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Assessment of Information and Communication Technologies use among Soyabean Farmers in Tarka Local Government Area of Benue State, Nigeria

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Abstract

This study assessed the use of Information and Communication Technologies among soya bean farmers in Tarka Local Government Area of Benue State, Nigeria. A total of 120 respondents were surveyed using a structured questionnaire, and data were analyzed descriptive statistics and logistic regression. Results showed that most farmers were middle-aged ($\bar{X}$ =44.13 years), and accessing weather information ($\bar{X}$ = 3.15) were sourced from agricultural information. Findings revealed most severe constraints identified in poor network coverage (95.8%), lack of electricity (95.0%), poor literacy levels (91.7%), and lack of relevant agricultural content (86.7%). The model shows that level of education (p = 0.000), marital status (p = 0.041), and occupation (p = 0.000) are the strongest and statistically significant determinants of ICT use among farmers. The study concludes that there was high level of information communication technologies among soya bean farmers in the study area. It recommends government should provide quality roads for easy access and transportation of network tools for enhance coverage.

Keywords: Assessment, Information, Communication, Technology and Farmers

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INTRODUCTION

Agriculture continues to serve as the fundamental pillar of rural livelihoods and economic stability in Benue State, Nigeria, where more than 75% of the population is engaged in farming activities. Within this agrarian economy, soybean constitutes one of the major cash crops of strategic importance (Wikipedia Knowledge Base, 2023). Tarka Local Government Area (LGA), situated within the fertile Benue River basin, plays a substantial role in the state's soybean production landscape. However, despite its comparative advantage in agro-ecological endowment, productivity levels remain suboptimal. This limitation has been largely attributed to the low adoption of modern agricultural technologies and inadequate access to timely and reliable agricultural information systems (Adebayo, Coker & Tsavhemba, 2018; Agada, 2010).

In contemporary agricultural development discourse, information and communication technologies (ICTs)—including mobile telephony, radio, internet-based platforms, and other digital communication tools—have been widely acknowledged as critical enablers of agricultural transformation. These technologies enhance knowledge dissemination, facilitate access to inputs and market intelligence, and strengthen systems for delivering extension services (Food and Agricultural Organization (FAO), 2024). In the Nigerian context, digital agricultural innovations, commonly referred to as e-agriculture, have demonstrated considerable potential in bridging informational gaps between smallholder farmers and relevant agricultural resources (Ayim, Kassahun, Tekinerdogan & Addison, 2020).

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Notwithstanding these advancements, empirical evidence from Benue State indicates that the potential benefits of ICT adoption among soybean farmers remain largely underexploited. This situation is exacerbated by structural and systemic constraints, including unreliable electricity supply, pervasive poverty levels, and weak agricultural extension infrastructure (Agada, 2010). These challenges collectively impede effective utilisation of ICT tools and limit their transformative impact on agricultural productivity.

Understanding these interrelated dynamics is therefore essential for the formulation of targeted policy interventions aimed at strengthening ICT-enabled agricultural extension systems, improving access to agricultural resources, and enhancing productivity outcomes. In agriculturally significant regions such as Tarka LGA, such interventions are critical not only for improving household income but also for advancing broader goals of food security, rural transformation, and sustainable agricultural development.

Consequently, this study addresses an existing empirical gap by examining the level of ICT uptake and utilisation among soybean farmers in Tarka LGA. By analysing the interaction between ICT usage and key socio-economic and technological determinants, the study seeks to identify both enabling and constraining factors influencing agricultural innovation adoption. The findings are expected to provide evidence-based insights that will support digital inclusion strategies and accelerate the integration of modern agricultural practices within rural farming systems in Nigeria.

Objectives of the Study

The broad objective of this study is to assess Information and Communication Technology (ICT) use among soybean farmers in the Tarka Local Government Area of Benue State, Nigeria.

Specifically, the study seeks to:

i. Describe the socio-economic characteristics of respondents in the study area.

ii. Identify ICT platforms commonly accessed by soybean farmers in Tarka LGA.

iii. Ascertain the frequency of ICT tool usage in accessing agricultural information.

iv. Examine the factors influencing the use of ICT tools among farmers in the study area.

v. Identify the constraints limiting farmers' use of ICT tools in the study area.

Hypothesis

H_0: Socio-economic characteristics of farmers have no significant effect on their use of ICT tools in the study area.

Methodology

The study was conducted in Tarka Local Government Area of Benue State, Nigeria. Tarka is widely recognised for its high agricultural productivity, with soybean being a major cash and food crop cultivated predominantly by smallholder farmers. Geographically, the LGA lies between latitude 7.502°N and longitude 8.918°E and shares boundaries with Gboko, Gwer, and Buruku Local Government Areas.

A multi-stage sampling procedure was employed to ensure adequate representation of soybean farmers across the study area. In the first stage, four communities were purposively selected based on their prominence in soybean production activities. In the second stage, a simple random sampling technique was adopted, applying a proportion of 0.5 to determine a sample size of 120 respondents.

Data collected were analysed using both descriptive and inferential statistical techniques. Descriptive statistics included frequency distributions, percentages, and mean scores, while inferential analysis was employed to examine relationships among variables and test the stated hypothesis.

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Table 1: Sample Size Selection Plan

Community	Estimated Population	Sample Size (0.5)
Wannune	82	41
Uchi	61	31
Tongov	50	25
Mbaajir	45	23
Total	**238**	**120**

RESULT AND DISCUSSION

The results presented in Table 2 indicate that a majority of the respondents (50.8%) fall within the 26–45 years age bracket, with a mean age of 44.13 years. This age distribution reflects a relatively active and economically productive farming population. It is consistent with the typical demographic structure of agricultural households in Nigeria, where middle-aged individuals constitute the dominant farming cohort. Empirical evidence by Ayanlade et al. (2021) suggests that farmers within this age range are more inclined to adopt improved agricultural innovations due to a favourable combination of physical strength and accumulated farming experience. Similarly, Nwankwo et al. (2022) reported that adoption of ICT-based agricultural information systems is most prevalent among farmers aged 35–55 years. The implication is that the sampled population represents a demographically suitable group for the uptake of agricultural innovations, including ICT-driven interventions.

In terms of gender distribution, Table 2 further reveals that 77.5% of the respondents were male, while 22.5% were female, indicating a pronounced male dominance in soybean farming activities within the study area. This pattern reflects the persistent gender imbalance in rural agricultural systems, where men often have greater control over productive resources and decision-making processes (Food and Agriculture Organization (FAO), 2020). Adegboye and Bolarinwa (2022) similarly observed that male farmers dominate ICT-enabled agricultural activities, a situation largely attributed to socio-cultural norms, land ownership patterns, and differential mobility between genders. This imbalance has important implications for ICT adoption, as female farmers may face additional barriers in accessing and effectively utilising digital agricultural tools.

Regarding marital status, the findings show that a significant proportion (72.5%) of respondents were married. This suggests that farming activities in the study area are largely organised within family-based households. Married farmers typically benefit from larger household labour availability, which enhances their capacity for agricultural production. Studies have demonstrated that marital status can positively influence the adoption of agricultural innovations, as household responsibilities often incentivise farmers to seek productivity-enhancing technologies (Ogunniyi et al., 2021). The high proportion of married respondents therefore indicates a stable farming population with strong potential responsiveness to extension and ICT-based agricultural interventions.

With respect to occupational status, the results indicate that farming constitutes the primary occupation for 50.8% of respondents, while the remaining proportion engage in farming alongside civil service or trading activities. This reflects the prevalent pattern of livelihood diversification among rural households in Nigeria. Ifeanyi-Obi and Nnadi (2022) observed that farmers whose primary occupation is agriculture are more likely to adopt ICT tools, given their higher dependence on timely agricultural information for decision-making. The present finding is therefore consistent with existing literature linking primary engagement in farming with increased demand for agricultural information services.

Educational attainment data reveal that a majority (69.2%) of respondents attained secondary education, while only 5.0% had no formal education. Education is

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widely recognised as a critical determinant of farmers' capacity to comprehend and utilise technological innovations, including ICT tools. Olaniyi (2020) established that farmers with secondary education are significantly more likely to adopt and effectively use digital agricultural platforms due to improved literacy and cognitive ability. However, the relatively low proportion of respondents with tertiary education suggests that advanced digital literacy may still be limited within the study population. This underscores the need for simplified ICT interfaces and strengthened extension support systems to enhance usability and accessibility.

In terms of farm size, approximately 44.2% of respondents cultivated land areas of less than or equal to one hectare, while 43.3% operated between two and three hectares. The mean farm size was 2.05 hectares, indicating that soybean production in the study area is predominantly undertaken by smallholder farmers. This aligns with national agricultural statistics, which show that over 80% of Nigerian farmers cultivate less than three hectares of land (Federal Ministry of Agriculture and Rural Development (FMARD), 2021). Smallholder farming systems are often characterised by limited capital and resource constraints, which may hinder the adoption of ICT tools unless they are affordable and contextually appropriate. Etim et al. (2022) similarly noted that smallholder farmers are more inclined to adopt ICT innovations when such tools reduce production risks and provide timely, actionable information.

Household size analysis shows that 45.8% of respondents had between 3 and 10 household members, with a mean household size of 8 persons. This suggests the prevalence of extended family systems in the study area. Larger household sizes often translate into greater availability of family labour, which supports agricultural activities. Moreover, they may also increase the motivation to access ICT-based agricultural and market information to sustain household livelihood needs. Idris et al. (2021) found that household size positively influences the adoption of agricultural technologies, particularly in smallholder systems where family labour constitutes a critical production input.

Finally, the results indicate that a majority of respondents (63.3%) belong to cooperatives or farmers' associations. Membership in such organisations is widely recognised as a significant facilitator of agricultural innovation adoption. Cooperative societies enhance access to information, credit facilities, training opportunities, and extension services. Akinnagbe and Lawal (2020) established that cooperative membership significantly increases the likelihood of adopting improved agricultural practices due to accelerated information diffusion through group networks. The relatively high level of cooperative participation observed in this study therefore represents an important enabling factor for ICT adoption and agricultural extension effectiveness.

Table 2 Distribution of Respondent according to Socio-Economic Characteristics (n = 120)

Variables	Frequency	Percentage (%)	Mean
Age (years)			44.13
≤ 25	8	6.7	
26 – 45	61	50.8	
46 – 65	41	34.2	
≥ 66	10	8.3	
Sex			
Male	93	77.5	
Female	27	22.5	
Marital Status			
Single	33	27.5	
Married	87	72.5	

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Variables	Frequency	Percentage (%)	Mean
Major Occupation			
Farming	61	50.8	
Trading	2	1.7	
Civil service	57	47.5	
Household Size (number)			8.01
≤ 2	22	18.3	
3 – 10	55	45.8	
11 – 18	37	30.8	
≥ 19	6	5.0	
Farm Size (hectares)			2.05
≤ 1.00	53	44.2	
2.00 – 3.00	52	43.3	
≥ 4.00	15	12.5	
Farming Experience (years)			6.62
≤ 1.00	2	1.7	
2.00 – 6.00	64	53.3	
7.00 – 11.00	48	40.0	
≥ 12.00	6	5.0	
Annual Income (₦)			468,807.50
≤ 200,000	52	43.3	
200,001 – 600,000	28	23.3	
600,001 – 1,000,000	32	26.7	
≥ 1,000,001	8	6.7	
Level of Education			
Non-formal	6	5.0	
Primary	17	14.2	
Secondary	83	69.2	
Tertiary	14	11.7	
Membership of Organization			
Yes	76	63.3	
No	44	36.7	

ICTs platforms commonly accessed by soya bean farmers

The results from Table 3 show that soybean farmers predominantly accessed television (96.7%), agricultural mobile apps (84.2%), mobile phones (77.5%), and radio (76.7%), indicating a strong blend of both traditional and digital information channels. Television emerged as the most widely used platform, reflecting its continued relevance in offering visually rich, easy-to-understand agricultural content, a pattern consistent with Owolabi et

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al. (2021), who noted television's dominance due to its credibility and household penetration. The high uptake of agricultural apps further demonstrates the increasing digital literacy and smartphone penetration among farmers, aligning with Nwankwo et al. (2022), who found that mobile-based agricultural applications significantly enhance farmers' access to real-time information.

Table 3: ICTs platforms commonly accessed by soya bean farmers

ICT Platform	Frequency*	Percentage
Radio	92	76.7%
Television	116	96.7%
Mobile phones	93	77.5%
Internet	65	54.2%
Agricultural apps	101	84.2%
Computer	64	53.3%
Extension agents	42	35.0%

Multiple responses*

Frequency of ICTs use for Agricultural Information

The highest-scoring purposes of ICT utilisation presented in Table 4 include access to market price updates (= 3.44), communication with extension agents (= 3.20), selling/marketing of produce (= 3.17), and acquisition of weather information (= 3.15). Collectively, these findings suggest that soybean farmers predominantly deploy ICT tools for functions that are directly linked to production efficiency, risk mitigation, and income optimisation.

Notably, the relatively highest mean score for market price updates underscores the centrality of ICTs in facilitating informed marketing decisions among farmers. This indicates that farmers actively use digital platforms to monitor price fluctuations, thereby enhancing their bargaining power within output markets and reducing information asymmetry. This observation aligns with the findings of Aker (2017), who demonstrated that access to digital market information significantly strengthens farmers' ability to negotiate more favourable prices and improves overall market participation outcomes.

Similarly, the use of ICTs for communication with extension agents reflects their growing importance in bridging gaps within agricultural advisory systems, enabling more timely and efficient dissemination of technical information. The use of ICTs for selling and marketing produce further highlights their role in improving market access and reducing transaction costs, while access to weather-related information indicates their contribution to risk management and climate-sensitive decision-making in agricultural production systems.

Overall, these patterns illustrate that ICT adoption among soybean farmers is largely driven by practical, economically orientated needs that enhance productivity, reduce uncertainty, and improve market engagement.

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Table 4: Frequency of ICTs use for Agricultural Information

Purpose	Mean	Standard Deviation
Accessing weather information	3.15	0.71
Market price updates	3.44	0.98
Farm management advice	2.85	0.71
Agricultural news and innovations	2.71	1.16
Communication with extension agents	3.20	0.65
Selling/marketing farm produce	3.17	1.16

Cutoff mean 2.50

Constraints in use of ICTs tools

The most severe constraints identified in Table 6 are poor network coverage (95.8%), lack of electricity (95.0%), poor literacy levels (91.7%), and lack of relevant agricultural content (86.7%). Collectively, these findings point to deep-seated structural and informational barriers that significantly hinder effective ICT utilisation among soybean farmers. The extremely high prevalence of poor network coverage reflects the persistent digital divide in rural areas, which limits farmers' access to timely agricultural information and communication services. This aligns with Asenso-Okyere and Mekonnen (2020), who emphasise that weak connectivity remains one of the most critical obstacles to digital agricultural transformation in sub-Saharan Africa.

Similarly, the near-universal constraint of inadequate electricity supply highlights severe infrastructural deficits that restrict consistent use of ICT tools, as farmers are unable to reliably power or charge devices. This is consistent with World Bank (2021) findings that unreliable rural electrification significantly constrains ICT adoption and agricultural productivity. In addition, poor literacy levels further limit farmers' ability to effectively interpret and utilise digital information, while a lack of relevant agricultural content reduces the practical usefulness of available ICT platforms. Together, these constraints underscore a multidimensional challenge combining infrastructural, educational, and content-related deficiencies that collectively impede ICT adoption in the study area.

Table 5: Constraints in use of ICTs tools

Constraint	Constraint (%)	Not a Constraint (%)
High cost of devices	75.8	24.2
Poor network coverage	95.8	4.2
Lack of electricity	95.0	5.0
Lack of technical know-how	73.3	26.7
Limited access to extension services	83.3	16.7
Poor literacy level	91.7	8.3
Lack of relevant agricultural content	86.3	13.7

Cut-off Mean: 2.50

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Factors influencing ICT use

The logistic regression results presented in the table examine the influence of farmers' socio-economic characteristics on ICT adoption, revealing a mix of statistically significant and non-significant predictors. The model indicates that level of education (p = 0.000), marital status (p = 0.041), and occupation (p = 0.000) are the most important and statistically significant determinants of ICT use among farmers. This implies that farmers with higher educational attainment, those who are married, and those primarily engaged in farming are more likely to adopt ICT tools for agricultural purposes. The coefficient for education (B = –1.029) suggests that progression across levels of formal education significantly increases the likelihood of ICT adoption, consistent with Mwololo et al. (2020), who emphasised that literacy enhances farmers' capacity to understand and effectively utilise digital platforms.

Table 6: Factors Influencing use of ICTs

Variable	B (Coefficient)	Std. Error	Wald / Beta	z-value	Sig. (p-value)
Age	-0.009	0.009	-0.089	-0.952	0.001
Sex	0.381	0.233	0.137	1.635	0.105
Level of education	-1.029	0.137	-0.591	-7.506	0.000
Years spent in school	0.056	0.069	0.665	1.057	0.415
Marital status	0.721	0.352	4.193	2.057	0.041
Occupation	0.425	0.103	0.363	4.135	0.000
Income	0.000	0.000	1.008	1.000	0.315
Constant	4.948	0.601	—	8.234	0.000

Occupation also emerges as a key determinant (B = 0.425), reinforcing the findings of Nyamba and Mlozi (2019) that full-time farmers are more dependent on ICTs for accessing production, market, and extension information. Similarly, marital status (B = 0.721) positively influences ICT adoption, indicating that married farmers are more inclined to adopt ICT tools, likely reflecting household-based decision-making dynamics and the need for improved livelihood stability as reported by Adebiyi et al. (2021). In contrast, age (p = 0.343), sex (p = 0.105), years spent in school (p = 0.415), and income (p = 0.315) do not significantly predict ICT adoption, suggesting that while these variables may shape general socio-economic conditions, they do not independently determine ICT uptake. This supports the findings of Ogunniyi and Omonona (2020), who observed that gender and age differences in ICT adoption tend to diminish when education and occupation are accounted for in the model.

Overall, the model performance indicators (Log likelihood = 109.022; χ^2 = 8.439; p = 0.011; pseudo R^2 = 0.408) show that the model is statistically significant and explains a substantial proportion of the variation in ICT adoption among farmers, indicating a good fit and strong explanatory power.

CONCLUSION

The study concludes that Results revealed that respondents were predominantly middle aged, majority of the respondents were male with secondary education. ICTs platforms commonly accessed by soya bean farmers were television while the key constraints to ICT use were poor network coverage, lack of electricity and poor literacy levels. The regression analysis reported occupation and level of education as major factors influencing ICT use among the respondents.

RECOMMENDATION

i. Soybean farmers in Tarka LGA should be periodically given training in the use of ICTs

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ii. The subscription rates should be subsidized to make it available to farmers.
iii. Government should improve on the electricity conditions of the study area.

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