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Effectiveness of Information and Communication Technology Use for Extension Services in Abia State, Nigeria

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[1]Nwankwo, Ifeoma Vivian; [2]Odoemelam, Lovina Enyidiya; [3]Mbajiuka, Stella
[1]Faculty of Education, Clifford University, Owerrinta, Abia State, Nigeria
[2]Department of Agricultural Extension and Rural Development, Michael Okpara University of Agriculture, Umudike Abia State, Nigeria
[3]Program Associate Justice, Development and Peace Caritas, Umuahia, Abia State, Nigeria
[3]Program Associate Justice, Development and Peace Caritas, Umuahia, Abia State, Nigeria
*Email: ifeomaviviankelechi@gmail.com; 07068163501 *ORCID: https://orcid.org/0009-0001-3768-793X

Abstract
This study investigated the extent to which ICT is utilized as a strategic tool for enhancing agricultural extension and advisory services in Abia State. A descriptive survey design was adopted, and data were collected from 150 respondents (comprising 120 farmers and 30 extension agents) using structured questionnaires. Descriptive statistics and Pearson correlation analysis were employed for data interpretation. Findings revealed a high level of awareness and usage of ICT tools such as mobile phones, WhatsApp, SMS, and social media platforms among extension agents and farmers. Despite this, a Pearson correlation result indicated a weak and statistically insignificant relationship ($r = -0.03$, $p = 0.715$) between ICT usage and perceived effectiveness of service delivery. This suggests that while ICT tools are widely used and appreciated, their full potential is yet to be realized due to numerous constraints. Key challenges identified include poor network coverage, irregular power supply, lack of digital literacy, high cost of ICT devices, and the absence of technical support structures. These findings highlight the need for a more holistic approach involving infrastructure development, digital training, and supportive policies to fully harness ICT's potential in agricultural extension. The study concludes that while ICT holds significant promise for improving AEAS in Abia State, its impact is currently limited by systemic barriers that must be urgently addressed.
Keywords: ICT, Agricultural Extension, Advisory Services, Rural farmers, Abia State.

Introduction

The goal of information and communication technology, or "e-agriculture," is to boost agricultural and rural development by means of better information and communication systems. To put it another way, ICT includes a variety of technologies that facilitate the processing, distribution, and storage of data and information (Radhika, Sandeep, Mohini, and Anil, 2024). Social media has taken over communication in the twenty-first century, and digital communication has infiltrated every industry. The importance of ICT tools in extension services is demonstrated by the highest use of digital tools by livestock and poultry farmers, followed by mass media exposure and extension agencies (Ifeoma et al., 2024).

The low level of agricultural information exchange among the various stakeholders in the agricultural sector has been one of the main obstacles to Nigeria's agricultural development. This is typically caused by a lack

of access to up-to-date and pertinent information sources as well as inadequate documentation, storage, and retrieval methods (Agwu and Uchemba, 2004). Furthermore, low agricultural output performance is the result of farmers' lack of knowledge or exposure to agricultural information and communication channels (Agwu and Adeniran, 2009). These indicate that farmers continue to require agricultural information. Information and communication technology, or ICT, has transformed human thought, aptitude, and capacity as well as all life processes and activities.

The implementation of Information and Communication Technology (ICT) across various global economic sectors has proven beneficial in enhancing productivity and efficiency. In particular, the agriculture sector has seen significant integration of ICT in all aspects of its operations. ICT's practical applications have the potential to address key agricultural challenges, such as pest and disease outbreaks, extended droughts, seasonal and spatial farming variations, information gaps, and high transaction costs (Anh *et al.*, 2019). Utilizing ICT throughout the agricultural value chain, from production to consumption, can provide stakeholders with timely, accurate, and relevant information, thereby increasing profitability, improving food security, and promoting sustainable and profitable agriculture (Purnomo and Lee, 2010). ICT also offers solutions to issues faced by farmers, governments, and land users in areas such as land registration, valuation, and taxation (Daum, 2020). ICT in agriculture is becoming more popular worldwide and is playing a key role in changing agricultural enterprises. By linking farmers with research and bringing improved technology from the lab to the field, agricultural extension services aim to increase production and productivity. Extension specialists used to visit farmers on their farms or at field schools to offer these services (Radhika et al., 2024). Technology and agricultural information can only be beneficial if it is disseminated to the intended audience. To do this, agricultural extension agents need to distribute information through a range of channels (Ifeoma et al., 2024).

It is currently beyond the capacity and resources to attend to the particular wants, requirements, and inquiries of farmers due to the high number of farmers per extension agent (more than 3000 families per officer) (Obiechina, 1999). Effective communication will be made possible by ICT applications, which will help extension services overcome time and location constraints. ICT will enable farmers to receive updates on temperature, humidity, rainfall, and other parameters like atmospheric pressure, solar radiation, soil moisture, and wind speed (Ifeoma et al., 2023). People are empowered by ICT because it gives them the chance to study, make money, and actively participate in decision-making (ADB, 2004). Stakeholders' abilities and competencies must be enhanced while giving the required advocacy in order to provide solutions on suitable ICT applications for enhancing extension services. ICTs and mobile-enabled agricultural services act as instruments to deliver extension services and help to create awareness amongst farmers (Mittal et al., 2010).

Traditional agricultural extension services in the state have been largely ineffective due to inadequate manpower, logistic challenges, and poor funding. With the global advancement of Information and Communication Technology (ICT), there is a growing recognition of its potential to transform agricultural extension and advisory services by bridging communication gaps between extension agents and farmers. ICT tools such as mobile phones, radio, television, internet platforms, and social media can facilitate faster dissemination of information, real-time feedback, and participatory learning among stakeholders. However, the effective adoption and integration of ICT in extension service delivery in Abia State remain limited by several challenges including lack of infrastructure, digital illiteracy among farmers and extension workers, and weak institutional support. This study, therefore, seeks to investigate the extent to which ICT is currently being utilized as a strategic tool to enhance agricultural extension and advisory services in Abia State. It also aims to identify the barriers hindering its effective application and to explore strategies for improving ICT-based extension delivery systems to better serve the needs of rural farmers.

The specific objectives of the study is to:

i. identify the types of ICT tools used in agricultural extension services in Abia State.
ii. assess the extent the ICT adoption and utilization among agricultural extension agents and farmers in the state.

iii. identify the challenges hindering the effective use of ICT in agricultural extension services in Abia State

Methodology

The study adopted a descriptive survey research design. The study was carried out in Abia State Agricultural Development Programme (Abia ADP). Abia State is located in the South-Eastern geopolitical zone of Nigeria and comprises three agricultural zones, namely: Aba Agricultural Zone, Umuahia Agricultural Zone, and Ohafia Agricultural Zone. The state is predominantly agrarian, with farming activities such as cassava, palm oil, maize, cocoyam, plantain, rice and livestock production being common occupations among rural households. Agricultural extension activities in the state are coordinated by the Abia ADP through the provision of advisory services to farmers. The population of the study comprised all the agricultural extension agents working under the Abia ADP and registered practicing farmers in selected local government areas (LGAs) in the state.

A multi-stage sampling technique was employed for selecting respondents for the study. Stage 1: The three agricultural zones in the state (Aba, Umuahia and Ohafia) were purposively selected. Stage 2: From each agricultural zone, two Local Government Areas (LGAs) were randomly selected to give a total of six LGAs. These include: Aba Agricultural Zone: Aba North and Aba South, Umuahia Agricultural Zone: Umuahia North and Umuahia South and Ohafia Agricultural Zone: Ohafia, Bende, and Isuikwuato. Stage 3: From each selected LGA, 20 farmers and 5 extension agents were purposively selected based on their involvement in agricultural extension activities and ICT use. This produced a sample size of (20 farmers × 6 LGAs) = 120 farmers, (5 extension agents × 6 LGAs) = 30 extension agents and total sample size of 150 respondents. Data were collected using a structured questionnaire consisting of four sections: Section A: Socio-demographic characteristics of respondents, Section B: Types of ICT tools used in agricultural extension service delivery, Section C: Extent of ICT adoption and utilization and Section D: Challenges hindering ICT use in agricultural extension services.

The variables were measured thus: identify ICT tools used = indicate Yes or No = Nominal (1 = Yes, 0 = No), assess extent of ICT adoption and utilization = 5-point Likert scale response options: Very High (5) to Very Low (1) or Always (5) to Never (1). = Ordinal (Likert Scale) and identify challenges hindering ICT use 5-point severity scale: Very Severe (5) to Not a Challenge (1). Ordinal (Likert Scale). Data collected were analyzed using descriptive statistics such as frequency counts, percentages, and mean scores to achieve objectives 1, 2, and 3. Pearson Product Moment Correlation (PPMC) was used to determine the relationship between ICT adoption and utilization and selected socio-economic characteristics of respondents at 0.05 level of significance.

Results

A number of ICT devices that are widely used for the delivery of extension services were identified in Table 1. Mobile phones (100%), WhatsApp (100%), SMS (98.3%), Twitter (98.3%), tele-meeting (98.3%), Google Meet (97.8%), Google Classroom (97.5%), television (97.5%), videos (96.6%), close circuit camera (95.0%), digital camera (93.3%), YouTube (91.6%), radio (89.3%), Facebook (86.6%), e-books/journals/e-data (83.3%), crowd mapping (82.5%), and emails (78.3%) are a few of these. Anyakoha (2005) outlined ICT and digital technologies, including the use of multimedia personal computers (PCs), laptops and notebooks with internet connectivity, digital cameras and videos connected to PCs and laptops, land area networks and wide area networks; the world wide web (www), e-books, e-journals, e-databases, floppies, CDs, and DVDs, cell phones with internet access, moving pictures, close circuit television (CCTV) cameras, computer-mediated video conferencing, virtual reality, telecommunication satellites, interactive televisions, and more. The most notable of these is the computer, a significant ICT instrument whose uses have drastically altered farming and animal husbandry and led to an astounding rise in output (Asenso-Okyere and Mekonnen, 2012).

Table 1: ICT for extension and advisory services delivery

ICT devices/tools	Frequency	Percentage (%)
Mobile phones	150	100
WhatsApp	150	100
SMS	147	98.3
Twitter	147	98.3
Tele-meeting	147	98.3
Google meet	147	97.8
Google classroom	146	97.5
Television	146	97.5
Videos	145	96.6
Close circuit television camera	142	95.0
Digital Camera	140	93.3
YouTube	137	91.6
Radio	134	89.2
Facebook	130	86.6
E-books	125	83.3
Crowd mapping	124	82.5
Emails	117	78.3
Instagram	117	78.3
Voice mail	70	46.6

Source: Field survey, 2024 ***Multiple responses***

With a discriminating mean index of 2.50, Table 2 showed a positive attitude of the extension agents towards the use and adoption of ICT to reach farmers. They responded as follows- reaching farmers through SMS and mobile phone is very highly effective ($\bar{x}$= 3.51), mobile phones are effective and good in disseminating agricultural information ($\bar{x}$=2.98), disseminating of agricultural information through website is effective ($\bar{x}$=3.21), improving /increase efficiency of extension staff ($\bar{x}$=2.86), minimizes work load of extension staff ($\bar{x}$=2.70), makes extension activities effective ($\bar{x}$=3.01), saves cost and time ($\bar{x}$ =2.67), spreads agricultural information rapidly ($\bar{x}$=2.84), establishment of better communication ($\bar{x}$ =2.86), increases extension workers responsibility ($\bar{x}$=2.74), improves rural livelihoods of staff ($\bar{x}$=3.10) better than traditional face to face method ($\bar{x}$=2.10), bringing together of stakeholders easily ($\bar{x}$ = 2.97), improve the practice of extension profession ($\bar{x}$ = 2.76). This overall mean value indicates that the respondents generally had a positive attitude towards the use of ICT devices. This corresponds to similar studies by (Adekunle et al., 2007; Albirini, 2004) who analyzed attitudes of extension workers towards the use of ICTs with identical results conducted in different countries. Majority of the respondents (90.6%) agreed with the statement, "Contacting farmers through mobile and SMS is very highly effective", with a mean value of ($\bar{x}$ = 3.51). The statement, "serve as method of professional development" witnessed also a mean value of ($\bar{x}$ = 3.51) from the respondents. 88% of the respondents agreed with the statement, "Mobiles are effective in disseminating agricultural information with a mean value of ($\bar{x}$ = 3.21). Whether it is a developed country or a developing country, mobile phones have become a regular part of daily life. Mobile phones have made our daily communication very easy and cheap between distant locations. They are also an important part of ICT services; farmers and extension workers can communicate with each other easily without the hindrance of scheduling face-to-face or roundtable meetings.

Table 2: Extent of ICT adoption and use in extension service delivery

Extent of ICT adoption and use	Mean	SD
Reaching farmers through SMS and mobile phones is very effective	3.51	0.68
Mobile phones are effective and good in disseminating agricultural information	2.98	1.28
Dissemination of agricultural information through website is effective	3.21	0.63
Increases efficiency of extension staff	2.86	1.26
Minimizes work load of extension officers	2.74	0.98
Efficient and effective agricultural information and services	3.01	1.42
Saves cost and time	2.67	0.74
Rapid spread of agricultural information	2.84	0.64
Establishment of better communication	2.80	1.01
Increases extension officers' responsibility	2.74	0.74
Improves the rural livelihood of staff	3.10	1.34
Better than the traditional face to face method	3.10	0.94
Linking of all farm stakeholders easily	2.97	0.84
Enhance the importance of extension work	2.88	1.02
Serves as method of professional development	3.51	0.81
Improves practice of extension profession	2.76	0.99

The obstacles to the efficient use of ICT technologies by Agricultural Extension and Advisory Services Providers (AEASP) in Abia State were displayed in Table 3. These difficulties include: illiteracy (87.5%), inconsistent power supply (100%), insufficient network coverage (100%), and lack of operational know-how on ICT tools (97.5%). Additional difficulties include the high cost of ICT equipment/devices (77.5%), message delivery delays caused by network outages (61.6%), a lack of expertise for maintaining ICT devices (81.6%), and the absence of repair shops in the service area (91.6%). These conforms to Nikola et al. (2019) that the utilization of digital innovations is influenced by literacy, digital skills, and technology availability.

Table 3: Challenges on the effective use of ICT in extension and advisory services

Challenges	Percentage
Lack of experience in use of ICT	97.5
Poor network coverage	100
Poor power supply	100
Illiteracy	87.5
High cost of ICT equipment	77.5
High maintenance cost	61.6
Lack of technical expertise	81.6
Non-existence of maintenance shops	91.6

Pearson Correlation

Table 4 showed the correlation coefficient of -0.030 suggests a very weak negative relationship. The p-value of 0.715 indicates that the result is not statistically significant at the 0.05 level. This implies that higher ICT usage does not necessarily correlate with improved effectiveness of extension services, possibly due to infrastructural or skill-related constraints.

Table 4: Correlation between ICT Usage and Effectiveness in Extension Services

Variables Compared	Correlation Coefficient (r)	P-value	Statistical Significance
ICT Usage vs. Effectiveness	-0.030	0.715	Not Significant

Source: SPSS output ver. 23

Discussion

The Pearson correlation analysis conducted showed a very weak and non-significant negative correlation ($r = -0.03$, $p = 0.715$) between ICT usage and perceived effectiveness of extension and advisory services in Abia State. This implies that increased use of ICT tools does not necessarily correlate with higher perceived performance or effectiveness in extension service delivery. This result appears to contrast with the descriptive findings where extension officers expressed a positive attitude toward ICT use. For instance, Table 2 reports high mean values for statements such as: "Reaching farmers through SMS and mobile phones is very effective" (Mean = 3.51), "Serves as a method of professional development" (Mean = 3.51) and "Improves rural livelihood of staff" (Mean = 3.10). These suggest a strong subjective belief in the benefits of ICT among extension agents. However, the gap between high subjective ratings and weak statistical correlation could be explained by implementation challenges such as despite the enthusiasm toward ICT tools, real-world constraints significantly hinder their effective use, as highlighted in Table 3 namely poor power supply, poor network coverage, lack of ICT experience, illiteracy and lack of technical expertise. These are critical barriers that prevent even the most promising ICT platforms from translating into real gains in extension effectiveness. The disconnect shown by the Pearson correlation may therefore reflect this practical dysfunction: although ICT is widely acknowledged as useful, many users cannot leverage it to full capacity due to infrastructural, technical, or literacy-related limitations.

Similar issues have been identified in other regions of Nigeria; Albert (2014) found that poor ICT infrastructure severely limited extension activities in Rivers State. Salau et al. (2008) reported poor access to ICTs among extension officers in Nasarawa State, despite growing interest in digital tools. Nwobodo and Nwabugwu (2016) noted that while ICT usage improved communication in Anambra State, digital skill gaps and tool maintenance remained unresolved barriers.

Another layer of complexity involves the digital divide among rural farmers. As Nikola et al. (2019) and the document note, most rural dwellers use mobile phones primarily for social or basic communication due to low digital literacy and inability to operate complex apps or e-learning platforms. This observation is consistent with the findings that only 46.6% of respondents use voicemail, Social platforms like Instagram and emails are among the least used tools. Furthermore, even when devices are owned, high maintenance costs and lack of repair services (reported by 91.6% of respondents) reduce long-term usability. This echoes Mittal et al. (2010), who emphasized that successful ICT adoption requires training, affordability, and user-centered design.

ICT adoption in agriculture has been more successful in other regions when support systems are present such as in Kenya, platforms like iCow and M-Farm have been effective due to combined efforts in training, telecom partnerships, and local language content. In India, mobile-based agricultural helplines succeeded because of state-level investment and user-friendly technologies tailored to rural farmers (Mittal et al., 2010). Abia State and similar regions in Nigeria can learn from these models by localizing content, investing in farmer training programs and creating public-private partnerships for ICT deployment.

The high mean scores in the descriptive analysis of ICT perception suggest that respondents believe in the value of ICT, but the weak correlation outcome may reflect incomplete integration of ICT into daily operations, lack of technical depth in usage (e.g., using WhatsApp vs. using data-logging apps), a "perception vs. performance" gap, where agents recognize ICT's potential but lack enabling conditions to realize it. This supports the study's conclusion that adoption alone is not enough there must be systemic investment in infrastructure, skills, and device sustainability for ICT to truly enhance extension performance.

Conclusion

While extension agents and farmers in Abia State display a positive attitude toward ICT tools, their practical effectiveness remains limited due to infrastructural, financial, and technical challenges. The findings align with broader Nigerian trends where enthusiasm for ICT exists but is tempered by systemic barriers. ICT

remains a strategic tool with transformative potential, but its success depends on contextual adaptation and support structures, especially in underserved agricultural communities. The study therefore recommends that, based on the findings of the study, the weak statistical correlation reinforces the need for holistic policy interventions not just providing tools, but ensuring they can be used effectively, affordably, and sustainably through skills and training.

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