Development Communication and Extension Effectiveness

Item	Mean	SD
Development communication improves understanding of innovations	4.32	0.81
Extension agents effectively use communication tools	3.88	0.93
Group meetings/demonstrations enhance learning	4.41	0.75
Communication with extension workers is regular	3.21	1.14
Development communication fosters cooperation	4.17	0.89
Poor communication limits extension effectiveness	4.48	0.70

These results reinforce existing literature, which highlights interpersonal and participatory communication as enablers of effective knowledge transfer.

3. Communication Strategies and Adoption of Improved Practices

Chi-square analysis was conducted to examine the relationship between communication channels and the adoption of improved agricultural practices. All tested channels demonstrated statistically significant relationships with adoption behavior ($p < 0.05$), as shown in Table 2.

Table 2. Association Between Communication Channels and Adoption of Innovations

Communication Channel	χ^2	df	p-value
Radio programs	12.45	4	0.014
Mobile phone messages	18.62	4	0.001
Town-hall/community meetings	9.83	4	0.043
Social media platforms	22.51	4	0.000

Mobile phones and social media exhibited the strongest associations, suggesting that farmers relying on digital platforms were more likely to adopt improved practices. These findings support emerging evidence that ICT-enabled agricultural information accelerates technology diffusion in rural contexts.

4. Influence of Development Communication on Food Security

A multiple regression analysis assessed the predictive effects of development communication components—extension communication quality, communication channels, and ICT/participatory models—on food security outcomes. The model accounted for 47.9% of the variance in food security indicators ($R^2 = 0.479$), demonstrating moderate to strong predictive power.

Table 3. Regression Summary for Predictors of Food Security

Predictor	β	t	p-value
Extension communication quality	0.28	4.51	0.000
Communication channel exposure	0.33	5.62	0.000
ICT and participatory models	0.41	6.88	0.000

ICT-enhanced and participatory approaches were the strongest predictors ($\beta = 0.41$), indicating that tools such as mobile phones, radio-based advisories, and farmer field schools significantly contribute to improved yields, adoption of improved varieties, and household food availability. These results align with recent studies highlighting the transformative potential of digital advisory systems in Sub-Saharan Africa.

5. Qualitative Insights from Open-Ended Questions

Open-ended responses were analyzed thematically. Four dominant themes emerged:

1. Insufficient Extension–Farmer Contact

Many respondents emphasized the need for more frequent visits from extension agents to improve clarity, feedback, and trust.

2. Demand for ICT-Based Communication

Farmers noted the usefulness of mobile phones, SMS alerts, and WhatsApp groups for receiving timely and personalized agricultural updates.

3. Enhancement of Local Radio Programming

Respondents recommended increased frequency of agricultural programs and delivery in local languages to reach a broader audience.

4. Increased Participatory Training

Requests for farmer field schools, cooperative-based training, and hands-on demonstrations were common, reflecting farmers' preference for experiential learning.

These qualitative insights corroborate the quantitative findings, highlighting communication accessibility, language appropriateness, and participatory engagement as key facilitators of innovation uptake.

Synthesis of Findings

The results demonstrate that development communication plays a critical role in strengthening agricultural extension and promoting food security in Kogi State. Communication strategies particularly ICT-based channels significantly influence farmers' adoption of improved practices. Extension communication quality, communication channel exposure, and participatory/ICT-driven approaches jointly predict nearly half of the observed food security outcomes. The convergence of statistical evidence and thematic insights underscores the importance of multi-channel communication systems and farmer-centered engagement strategies in enhancing agricultural performance.

V. CONCLUSION

Based on the findings, the study concludes that development communication is a critical driver of effective agricultural extension and food security in

Kogi State. The use of participatory, interactive, and group-centered communication channels promotes mutual learning, trust, and active involvement of farmers in the innovation process. The study also concludes that the effectiveness of agricultural extension depends not only on the content of messages but also on the process through which they are communicated. Participatory dialogue, group training, and ICT-based interaction make farmers more receptive to new technologies and increase the rate of adoption. Furthermore, development communication bridges the gap between research institutions, extension services, and farming communities. When communication is inclusive and culturally adapted, it enhances behavioral change, boosts productivity, and strengthens food security at the household and community levels. Thus, integrating development communication principles into extension systems is essential for sustainable agricultural transformation in Kogi State and beyond.

Recommendations

In line with the findings and research questions, the study recommends the following:

1. Extension agencies should institutionalize participatory models such as farmer field schools, cooperative dialogues, and village demonstration plots. These platforms enhance group learning, feedback, and co-creation of agricultural solutions.
2. Agricultural communication should combine traditional and modern tools including community radio, mobile phones, and digital platforms to ensure information reaches all farmers, regardless of literacy level or location.
3. The state government and agricultural development partners should expand access to ICT infrastructure and train extension agents in digital communication to improve efficiency and inclusivity in information dissemination.
4. Continuous training should be provided to extension workers on participatory communication, gender-sensitive approaches, and the use of modern information tools to improve their outreach capacity and responsiveness.

5. Communication strategies should actively involve women and youth through targeted programs that address their specific constraints and promote equal access to agricultural information and innovation opportunities.

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