



FACTORS INFLUENCING THE UTILISATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) AMONG RICE FARMERS IN BAUCHI STATE, NIGERIA

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ABSTRACT

The study examined the factors influencing the utilisation of information and communication technologies (ICTs) among rice farmers in Bauchi State, Nigeria. Multi-stage sampling techniques was used in selecting 433 respondents. Data were collected using structured questionnaires and analyzed using both descriptive and inferential statistics. The results revealed that more than half (54.3%) of the respondents had low knowledge of ICTs, while 45.7% had medium knowledge. The results also disclosed that 53.1% of the respondents utilized ICTs at medium level while 46.7% and 0.2% used it at low and high level. The results further revealed majority (58.2%) of the respondents used mobile phones most frequently on daily basis. Majority (74.4%) used ICTs to learn about new farming techniques while 74.1% and 73.4% use it in communication with other farmers and accessing market information). The results of regression analysis revealed that household size ($P<0.05$), educational level ($P<0.01$), farming experience ($P<0.05$), membership of cooperatives ($P<0.05$), access and frequency of extension contacts ($P<0.01$) were the factors influencing the level of utilisation of ICTs. The results of t-test statistic for rice output ($t = 26.470$; $P < 0.01$) indicate a strong, positive and significant relationship between the rice output and ICT utilization in the study area. The major constraint to effective utilization of ICTs were high cost of ICT devices and maintenance (75.1%), poor internet connectivity (73.5%), erratic power supply (71.6%) and high cost of internet subscription (71.1%) which were ranked 1st, 2nd, 3rd and 4th, respectively. The study concluded that household size, educational level, farming experience, membership of cooperatives, access and frequency of extension contacts, were the significant factors influencing the utilization of ICTs among rice farmers in the study area. The study recommended that government and development partners should subsidize ICT devices for farmers and promote affordable maintenance services to enhance accessibility, ICT platforms should be developed with localized, user-friendly content in local languages to ensure that farmers receive information relevant to their needs and ICT companies should provide affordable repair services and reliable after-sales support.

Keywords: ICTs, Utilisation, Rice, Farmers

INTRODUCTION

Agriculture remains a cornerstone of Nigeria's economy, providing food, employment, and rural livelihoods for the majority of the population (FAO, 2020). Despite its central role, smallholder farmers continue to struggle with low productivity, largely due to poor access to timely and reliable agricultural information. This gap in information dissemination has been widely acknowledged as a major barrier to sustainable agricultural growth and food security (Okeke *et al.*, 2020). In recent years, ICTs have emerged as transformative tools in bridging this information divide. ICTs such as mobile phones, radio, internet platforms, and agricultural applications have demonstrated enormous potential in expanding farmers' access to extension services, weather forecasts, market opportunities, and improved farming techniques (Ezeh 2021; Oyeyinka and Bello (2017). By enabling real-time communication and knowledge sharing, ICTs empower farmers to make informed production and marketing decisions that directly affect their productivity and income. However, despite these



potentials, the utilization of ICTs among Nigerian farmers, particularly rice farmers in Bauchi State, remains limited. Research suggests that a range of socio-economic and institutional factors such as education, income, farm size, extension contact, and infrastructural constraints play a decisive role in determining ICT adoption and usage (Olowu & Oyedokun, 2021; Musa *et al.* 2019). Understanding how these factors influence ICT utilization is important for developing policies and interventions that can strengthen ICT-driven agricultural development.

Rice is one of Nigeria's most important staple crops, and Bauchi State is one of the leading producers with significant potential to contribute to national food security (Lawal *et al.*, 2020). Yet, farmers in the state often suffers inadequate timely access to information on improved production practices and market opportunities. Leveraging ICTs could help close these gaps, improve efficiency, raise output, and increase household income. Similarly, the benefits of ICTs depend on the extent of their utilization and the socio-economic factors that shape farmers' engagement with these tools. This study therefore seeks to assess the factors influencing the utilization of ICTs among rice farmers in Bauchi State, Nigeria. Specifically, the study aimed at;

- i. describe the rice farmers' level of utilisation ICTs;
- ii. examine the effect of ICT utilization on productivity of the respondents;
- iii. determine the factors influencing the level of utilization of ICTs among rice the rice farmers; and
- iv. describe the constraints to the utilization of ICTs in the study area.

MATERIALS AND METHODS

The Study Area

Bauchi State, created in 1976, is located in the North-East geopolitical zone of Nigeria and spans about 49,596 km². It lies between latitudes 9°30' and 12°30' North and longitudes 8°45' and 11°0' East, bordered by Kano and Jigawa to the north, Taraba and Plateau to the south, Gombe and Yobe to the east, and Kaduna to the west. The state is divided into 20 Local Government Areas (LGAs) with an estimated population of 8.6 million people in 2023, growing at 3.7% annually (NPC, 2006). It is ethnically diverse, with Hausa, Fulani, Jarawa, and Sayawa being among the predominant groups (BSEEDS, 2016). Bauchi State's landscape includes the continuation of the Jos Plateau in the southwest and sandy terrain in the north, while it is ecologically characterized by two main vegetation zones: the Sudan savannah in the south and the Sahel savannah in the north (BSADP, 2019). Rainfall patterns in Bauchi State vary significantly from south to north, ranging from 1,300mm annually in the south to 700mm in the extreme north, influenced by the south-western winds of West Africa. This creates earlier and heavier rains in the southern parts, while the north experiences drier conditions with delayed rains. Rivers such as the Gongola and Jama'are, along with parts of the Hadeja-Jama'are basin, provide fertile floodplains (fadama) suitable for farming, supported further by dams such as Gubi and Tilde-Fulani and lakes like Maladumba (BASG, 2019). Agriculture remains the mainstay of the economy, with rice, sorghum, and soybean common in the western zone, millet, cowpea, and sesame in the central and northern zones, and livestock rearing of cattle, goats, sheep, and poultry practiced widely (BSEEDS, 2016).

Sampling Technique and Sampling Size

A multi-stage sampling procedure was used to select the respondents from the study area. In the first stage, all the Bauchi State Agricultural Development Programme (BSADP) zones (Western, Central and Northern zones) were selected for the study using stratified sampling technique. The second stage involved the purposive selection of nine (9) LGAs due to their intensity of rice production. In the third stage, two (2) villages from each of the selected LGAs were purposively selected. The purposive sampling was based on comparative advantage for rice production making a total of 18 communities. In the final stage, 433 rice farmers were proportionately (0.8%) and randomly and selected as the sample size for the study.



Table 1: Sample Frame and Sample Size Selection Plan

Zone	LGAs	Villages	Sampling frame	Sample size (0.8%)
Western Zone	Bauchi	Liman Katagum	2,788	22
		Bauchi	6,896	55
	Dass	Wandi	1,265	10
		Bundot	2,491	20
	Alkaleri	Duguri	1,027	08
		Kwala	1,622	13
Central Zone	Ningi	Gadar Maiwa	2,398	19
		Dingis	5,988	48
	Warji	Dagu	3,915	31
		Gabanga	3,421	27
Northern Zone	Shira	Zigau	3,745	30
		Faggo	2,604	20
	Jama'are	Dako-Dako	1,894	15
		Yola	2,762	22
	Itas	Gadau	2,847	23
		Buzawa	1,795	14
	Zaki	Katagum	2,573	21
		Sakwa	4,425	35
Total	9	18	54,456	433

Source: BSADP, 2021

Method of Data Collection and Analysis

Data were collected using structured questionnaire. Descriptive and inferential statistics were used in analyzing the data. Descriptive statistics such as frequency distribution, proportion, percentage, mean, and standard deviation were used to achieve objectives i and iv while tobit and logit regression were used to achieve objective ii and iii respectively.

Tobit regression model was used to achieve objective iii which is to determine the effect of ICT utilisation on productivity of the rice farmers. The explicit form of the model is written as:

$$Y = \beta_1 X_1 + e \quad \dots(1)$$

Where;

Y= ICT usage (1= Used ICT, 2= Otherwise)

β_1 β_2 = Regression coefficients

X_1 = Rice output

e = error term

Logit regression model on the other hand was used to analyse factors influencing the utilization of ICT among the rice farmers in the study area. The explicit form of the model is written as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_9 X_9 + e \quad \dots(2)$$

Where;

Y= ICT utilization (number of ICTs used)

a = constant

β_1 β_9 = Regression coefficients

X_1 = Age (years)

X_2 = Sex (male = 1, female = 2)

X_3 = Educational level (1=primary education, 2= secondary education, 3= tertiary education, 4= Adult education, 5= never go to school)

X_4 = Income (Naira)

X_5 = Cost effectiveness (Yes = 1, No = 0)

X_6 = Perceived Usefulness (Useful = 1, Not Useful = 0)

X_7 = Perceived Ease of use (1= Easy to use, 2= Not easy to use)

X_8 = Availability (Yes = 1, No = 0)



X_9 = Affordability (Affordable = 1, Not affordable = 0)
 e = error term

RESULTS AND DISCUSSION

Level of Awareness on ICT, Level of ICT Utilization and Training Received on ICT Tools of the Respondents

Table 2 revealed that majority (54.3%) of the respondents had low knowledge of ICTs, while 45.7% had medium knowledge. None of the respondents reported high knowledge. This indicates that farmers may be aware of ICT tools but lack sufficient understanding of their full functionality and applications in rice production. With regard to utilization, the results further disclosed that 53.1% of the respondents utilized ICTs at a medium level while 46.7% and 0.2% used it at a low and high level. This finding is consistent with the report of Musa *et al.* (2019), that awareness alone does not guarantee ICT adoption unless farmers acquire practical skills to apply the tools effectively. It is also in line with Mittal and Mehar (2019), who reported that ICT utilization among smallholder farmers is often low due to inadequate training and infrastructural challenges.

Table 2: Distribution of the Respondents According to Level of Knowledge and Utilization of ICT (n = 433)

Variable	Frequency	Percentage
Level of knowledge on ICT		
Low	235	54.3
Medium	198	45.7
Level of ICT utilization		
Low	202	46.7
Medium	230	53.1
High	1	0.2

Source: Field Survey, 2025

Type of ICTs Accessed by the Respondents

Table 3 depicted that 45.7% and 43.2% of the respondents' accessed smartphones and radio while 3.9%, 3.7%, 2.1% and 1.4% accessed video cassette players, CD/DVD players, satellite decoders, and television, respectively. This shows that smartphones and radio were the dominant ICTs accessed by rice farmers in the study area. This indicates that farmers preferred ICT tools that are both affordable and versatile. Smartphones provide multiple functions, including internet access, social media, and mobile applications, which can enhance farmers' awareness and access to agricultural information. Radios, on the other hand, remain an important traditional medium because of their affordability, simplicity, and widespread availability, especially in rural areas with limited electricity or internet connectivity. The result corroborates the finding of Fadairo (2020), who reported that radio remains a major source of agricultural information in rural Nigeria, but that mobile phones are increasingly gaining popularity among farmers.

Table 3: Distribution of the Respondents According to Type of ICTs Accessed (n = 433)

Type of ICTs accessed	Frequency	Percentage
Smart phones	198	45.7
Radio	187	43.2
Television	6	1.4
Satellite decoder	9	2.1
CD/DVD Player	16	3.7
Video cassette player	17	3.9

Source: Field Survey, 2025



Respondents' Perceived Benefit of ICT Utilization

The results in Table 4 revealed that majority (71.6%) of the respondents perceived that ICTs help in improving rice production. This shows that the majority of rice farmers in the study area recognized ICTs as beneficial to their production activities. With regard to specific benefits, majority (67.7%) of the respondents also identified reporting problems on farming activities as the major benefit of ICTs, followed by the respondents that are receiving advice on agricultural problems (66.3%). Respondents that were getting information on agricultural development and reduction of transaction costs constitute 66.5% and 65.6%, respectively. Similarly, 65.4% each reported pest and disease control measures and receiving early warnings/alarms as perceived benefits while 63.7% indicated that ICTs facilitated viewing agricultural programs via cinema or video players. The result further disclosed that majority (63.5%) each noted that ICTs enabled them to get information on government policies and agricultural technologies. while 60.3%, 57.5% and 56.6% of the respondents used ICTs for accessing market information, taking agricultural photos with cameras, and for recording extension messages as perceived benefits, respectively. This shows that farmers viewed ICTs not only as tools for accessing information but also as platforms for problem-solving, advisory services, and cost reduction. This finding is in line with the report of Lawal *et al.* (2020) that the perceived benefits of ICTs strongly influence farmers' willingness to integrate them into production systems. Similarly, Ezech *et al.* (2019) reported that farmers perceive ICTs as useful for enhancing decision-making and managing risks in production.

Table 4: Distribution of the Respondents According to Perceived Benefit of ICT Utilization (n = 433)

Variable	Frequency*	Percentage
ICT improved rice production		
Yes	310	71.6
No	123	28.4
Benefits if ICTs utilization		
Reporting problems on farming activities	293	67.7
Receiving advise on agricultural problems	287	66.3
Getting information on agricultural development	288	66.5
Reduction of transaction cost	284	65.6
Pest and diseases control measures	283	65.4
Receiving early warning/alarms	283	65.4
Viewing of agricultural programmed in cinema /VCD/video player	276	63.7
Getting information on government policies	275	63.5
Getting information on agricultural technologies	275	63.5
Getting market information	261	60.3
Recording extension messages	245	56.6
Taking of agricultural photos with camera	249	57.5

Source: Field Survey, 2025

*Multiple response

Effect of ICT on Rice Production

The results in Table 5 reveal that the effect of ICTs on rice production was highly significant. The t-test statistic for rice output ($t = 26.470$; $P < 0.01$) indicates a strong and positive relationship, showing that ICT utilization had a significant effect on rice production in the study area. This implies that farmers who accessed and used ICTs recorded higher rice output compared to those who did not. This agreed with the report of Musa *et al.* (2020) that ICTs use improves agricultural productivity by providing timely and reliable information. It also aligns with Ezech *et al.* (2019), who reported that ICTs awareness and utilization significantly enhance crop yield and farm income.

Table 5: Effects of ICTs Utilization on Rice Production

Variables	V	df	Sig. (2-tailed)	Mean Difference
Rice output	26.470	432	.000	2.77829

Source: Field Survey, 2025

Factors Influencing Level of Utilization of ICTs

The results in Table 6 reveal that eight variables significantly influenced the level of ICT utilization among rice farmers in the study area. These include household size, educational level, years of formal education, farming experience, membership of cooperatives, rice output, average income, extension contacts, and frequency of extension contact. Household size was negative and significant ($P < 0.040$), implying that farmers with larger households were less likely to utilize ICTs. Larger families often stretch household resources, limiting funds for ICT tools and services. Educational level was positive and highly significant ($P < 0.002$), indicating that farmers with higher education were more likely to utilize ICTs. Similarly, years of formal education also had a positive and significant influence ($P < 0.004$). Education enhances literacy, technical understanding, and the ability to navigate ICT tools. This result is consistent with Oyeyinka and Bello (2017) who reported that higher educational attainment increases the likelihood of using ICTs effectively in agriculture. The farming experience was positive and significant ($P < 0.016$), indicating that more experienced farmers could be more likely to utilize ICTs. With longer involvement in rice farming, farmers develop awareness of the challenges that ICTs can solve and are more inclined to apply them in practice. This finding corroborates Daudu and Okwoche (2021), who reported that years of farming experience influence the decision to adopt agricultural innovations, including ICTs.

Table 6: Factors Influencing Level of Utilization of ICTs

Variables	Odd Ratio	Std. Error	z	P> z
Age	0.963471	0.042133	-0.85	0.397
Sex	1.482351	0.584129	1.08	0.281
Marital status	1.126948	0.352871	0.39	0.698
Household size	0.742358	0.092174	-2.05	0.040**
Educational level	2.186472	0.541293	3.11	0.002***
Years of formal education	1.193572	0.072384	2.89	0.004***
Occupation	0.982413	0.284127	-0.06	0.949
Farming experience in Rice prod.	1.327518	0.158912	2.42	0.016**
Farm size	1.174289	0.306285	0.62	0.533
Number of hectares under rice	1.089471	0.418729	0.22	0.824
Membership of cooperatives	1.672159	0.603412	2.10	0.036**
Land ownership	1.047193	0.193182	0.25	0.803
Rice output	1.384216	0.218945	2.11	0.035**
Average income	1.000024	8.01e-06	2.25	0.024**
Extension contacts	2.273594	0.791254	2.68	0.007***
Frequency of extension contact	1.692371	0.288374	2.95	0.003***
Cons	0.842197	0.481349	-0.29	0.774

Source: Field Survey, 2025

*** Significant at 1% and **Significant at 5%

The result also depicted that membership of cooperatives also had a positive and significant influence ($P < 0.05$) on ICTs utilization among the respondents in the study area. Farmers belonging to cooperatives were more likely to use ICTs, possibly due to information sharing, group training, and collective access to resources. This result agreed with the report of Olowu and Oyedokun (2021) that cooperative membership improves access to information and fosters greater ICT adoption. Similarly, rice output had a positive and significant ($P < 0.05$) influence implying that farmers with higher yields were more likely to utilize ICTs. This indicate that output-oriented farmers seek out ICTs to sustain or further improve their productivity. Similarly, average income was also positive and significant ($P < 0.05$). Farmers with higher incomes were more likely to utilize ICTs because they could afford the cost of devices, subscriptions, and training. This finding is in line with the report of Fadairo (2020) that farmers with higher income levels are better positioned to access and apply ICTs in their farming operations. The results further reveal that extension contacts were positive and significant ($P < 0.01$), indicating that farmers who interacted with extension agents were more likely to utilize ICTs. Likewise, frequency of extension contacts also had a positive and significant influence ($P < 0.01$). Frequent extension visits increase farmers' exposure to ICTs, reduce uncertainties about their use, and



encourage adoption. These findings are consistent with Lawal *et al.* (2020), who reported that regular extension contact significantly influenced ICT utilization among farmers.

Respondents' Constraints to the Effective Utilization of ICTs

The results in Table 7 reveal challenges faced by the respondents in utilizing ICTs in the study area. The major constraint identified was the high cost of ICT devices and maintenance (75.1%), ranked 1st. This indicates that affordability remains a major barrier, as farmers often find it difficult to purchase smartphones, computers, or maintain these devices. This finding agrees with Oyeyinka and Bello (2017), who reported that high costs of ICT devices discourage many smallholder farmers from effective utilization. The second major constraint was poor internet connectivity (73.5%). Even when devices are available, inadequate network coverage limits consistent usage. This finding is in line with Lawal *et al.* (2020), who emphasized that poor ICT infrastructure significantly reduces agricultural technology adoption in rural areas. Erratic power supply (71.6%) and high cost of internet subscription (71.1%) were also among the top constraints. Without reliable electricity and affordable internet, the frequency and efficiency of ICT usage are undermined. Similar observations were made by Umeh and Chukwu (2019), who noted that infrastructural deficits remain critical barriers to ICT use among farmers.

Table 7: Distribution of the Respondents According to Constraints to ICTs Utilization

Constraints	Frequency*	Percentage	Ranking
High cost of ICT devices and maintenance	325	75.1	1 st
Poor internet connectivity	318	73.5	2 nd
Erratic power supply	310	71.6	3 rd
High cost of internet subscription	308	71.1	4 th
Limited ICT skills and technical know-how	297	68.6	5 th
Lack of locally relevant agricultural content	289	66.7	6 th
Frequent breakdown of ICT facilities (phones, apps, devices)	275	63.5	7 th
Inadequate awareness of ICT application in marketing and record keeping	260	60.0	8 th

Source: Field Survey, 2025

* Multiple Response

Other constraints were limited ICT skills and technical know-how (68.6%), reflecting farmers' difficulty in effectively operating ICT devices and applications. This is inline with the report of Ezech *et al.* (2019) that inadequate technical literacy among farmers hampers full utilization of ICT tools. Other important constraints include lack of locally relevant agricultural content (66.7%), frequent breakdown of ICT facilities (63.5%), and inadequate awareness of ICT applications in marketing and record-keeping (60.0%) indicate the multifaceted challenges respondents encounter in the study area towards the utilization of ICTs. These results indicate that utilization is hindered not only by economic and infrastructural barriers but also by social and institutional limitations.

CONCLUSION AND RECOMMENDATIONS

The study concluded that household size, educational level, farming experience, membership of cooperatives, access and frequency of extension contacts, were the factors significantly influenced the utilization of ICTs. Also, there is strong and positive relationship between ICTs utilization and rice production in the study area.

Based on the finding of the study, the following recommendations were made;

- Government and development partners should subsidize ICT devices for farmers and promote affordable maintenance services to enhance accessibility.
- Telecommunication companies should be incentivized to expand rural broadband and network coverage to improve farmers' access to reliable internet services.
- Policy interventions should support affordable internet packages for farmers, possibly through special agricultural data bundles or group access schemes.
- Regular training programmes and capacity-building workshops should be organized for farmers to improve their ICT literacy and confidence in using digital tools.



- v. ICT platforms should be developed with localized, user-friendly content in local languages to ensure that farmers receive information relevant to their needs.
- vi. ICT companies should provide affordable repair services and reliable after-sales support should be made available in rural areas to reduce downtime and encourage consistent usage.

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