



**ASSESSMENT OF FACTORS INFLUENCING LEVEL OF AWARENESS OF
INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) AMONG RICE
FARMERS IN BAUCHI STATE, NIGERIA**

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ABSTRACT

The study assessed the factors influencing level of awareness 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 majority (71.1% and 70.4%) of the respondents were male and married, with a mean age, household size, farming experience, and farm size, of 35 years, 4 persons, 6 years, and 2 ha, respectively. The results also depicted that 38.6% of the respondents had secondary education and majority (75.3%) belonged to cooperative societies. Majority (89.2%) of the respondents produced between 1–5 tonnes of rice annually and their major sources of information were extension agents and television each accounting for 79.2%. More than half (54.0%) and 42.5% of the respondents had low and medium awareness of ICT. The results of regression analysis revealed that age ($P<0.005$), marital status ($P<0.024$), household ($P<0.000$), educational level ($P<0.017$) and membership of cooperatives ($P<0.019$) were the factors influencing the level of awareness of ICTs among the respondents in the study area. Inadequate of ICT training centers and facilities (75.3%), limited ICT literacy among extension agents (73.9%) and language barrier (73.0%) were the major constraints to awareness of ICTs which were ranked 1st, 2nd, and 3rd, respectively. The study concluded that age, marital status, household size, educational level and membership of cooperatives significantly influenced the level of awareness on ICTs. The study recommended that; regular training programmes and capacity-building workshops should be organized for farmers to improve their ICT literacy and confidence in using digital tools, ICT platforms should be developed with localized, user-friendly content in local languages to ensure that farmers receive information relevant to their needs.

Keywords: Information, Communication, Technologies Awareness, Rice, Farmers

INTRODUCTION

Agriculture remains the backbone of Nigeria's economy, providing food, employment and raw materials for industry (FAO, 2020). The country is endowed with vast arable land and favorable agro-ecological conditions that offer substantial scope for increasing agricultural productivity, yet smallholder farmers continue to record low yields owing largely to limited access to timely and reliable agricultural information (Okeke *et al.*, 2020). This persistent information gap is widely recognized as a major constraint to sustainable agricultural growth and national food security (Olowu & Oyedokun, 2021). Information and Communication Technologies (ICTs) have emerged as important instruments for bridging that information divide by enhancing the flow of agricultural knowledge. ICTs including mobile phones, radio, internet platforms and agricultural apps provide farmers with improved access to extension advice, weather forecasts, market prices and pest-management information (Ezeh, 2021; Oyeyinka and Bello, (2017). When effectively integrated into agricultural systems, ICTs can improve operational efficiency, reduce production risks, and support evidence-based decision making at the farm level (Musa *et al.*, 2019).



Despite this potential, effective utilization of ICTs among Nigerian farmers and rice farmers in Bauchi State in particular remains limited. Empirical studies suggest that socio-economic and institutional factors such as education, income, farm size, extension contact and infrastructural constraints significantly influence farmers' adoption and use of ICT tools (Olowu & Oyedokun, 2021; Okeke *et al.*, 2020). Understanding how these factors shape ICT utilisation is therefore essential to designing interventions that enhance digital extension services and improve productivity. Rice is a staple crop of national importance and Bauchi State is an important rice-producing area with considerable potential to contribute to food security (Lawal *et al.*, 2020). However, production in the state remains below potential, in part because many farmers suffers inadequate timely access to information on improved practices and market opportunities. Strengthening ICT awareness and utilization among rice farmers can help close these gaps by enabling better input management, market linkages and yield improvements, but such gains depend on addressing the socio-economic and institutional determinants of ICT use. It is against this backdrop that the study was conducted and assessed the factors influencing the level of awareness of of ICTs among rice farmers in Bauchi State, Nigeria, with specific aim of;

- i. describe the socio-economic characteristics of rice farmers in the study area;
- ii. describe the rice farmers' level of awareness on ICTs;
- iii. determine the factors influencing the level of awareness on ICTs and
- iv. describe the constraints to awareness on 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 of 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 (0.8%)	size
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	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, ii and iv while logit regression was used to achieve objective iii.

Logit regression model was used to achieve objective iv which is to determine factors influencing level of awareness on ICT among the rice farmers in the study area.

The explicit form of the model is written as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_8 X_8 + e \quad \dots(1)$$

Where;

Y= ICT Awareness (1 =Yes, 2= No)

a = constant

$\beta_1 \dots \beta_8$ = Regression coefficients

X_1 = Age (years)

X_2 = Sex (Male = 1, Female = 2)

X_3 = Marital status (1= married, 2= single, 3= divorced, 4= widowed)

X_4 = Household size (number)

X_5 = Educational level (1=primary education, 2= secondary education, 3= tertiary education, 4= Adult education, 5= never go to school)

X_6 = Years of formal education (number)

X_7 = Farming experience in rice production (years)

X_8 = Membership of cooperatives (Yes = 1, No = 0)

X_9 = Extension contacts (Yes = 1, No = 0)

e = error term

RESULTS AND DISCUSSION

Age, Sex and Marital Status of the Respondents

The results in Table 2 revealed that 35.3% of the respondents were between the age bracket of 30–35 years, while 29.6%, 18.0%, 10.4% and 6.7% fell between 36–41 years, 42 years and above,



24–29 years, and 18–23 years respectively. This shows that majority of the rice farmers in the study area are in their active age to participate effectively in rice production. This finding is similar to the report of Adesida (2021) that the average age of rice farmers in sub-Saharan Africa was about 41 years, placing them in the productive age group. The result

Table 2: Distribution of the Respondents According to Age, Sex and Marital Status (n = 433)

Variable	Frequency	Percentage
Age (Years)		
18-23	29	6.70
24-29	45	10.39
30-35	153	35.33
36-41	128	29.56
42 and above	78	18.01
Sex		
Male	308	71.1
Female	125	28.9
Marital status		
Single	81	18.7
Married	305	70.4
Divorced	17	3.9
Widowed	30	6.9

Source: Field Survey, 2025

The results also revealed that majority (71.1%) of the respondents were male, while 28.9% were female. This indicates that rice farming in the study area was dominated by men. The implication of this finding is that men are more actively involved in rice production activities than women, possibly due to the labour-intensive nature of rice production which requires more physical strength. This result is in line with the findings of Solaja *et al.* (2024) who reported that the majority of rice farmers in Kebbi State, Nigeria, were male, indicating that male farmers are more engaged in rice cultivation than their female counterparts. The Table further disclose that that majority (70.4%) of the respondents were married while 18.7%, 6.9% and 3.9% single, widowed and divorced, respectively. This shows that rice farming in the study area was largely carried out by married individuals. The results implies that household play an important role in rice production and in the utilization of ICTs. Married farmers, due to family commitments, may be more willing to utilize ICT tools that enhance productivity and income stability. This result agrees with the findings of Solaja *et al.* (2024) that most rice farmers in Kebbi State were married, which they linked to the importance of farming as a livelihood strategy for household sustenance.

Respondents' Household Size, Educational Level and Years of Formal Education

Table 3 revealed that majority (70.9%) of the respondents had a household size of 1–5 persons while 25.9%, 2.3% and 0.9% had 6–10, 11–15 and 16–20 persons, respectively. This shows that most of the respondents had small to medium household sizes. This finding is consistent with Fadairo (2020), who reported that household dynamics strongly influence farming participation and gender roles, as family labour is often mobilized in agricultural activities.



Table 3: Distribution of the Respondents According to Household Size, Educational Level and Years of Formal Education (n = 433)

Variable	Frequency	Percentage
Household size (number)		
1-5	307	70.90
6-10	112	25.87
11-15	10	2.31
16-20	4	0.92
Educational level		
Primary	105	24.2
Secondary education	167	38.6
Tertiary education	75	17.3
Adult and literacy education	44	10.2
Qur'anic education	39	9.0
No education	3	.7
Years of formal education		
1-5	21	4.85
6-10	160	36.95
11-15	213	49.19
16-20	39	9.01

Source: Field Survey, 2025

The results in Table 3 also revealed that 38.6% of the respondents had secondary education, while 24.2%, 17.3%, 10.2%, 9.0% and 0.7% had primary, tertiary adult/literacy classes, Qur'anic and no formal education, respectively. This shows that most of the respondents had basic to moderate levels of education. This result agrees with the report of Venkatesh (2020), who revealed that educational attainment enhances the ability to acquire and use ICT devices, thereby influencing utilization patterns. The results further disclosed that almost half (49.2%) of the respondents had 11–15 years of formal education, 36.9% had 6–10 years, 9.0% had 16–20 years, while only 4.9% had 1–5 years of education. This shows that majority of the respondents had up to secondary school education, and some even extended into tertiary levels. The results is in tandem with Ezech, (2021) and Onyeneke (2017), who both emphasized that years of formal education significantly improve farmers' capacity to access and utilize ICTs for agricultural purposes.

Farming Experience and Membership of Cooperative Society

The Table also showed that almost half (48.5%) of the respondents had between 6–10 years of farming experience, while 42.0% had 1–5 years. Only 8.6% had 11–15 years of experience, while 0.7% and 0.2% had 16–20 years and 21–25 years of farming experience respectively. This indicates that rice production in the study area is dominated by farmers who are still in the early to middle stages of their farming careers. Mittal and Mehar (2019) and Musa *et al.* (2019) confirmed that experience levels significantly influence the extent of ICT utilization, as less experienced farmers often seek knowledge to improve efficiency and yields. The results also revealed that majority (75.3%) of the respondents belonged to cooperative societies, while 24.7% were not members. This shows that most of the rice farmers in the study area recognize the importance of group participation in farming activities. This indicates that cooperative societies play an important role in mobilizing resources, sharing knowledge, and enhancing access to extension services, credit, and ICT-based innovations. This finding agreed with the report of Mittal and Mehar (2019) that cooperative membership enhances farmers' access to information and inputs, thereby strengthening their production capabilities.



Table 4: Distribution of the Respondents According to Occupation, Farming Experience and Farm Size (n = 433)

Variable	Frequency	Percentage
Farming experience		
1-5	182	42.03
6-10	210	48.50
11-15	37	8.55
16-20	3	0.69
21-25	1	0.23
Membership of cooperative society		
Yes	326	75.3
No	107	24.7

Source: Field Survey, 2025

Respondents' Access and Frequency of Extension Contact

The results in Table 5 revealed that most (93.1%) of the respondents had access to extension services, while only 6.9% reported no access. This shows that extension services were widely available to rice farmers in the study area. The results also disclosed that 34.9% of the respondents interacted with extension agents fortnightly while 19.9%, 15.5%, 13.4%, 9.0% and 7.4% had contact monthly, weekly, annually, quarterly, and semi-annually, respectively. This indicates that farmers not only had access but also maintained consistent interaction with extension services, which may have enhanced their awareness and understanding of ICT applications in farming. This is in line with the report of Oyeyinka and Bello, (2017) that frequent contact with extension agents increases farmers' access to information and improves awareness of ICT innovations.

Table 5: Distribution of the Respondents According to Access and Frequency of Extension Contact (n = 433)

Variable	Frequency	Percentage
Access to extension		
Yes	403	93.1
No	30	6.9
Frequency of extension contact		
Weekly	67	15.5
Fortnightly	151	34.9
Monthly	86	19.9
Quarterly	39	9.0
Semi-annually	32	7.4
Annually	58	13.4

Source: Field Survey, 2025

Sources of Information on Rice Production

The results in Table 6 show the various sources of information among the respondents in the study area in which the most prominent sources of information on rice production were extension agents and television, each accounting for 79.2% of the respondents. The results also showed that radio (73.2%), friends (67.2%), relatives (66.5%), and newspapers (63.5%) were other sources through which respondents sourced their information on rice production. Furthermore, 60.3%, 58.9% and 58.0% sourced information from NGOs, mobile phones and the internet. This shows that rice farmers in the study area accessed information through multiple channels, with extension agents and mass media standing out as the leading sources. This finding is in agreement with the report of Lawal *et al.* (2020) that multiple sources of agricultural information improve the reliability and accessibility of knowledge among farmers. Similarly, Olowu and Oyedokun (2021) reported that ICT-based platforms such as mobile phones and internet services are increasingly being utilized by farmers as



alternative channels of agricultural information, complementing the roles of extension and mass media.

Table 6: Distribution of the Respondents According to Sources of Information on Rice Production (n = 433)

Sources of information on rice production	Frequency	Percentage
Extension agents	343	79.2
Television	343	79.2
Radio	317	73.2
Friends	291	67.2
Relatives	288	66.5
Newspapers	275	63.5
NGOs	261	60.3
Handsets	255	58.9
Internet	251	58.0

Source: Field Survey, 2025

Respondents' Level of Awareness on ICTs

The results in Table 7 reveal respondents' level of awareness on ICTs in which majority (79.0%) of the respondents were aware of ICTs, while 21.0% reported no awareness. With regard to the levels of awareness, the results disclosed that more than half (54.0%) of the respondents had low awareness while 42.5% and 3.5% had medium and high awareness. This shows that although majority of the respondents were aware of ICTs, their knowledge and exposure remained generally low to moderate. This finding is in agreement with the report of Onyeneke (2017) that awareness is a prerequisite for the utilization of ICTs in agriculture while Mittal and Mehar (2019) stressed that higher awareness levels are positively correlated with ICT adoption and effective use.

Table 7: Distribution of the Respondents According to Level of Awareness on ICTs (n = 433)

Variable	Frequency	Percentage
Awareness on ICTs		
Yes	342	79.0
No	91	21.0
Level of Awareness on ICT		
Low	234	54.0
Medium	184	42.5
High	15	3.5

Source: Field Survey, 2025

Factors Influencing Level of Awareness on ICTs

The results in Table 8 reveal that age ($P < 0.005$), marital status ($P < 0.024$), household size ($P < 0.000$), educational level ($P < 0.017$), membership of cooperatives ($P < 0.019$), rice output ($P < 0.003$), and average income ($P < 0.050$) were the factors influencing awareness of ICT among rice farmers in the study area. The significance of these factors implies the complexity of socio-economic conditions that determine whether rice farmers become aware of ICTs and subsequently integrate them into their production practices. Age and education were found to be positive and significant determinants of ICT awareness. Older farmers, through accumulated experience and broader exposure to agricultural networks, were more likely to be ICT-aware, consistent with Deng *et al.* (2022), who reported that age enhances technology awareness through social interactions. Similarly, higher levels of education increased the likelihood of awareness, as literacy and cognitive skills help farmers understand and navigate ICT tools effectively. This finding supports Oyeyinka and Bello, (2017) that education improves farmers' capacity to comprehend and utilize modern agricultural innovations. On the other hand, marital status, household size, rice output, and cooperative membership were significant but negatively associated with ICT awareness. Married farmers, due to family responsibilities, were less likely to engage in ICT-related training, a result aligning with Okeke *et al.* (2020) that marital



obligations reduce flexibility for adopting innovations. Large household sizes limited ICT awareness as resources were stretched, corroborating Daudu and Okwoche (2021). However, cooperative membership enhanced awareness through group learning and training, consistent with Olowu and Oyedokun (2021). Additionally, income positively influenced ICT awareness, as wealthier farmers could afford ICT devices and services, a finding consistent with Fadairo (2020).

Table 8: Factors Influencing Level of Awareness on ICTs

Variables	Odd Ratio	Std. Error	z	P z
Age	1.159152	0.0613308	2.79	0.005***
Sex	2.725614	1.975428	1.38	0.167
Marital status	0.4038566	0.1620572	-2.26	0.024**
Household size	0.6540397	0.0765737	-3.63	0.000***
Educational level	1.720318	0.3920542	2.38	0.017**
Years of formal education	1.074262	0.0738782	1.04	0.298
Farming experience in Rice production	1.071682	0.1077678	0.69	0.491
Membership of cooperatives	0.2726921	0.1514678	-2.34	0.019**
Rice output	0.6936965	0.0840068	-3.02	0.003***
Average income	1.000002	1.10e-06	1.96	0.050**
Extension contacts	1.81914	2.31943	0.47	0.639
Cons	1.045042	2.406377	0.02	0.985

Source: Field Survey, 2025

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

Constraints to ICTs Awareness of the Respondents

The results in Table 9 reveal the various constraints of the respondents limiting ICT awareness in the study area. Majority (75.3%, 73.9%, and 73.0%) of the respondents reported that use of ICT in the study area were constrained by inadequate of ICT training centers and facilities, limited ICT, literacy among extension agents and Language barrier which were ranked 1st, 2nd, and 3rd, respectively. This shows that farmers lack accessible institutions and opportunities to acquire the necessary skills for ICT use. This finding is consistent with the report of Olowu and Oyedokun (2021) that inadequate training opportunities significantly reduce farmers' ICT awareness and subsequent adoption. Another challenge was limited ICT literacy. This indicates that even when farmers interact with extension workers, they may not receive adequate ICT guidance due to the workers' own limitations. This agreed with the report of Ezech 2021) who argued that extension staff's ICT competence strongly determines how well farmers become aware of and adopt such technologies.

Table 9: Distribution of the Respondents According to Constraints to ICTs Awareness

Constraints	Frequency*	Percentage	Ranking
Inadequate ICT training center and facilities	326	75.3	1 st
Limited ICT literacy among extension agents	320	73.9	2 nd
Language barrier	316	73.0	3 rd
Poor internet connectivity	310	71.6	4 th
Illiteracy	305	70.4	5 th
Inadequate technical know-how and training	305	70.4	5 th
Inadequate awareness on ICTs benefits in agriculture	305	70.4	5 th
Limited ICT support for women	303	70.0	6 th
High cost of ICT facilities/device	277	64.0	7 th
Erratic power supply	272	62.8	8 th
High cost of internet subscription	268	61.9	9 th

Source: Field Survey, 2025

*Multiple Response

The results further show that poor internet connectivity, illiteracy (71.6%), inadequate technical know-how and training (70.4%), and inadequate awareness of ICT benefits in agriculture (70.4%) were also constraints hindering the awareness on ICTs. These shows that both infrastructural



gaps and personal limitations interact to hinder farmers' ICT awareness. Similar findings were reported by Mittal and Mehar (2019) that poor connectivity and inadequate ICT knowledge were major bottlenecks to ICT use in rural agriculture. Other notable constraints include limited ICT support for women (70.0%), high cost of ICT devices (64.0%), erratic power supply (62.8%), and high cost of internet subscription (61.9%). These financial and infrastructural challenges underline the broader socio-economic and structural issues that continue to restrict ICT awareness in rural Nigeria. These align with the findings reported by Musa *et al.* (2020) that affordability and infrastructure are crucial determinants of ICT adoption in farming.

CONCLUSION AND RECOMMENDATIONS

The study concluded that age, marital status, household, educational level and membership of cooperatives were the factors that significantly influenced the level of awareness on ICTs among the respondents in the study area.

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

- i. Regular training programmes and capacity-building workshops should be organized for farmers to improve their ICT literacy and confidence in using digital tools.
- ii. Awareness campaigns and demonstrations should be conducted by extension workers to show farmers how ICT tools can support marketing, pricing, and farm record management.
- iii. Policy interventions should support affordable internet packages for farmers, possibly through special agricultural data bundles or group access schemes.
- iv. ICT platforms should be developed with localized, user-friendly content in local languages to ensure that farmers receive information relevant to their needs.
- v. Gender-sensitive ICT programmes should be designed to empower women farmers by addressing cultural, financial, and technical barriers that limit their usage.

REFERENCES

- Adesida, I. E., Nkomoki, W., Bavorova, M., & Madaki, M. Y. (2021). Effects of agricultural programmes and land ownership on the adoption of sustainable agricultural practices in Nigeria. *Sustainability*, **13**(13): 7249.
- Bauchi State Agricultural Development Program (BSADP) (2021). The structural designed of the ADP Bauchi state, Nigeria.
- Daudu, C. K., & Okwoche, V. A. (2021). Household size and adoption of agricultural innovations among smallholder farmers in Nigeria. *International Journal of Agricultural Extension*, **9**(2): 51–60.
- Deng, H., Jing, X., and Shen, Z. (2022). Internet technology and green productivity in agriculture. *Environmental Science and Pollution Research*, **29**(54): 81441-81451.
- Eze, E. I. (2021). Extension Agents' Use of Mobile Phone Applications for Agricultural Extension Service Delivery in Ebonyi State Agricultural Development Programme, Nigeria. *The Journal of Agricultural Extension*, **4**(2): 245-256.
- Fadairo, O. S. (2020). Farm income and ICT adoption among smallholder farmers in Nigeria. *Nigerian Journal of Rural Sociology*, **20**(1): 55–65.
<https://www.njrs.org/articles/2020/vol20no1/fadairo.pdf>
- Food and Agricultural Organization (FAO) (2020). Nigeria at a glance. Retrieved from <https://www.fao.org/nigeria/fao-in-nigeria/nigeria-at-a-glance/en/> On 23th February, 2023.
- Food and Agricultural Organization (FAO) (2022). Nigeria at a glance. Retrieved from <https://www.fao.org/nigeria/fao-in-nigeria/nigeria-at-a-glance/en/> On 23th February, 2023.
- Lawal, T., Ojo, T. O., & Baiyegunhi, L. J. S. (2020) Can mobile phones improve agricultural outcomes? Evidence from a randomized experiment in Niger. *World Development*, **135**, 105084. <https://doi.org/10.1016/j.worlddev.2020.105084>
- Mittal, M. & Mehar, U. (2022). ICT usage and agricultural productivity among arable crop farmers in South-west Nigeria. *Journal of Rural Studies*, **89**: 13–21.
<https://doi.org/10.1016/j.jrurstud.2021.11.015>



- Musa, F., Dauda, A., Abdulazeez, D. A., Baba, K., Shitu, S., and Adeyeye, M. M. (2019). Digital Entrepreneurship and E-Commerce in the Shea Butter Industry: Innovations in Agroforestry, Women's Cooperatives, and Climate-Smart Value Chains.
- National Population Commission, (2006). National population census 2019 projected data to 2020. <https://en.m.wikipedia.org.ng/adamawastate/bauchistate/bornostate/gombeststate/tarabastate/yobestate>
- Okeke, J. J., Kirui, O. K., Njiraini, G. W. and Gitonga, Z. M., (2020). Drivers of Use of Information and Communication Technologies by Farm Households: The Case of Smallholder Farmers in Kenya. *Journal of Agricultural Science*, **4**(2): 111-124
- Olowu, R. A., & Oyedokun, J. A. (2021). Role of farmers' cooperatives in promoting ICT adoption for agricultural productivity in Nigeria. *African Journal of Science, Technology, Innovation and Development*, **13**(6): 709–718. <https://doi.org/10.1080/20421338.2020.1788642>
- Onyeneke, O. A. Adetumbi, S. I. and Adereti, M. A (2017). Accessibility and relevance of information and communication technologies (ICTs) among cassava farmers in Nigeria, *African Journal of Agricultural Research*, **8**(35): 4514 – 4522.
- Oyeyinka R. A. and Bello R. O. (2017). Farmers Use of ICTs for Marketing Information Outlets in Oyo State, Nigeria. *Journal of Agricultural Science*; **5**(11): 156-159.
- Solaja, S. O., Ayorinde, K., Awe, T. E., Oriade, O., Ayojimi, W., Ojo, I., Nayan, G., Adedayo, R. A., Etta-Oyong, S. O., Olasehinde, F., Asemokhai, O., & Nsikak, I. (2024). Assessment of smallholder rice farmers' adaptation strategies to climate change in Kebbi State, Nigeria. *Heliyon*, **10**(15). <https://doi.org/10.1016/j.heliyon>
- Venkatesh, V. (2022). Adoption and use of AI tools: a research agenda grounded in UTAUT. *Annals of operations research*, **308**(1): 641-652.