



**ASSESSMENT OF THE LEVEL OF ACCESS AND UTILIZATION OF ICT4AG TOOLS  
AMONG EXTENSION PERSONNEL IN KADUNA STATE**

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**ABSTRACT**

The paper critically explores the potential of Information and Communication Technologies (ICTs) in advancing agricultural development. Specifically, it examines the extent of access to and utilization of ICT4Ag tools among public agricultural extension agents in Kaduna State, Nigeria. Using a three-stage purposive sampling technique, 80 field extension agents were selected for the study. Data collection was carried out through structured questionnaires, and the results were analysed using both descriptive and inferential statistics. Findings revealed that 75% of the respondents had access to mobile phones, while only 45% had access to computers. Among the ICT4Ag tools assessed, 60% of Agricultural Extension Agents (AEAs) had access to and utilized smart/android phones. In terms of application, 60% of the extension agents reported using these tools primarily for information dissemination, while 40% used them for profiling farmers. Additionally, 37.5% engaged with Zoom and other virtual tools, 35% utilized the Open Data Kit (ODK), and 26.5% made use of Kobo Collect for data collection activities. Similarly, only 10% are actively involved in diagnosing plant diseases, pests, and nutrient deficiencies. Despite the potential of ICT4Ag tools, the study identified several constraints hindering their optimal use. The findings indicated inadequate training, high cost of data and erratic internet connectivity ranked as the major constraints. To address these challenges, the study recommends that government agencies and development partners intensify efforts in providing targeted training, infrastructural support, and sustainable funding mechanisms to strengthen the capacity of extension agents in utilizing ICT4Ag tools effectively.

**Keywords :** Extension, Agents, Usage, ICT4Ag, Tools,

**INTRODUCTION**

In recent years, research in agricultural extension methodologies in Nigeria has been evolving to address the changing needs of farmers, especially in the context of climate change, technology, and sustainable agricultural practices. Information and Communication Technologies for Agriculture (ICTs4ag) tools usage are redefined especially during the COVID-19 pandemic, when physical movement and interaction was restricted. Generally, ICTs are ready tools for all strata of the society because they are applied in a particular situation, such as ICTs for agriculture, ICTs in education, health care, libraries etc. Various studies have documented the role of ICT in agriculture, particularly its impact on extension services. The widespread use of mobile phones and internet access in Nigeria has facilitated the growth of ICT in agriculture. Ishaku & Mohammed (2021) observed emerging trends in the use of mobile applications such as e-extension platforms, weather forecasting apps, market price information tools, and farm advisory services. These digital innovations have significantly contributed to improving the productivity and livelihoods of smallholder farmers by enhancing access to timely, relevant, and location-specific agricultural information. A good ICT extension delivery programme might help to reach many farmers simultaneously and also overcome the geographical challenges of extension delivery in Nigeria. Similarly, Daniel & József (2021) opined that ICTs have the ability to intensify the linkages between extension, research, and farmers. ICT can be a medium through which information on new research findings can be communicated to extension workers by the research institutions for onwards communication to farmers. Ishaku & Mohammed (2021) found that while mobile applications for agriculture are widely available, the use and adoption by extension agents remain limited in some areas due to infrastructure issues, lack of training, and internet connectivity problems. Raji and Alabi (2020) examined the role of ICT tools like mobile phones, internet platforms, and agricultural apps in supporting farmers, particularly in rural communities. Their study highlighted



the growing adoption of these technologies by farmers but emphasized a key challenge which was access to ICT tools among extension agents remains uneven, with those in remote or underserved areas experiencing limited availability and use. However, Adam *et al* (2020) noted that this disparity affects the effectiveness of agricultural advisory services and points to the need for more inclusive ICT infrastructure and support for frontline extension workers. Therefore, ICTs could serve as a facilitator in the agricultural extension work, which is to change farmers' outlook towards their difficulties for a meaningful improvement and productivity (Stephen, 2015).

The challenges of the traditional agriculture could be addressed significantly by using information and communication technologies that play an important role in uplifting the livelihoods of the rural small landholder farmers (Qamar, 2015). To be effective therefore, the extension worker needs to be familiar with the various ICTs tools and the proficiency to use them. However, in Kaduna State, ICT is chatted everywhere but yet to be fully embraced and integrated into the sectors of the government especially in the agricultural extension and advisory services sub-sector. As observed by Kacharo, (2020), the traditional methods of information dissemination are still prevalent in agricultural extension services. Despite the overwhelming influence of ICT in extension service deliveries globally, Ajiboye, Adu and Wajuade (2023), observed ICT usage among extension workers is still not encouraging despite its effectiveness in extension service deliveries as indicated in their preliminary stakeholders perceptions of the impact of GSM on Nigerian rural economy. However, these challenges according to Oladele, (2021) could be mitigated through the effective adoption of innovative solutions that integrate information and communication technologies (ICTs) into agricultural information delivery systems. Akinwale & Lawal (2020) noted that leveraging on ICT tools could strategically enhances the capacity of extension services to become more efficient, accessible, and responsive to the needs of both farmers and field agents, especially in underserved and rural areas. However, despite the potential benefits of ICT tools in enhancing extension service delivery, their adoption remains notably low in Northwest Nigeria. Against this backdrop, the present study was designed to assess the extent of access to and utilization of ICT4Ag tools by extension personnel in Kaduna State, with the aim of understanding current usage patterns, identifying gaps, and informing strategies for improved digital integration in agricultural extension services.

The Specific objectives were to:

- i. identify availability and operational use of ICT-based agricultural tools among extension agents
- ii. assess the extent to which agricultural extension agents in Kaduna State have access to ICT4Ag apps.
- iii. evaluate the utilization and effectiveness of these apps in delivering agricultural extension services.
- iv. identify the challenges faced by extension agents in utilizing ICT4Ag tools.

## **METHODOLOGY**

### **The Study Area**

The study area is Kaduna State, which lies in the north western part of Nigeria's geo-political zones. The State is located on the southern end of the high plains of northern Nigeria, lies between latitudes 09° 00' 59" and 11° 19' 30" North of the Equator and longitudes 06° 45' 0 and 09° 10' 0 E East of the Greenwich Meridian. Kaduna State shares boundary with Katsina State to the North, Niger State to the west and Abuja to the southern west, Plateau State to the south east and Kano State to the north –east, Bauchi State to the east and Nassarawa State to the south.

The State is divided into four agricultural zones, viz. Maigana, Lere, Samaru Katsf and Birnin Gwari zones. Politically, the state is divided into three senatorial zones, namely; Kaduna North, Central and South and it comprises twenty three (23) Local Government Areas, namely Giwa, Ikara, Kudan, Makarfi, Sabongari, Soba, Zaria, Kachia, Zangon Katsf, Jaba, Jema'a, Kaura, Kagarko, Sanga, Birnin Gwari, Chikum, Kaduna North, Kaduna South, Igabi, Kajuru, Lere, Kubau and Kauru and there are 255 political wards (NPC, 2006). It has a land area of 4.5 million ha with 2.2 million ha under cultivation, representing about 4.6% of the total land area of Nigeria.



The 2006 national census conducted by the National Population Commission recorded Kaduna State’s population at 6,113,503. Projecting this figure to 2025 using an assumed annual growth rate of 2.6%, the population is estimated to reach approximately 9.96 million. This represents substantial demographic growth over the 19-year period, with significant implications for planning in sectors such as agriculture. According to projection estimates for (2025), Kaduna State have approximately 1,571,600 farming households, the extension-to-farm-family ratio increased to approximately 1:6,660, indicating a widening service gap. The number of extension agents in the entire State reported to be 257. Although a majority of the people lives and depends on the rural areas, about one third of the state population is located in the two major urban centres of Kaduna and Zaria.

**Method of Data Collection**

The instrument used for data collection was a structured questionnaire developed by the researcher to obtain the required information from the respondents. It was validated and tested for reliability and 0.75 was found. The questionnaire was divided into three sections. Section A was designed to elicit data on the awareness and accessibility of the ICT4Ag tools by the extension agents. Section B was designed to investigate the specific activities and the extent of availability and use of ICTs facilities by the extension workers. Section C was designed to elicit information about the effects of ICTs on agricultural information disseminations and productivity in Kaduna State.

**Sampling Procedure and Sample Size**

A Multi stage sampling technique was used to select the samples. The first stage, was purposive sampling of two (Maigana and Lere) from the Kaduna State Agricultural Development Agency (KADA) due to distance and security constraints. In the second stage, three LGAs in each of the two zones were purposively selected based on the availability and number of extension workers. The whole extension agents (both KADA and LGAs staff) in the selected LGAs served as respondents (80) for convenience. This is because of the small number of the targeted population who are the extension agents in the LGAs.

**Table 1:** Population, Sampled LGAs and Number of Extension Agents

KADA Zones	LGAs	Number of extension workers
Maigana	Kubau	7
	Makarfi	8
	Kudan	6
	Sabongari	11
Lere	Lere	10
	Kauru	9
	Igabi	7
Samaru	Kagarko	6
	Kachia	8
	Chikun	8
<b>Total</b>		<b>80</b>

Source: Kaduna State Agricultural Development Agency (KADA) and Kaduna State Ministry of LG, (2024)

**Methods of Data Analysis**

Descriptive statistics such as frequency counts, percentages distribution and ranking were used in analysing the data collected. To achieve objective which was to assess the effects of the use of ICTs tools on agricultural information disseminations and productivity in Kaduna State, likert scale analysis was used. “Strongly agreed” and “Agree” were classified as “Agreed” and “Strongly disagree” and “Disagree” were classified as “disagreed”. A mean score of 2.5 and above was taken as an index of agreed while a mean score below 2.5 was taken as an index of disagreed.



**RESULT AND DISCUSSIONS**

**Availability and Usage Patterns of ICT for Agriculture (ICT4Ag) Tools among Extension Agents**

The findings presented in Table 2 indicate that 60% of Agricultural Extension Agents (AEAs) had access to and utilized smart/android phones, while 30% reported that although the devices were available, they lacked access to ICT4Ag tools. Among those with access to smartphones, 72.5% used social media platforms such as Facebook and WhatsApp for extension-related communication. Additionally, 37.5% engaged with Zoom and other virtual tools, 35% utilized the Open Data Kit (ODK), and 26.5% made use of Kobo Collect for data collection activities. Furthermore, 26.3% of the respondents indicated they had used the Optimum Fertilizer Recommendation Application (OFRA App) as part of their extension toolkit. The findings highlight a growing trend in the use of digital tools among extension agents suggesting an increasing awareness and willingness to integrate ICTs into agricultural extension services. However, the relatively low usage of specialized apps indicates the need to enhance digital literacy and maximize the potential of ICT4Ag tools for effective extension delivery. This could be due to the fact that many extension agents lack adequate training on how to use specialized agricultural apps effectively, face limited access to stable internet connectivity, or operate in environments with insufficient digital infrastructure. The findings are consistent with existing literature that shows increasing awareness and adoption of basic ICT tools among extension agents (Aker, 2011; Davis & Sulaiman, 2014), but continued underutilization of specialized agricultural applications due to capacity constraints, infrastructural limitations, and institutional weaknesses (Mittal & Mehar, 2016; Fabregas *et al.*, 2019).

**Table 2:** ICT Tools for Agriculture Availability and Usage among Extension Agents in Kaduna State (N=80)

ICT for Agric. tools	Not Availability	Available not Access	Access and Used
	Freq/ (%)	Freq (/%)	Freq (/%)
Smart/Android phones	8 (10)	24 (30)	48 (60)
ODK tools for data collection App	32 (40)	20 (25)	28 (35)
RiceAdvice tool	40 (50)	21 (26.3)	19 (23.7)
Optimum Fertilizer Recommendation Optimization (OFRA) App	44 (55)	15 (18.8)	21 (26.3)
Zoom/Virtual tools App	28 (34.1)	22(27.5)	30 (37.5)
Kobocollect Toolbox’s data collection App	38 (47.5)	21 (26.5)	21 (26.5)
Social media platforms such as Facebook and WhatsApp	8 (10)	14 17.5)	58 (72.5)
Plantix	45 (56.3)	21 (26.3)	14 (17.5)

Source: Field Survey, 2024

**ICT4Ag Tools Utilization among Extension Agents**

The results in Table 3 revealed a significant gap in the core extension functions of Agricultural Extension Agents (AEAs) in Kaduna State. About 45% of respondents reported always conducting surveys and data collection, 42.5% are involved in field mapping and geo-referencing, and 38.8% in farmer listing activities. Community mobilization was occasionally carried out, with 53.8% indicating they perform it sometimes, suggesting it is not yet institutionalized. These results suggest a shift in focus away from traditional extension functions toward data collection and project-based roles. A large majority (77.5%) reported that they never advise farmers on techniques of agricultural innovations, while 52.5% never teach agronomic practices such as fertilizer and herbicide application. Similarly, only 10% are actively involved in diagnosing plant diseases, pests, and nutrient deficiencies. In contrast, AEAs appear more engaged in administrative and data-related roles. This finding aligns with the report by Ifabiyi *et al.* (2024), which reported that the most commonly used ICT/digital tools by extension agents in Kwara State were smartphones for calls and data collections, and GPS devices for determining farms locations. This supports the observed trend in Kaduna State, where similar tools dominate usage,



reflecting a broader reliance on accessible and multifunctional digital technologies among extension personnel across different regions.

**Table 3:** Activities and the extent to which ICT4Ag Tools Used among Extension Agents (N=80)

<b>Extension Activities</b>	<b>Always</b>	<b>Sometimes</b>	<b>Never</b>
Advice farmers on techniques of certain agricultural innovation	06(7.5)	12(15)	62(77.5)
Teach farmers certain agronomic practices such as fertilizer and herbicides application	14(17.5)	21(35)	45(52.5)
Diagnosing plant diseases, pests, and nutrient deficiencies	08(10)	26(32.5)	46(42.5)
Community mobilization and sensitization	12(15)	43(53.8)	25(31.2)
Market information services (such as commodity prices by crop, by market)	20(25)	22(27.5)	38(47.5)
Survey and data collection	36 (45)	24(30)	20(25)
Enumeration/farmers listing	31(38.8)	16(20)	33(41.2)
Field mapping and Geo-referencing	34(42.5)	08(10)	38(47.5)

**Source:** Field Survey, 2024

### **Perceived Effectiveness of ICT4ag in Extension Service Delivery**

The result on Table 4 on the perception of Agricultural Extension Agents (AEAs) on the effects of ICT4Ag tools reveals varying levels of agreement across several dimensions. ICTs were perceived to notably improve information dissemination processes (Mean = 2.80) and enhance the quality of extension and advisory services (Mean = 2.70), showing the highest levels of positive impact. Similarly, agents acknowledged ICT's role in improving data collection and retrieval (Mean = 2.64) and facilitating access to information (Mean = 2.56). Conversely, ICT tools were not strongly perceived to reduce physical extension visits (Mean = 1.73) or significantly increase the adoption of appropriate fertilizer use and seed spacing (Means = 1.78 and 2.15 respectively). Also, support in expanding cultivated areas (Mean = 2.08) and encouraging the use of improved crop varieties (Mean = 1.80) ranked low. Overall, while ICT4Ag tools were positively perceived in enhancing communication and service delivery, their impact on influencing specific on-farm practices appeared limited. The findings suggest that while ICT4Ag tools are valued for enhancing communication and service delivery in agricultural extension, their impact on shaping specific on-farm practices remains limited. This implies that technology alone may not drive changes in farmer behaviors like adoption of improved techniques, indicating a need for complementary approaches combining digital tools with traditional extension methods for more tangible outcomes in agricultural productivity. Ifabiyi *et al.* (2024) investigated extension agents' perceptions of ICT use in Kwara State, Nigeria. The study reported that extension agents generally held positive attitudes toward ICTs and acknowledged their effectiveness in improving communication, record-keeping, and service delivery efficiency. The study reinforced the findings that while ICT4Ag tools are valued for strengthening communication and service delivery in Nigeria's agricultural extension system, their capacity to influence concrete behavioral changes among farmers depends on complementary extension strategies, infrastructure readiness, and sustained institutional support.



**Table 4:** Perceived Effects of the Use of ICT4Ag Tools on Agricultural Information Dissemination and Productivity in Kaduna State (N=80)

Perceived effects ICTs4Ag tools	Response categories				Weighted Score	Mean Score
	SA	A	DA	SD		
Facilitated ready access to information	18	22	25	17	205	2.563
Improve quality of data collection and retrievals	12	31	33	04	211	2.638
Facilitated information transfer and knowledge sharing	23	21	16	20	207	2.250
Reduce extension visits and contact with farmers	08	06	22	44	138	1.725
Improve quality of extension and advisory services	23	26	15	16	216	2.70
Improve information dissemination processes	22	30	18	10	224	2.80
Increased the use of appropriate fertilizers application methods on crop production	04	10	30	36	142	1.775
Help to encourage farmer's use of appropriate seed rate and spacing in their crop production	12	06	44	18	172	2.15
Supported in Expansion of area cultivated for crop production in Kaduna State	10	08	40	22	166	2.075
Encourage farmers' use of improved varieties of crops	02	05	48	25	144	1.80

**Source:** Field Survey, (2024) SA=Strongly Agree (4), A=Agree (3), D=Disagree (2), SD=Strongly Disagree (1)

**Challenges to Effective Utilization of ICT4Ag Tools among Extension Services**

The findings highlight inadequate training (85%) as the top constraint limiting ICT4Ag tool usage among AEAs, followed by the high cost of data and poor internet connectivity. These barriers suggest the need for capacity building, subsidized data access, and improved ICT infrastructure to enhance digital extension services. These results similarly underscore infrastructure challenges and limited connectivity as major barriers to effective use of ICT4Ag tools. Other notable constraints include poor communication network (68.8%), high maintenance cost (51.3%), and frequent gadget breakdowns (47.5%). Lesser-reported issues were related to durability (45%) and inadequate gadget components (28.8%). This finding aligns with Kacharo (2020), which reported that 74.5% of surveyed students experienced poor network connectivity, 64.2% cited high service charges, 55.7% lacked consistent electricity for charging devices, and 51.9% faced high maintenance costs.

**Table 6:** Challenges Encountered when Using ICT4Ag tools (N=80)

Constraints	YES	%	NO	%	Rank
Inadequate training/capacity development	68	85.0	12	15.0	1st
High cost of data	64	80.0	16	20.0	2nd
Erratic internet connectivity	59	73.7	21	26.3	3rd
Poor communication network	55	68.8	25	31.2	4th
High cost of maintenance	41	51.3	39	48.7	5th
Frequent breakdown of the gadgets	38	47.5	42	52.5	6th
Durability of the gadgets	36	45.0	44	55.0	7th
Inadequate components of the gadgets	23	28.8	57	71.2	8th

**Source:** Field Survey, 2024



## CONCLUSION AND RECOMMENDATIONS

The findings indicate strong potential for digital extension, as many Agricultural Extension Agents (AEAs) already use smartphones and social media platforms. By fostering participatory approaches and global collaborations, ICT can empower agricultural extension workers to overcome emerging challenges, ensuring sustainable agricultural development and contributing to food security worldwide.

Based on the findings of this study, the following recommendations are proposed to access to and utilization of ICT4Ag tools for extension service delivery among Agricultural Extension Agents (AEAs) in the study area:

- i. There is need for Local agricultural experts and ICT developers collaborate to create locally relevant and accessible content tailored to the needs of smallholder farmers to be used by the Agricultural Extension workers
- ii. Non-Governmental Organizations (NGOs) and educational institutions should organize programs to enhance Agricultural Extension workers' skills and knowledge on ICT4Ag applications and intensify efforts to provide targeted capacity-building initiatives
- iii. The government should coordinate with telecom companies to improve and provide reliable and affordable internet coverage, particularly in remote areas.
- iv. Strengthening institutional support systems would enhance data-driven and efficient extension service delivery and sustainable funding mechanisms to improve AEAs' effective use of ICT4Ag tools.

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