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## FARMERS' PREFERENCES AND CHALLENGES TO e-EXTENSION TOOLS UTILIZATION IN CHIKUN LGA OF KADUNA STATE, NIGERIA

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### ABSTRACT

*This study assessed the barriers to the utilization of e-Extension tools among rural farmers in Chikun LGA of Kaduna state, Nigeria, with emphasis on their socio-demographic characteristics, awareness levels, tool preferences, and adoption barriers. A multi-stage random sampling technique was adopted to select 80 farmers as respondents for the study. Primary data were collected through structured questionnaires and interviews. Descriptive statistics were used to analyze the collected data. The result revealed that 75% of respondents were male and 80% were married, while 60% had no formal education—posing a significant barrier to digital literacy. Youth engagement was notable, with 75% of respondents aged 18-35, indicating growing youth participation in agriculture. Farming remained the primary occupation for 50% of respondents, and 85% reported membership in development associations, highlighting the potential for community-led information dissemination. Farmers showed high awareness of e-Extension tools, with radio (mean = 2.87), mobile voice calls (2.97), and SMS (2.87) ranking highest. Despite this awareness, utilization was skewed toward radio (45%) and voice calls (35%), with WhatsApp, Facebook, SMS, and television each used by only 5%. Information sought primarily focused on improved seeds (45%) and fertilizer (30%). Major constraints to e-Extension tools adoption included awareness (mean = 4.50), ICT skills (4.50), literacy (4.40), insecurity (4.35), and cost-related factors (4.10). The study concludes that while awareness is high, actual usage remains limited by systemic challenges. It recommends investment in rural ICT infrastructure, digital literacy programs, media integration, security enhancement, and subsidized access to digital tools to optimize e-Extension service delivery and agricultural productivity in Northern Nigeria.*

**Keywords:** *e-Extension, preferences, challenges, utilisation and farmers*

### INTRODUCTION

Agricultural extension remains a cornerstone in promoting sustainable agricultural development and improving the livelihoods of rural farming communities. Traditional extension services have historically played a critical role in disseminating innovations, technical advice, and production-enhancing practices to farmers. However, in many developing countries, including Nigeria, traditional extension methods have encountered significant limitations.

These range from underfunding, insufficient personnel, and poor infrastructure to inefficient communication systems, all of which restrict timely and widespread access to agricultural information (Aker, 2011). In Kaduna State, the challenge is particularly acute; recent assessments reveal a disproportionate extension agent-to-farm family ratio, with some agents assigned to over 1,700 farmers—far exceeding the FAO recommended ratio of 1:1,000 (Adam, Daudu, and Mahmud, 2026; Mani *et al.*, 2021).

The concept of electronic extension (e-Extension) has emerged as a technology-driven alternative which involves the use of digital platforms such as mobile phones, radio, television, and the internet to deliver agricultural knowledge to farmers in real time (Fawole and Olajide, 2012). These tools provide farmers with immediate access to crucial information on improved farming practices, pest and disease management, climate-smart agriculture, and market prices (Adejo and Haruna, 2009). E-extension is highly relevant in the current digital age, where mobile penetration and internet access are increasingly widespread across rural communities (Relebohile and Keregero, 2019). In Northern Nigeria, mobile phones and radio remain the most utilized e-extension channels due to their relative affordability and ease of use (Adam *et al.*, 2026; Haruna *et al.*, 2013).

Despite the potential of e-extension to transform agriculture, its adoption in Northern Nigeria remains suboptimal and uneven. While awareness of tools like SMS-based advisories and radio programs is high, the actual adoption of advanced platforms like mobile apps and AI-driven weather forecasting is low (Lai-Solarin *et al.*, 2025). Several barriers—including poor digital infrastructure, limited digital literacy, high costs of data, socio-cultural resistance, and regional insecurity—continue to hinder effective use (Adam *et al.*, 2026; Sennuga *et al.*, 2020). In Kaduna State, specifically within the Maigana agricultural zone, research indicates that while younger farmers are more receptive to e-extension, the high cost of internet data (75.7%) and poor network coverage in rural areas (83.3%) remain primary deterrents (Relebohile and Keregero, 2019; Rico *et al.*, 2024).

Moreover, digital literacy remains a foundational determinant of e-extension adoption. Without the basic skills to operate digital devices, interpret messages, and interact with electronic content, rural farmers are less likely to benefit from e-extension services (Ajani, 2014). This problem is exacerbated by low levels of formal education in many parts of Northern Nigeria, where large segments of the farming population are unable to read or comprehend digitally transmitted messages (Fawole and Olajide, 2012). Furthermore, a lack of trust in digital information and the absence of intermediary support systems, such as extension agents trained to interpret complex digital data, further stagnates utilization (Lai-Solarin *et al.*, 2025).

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The persistent gap between the availability of digital extension tools and their actual usage by rural farmers is core issue begging for answers. Although several e-extension platforms and initiatives, such as the e-wallet system and various ICT4Ag projects, have been introduced across the region, adoption remains marginal due to a convergence of socio-economic, infrastructural, and cultural factors. In Kaduna State, the situation is further complicated by erratic electricity supply and the high cost of maintaining digital devices, which restricts farmers to more traditional, interpersonal sources of knowledge (Adam *et al.*, 2026; Haruna *et al.*, 2013). These challenges not only limit the effectiveness of extension service delivery but also hinder farmers from accessing timely and critical information needed to make informed production and marketing decisions.

Given the central role of agriculture in employment, food security, and national economic development, it is imperative to examine the factors constraining the use of e-extension and to understand farmers' preferences for communication tools. The underutilization of e-extension technologies not only reflects a missed opportunity for innovation uptake but also represents a policy and implementation gap in the national agricultural extension framework (Oluwatusin, 2014).

This study is therefore justified on several grounds. First, it seeks to generate empirical insights into the socio-technical barriers that inhibit e-extension adoption, particularly in a context marked by infrastructural challenges and digital exclusion. Second, the research offers practical value for policymakers and extension stakeholders by identifying priority areas for intervention, including digital literacy training, rural ICT investment, and inclusive design of extension content (Sennuga *et al.*, 2020).

Third, the findings will contribute to ongoing discourse on how to strengthen agricultural innovation systems in Northern Nigeria and Kaduna State by leveraging information and communication technologies (ICTs) to improve farmers' decision-making and productivity.

In addressing these gaps, the study will focus on identifying the specific challenges rural farmers face in accessing and using e-extension tools, understanding their preferences for communication methods, and providing actionable recommendations for enhancing digital engagement in Northern Nigeria.

## **METHODOLOGY**

The study was carried out in Chikun Local Government Area (LGA) of Kaduna State, Nigeria. Chikun LGA spans approximately 4,466 km<sup>2</sup> with its administrative headquarters in Kujama (population ~12,967) (Adebayo *et al.*, 2023). It is situated within the Sudan savanna ecological zone of Kaduna State, characterized by a tropical climate (Köppen Aw), with distinct wet (May–September) and dry seasons (October–April), and mean annual temperatures around 33 °C. The indigenous population is predominantly Gbagyi, alongside other ethnic groups, and the local economy relies heavily on agriculture—notably maize, millet, cassava, yams—along with weaving, pottery, mat-making, and small-scale trade.

A multi-stage simple random sampling design was employed to select respondents. First, four (4) wards were randomly chosen from the twelve wards in Chikun LGA. From each selected ward, one village was randomly selected, and twenty (20) farmers were randomly sampled from each village, yielding a total sample size of eighty (80) respondents. Chikun LGA is a major agricultural hub in central Kaduna State, with a projected population of approximately 550,000 residents as of 2022 (National Bureau of Statistics [NBS], 2022). The selection of 80 respondents is justified by the need for in-depth, high-quality data collection within a region characterized by diverse farming systems and significant logistical constraints. Similar studies in Kaduna State, such as those by Rico, Sennuga, and Barnabas (2024) and Umeh and Ojiako, (2018) have utilized comparable sample sizes (ranging from 60 to 97 respondents) to achieve statistical relevance while maintaining manageability in the face of regional security challenges and poor rural road networks. This approach ensured that the sample remained representative of the diverse farming population across Chikun LGA without selection bias, providing a 95% confidence level with a margin of error suitable for descriptive agricultural research.

Primary data were collected using a well-structured questionnaire designed to gather information aligned with the study's objectives. For respondents with limited literacy, face-to-face interviews, conducted in appropriate local languages, were used to ensure completeness and clarity of responses. Data analysis involved descriptive statistics, including frequency distributions, percentages, and means techniques, to summarize patterns, identify trends, and determine the relative importance of responses in line with the research aims.

## RESULT AND DISCUSSION

### Socio-economic characteristics of respondents

Table 1 shows a male-dominated gender distribution in the agricultural sector, with 75% of participants being male. This reflects prevailing gender disparities in access to agricultural resources and digital extension tools.

**Table 1. Socio-Economic Characteristics of the Respondents**

Variable	Frequency	Percentage (%)
<b>Sex</b>		
Male	60	75.0
Female	20	25.0
<b>Age</b>		
18-25	32	40.0
26-35	28	35.0
36-45	12	15.0
46 Years Above	8	10.0
<b>Marital Status</b>		
Married	64	80.0
Single	8	10.0
Widow	4	5.0
Divorced	4	5.0
<b>Educational Qualification</b>		
Non formal Edu.	48	60.0
Primary Edu.	16	20.0
Secondary Edu.	12	15.0
Tertiary Edu.	4	5.0
<b>Occupation</b>		
Student	12	15.0
Farmer	40	50.0
Trader	16	20.0
Unemployed	4	5.0
Civil Servant	4	5.0
Security forces	4	5.0
<b>Membership of Organization</b>		
Yes	68	85.0
No	12	15.0

**Source:** 2022 Field Survey

Similar findings were reported by Olaniyi *et al.* (2022), who emphasized the persistent gender gap in agricultural participation and technology access in rural Nigeria. Hence addressing this disparity is critical for inclusive agricultural transformation. The age profile of respondents showed that a significant proportion (40%) were within the 18–25 age bracket, while 35% were aged 26–35. This demographic pattern suggests that younger farmers are increasingly involved in agricultural activities. This is consistent with trends reported by Chukwu *et al.* (2023), which highlight a growing interest among youths in agribusiness, particularly in regions where employment opportunities are limited. This youth engagement represents a strategic entry point for scaling up digital agricultural innovations, especially e-extension tools.

Marital status data indicated that 80% of the respondents were married, implying a stable social structure that can enhance receptiveness to agricultural innovations. Meanwhile, respondents' educational backgrounds revealed that 60% lacked formal education, posing a significant barrier to digital literacy—a key factor in e-extension utilization. This aligns with the observations of Akinola and Adebayo (2021), who reported low literacy levels as a limiting factor in the adoption of digital tools among rural farmers.

Farming was the dominant occupation among respondents (50%), reinforcing agriculture's centrality in the local economy. Interestingly, 85% of farmers reported membership in local development associations, suggesting a vibrant community structure that can support peer learning, knowledge transfer, and the dissemination of digital agricultural services.

### Awareness level of e-Extension tools

Table 2 revealed that farmers had high familiarity with several e-extension communication tools. Telephone voice calls (mean = 2.97), SMS (2.87), radio (2.87), television (2.87), WhatsApp (2.72), and Facebook (2.55) were widely identified by respondents as sources of agricultural information. This widespread awareness is consistent with findings from Ibezim (2015) and Chiazoka *et al.* (2021), who reported increases in awareness of and identification with digital communication platforms among rural farmers in Nigeria.

**Table 2. Awareness Level of E-Extension Tools**

Awareness of E-extension Tools	Undecided (1)	Unaware (2)	Aware (3)	Mean
Phone call	1	0	79	2.97**
WhatsApp	3	16	61	2.72**
Telegram	18	55	7	1.86
YouTube	19	56	5	1.82
Facebook	5	26	49	2.55**
Instagram	17	56	7	1.87
Snapchat	6	72	2	1.95
Blogs	0	76	4	2.05
Websites	15	60	5	1.87
SMS	3	4	73	2.87**
Web Portal	14	60	6	1.90
Radio	4	2	74	2.87**
Television	4	6	70	2.82**

Source: 2022 Field Survey

\*\* Significant Awareness (>2.5), Unaware (>2.5)

### Level of usage of e-Extension tools for farm information

The result of Table 3 indicated that, despite multiple available tools, radio emerged as the most important e-extension medium (mean = 2.65) for accessing agricultural information. This underscores its continued relevance, particularly in regions where access to internet-enabled devices is limited. The findings corroborate those of Aminu *et al.* (2018), who emphasized radio's effectiveness as a cost-efficient and accessible communication channel for disseminating agricultural knowledge in Northern Nigeria.

**Table 3. Level of usage of e-extension tools for farm information**

Usage of E-extension Tools	Never Used (1)	Rarely Used (2)	Always Used (3)	Mean
Phone call	28	44	8	1.75
Computer	60	16	4	1.30
Websites	72	4	4	1.15
Online	72	4	4	1.15
Radio	4	20	56	2.65**
Television	40	32	8	1.60
Facebook	64	12	4	1.25
Instagram	76	4	0	1.05
YouTube	72	8	0	1.10
SMS	68	8	4	1.20
Telegram	80	0	0	1.00

Source: 2022 Field Survey\*\* Significant Usage (>2.5).

### Major farm activities sorted through e-extension

Table 4 revealed that the major purposes for farmers using e-extension services was to get information about improved seeds (45%), followed by fertilizer (30%), market prices (15%), weed control (5%), and harvest techniques (5%). This reflects a clear preference for information that directly influences farm productivity and profit margins. These results support the findings of Mohammed *et al.* (2021), who identified improved seeds and fertilizer usage as the most sought-after content among farmers using digital platforms.

**Table 4. Major farm activities sorted thorough e-extension**

Variables	Frequency	Percentage (%)
<b>Most Common Farm Information Sorted</b>		
Improved Seeds	36	45.0
Weed Control	4	5.0
Fertilizer	24	30.0
Market Price Information	12	15.0
Harvesting Method	4	5.0

Source: 2022 Field Survey

### Most preferred e-Extension tools

The result of table 5 shows that radio (45%) and mobile voice calls (35%) were the most referred e-extension tools by the farmers. Other platforms such as SMS, WhatsApp, Facebook, and television had lower preference (each at 5%). These results mirror those of Oyelami *et al.* (2022), which observed that rural farmers tend to favor low-cost, easy-to-use platforms such as radio and mobile calls over internet-based tools that require advanced digital literacy or expensive data subscriptions.

**Table 5. Most preferred e-extension tools**

Variables	Frequency	Percentage (%)
Mobile Phone Call	28	35.0
Text Message	4	5.0
WhatsApp	4	5.0
Facebook	4	5.0
Radio	36	45.0
Television	4	5.0

**Source:** 2022 Field Survey

### Major constraints to e-Extension tools adoption

The result of table 6 revealed that the major constraint to the adoption of e-extension tools included awareness of e-extension tools (mean = 4.50), ICT skills (mean = 4.50), literacy levels (mean = 4.40), insecurity (mean = 4.35), cost of data and tariffs (mean = 4.10), and economic status (mean = 4.10).

**Table 6. Major Constraints To E-Extension Tools Adoption**

Variables	SD (1)	DG (2)	UN (3)	AG (4)	SA (5)	Mean
Knowledge of E-extension Tools	4	4	4	4	64	4.50**
Availability of Telecommunication Infrastructure	60	4	4	8	4	1.65
Cost of Tariff and Data	4	4	12	20	40	4.10*
Literacy Level of Farmers	4	4	4	12	56	4.40*
ICT Know How	4	4	4	4	64	4.50**
Insecurity Level	0	4	4	32	40	4.35*
Availability of Enabling Environment	20	24	24	8	4	2.40
Availability of Incentive	8	40	24	4	4	2.45
Financial Factor	4	12	8	4	52	4.10*

**Source:** 2022 Field Survey \*\* Major Factor, (>4.5) \*Minor Factor (>4.0).

SD = Strongly Disagree, DG = Disagree, UN = Undecided, AG = Agree, SA = Strongly Agree.

These findings are in strong agreement with Kante *et al.* (2016), who identified similar variables as critical barriers to the uptake of digital communication tools among smallholder farmers. The strong influence of awareness and digital skills underscores the importance of targeted digital literacy campaigns as a foundational step toward enhancing e-extension adoption. Furthermore, the negative impact of insecurity and infrastructural deficits—such as erratic power supply and weak network connectivity—was consistent with findings by Ogunbameru *et al.* (2012) and Sennuga *et al.* (2020), who emphasized the vulnerability of rural ICT infrastructure to regional insecurity and economic hardship.

## CONCLUSION AND RECOMMENDATIONS

The findings reveal that although farmers in Chikun LGA of Kaduna state demonstrate a relatively high level of awareness regarding e-extension tools, actual utilization remains inconsistent. This gap is primarily due to low levels of digital literacy, high costs of digital access, and infrastructural limitations. The continued reliance on radio and voice calls reflects a clear preference for familiar, accessible communication channels, as well as limited access to more advanced digital technologies in rural areas.

To address these constraints and enhance the adoption of e-extension services, several strategic interventions are essential as recommended below.

1. There is a need to enhance digital literacy through targeted training programs, particularly for women and farmers with limited educational backgrounds. This will ensure that users can effectively engage with digital platforms and utilize agricultural information.
2. Government and private-sector stakeholders should prioritize expanding internet connectivity, mobile networks, and electricity in underserved farming communities to create an enabling environment for e-extension adoption.
3. The role of trusted media, such as radio, should be further leveraged upon by the ADPs and extension partners. Given its widespread use and credibility among rural farmers, it is only wise that it should be integrated more deliberately into e-extension strategies to improve reach and effectiveness.
4. The Nigeria government should adopt measures that subsidize access to digital tools such as smartphones, mobile data, or platform subscriptions which will also reduce economic barriers faced by smallholder farmers and encourage broader participation in digital extension systems.
5. The Nigerian government should strengthen the security environment and rebuilding trust in public institutions are crucial steps toward restoring farmers' willingness to engage with innovative agricultural technologies. A secure and supportive setting is fundamental to increasing farmer participation in digital initiatives.

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