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Impact of Information and Communication Technologies (ICTs) Usage on Maize Farmers Livelihood in Katsina State, Nigeria

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Abstract

This study was carried out to investigate the impact of usage of Information and Communication Technologies (ICTs) on maize farmers' livelihood in Katsina state, Nigeria. Specifically, the study described the socio-economic characteristics of the maize farmers, identify the type of ICTs used by the maize farmers, ascertain the frequency of ICTs usage by the maize farmers, determine the factors influencing ICTs usage by the maize farmers, assess the livelihood status of maize, examine the impacts of ICTs usage on maize farmers' yield and income and identify the constraints associated with the usage of ICTs among maize farmers. A multi-stage sampling technique was employed to select 401 maize farmers. Primary data were collected using questionnaire and analysed using descriptive and inferential statistics. The findings revealed that the mean age of maize farmers was 58 years and their most important source of information on maize farming was radio and mobile phone with mean score ($\bar{x} = 4.62$) while mean total yield in kg of maize farmers after usage of ICTs (105,732) was higher than that of before usage (60,190) and mean income of harvested by farmers was significantly higher after usage (₦ 52,774,905.86) than that of before usage (₦ 10,880,566.08). Tobit regression analysis showed that marital status ($\beta = 3.780587$; $p < 0.01$), farming experience ($\beta = -0.2988452$; $p < 0.01$); farm size ($\beta = 9.48E-08$; $p < 0.01$), farm income ($\beta = -6.77701$; $p < 0.01$), and access to credit ($\beta = 10.06963$; $p < 0.01$) were the factors that influence ICT usage, significantly influenced income and yield. The Pearson Product Moment Correlation analysis showed that sex, marital status, level of education, farming experience, farm size, farm income, access to credit and extension agent had significant relationships with the ICT usage. Major constraints limiting the usage of ICTs were lack of awareness of ICT tools ($\bar{x} = 2.25$), lack of ICT skills ($\bar{x} = 2.25$), high cost of acquiring ICT tools ($\bar{x} = 2.24$), poor network coverage ($\bar{x} = 2.24$), and irregular power supply ($\bar{x} = 2.24$). The study concluded that common ICT facilities used were radio, mobile phones, projectors and digital cameras. This research recommend that, government should establish the policies aimed at improving internet access, digital literacy, rural electrification, and affordability of ICT devices to enhance the effective utilization of modern agricultural information technologies that could lead to higher productivity and income.

Keywords: Impact, ICTs, Usage, Maize Farmers Livelihood

INTRODUCTION

Maize (*Zea mays L.*) belongs to a family (gramineae), and the most important cereal crop and one of the major food crops in Nigeria (Kamara et al., 2020). It originated from South and Central America and was introduced to West Africa by the Portuguese in the 10th century. It is the world's highest supplier of calories with the caloric supply of about 19.5%. It

provides more calories than rice (16.5%) and wheat (15.0%) (Agricdemy 2020). Maize is the most essential cereal crop in Sub-Sahara Africa (SSA), a vital staple food for more than 1.2 billion people in SSA and Latin America International Institute of Tropical Agriculture IITA (2023).

Maize is recognized as a major source of food and cash income among the predominantly small-holder farmers in

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Nigeria. It has evolved from a backyard crop in the 1970s to become the third most important, in terms of output and area cultivated, after sorghum and millet in the 1990s.

Nigeria is the Africa's second major maize producer after South Africa and the 14th highest producer of the crop worldwide. Maize production in Nigeria amounted to 11.2 Million Metric Tons (MMT) in 2024. This grew by about 2.0% to reach 11.4 Million Metric Tons (MMT) in 2025 within the observed period (Statista, 2026). According to Price Waterhouse Coopers

[PWC] (2023), maize is one of the most planted crops in Nigeria and it accounts for the biggest share of the country's best grain production. It is produced in almost all the geographical zones in Nigeria, however, the bulk of the country's maize production is concentrated in Borno, Niger, Plateau, Katsina, Gombe, Bauchi, Kogi, Kaduna, Oyo and Taraba states. These top ten maize producing states account for nearly two-thirds (64%) of maize produced in Nigeria (PWC, 2023). Funtua Local Government Area (LGA) of Katsina State, belonging to Zone II of the State ADP, acknowledged as the second largest producer of maize in the northwest after Lere Local Government Area (LGA) in Kaduna State, with an average annual growth rate of 7.29% (knoema.com.agric.data. 2022). In the same perspective, Malunfashi Local Government Area (LGA) under the previously mentioned Zone is the fourth major maize producing area in the state (KTARDA, 2021).

All parts of the crop are utilized for food and non-food products. Maize accounts for 30 – 50% of low household expenditures in Africa. Over 30% of the caloric intake of people in SSA comes from maize based on which many African countries depend on maize as a staple food crop. It consumed as a major source of carbohydrate and it is rich in fiber and other nutrients (IITA, 2023). Over the years, the International Institute of Tropical Agriculture (IITA) has the National mandate in maize production in collaborations with the Institute for Agricultural Research and other partners. This institute have developed improved maize varieties such as; 2000 SYN EE (white), ACR 95 TZE COMP 5 W (white), EV 99 DT W STR (SAMMAZ 27) (white) and 99 TZEE Y STR (yellow). With attributes such as high grain and yields, resistance to major insects, pests and diseases, with accompanying recommended practices disseminated to farmers through the (ADPs) extension agents (Kamara et al., 2020).

However, drastic changes in rainfall patterns and rise in temperatures have introduced unfavourable growing conditions into the cropping calendars thereby modifying growing seasons which consequently affect crop productivity. These changes affect food prices, food security, land use and subsequently caused uncertainty for crop managers (Tumbo, et al., 2020). According to Taghavifard et al. (2020), the severity of climate change impact depends on the degree of adaptation at the farm level, farmers' investment decisions and policy choices, though; these factors are interrelated and negatively affect the quantity of output in most times. Climate

change such as extreme weather, unexpected temperature and rainfall fluctuations cause several significant risks to the agro-economy (Ojo and Baiyegunhi 2020).

However, ICT consists of the increasing communication between the different maize farmers of the world unifying their societies, cultures and markets, through a series of transformations at a global level (Mysore et al., 2019). Communications and computing is the engine of global ICT, since the advances in computing and electronic elements used for communications have been admirable in the maize production (Togola et al., 2019).

ICTs are part of the technological culture, since they help advance maize farming. These give us great advantages, because they are fast processors of viable information for our knowledge, they contain a large amount of data in their storage base and we can communicate with various information programmes (Malmodin and Lundén, 2018). ICTs feel the births of scientific knowledge as part of the evolution in socioeconomic development thus modifying the value system. This technology has managed to grow and grow in all areas and strata of society, each time with more advanced and new technologies that can be easily accessed on maize production (Orji et al., 2020)

As technologies are increasingly present in all spheres of human life, ICTs are playing a key role in agriculture especially maize production by enhancing innovation, knowledge sharing, and productivity. Relying mostly on mobile technologies, digital applications for agriculture are providing farming information via text messages and online multimedia contents to agricultural agencies, researchers, and farmers. Advanced technologies such as aerial images from civilian drones and satellites, weather forecasts, and soil data are shared with farmers providing them with information on crop growth and planting conditions (Agbebi et al., 2021).

Indeed in sub-Saharan Africa, one of the mobile telecommunication devices that is the Global System for Mobile Communication (GSM) has been witnessing largest patronage within the farming families, the impact of the maize farmers, in general, is increasingly visible, and we find ourselves in a permanent state of transformation and improvement due to the dizzying proliferation of technologies (Taghavifard et al., 2020). In the same context, Adam et al. (2020) pointed out that (ICTs) in agriculture, just like in the other field of knowledge has been gaining popularity in Africa, during the last two decades; as the continent witnessed an unprecedented growth in the area of (ICTs). Affirmatively, many Africans in various sectors of agriculture inclusive have now own and use ICT devices such as computers, tablets and mobile phones among others for a variety of uses from personal communication to market intelligent.

In Nigeria, prior to the year 2000, ICTs use was primarily limited to radio, television and landline telephones, whereas, the country made the ICT sector reform in 2001, with a full liberalization of telecoms industry (Sennuga, 2020).

Accordingly, ICTs in agriculture has received prominence among which is the application of E-wallet system technology that ensure maize farmers to receive farm input subsidy support from FGN via accredited agro-allied dealers, provides vital agro-information alerts, and facilitate micro lending and insurance scheme (Uduji et al., 2019). Precision maize farming, which adopt measures and analyses soil properties such as temperature, nutrients, and vegetative health to help maize farmers apply the right fertilizers and to optimally irrigate their farms. In addition, Zenvus' digital services offer tailored advice to farmers on what, when, and how to plant, and allows them to view real-time crop prices (Uduji et al., 2019).

MATERIAL AND METHODS

Description of the study area

The study was carried out in Katsina State, Nigeria. The state, is located in the North West Geo-Political Zone of Nigeria with its capital in Katsina with 34 LGAs Katsina State is bounded to the East by Kano and Jigawa States, to the West by Zamfara State, to the South by Kaduna State and to the North by the Niger Republic. The projected population of the state was put at 11,565,586 in 2025 from the 2006 figure of 5,792,578 at a growth rate of 4.0 percent per annum (NPC, 2006). Katsina State occupies 24,192 square kilometers of land and is located between latitudes 11°07'49" and 13°22'57"N and longitudes 6°52'03" and 9°20'00"E. in north western Nigeria. Katsina state can be classified into two climatic zones; tropical continental and semi-arid continental (Adamu, 2000). The southern part of the state (from Funtua to Dutsin-ma) is located in the former zone with total annual rainfall figures ranging from 1000mm around Funtua to over 800mm around Dutsin-ma. The north of Katsina state (from around Kankia to the extreme north-east) has total rainfall figures ranging from 600-700mm annually. Generally, climatic conditions in the state vary considerably according to months and seasons. Thus, the state experiences a cool dry (Harmattan) season from December to February; a hot dry season from March to May; a warm wet season from June to September; and a less marked season after rains during the month of October to November, characterized by decreasing rainfall and gradual lowering of temperature (Adamu, 2000). Katsina State has agriculture as the mainstay of its economy with the production of varieties of cash crops throughout the year. The state is predominantly agrarian with majority of the population actively involved in farming. The two major ethnic groups in Katsina State are Hausa and Fulani. Likewise, the men from these two ethnic groups are the major maize producers in the state. Other food crops produced within the study area apart from maize include sorghum, millet, rice, soya bean, cassava and cowpea. Maize occupies a dominant position among cereals crops grown in Katsina State. Farmers in the state cultivate maize as sole crop in the field or as intercrop with others such as sorghum, millet and cowpea. Katsina State is one of the major maize producers and it is ranked among 5 major states of maize production in Nigeria, (Katsina State Promotion Agency, 2023).

Sampling Technique and Sample Size

The population of the study consisted of all maize farmers' in Katsina State. Multi-stage sampling technique was used to select the sample for this study. The first stage involved a selection of Funtua, Dutsin-ma and Ajiwa agricultural zones. This is because of the high concentration of maize producers based on the data obtained from KTARDA to had full representation of maize farmers. The second stage involved a random selection of seven (7) Local Government Areas from the selected zones notable for intensive maize production. In this regard, Danja, Bakori, Malumfashi, Dutsin-ma, Matazu, Batagarawa and Charanchi were selected; because of the prevalence of maize production in the areas. The third stage involved the purposive selection of two (2) major maize-producing communities from each of the seven (7) Local Government Areas. In the fourth stage, the list of the registered maize farmers was obtained from Katsina State Agricultural Development Authority in Katsina states to determine the sample size from each community while Taro Yamane's (1973) formula was used in computing the proportionate sample size for the study. The formula is stated as follows:

The total number of the registered maize farmers sample are : 7,737.

$$n = N / 1 + N (e)^2 \dots \dots \dots \text{equation (1)}$$

Where n = required sample size, N = number of maize farmers obtained from the list of registered maize farmer in each community; and e = permissible error (0.05). Substituting the values of N and e into Equation 1, we have:

$$n = 7737 / 1 + 7737 (0.05)^2$$

$$n = 7737 / 19.345 = 401 \text{ (Members of maize farmers)}$$

Maize Farmers from each community were selected randomly and proportionately using the expression below;

$$x = (X/n) * N \dots \dots \dots \text{equation (2)}$$

Where;

x = Sample size per community

X = Number of registered maize farmers per community

n = Total number of registered maize farmers in three Zones

N = required sample size for the study (from Taro Yamane's 1973 formula)

The selected Zones, Local Government Areas, communities and number of sampled maize farmers from each community is presented in Table 1 below.

Table 1: Sample size of the Maize farmers

Zones	Selected LGAs	Selected communities	Sample Frame	Sample Size
Funtua	Malumfashi	Malumfashi B	900	47
		Ruwansanyi	600	31
	Dandume	Tumburkai	900	46
		Mahuta	960	50
	Danja	Jiba	720	37
		Kahutu	600	31
Dutsin-ma	Dutsin-ma	Makera	475	25
		Turare	438	23
	Matazu	Mazoji	326	17
		Sayaya	347	18
Ajiwa	Batagarawa	Ajiwa	451	23
		Dandagoro	332	17
	Charanchi	Koda	343	18
		Doka	345	18
Total	7	14	7,737	401

Source: Reconnaissance survey and Author's computation (2025). List of maize farmers' was obtained from KTARDA.

Data collection

The study used primary data which was collected using a structured questionnaire. A total of 401 questionnaires were administered to the sampled maize farmers by seven (7) trained enumerators. The data collected include information on the socioeconomic variables of the maize farmers, type of ICTs used by the maize farmers, frequency of ICTs usage, factors influencing ICTs usage by the maize farmers.

Data Analysis

The data was analyzed using analytical tools such as Tobit Regression Model Z-test Statistic Livelihood index (SLI).

Tobit Regression Model

The Tobit Regression Model is a quantitative measurement tool that aims to determined factors influencing ICTs usage among maize farmers. This is expressed as percentage of the optimum usage; thus the dependent variable must be between 0 limit and continuous level of the usage of information and communication. Tobit Regression Model is estimated through the Maximum Likelihood Estimation (MLE) procedure. It is specified as:

$$Y_i = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + e$$

Where:

Y_i = ICTs usage by the maize farmers

X_1 = Age (years)

X_2 = Sex (1 = male, 0 = female)

X_3 = Marital Status (Dummy = 1 if married; 0, if otherwise)

X_4 = Household Size (number)

X_5 = Educational Level (years)

X_6 = Farming Experience (years)

X_7 = Farm Size (hectares)

X_8 = Quantity of maize Produced (Naira)

X_9 = Access to ICTs (Yes=1, No= 0)

X_{10} = Access to Farm input (Yes=1, No= 0)

X_{11} = Extension Agent Contact (Yes=1, No= 0)

X_{12s} = Membership of Cooperative (Yes=1, No= 0)

e = error term

Tobit regression estimates results of the socio economic factors influencing ICT usage among maize farmers. The Tobit model was appropriate because ICT usage was measured as a censored dependent variable. The model was statistically significant at 1% level (LR Chi² = 288.11; $p < 0.001$), indicating that the explanatory variables jointly influenced ICT usage by the farmers. The pseudo R² value of 0.1018 suggests that approximately 10.18% of the variation in ICT usage was explained by the variables included in the model. The twelve items to determined are:

- What is your age by years?
- What is your sex?
- What is your marital status?
- What is your house hold size?
- What is your highest level of education?
- How long have you been planting maize?
- What is the Size of your maize field in 2025 cropping season?
- How many bags (100kgs) of maize did you harvest in 2025 cropping seasons?
- How many bags (100kgs) did you sell in 2025 cropping seasons?

- x. How much did you sell a bag (100kgs) of maize in 2024 cropping seasons?
- xi. What is the total income received from the sales of maize in 2024 cropping seasons?
- xii. Did you obtain credits for your farm activities in the last cropping season?
- xiii. Were you visited by any extension agent during the last cropping season?
- xiv. Do you belong to any social organization/farmers association (s)?
- xv. Which types of information and communication technology (ICT) facilities do you use in maize production??
- xvi. How frequent do you use information and communication technology (ICT) facilities?

RESULTS AND DISCUSSION

Socio economic Characteristics of Maize Farmers

Table 2 presents the socio-economic characteristics of the maize farmers in the study area. Socio-economic characteristics are important because they influence farmers' access to information, adoption of innovations, productivity, and utilization of ICT facilities.

Age of the maize farmers

The finding revealed that the mean age of farmers was 58 years, with 34.4% falling within the age bracket of 51–60 years, followed by 41–50 years (32.6%). This indicates that maize farming in the study area is dominated by middle-aged and elderly farmers. The predominance of older farmers suggests that they possess substantial farming experience and accumulated indigenous knowledge. However, advanced age may reduce willingness to adopt new technologies, including ICT-based agricultural innovations. This finding agrees with Oyetunde et al. (2023), who reported that age significantly influences adoption of improved maize technologies among farmers in Nigeria, with older farmers often relying on established farming practices. Furthermore, Ezike et al. (2024), found that age remains an important determinant of maize production decisions among smallholder farmers in Nigeria.

Sex of the maize farmers

With reference to the sex of the maize farmers, the findings showed that 97.0% of them were male, while only 3.0% were female. This implies that maize productions in the study area are predominantly undertaken by men. The dominance of males may be attributed to cultural norms, land ownership structures, and the labour intensive nature of maize production. The finding is consistent with Fawole et al., (2024) who reported that male farmers constituted over 90% of maize farmers in Kaduna State, Nigeria. Similarly, Ezike et al. (2024), found that maize farming in Nigeria is largely dominated by male household heads due to their greater access to productive resources.

Marital status

The findings indicate that 88.3% of the maize farmers were married, while only a small proportion (9.2%) were single, widowed, or widowers. The high proportion of married farmers suggests the availability of family labour, which can contribute positively to farm productivity and technology utilization. Married farmers often have greater economic responsibilities, motivating them to seek productivity-enhancing innovations. This finding agrees with Adeyemi et al. (2023), who reported that married farmers are more likely to participate in agricultural innovations because of their household responsibilities and need for increased income.

Household size

The finding also shows that the mean household size of the farmers was 10 persons, indicating relatively large households among the maize farmers. About 32.4% of the farmers had household sizes between 1 and 5 persons, while a substantial proportion had household sizes exceeding 10 members. Large household sizes provide family labour for farming activities and reduce dependence on hired labour. The finding corroborates with Fawole et al. (2024), who reported that maize farmers in Kaduna State generally maintain large household sizes which serve as an important source of farm labour. Similarly, Ezike et al. (2024) found that household size positively contributes to maize production through increased labour availability.

Education attainment

The findings revealed that 35.4% of the farmers had secondary education, 28.5% had primary education, and 13.7% had tertiary education, while only few (18.5%) had no formal education. This implies that most of farmers possessed some form of formal education, which may facilitate understanding and adoption of ICTs based agricultural information. Education enhances farmers' ability to access, interpret, and utilize information effectively. The finding agrees with Onwuaroh et al. (2024) who reported that educational attainment significantly influences the adoption of improved maize production technologies among farmers in Gombe State, Nigeria. Similarly, Osabohien, (2024) found that education positively influences ICT adoption in the agricultural sector.

Farming experience

Finding in Table 2 also revealed that the average farming experience of the maize farmers was 22 years, with 43.6% having between 11 and 20 years of farming experience and 34.4% having between 21 and 30 years. This suggests that the farmers were experienced farmers with substantial practical knowledge of maize production. Experienced farmers are generally better positioned to evaluate agricultural innovations and make informed production decisions. This finding is consistent with Ezike et al. (2024), who reported that farming experience significantly contributes to maize production efficiency among smallholder farmers.

Farm Size

With respect to farm size, the mean farm size was 4 hectares, and 92.5% of them cultivated between 1 and 5 hectares. This

indicates that the majority of them were smallholder farmers. The finding also supports of Ezike et al. (2024) who reported that most maize farmers in Nigeria cultivate relatively small landholdings ranging between 2 and 5 hectares. Similarly, Oyetunde et al, (2023), observed that small farm size remains a defining characteristic of maize farming systems in Nigeria.

Income

For farm income, 45.3% of the farmers earned less than ₦5,000,000 annually, while 41.3% earned between ₦5,000,001 and ₦10,000,000. ($\bar{x} = 62244.22$) this suggests moderate income levels among maize farmers. Farm income plays a critical role in determining farmers' capacity to invest in improved technologies and ICT facilities. This finding is in line with Ayanwale et al. (2023), who reported that income significantly influences farmers' participation in agricultural innovation platforms and technology adoption.

Access to Credit

The finding also showed that only 11.2% of the maize farmers had access to credit, while 88.8% lacked access to credit facilities. This indicates poor financial inclusion among maize farmers and may limit their ability to purchase ICT devices, farm inputs, and improved technologies. The finding agrees with Fawole et al. (2024) who reported that a large proportion

of maize farmers in Kaduna State lacked access to formal credit. Similarly, Afolami et al. (2023) found that access to credit significantly influence technology adoption and productivity among maize farmers in Nigeria.

Extension Contact

Furthermore, slightly above half (52.6%) of the maize farmers had contact with extension officers, while 47.4% had no contact. Extension services play an important role in disseminating agricultural information and promoting technology adoption among farmers. This finding is consistent with Afolami et al. (2023) who reported that extension contact significantly influences farmers' adoption of improved maize varieties and agricultural innovations.

Cooperative Membership

The findings revealed that majority (84.7%) of the maize farmers belonged to cooperative societies, indicating a high level of participation in farmer organizations. Cooperative membership provides farmers with opportunities for information sharing, access to credit, input procurement, and collective marketing. This finding agrees with Kehinde et al. (2024), who reported that participation in farmer associations and social capital networks significantly enhances farmers' productivity and access to agricultural information.

Table 2: Distribution of Maize Farmers According to their Socio-economic characteristics

Variables	Frequency	Percentage	Mean (401)
Age (Years)			
21-30	33	8.23	58 years
31-40	99	24.69	
41-50	131	32.6	
51-60	138	34.41	
Sex			
Male	389	97.0	
Female	12	3.0	
Marital Status			
Single	37	9.2	
Married	355	88.3	
Widow	8	2.0	
Widower	1	0.2	
Household size (people)			
1-5	137	34.17	10 person
6-10	109	27.19	
11-15	95	23.69	
16-20	60	14.96	
Educational Level			
No formal education	74	18.5	
Primary education	115	28.5	
Secondary education	142	35.4	
Tertiary education	55	13.7	

Vocational	15	3..7	
Farming Experience (Years)			
1-10	52	12.97	22 years
11-20	175	43.64	
21-30	138	34.41	
31-40	36	8.98	
Farm Size (Hectare)			
1-5	371	92.52	3 hectares
6-10	24	5.99	
11-15	6	1.50	
Farm Income (₦)			
₦ ≤5000000	158	45.27	₦ 62244.22
₦ 5000001- ₦ 10,000000	144	41.26	
₦ 10,000001- ₦ 15,000000	37	10.60	
₦ 15,000001- ₦ 20,000000	1	0.29	
₦ >20,000000	9	2.58	
Access to credit			
Had access	45	11.2	
No access	356	88.8	
Extension contact			
Had contact	211	52.6	
No contact	190	47.4	
Membership of cooperative association			
Members	337	84.70	
Non members	61	15.30	

Source: Field Survey, (2026)

Types of ICT Facilities Used by the Maize Farmers

Figure 1 presents the various ICT facilities used by maize farmers in the study area. The findings indicate that they used a wide range of ICT tools for accessing agricultural information, communication, and knowledge sharing. The most commonly used ICT facilities were radio (95.8%), mobile phone (90.5%), projectors (84.5%), and digital cameras (84.3%). In contrast, relatively low proportions of maize farmers reported using email (19.5%), computers (16.7%), television (14.5%), internet (13.0%), and print media (11.5%).

The findings further show that radio was the most widely used ICT facility among the maize farmers with 95.8% reporting its usage. This suggests that radio has been an important channel for agricultural information dissemination. However, their high usage in this study may indicate dependence on conventional mass media channels in some rural communities. This finding agrees with Mapiye et al. (2023), who reported that radio remained one of the most accessible agricultural communication tools among rural farmers in Africa.

Mobile phone emerged as the second most used ICT facility, with 90.5% of maize farmers indicating its usage. This high level usage of the device suggests that farmers increasingly rely on digital messaging platforms for information exchange, networking, and access to agricultural advisory services. Mobile phone allows farmers to receive timely updates on weather conditions, pest outbreaks, input availability, and market opportunities. This finding is consistent with Elkassim et al. (2024), who reported that digital communication platforms significantly improve information dissemination and knowledge sharing among farmers in Northern Nigeria. Likewise, Tsan et al. (2024), reported that messaging applications are becoming increasingly important tools for agricultural extension and farmer-to-farmer communication across Sub-Saharan Africa. The finding corroborates with Aker and Blumenstock (2024), who reported that mobile phones are the dominant ICT tools among smallholder farmers in Africa because they facilitate access to market information, extension and financial services.

Furthermore, the high usage of projectors (84.5%), and digital cameras (84.3%) suggests that audiovisual and storage technologies play important roles in agricultural information

management among farmers. These tools facilitate the storage, transfer, and presentation of agricultural knowledge, particularly during training programmes and extension activities. This finding supports Ibrahim et al. (2025), who observed that audiovisual extension technologies significantly improve farmers' understanding and adoption of improved agricultural practices. Similarly, Aker (2023) noted that multimedia-based agricultural information systems enhance learning outcomes among rural farmers because they simplify complex agricultural messages.

The finding also revealed that only few (14.5%) of maize farmers used television in their activities. Traditionally television has been important channels for agricultural information dissemination. However, their low usage in this study may indicate a gradual shift towards more interactive and personalized digital communication platforms. This finding differs from the observations of Mapiye et al. (2023), who observed that radio remained one of the most accessible agricultural communication tools among rural farmers in Africa. However, World Bank (2024) reported that the emergence of digital communication technologies is gradually reducing dependence on conventional mass media channels in some rural communities.

The relatively low usage of computers (16.7%), internet (13.0%), and print media (11.5%) suggests that farmers have limited access to advanced digital technologies. The low usage levels may be attributed to poor digital literacy, inadequate internet infrastructure, high data costs, and limited access to digital devices. This finding agrees with Tsan et al. (2024), who identified poor connectivity, low digital skills, and affordability constraints as major barriers to digital technology adoption among smallholder farmers in Sub-Saharan Africa. Similarly, World Bank (2024) reported that although internet penetration is increasing across Africa, significant digital devices persist between urban and rural populations.

Figure 1: Distribution of Maize Farmers According to Types of ICT Facilities Use

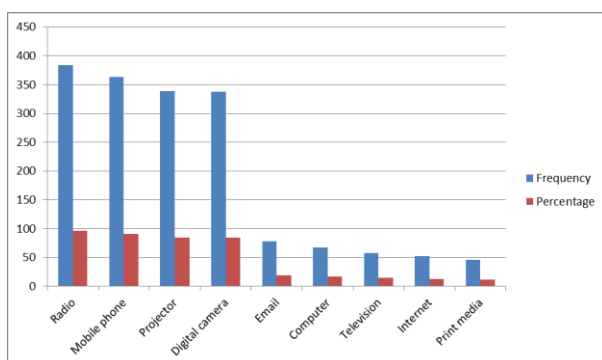


Table 3. : Distribution of Maize Farmers According to Frequency of ICT Facilities Usage (401)

(ICT) Facilities	Daily	Weekly	Fortnightly	Monthly	Never	Mean	Ranking
Mobile phone	352(87.8)	9(2.2)	5(1.2)	6(1.5)	29(7.2)	4.62	1 st
Radio	323(80.5)	37(9.2)	19(4.7)	11(2.7)	11(2.7)	4.62	1 st

Source: Field Survey, 2026

Frequency of ICT Facilities Usage by the Maize Farmers

Table 3 presents the frequency with which maize farmers used various ICT facilities. The findings revealed that mobile phone ($\bar{x} = 4.62$) and radio ($\bar{x} = 4.62$) were the most frequently used ICT facilities among maize farmers, ranking first. Specifically, 87.8% of the maize farmers reported using mobile phone daily, while 80.5% used radio daily. This suggests that these communication channels serve as the primary sources of agricultural information among farmers in the study area. The frequent use of mobile phone may be attributed to its ability to facilitate rapid dissemination of information, while radio remains relevant because it is relatively affordable and accessible to rural farmers. The finding agrees with Afolabi et al. (2024) who reported that maize farmers in Nigeria increasingly utilize digital communication platforms and smart media tools to access agricultural information and extension messages. Similarly, Elkassim et al. (2024), reported that digital communication platforms significantly enhanced access to agricultural knowledge, timely information sharing, and decision-making among farmers in Kaduna State.

Digital cameras ($\bar{x} = 4.35$), and projectors ($\bar{x} = 4.33$) were also frequently used. The high frequency use of these devices indicates that farmers rely on audiovisual materials for learning improved agricultural practices. These technologies facilitate storage, retrieval, and transfer of agricultural information and training materials. This finding corroborated with Ibrahim et al. (2025) who reported a high adoption rate of e-extension tools among maize farmers in Kaduna State because of their usefulness in accessing agricultural information and improving productivity.

Conversely, computers ($\bar{x} = 2.50$), email ($\bar{x} = 2.07$), internet ($\bar{x} = 2.05$), television ($\bar{x} = 1.95$), and print media ($\bar{x} = 1.78$) recorded relatively low frequencies of usage. The low usage of internet-based technologies may be associated with poor digital literacy, inadequate internet infrastructure, and the high cost of internet services in rural areas. This finding is consistent with Ajayi and Soyibo (2023) who reported that computer-based technologies and internet services were less utilized among arable farmers because of limited knowledge and inadequate access to digital facilities.

Digital camera	326(81.6)	4(1.0)	10(2.5)	8(2.0)	53(13.2)	4.35	3 th
Projector	323(80.5)	7(1.9)	5(1.2)	11(2.7)	55(13.7)	4.33	4 th
Computer	47(11.7)	42(10.5)	45(11.2)	198(49.4)	69(17.2)	2.50	5 th
Email	13(3.2)	10(2.5)	32(8.0)	285(71.1)	61(15.2)	2.07	6 th
Internet	17(4.2)	9(2.2)	39(9.7)	250(62.3)	86(21.4)	2.05	7 th
Television	66(16.5)	2(0.5)	4(1.0)	101(25.2)	228(56.9)	1.95	8 th
Print media	8(2.0)	23(5.7)	31(7.7)	149(37.2)	190(47.4)	1.78	9 th

Source: Field Survey, (2026); figures in parenthesis are percentages

Factors Influencing ICTs Usage among Maize Farmers

Table 4 presents the Tobit regression estimates results of the socio economic factors influencing ICT usage among maize farmers. The Tobit model was appropriate because ICT usage was measured as a censored dependent variable. The model was statistically significant at 1% level (LR Chi² = 288.11; $p < 0.001$), indicating that the explanatory variables jointly influenced ICT usage by the farmers. The pseudo R² value of 0.1018 suggests that approximately 10.18% of the variation in ICT usage was explained by the variables included in the model. Although the explanatory power appears modest, it is acceptable in studies involving human behaviour and technology adoption.

Marital status had a positive and highly significant influence on ICT usage ($\beta = 3.780587$; $p < 0.01$). This indicates that married farmers were more likely to use ICT facilities than unmarried farmers. Married farmers often have greater household responsibilities and stronger incentives to seek agricultural information that can improve productivity and household welfare. This finding is consistent with Amoako et al. (2024), who reported that married farmers tend to be more active users of agricultural information technologies because of their need to improve household income and food security. Similarly, Manda and Benos (2023) found that family responsibilities encourage greater participation in information-seeking behaviours among rural households.

Farming experience had a negative and significantly influenced ICTs usage ($\beta = -0.2988452$; $p < 0.01$). This implies that farmers with more years of farming experience were less likely to use ICT facilities. A possible explanation is that highly experienced farmers tend to rely on indigenous knowledge and traditional information sources rather than modern communication technologies. This finding agrees with Fabregas, Kremer, and Schilbach (2024), who reported that experienced farmers often rely on established practices and may be slower to adopt new information technologies. Similarly, Tsan et al. (2024) observed that older and more experienced farmers frequently exhibit resistance to digital innovations.

Farm size had a positive and significant influenced on ICTs usage ($\beta = 9.48E-08$; $p < 0.01$). This indicates that farmers operating larger farms were more likely to use ICT facilities. Large-scale farmers often require more information on production, marketing, and farm management, making ICTs valuable decision-support tools. The finding supports Amoako et al. (2024), who reported that farm size positively influences digital technology adoption because larger farms have greater information needs and stronger incentives to improve efficiency. Likewise, Tsan et al. (2024) found that larger farms are more likely to invest in digital agricultural technologies.

Farm income had a negative and highly significant coefficient ($\beta = -6.77701$; $p < 0.01$). This finding suggests that higher farm income was associated with lower ICT usage among farmers. Although this relationship appears counterintuitive, it may indicate that some high-income farmers rely on established market networks and traditional sources of information rather than ICT tools. The finding differs from Amoako et al. (2024) and Ma et al. (2024), who reported positive relationships between income and digital technology adoption. The discrepancy may reflect local contextual factors or the specific nature of ICT facilities usage in the study area.

Access to credit had a positive and highly significant effect on ICT usage ($\beta = 10.06963$; $p < 0.01$). This indicates that farmers who had access to credit were more likely to use ICT facilities. Credit improves farmers' ability to acquire ICT devices, pay for internet services, and participate in digital agricultural programmes. This finding agrees with Amoako et al. (2024), who found that financial access significantly enhances digital technology adoption among smallholder farmers. Similarly, World Bank (2024) emphasized that access to rural finance is a critical prerequisite for digital agricultural transformation.

Finally, Tobit regression results indicate that marital status, farming experience, farm size, farm income, and access to credit were the major determinants of ICT usage among maize farmers. Among these variables, access to credit emerged as the most influential factor, highlighting the importance of financial inclusion in promoting digital agriculture.

Table 4: Tobit Regression Results of the relationship between Socio-economic and Factors Influencing ICTs Usage

Variables	Coefficient	Standard error	t-value	P- value
Sex	2.789568	1.810811	1.54	0.124
Age	0.0661687	0.0546422	1.21	0.227
Marital status	3.780587***	0.9905542	3.82	0.000
Monthly income	0.1037457	0.0739279	1.40	0.161
Level of Education	-0.1070692	0.066275	-1.62	0.107
Farming Experience	-0.2988452***	0.0959728	-3.11	0.002
Farm Size	9.48e-08***	3.55e-08	2.67	0.008
Farm Income	-6.77701***	0.995201	-6.81	0.000
Access to Credits	10.06963***	0.5957865	16.90	0.000
Extension Agent Visit	2.371631	2.623916	0.90	0.367
Constant	0.2053204	3.803973	0.05	0.957
/sigma	5.777999	0.2044476		
Number of observations	401			
LR Chi2 (10)	288.11			
Prob > Chi2	0.0000			
Log likelihood	-1270.6742			
Pseudo R ²	0.1018			

Source: Field Survey, 2026.

*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level.

LR = Likelihood Ratio.

Conclusion

This study concludes that, the Information and Communication Technology ICT facilities used were radio, mobile phones, projectors and digital cameras. Moreover, the use of such facilities in maize farming was revealed the overall livelihood status showed that all the maize farmers fell within the low level livelihood status, while none were classified as having very low, medium, or high livelihood status. Nevertheless, marital status, farming experience, farm size, access to credit and farm income was significantly had impact relationship with the level of ICTs usage. The usage of ICTs had positive and significant effect on the yield and income of the maize farmer in the study area.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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