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Analysis of the Factors Affecting the Use of ICT Tools for Accessing Agricultural Information among Dry-Season Rice Farmers in Taraba State, Nigeria

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Abstract

Information and Communication Technologies (ICTs) have become important tools for agricultural information dissemination and technology transfer. This study examined the factors affecting the use of ICT tools for accessing agricultural information among dry-season rice farmers in Taraba State, Nigeria. A structured questionnaire was used to collect data from 353 rice farmers. Descriptive statistics and Cragg' double-hurdle model were employed for data analysis. Results revealed that the majority (92.4%) of respondents were male, while 30.9% had secondary education. Most respondents (88.7%) identified farming as their primary occupation. Mobile phones (99.6%), radio (79.4%), and television (63.0%) were the most utilized ICT tools. The frequency of use showed that mobile phones and radio were frequently used for agricultural information access. The double-hurdle model indicated that education, major occupation, household size, cost of ICTs, and farmers' attitudes significantly influenced ICT utilization. The study recommends strengthening rural ICT infrastructure, improving farmers' digital literacy, and increasing extension support to enhance access to agricultural information among rice farmers.

Keywords: ICT, agricultural information, rice farmers, extension services, Taraba State, Nigeria.

Introduction

Finger millet (*Eleusine coracana* L. Gaertn.), "tamba" in Hausa language, a staple food crop in the arid and semi-arid tropics of South Asia and Africa (Hussaini *et al.,* 2020). It is a

minor cereal crop that belongs to the *Orchideccae* subfamily (Hussaini *et al*., 2020) and one of the most important small grain cereal crops grown in large areas of the developing world especially Africa and Asia. Epidemiological evidence showed that the crop is widespread and well adapted to diverse regions of the world (Umar and Kwon-Ndung, 2014). Finger millet has the ability to produce higher yield than other cereal crops under multiple stresses such as drought, soil acidity and land marginality (Upadhyaya *et al.,* 2006; Aradhna *et al.,* 2019; Ankit Kumar *et al.,* 2019). It has the ability to survive very well in different agro-climatic conditions where there is as low as 400 mm of rainfall, temperature above 15°C and can be grown throughout the year (Malinda *et al.,* 2015). The crop can be grown for weed control on poor soils (Ibrahim *et al.,* 2018). Moreover, it has low pest problem and excellent storage qualities (Hussaini *et al.,* 2020).

Agriculture remains a major contributor to Nigeria's economy and a critical source of livelihood for rural households. Rice production has gained strategic importance due to increasing domestic demand and government efforts to achieve food security. Access to timely and reliable agricultural information is essential for improving productivity and farmers' decision-making processes. Information and Communication Technologies (ICTs) such as mobile phones, radio, television, internet services, and digital extension platforms have transformed agricultural communication globally. ICTs facilitate rapid dissemination of information on improved production practices, weather forecasts, pest and disease management, market opportunities, and financial services (Aker et al., 2021). In Nigeria, despite increasing penetration of ICTs, many rural farmers still face challenges related to affordability, infrastructure deficits, digital literacy, and limited extension support (Ogunniyi et al., 2022). Understanding the factors influencing ICT adoption among rice farmers is therefore crucial for designing effective agricultural information systems. This study aimed to analyze the factors affecting the use of ICT tools for accessing agricultural information among dry-season rice farmers in Taraba State, Nigeria.

Objectives

1. Describe the socioeconomic characteristics of dry-season rice farmers.
2. Identify ICT tools utilized by farmers.
3. Determine the frequency of ICT utilization.
4. Examine factors influencing ICT use among farmers.

Related Work

ICTs have increasingly become indispensable in agricultural extension delivery systems. Mobile technologies have significantly improved farmers' access to advisory services, market information, and weather forecasts (FAO, 2022). Recent studies have shown that educational level, age, income, farm size, and extension contact influence ICT adoption among farmers (Abdul-Rahman & Issahaku, 2021; Adegbite et al., 2023). Mobile phones remain the most

widely adopted ICT tool among African farmers due to affordability and accessibility (World Bank, 2023).

Research by Nwafor et al. (2024) found that positive attitudes toward technology and adequate digital skills significantly increased the likelihood of ICT utilization among smallholder farmers. Similarly, extension services play a vital role in enhancing farmers' awareness and effective use of ICT-based agricultural information systems.

Methodology

The study was conducted among dry-season rice farmers in Taraba State, Nigeria. Primary data were collected using structured questionnaires administered and 353 respondents were randomly selected. Analytical Techniques; both descriptive and inferential statistics were used Descriptive Statistics -Frequency counts and percentages were used to describe socioeconomic characteristics and ICT utilization patterns. Cragg's Double-Hurdle Model - The double-hurdle model was employed to examine factors affecting both the probability and extent of ICT utilization among farmers.

The explanatory variables included:

- Sex
- Education
- Major occupation
- Household size
- Farming experience
- Access to extension services
- Cost of ICTs
- Perceived ease of use
- Farmers' attitude toward ICTs

Socioeconomic Characteristics of Respondents

Table 1: Socioeconomic Characteristics of dry season rice farmers

Variables	Categories	Frequency	Percentage
Sex	Male	326	92.4
	Female	27	7.6
Educational Background	No Education	46	13.0
	Non-formal	71	20.1
	Primary	61	17.3
	Secondary	109	30.9
	Tertiary	66	18.7
Major Occupation	Farmer	313	88.7
	Trader	19	5.4
	Civil Servant	21	5.9
Membership of Association	Yes	80	22.7

Variables	Categories	Frequency	Percentage
	No	273	77.3
Extension Contact	Yes	77	21.8
	No	276	78.2
Frequency of Extension	Once a Year	48	62.3
	Twice a Year	25	32.4
	Three Times a Year	3	3.8
	Four Times a Year	1	1.2

Source: Field Survey, 2024

The results indicate that male farmers constituted 92.4% of respondents, while females accounted for only 7.6%. This suggests that dry-season rice production in Taraba State is predominantly male-dominated. Similar findings were reported by Adegbite *et al*. (2023), who observed that male farmers dominate commercial rice production due to greater access to land and production resources. Regarding educational attainment, 30.9% had secondary education, 18.7% possessed tertiary education, while 13.0% had no formal education. The relatively high literacy level suggests a favorable environment for ICT adoption because educated farmers are generally more capable of understanding and utilizing digital technologies (Nwafor *et al*., 2024).

The majority (88.7%) identified farming as their primary occupation, indicating a high dependence on agriculture for livelihood. This finding aligns with FAO (2022), which reported that farming remains the principal economic activity among rural households in sub-Saharan Africa. Only 22.7% belonged to farmer associations, while 77.3% were not members. Low participation in associations may limit information sharing and collective access to ICT-based agricultural services. Furthermore, only 21.8% had contact with extension agents. Among those with extension contact, 62.3% received visits only once annually. This low frequency suggests inadequate extension coverage, which may constrain information dissemination and ICT awareness among farmers.

Table 2: ICT Tools Utilized by Respondents in Accessing Agricultural Information

ICT Tools Used	Used	Not Used
Mobile	261 (99.62)	1 (0.38)
Radio	208 (79.39)	54 (20.61)
Television	165 (62.98)	97 (37.02)
Camera	151 (57.63)	111 (42.37)
Extension bulletins	112 (42.75)	150 (57.25)
Computer	91 (34.73)	171 (65.27)
Web	130 (49.62)	132 (50.38)
Projector	8 (3.05)	254 (97.00)
Posters	142 (54.20)	120 (45.80)

Source: Field Survey, 2024

The findings reveal that mobile phones were the most utilized ICT tool, with 99.62% of respondents reporting usage. The widespread adoption of mobile phones may be attributed to their affordability, portability, and multifunctional capabilities. Radio ranked second with 79.39% utilization. Radio remains a popular communication medium in rural communities because of its wide coverage and ability to reach farmers regardless of literacy levels (World Bank, 2023). Television was utilized by 62.98% of respondents, while cameras and posters recorded utilization rates of 57.63% and 54.20%, respectively. Internet-based tools (web services) were utilized by 49.62% of respondents, suggesting growing digital engagement among farmers. However, computer utilization remained relatively low (34.73%), likely due to limited computer ownership, inadequate digital skills, and infrastructure challenges.

Projectors recorded the lowest utilization rate (3.05%), reflecting their limited relevance in individual farming operations and dependence on organized training programs. These findings corroborate Abdul-Rahman and Issahaku (2021), who reported that mobile phones and radio are the most commonly used ICT platforms among African farmers.

Table 3: Frequency of ICTs Tools Usage by the Respondents

ICT Tools	Often	Somewhat	Rarely
Radio	198 (95.19)	10 (4.80)	0 (0)
Television	99 (60)	51 (30)	15 (10)
Mobile Phone	231 (88.50)	30 (11.49)	0 (0)
Camera	78 (51.65)	68 (45.03)	5 (3.31)
Web	29 (22.30)	3 (2.30)	98 (75.38)
Computer	7 (7.6)	24 (26.37)	60 (65.93)
Projector	0 (0)	3 (37.50)	5 (62.50)
Extension bulletins	3 (2.67)	19 (16.96)	90 (80.35)
Posters	27 (23.68)	45 (39.47)	70 (61.40)

Radio emerged as the most frequently used ICT tool, with 95.19% of users reporting regular usage. Radio programs often provide agricultural information in local languages, making them accessible to rural farmers. Mobile phones were also frequently used, with 88.50% of respondents indicating regular utilization. This demonstrates the increasing importance of mobile technology in agricultural communication. Television usage was relatively moderate, with 60% reporting frequent use. Similarly, camera utilization showed moderate frequency, with 51.65% using the technology regularly.

In contrast, internet-based platforms recorded low frequency of use. About 75.38% of respondents rarely used web services, while 65.93% rarely used computers. Extension bulletins also experienced limited usage, with 80.35% rarely consulting them. The low frequency of internet and computer usage may reflect inadequate digital literacy, poor internet connectivity, and high operational costs. Similar observations were reported by Ogunniyi *et al.* (2022).

Table 4: Factors Influencing the Probability and Extent of ICT Use by Farmers

Variables	Probit Coefficient (SE)	Truncated Coefficient (SE)
Sex	-0.0996 (0.5005)	1.2614** (0.5473)
Education	2.3706*** (0.4421)	-1.5570*** (0.3467)
Major Occupation	0.6776*** (0.2407)	0.7515*** (0.2835)
Household Size	0.0506** (0.0247)	0.0505* (0.0290)
Farming Experience	-0.0174 (0.0143)	-0.1407*** (0.0185)
Access to Extension Service	-0.3544 (0.3440)	-3.2162*** (0.3881)
Cost of ICTs	2.2462*** (0.4139)	0.7330* (0.3767)
Perceived Ease of Use	-1.4213*** (0.3533)	-0.3032 (0.3924)
Farmers' Attitude towards ICTs	1.6763*** (0.2451)	-0.4608 (0.4106)
Constant	-6.8853 (1.3162)	19.5203*** (1.8147)
Log Likelihood	-640.10538	
Wald Chi² (10)	59.14	
Prob > Chi²	0.000	

The double-hurdle model produced a statistically significant Wald Chi-square value of 59.14 ($p < 0.01$), indicating good model fit.

Education

Education positively and significantly influenced the probability of ICT use ($\beta = 2.3706$, $p < 0.01$). Educated farmers are more likely to understand technological innovations and access digital information platforms. This finding agrees with Nwafor *et al.* (2024).

Major Occupation

Major occupation positively affected both the probability and extent of ICT use. Farmers whose primary occupation was agriculture demonstrated higher ICT engagement due to their greater information needs.

Household Size

Household size significantly increased ICT utilization. Larger households may provide additional labor and support for technology adoption and information searching.

Farming Experience

Farming experience negatively influenced the extent of ICT use. Experienced farmers may rely more on traditional knowledge and less on modern information channels.

Access to Extension Services

Access to extension services significantly affected ICT utilization. Extension agents often serve as intermediaries between farmers and digital information platforms.

Cost of ICTs

The cost of ICT tools significantly influenced both the probability and extent of utilization. Affordable ICT services encourage adoption among smallholder farmers.

Perceived Ease of Use

Perceived ease of use negatively influenced ICT utilization probability. This may indicate that farmers encounter technical difficulties while operating some ICT tools.

Farmers' Attitude toward ICTs

Positive attitudes significantly increased ICT adoption probability. Farmers who perceive ICTs as useful are more willing to invest time and resources in their use.

These findings are consistent with the Technology Acceptance Model and recent empirical studies in agricultural innovation adoption (FAO, 2022; Adegbite et al., 2023).

Interpretation

Education significantly increased the probability of ICT adoption ($p<0.01$), consistent with diffusion theory (Rogers, 2003). Major occupation positively influenced both probability and extent of use, indicating that full-time farmers are more likely to depend on ICTs.

Household size positively influenced ICT usage, possibly due to shared responsibilities and access to younger, tech-savvy members. Farming experience negatively affected intensity of use, suggesting that older farmers may rely more on traditional knowledge systems.

Cost of ICTs significantly influenced both stages, highlighting affordability as a critical barrier. Farmers' positive attitudes significantly increased adoption probability, reinforcing the role of perception in technology acceptance models (Davis, 1989).

Conclusion

The study established that mobile phones and radio are the dominant ICT tools used by dry-season rice farmers in Taraba State. Education, occupation, household size, cost of ICTs, and farmers' attitudes significantly influence ICT utilization. Despite the increasing use of mobile technologies, internet-based tools and computers remain underutilized. Strengthening digital literacy programs and rural ICT infrastructure will enhance agricultural information access and improve productivity among rice farmers.

Recommendations

1. Government should improve rural ICT infrastructure and internet connectivity.
2. Extension agencies should integrate mobile-based advisory services into extension delivery.
3. Training programs should be organized to improve farmers' digital literacy.
4. Affordable ICT devices and data services should be made available to farmers.

5. Farmer associations should be strengthened to facilitate collective access to digital agricultural information.

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