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EXPLORING THE ADOPTION AND USE OF ICTS FOR MARKET INFORMATION ACCESS AMONG SMALLHOLDER SOYBEAN FARMERS IN KUJE AREA COUNCIL, ABUJA, NIGERIA

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Abstract

The increasing importance of Information and Communication Technologies (ICTs) in agricultural marketing has prompted significant interest in understanding their adoption among smallholder farmers. This study examined the adoption and use of Information and Communication Technologies (ICTs) for accessing market information among smallholder soybean farmers in Kuje Area Council, Abuja, Nigeria. A multistage sampling technique was employed to select 100 respondents across five wards and villages. Data were collected using structured questionnaires complemented with interview schedules. Descriptive statistics including frequencies, percentages, means and Likert scale were used to analyzed the data. Findings revealed that the majority of soybean farmers were middle-aged, male, and married, with varied educational levels and farm sizes, indicating an experienced farming population. ICT use yielded significant benefits such as increased income (74%), valuable market information (71%),

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reduced reliance on middlemen (71%) and better understanding of market demands (68%). However, major constraints included the high cost of internet data ($\bar{X}$ = 3.09) and devices ($\bar{X}$ = 3.03) and inadequate training ($\bar{X}$ = 3.01). The most recommended strategies for ICT adoption were the provision of affordable devices and data (85%), training and capacity building (82%) and localized relevant content (78%). The study concludes that although ICTs offer substantial benefits in market access, their potential remains underutilized due to systemic and infrastructural challenges. The study therefore recommends, coordinated interventions by government, telecom providers, extension agents and cooperatives to scale ICT access and capacity to improve market outcomes for smallholder soybean farmers in the study area.

Keywords: ICTs, adoption, market, information, soybean, farmers

1.0 INTRODUCTION

Agriculture remains the backbone of many developing economies, particularly in sub-Saharan Africa, where a majority of the population depends on smallholder farming for their livelihoods (Giller *et al.,* 2021; Olawumi *et al.,* 2025). However, for smallholder farmers to thrive in modern agricultural systems, access to accurate and timely market information is essential. Efficient agricultural marketing is dependent on the flow of relevant information regarding prices, demand, consumer trends, and market dynamics (von Cramon-Taubadel and Goodwin, 2021). According to Shepherd *et al.,* (2020), marketing agricultural products effectively requires updated and precise information that supports informed decision-making and enhances value addition. This is particularly important for smallholder farmers whose operations are highly sensitive to market fluctuations and input-output dynamics (Olaitan *et al.,* 2025).

The emergence of Information and Communication Technology (ICT) has introduced new opportunities for farmers to overcome information-related constraints. ICT is described by Ratheeswari (2018) as a technological and engineering discipline that applies scientific and managerial methods in handling information. In the agricultural sector, ICT tools such as mobile phones, internet-based platforms, social media, SMS services, and mobile applications offer farmers the opportunity to access market data, consumer demand trends, and price changes in real time (Baumüller, 2022; Maisule *et al.,* 2025). These tools not only bridge the gap between producers and buyers but also promote transparency, reduce transaction costs, and improve the bargaining power of farmers (Pingali *et al.,* 2019; Joel *et al.,* 2025).

ICT adoption has transformed marketing systems in many developing regions by enabling smallholder farmers to interact directly with traders, cooperatives, and agricultural institutions. As noted by Tulinayo *et al.,* (2022), market access is a critical factor influencing the performance of smallholder agriculture, and ICT has the potential to mitigate barriers created by distance, poor infrastructure, and information asymmetry. Moreover, ICT marketing tools help farmers track consumer behavior, access new markets, and respond to emerging opportunities through data-driven decisions (Maru *et al*., 2018; Adeyemi *et al.,* 2025).

Despite its growing significance, the adoption of ICT in agricultural marketing in Nigeria remains uneven. Soybean, one of the most important cash crops in Nigeria, offers significant economic potential due to its use in food processing, animal feed, and oil production (Khojely, 2018; Yunus *et al.,* 2025). Nigeria is the largest producer of soybean in sub-Saharan Africa, yet marketing challenges persist, limiting the full exploitation of this potential. Among the five key constraints identified in soybean production in Nigeria, poor access to markets ranks high, often resulting in post-harvest losses and low income for farmers (Idu *et al.,* 2025).

Smallholder soybean farmers often face challenges in utilizing ICT for accessing market information (Mapiye *et al.,* 2023). Although digital technologies are expanding nationally, barriers such as poor ICT literacy, limited exposure, high cost of ICT tools, and inadequate extension support are particularly common in the study area. These constraints limit the effective uptake of ICT tools, depriving farmers of valuable market insights and thereby reducing their competitiveness in both local and regional markets (Olusanya *et al.,* 2025).

In a rapidly evolving agricultural environment, timely access to market information is fundamental to the productivity, profitability, and sustainability of smallholder farming. Despite the potential of ICT to revolutionize market access and decision-making among farmers, its adoption for marketing purposes among smallholder soybean farmers in Kuje Area Council, Abuja, remains suboptimal. Several barriers including limited digital literacy, poor access to infrastructure, high cost of devices and inadequate knowledge of ICT tools continue to undermine the effective use of ICT in agricultural marketing.

This gap in ICT adoption perpetuates the cycle of poor market participation, low income, and vulnerability among soybean farmers. Without appropriate market data, farmers are unable to make informed choices regarding when, where, and how to sell their produce. The consequences include price exploitation by middlemen, limited access to high-value markets, and reduced economic returns. Therefore, it becomes imperative to explore the specific challenges faced by soybean farmers in adopting ICT for market information and to identify strategies that can enhance their use of digital technologies. This study addressed this gap by examining how smallholder soybean farmers in the study area can leverage ICTs to access market information, ultimately enhancing their sales and increasing their income. To achieve this, the following specific objectives were formulated:

i. **describe the socio-economic characteristics of soybean farmers in the study area.**
ii. **assess the benefits of using ICT to access market information among soybean farmers in the study area.**
iii. **identify the challenges faced by soybean farmers in accessing market information through ICT in the study area.**

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iv. **examine strategies for enhancing the adoption of ICT in accessing market information among smallholder soybean farmers in the study area.**

2.0 MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Kuje Area Council, located within the Federal Capital Territory (FCT) of Nigeria. Kuje is situated approximately 40 kilometers southwest of Abuja, the nation's capital, and serves as one of the six administrative divisions within the FCT. The area encompasses a landmass of approximately 1,644 square kilometers and, as of the 2022 census, has an estimated population of 212,100 residents. Geographically, Kuje is positioned at a latitude of 8.8795° N and a longitude of 7.2276° E . The council comprises 10 wards: Chibiri, Guabe, Gudun Karya, Gwargwada, Kabi, Kujekwa, Kwaku, Rubochi, and Yenche.Agriculture is the predominant economic activity in Kuje, earning it the moniker "Food Basket of Abuja." The fertile land supports the cultivation of various crops, including maize, rice, yam, plantain, tomatoes, groundnuts, and notably, soybeans. These crops are cultivated both for subsistence and commercial purposes, contributing to the local economy and food security. The region's climate is characterized by a distinct wet and dry season pattern, with an average annual rainfall of approximately 1,250 mm and average temperatures ranging from 30°C . These climatic conditions are conducive to diverse agricultural practices, although they also present challenges such as seasonal flooding and soil erosion, which can impact crop yields.

2.2 Sampling procedure and Sample size

The study employed a multistage sampling technique. In the first stage, **Kuje Area Council** was purposively selected due to its high level of soybean production. In the second stage, **five (5) wards** were selected from the ten (10) wards in Kuje Area Council using the simple random sampling technique. The selection process involved writing the names of all ten wards on separate pieces of paper, shuffling them, and then randomly balloting five wards. In the third stage, **one (1) village** was randomly selected from each of the five selected wards, resulting in a total of five (5) villages. This selection was also done using the simple random sampling technique. In the final stage, **twenty (20) soybean farmers** were selected from each of the five villages using simple random sampling, resulting in a total sample size of **100 soybean farmers**.

2.3 Data collection and Analysis

Data for the study were collected using well-structured questionnaires complemented with interview schedules. The research instrument was designed around key themes, including the socio-economic characteristics of soybean farmers; benefits of ICT use for accessing market information; challenges in ICT-based market information access; and strategies to enhance ICT adoption among smallholder soybean farmers in the study area.To ensure both face and content validity, the instrument was subjected to expert review by professionals in the Department of Agricultural Economics and pre-tested for clarity and relevance. Reliability was assessed using the test-retest method, where 10 questionnaires were administered twice to respondents from the sample population to evaluate the consistency of responses over time. Data collected were analyzed using descriptive statistics such as frequencies, percentages, means, and Likert scale measures.

3.0 RESULT AND DISCUSSION

3.1 Socioeconomic Characteristics of Soybean Farmers in the Study Area

The socio-economic characteristics of the respondents examined include age, gender, marital status, religion, household size, income, education, farming experience, and farm size. Table 1 shows that most respondents (71%) were aged 41 years and above, with 36% between 41 and 50 years and 35% aged 51 years and above. This suggests an experienced farming population capable of making informed agricultural decisions. The low proportion of youth (13%) may indicate challenges in youth involvement in farming, consistent with findings by Geza *et al.,* (2021), who observed declining youth participation in agriculture in many rural communities.

More so, gender distribution reveals that 65% of respondents were male, while 35% were female, highlighting the predominance of males in agricultural activities within rural settings. This aligns with Slavchevska (2021), who reported gender disparities in access to resources and farming opportunities, often favoring men.

Regarding marital status, 56% of respondents were married, implying that most respondents have household responsibilities that may drive the need for stable income sources through farming. This is consistent with the study of Badstue *et al.,* (2020), who found that married farmers tend to be more committed and motivated in agricultural production to meet family needs. Additionally, religion was almost evenly split, with Christians representing 57% and Muslims 43%. This diversity highlights the need for culturally sensitive approaches in agricultural extension services, as noted by Antwi-Agyei and Stringer (2021).

Furthermore, household sizes varied, with 32% having 5 to 7 members, followed by 24% with 8 to 10 members, and 22% each for households with 1 to 4 and 11 or more members. This distribution suggests varying labor availability and consumption needs within households. The findings align with findings of Pawlak and Kołodziejczak (2020), who emphasized the dual role of household size in providing labor and increasing food demands.

The majority (71%) earned an annual household income between ₦201,000 and ₦450,000, indicating moderate income levels among the respondents. This result agrees with findings of Ojo *et al.,* (2020), who noted that smallholder farmers in Nigeria often have limited financial resources, which may restrict their farming investments.

Educational attainment showed that most respondents had at least secondary education (35%), followed by primary education (31%) and university education (24%). Only 9% had no formal education. This distribution suggests a relatively educated farming population capable of adopting new agricultural technologies. This finding is consistent with Sharma and Srivastava (2020), who found that higher education levels positively influence technology adoption.

Moreover, farming experience was well distributed, with the largest group (31%) having 21 to 30 years of experience, followed by 29% with 11 to 20 years, 23% with over 31 years, and 17% with less than 10 years. Additionally, farm sizes were predominantly smallholder, with 51% cultivating 1 hectare, 23% cultivating 0.5 hectare, and smaller proportions cultivating 1.5 hectares (19%) and 2 hectares (7%). This indicates the predominance of small farm sizes among soybean farmers, which often limits mechanization,

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reduces marketable surplus, and weakens bargaining power of soybean farmers in the study area.

Table 1: Socio-economic Characteristics of the Respondents in the Study Area

Variables	Frequency (n=100)	Percentage (%)
Age (years)		
18 – 30	13	13.0
31 -40	16	16.0
41-50	36	36.0
51 and above	35	35.0
Gender		
Male	65	65.0
Female	35	35.0
Marital status		
Married	56	56.0
Single	16	16.0
Divorced	14	14.0
Widow	14	14.0
Religion		
Islam	43	43.0
Christianity	57	57.0
Household size		
1-4	22	22.0
5-7	32	32.0
8-10	24	24.0
11 and above	22	22.0
Total household income (Naira)		
50,000 – 200,000	15	15.0
201,000 - 450,000	71	71.0
451,000 - 750,000	14	14.0
751,000 – 100,000,000	0	0.0
Educational level		
Primary school	31	31.0
Secondary school	35	35.0
University	24	24.0
No level of education	9	9.0
Farming experience		
1-10yrs	17	17.0
11-20yrs	29	29.0
21-30yrs	31	31.0
31 and above	23	23.0
Farm size		
0.5	23	23.0
1	51	51.0
1.5	19	19.0
2	7	7.0

Source: Field Survey, 2024.

3.2 Benefits of ICTs Utilization for Market Information Access among Smallholder Soybean Farmers

The results presented in Table 2 indicate a significant number of smallholder soybean farmers acknowledge the beneficial effects of ICT use on different dimensions of their market participation. The highest benefit reported is a positive change in income, with 74% of respondents affirming this advantage, indicating that ICT adoption can directly improve farmers' earnings. This finding aligns with previous studies by Aker (2011) and Hoang (2020), who noted that access to timely market information through ICT enhances farmers' income by enabling better market decisions.

Similarly, 71% of respondents acknowledged that ICT provides valuable soybean market information and reduces reliance on middlemen, which can empower farmers by increasing their bargaining power and market control. This is consistent with findings from Zhang *et al.,* (2020), who reported that ICT helps farmers bypass intermediaries, thus improving profitability.

Furthermore, other notable benefits include an enhanced understanding of market demand (68%) and faster communication with buyers (65%), which contribute to more responsive and efficient marketing strategies. Additionally, improved price negotiation (63%) and better market decision-making (62%) highlight the role of ICT in empowering farmers with the knowledge and confidence needed to optimize their sales outcomes.

Benefits related to pricing strategies (61%), increased ability to plan production (60%), and marketing strategies (59%) indicate that ICT supports more strategic and informed agricultural practices. Access to wider markets (56%) and government and extension support (55%) were also acknowledged, though to a slightly lesser extent, reflecting some remaining barriers to fully leveraging ICT for broad market integration and institutional engagement.

These results confirm the critical role of ICT in enhancing market access and operational efficiency among smallholder soybean farmers, a finding that is consistent with study by Martens and Zscheischler (2022), who emphasized ICT's transformative potential in agricultural value chains.

Table 2: Benefits of Using ICT for Market Information Access among Smallholder Soybean Farmers

Benefits of Using ICT	YES (%)	NO (%)
Positive change in income	74.0	26.0
Valuable soybean market information	71.0	29.0

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Reduced reliance on middlemen	71.0	29.0
Better understanding of market demand	68.0	32.0
Faster communication with buyers	65.0	35.0
Improved price negotiation	63.0	37.0
Improved market decisions	62.0	38.0
Pricing strategies	61.0	39.0
Increased ability to plan production	60.0	40.0
Marketing strategies	59.0	41.0
Access to wider market	56.0	44.0
Access to government and extension support	55.0	45.0

Source: Field Survey, 2024.

3.3 Analysis of the Challenges Hindering Farmers' Utilization of ICTs for Accessing Market Information

The data presented in Table 3 identify key challenges limiting smallholder soybean farmers' use of ICT for accessing market information. The most significant barrier is the high cost of internet data, with 80% of respondents agreeing or strongly agreeing to its impact, reflected by the highest mean score of 3.09. This highlights the financial burden of maintaining internet access, a challenge emphasized in studies by Sennuga *et al.,* (2020), which highlight cost as a primary deterrent to ICT adoption in rural agriculture

Closely following is the high cost of ICT devices, noted by 83% of respondents, ranking second with a mean of 3.03. This reveals that affordability of smartphones or computers remains a major constraint, consistent with findings from Phiri *et al.,* (2019), who reported device costs as a critical obstacle to ICT uptake among smallholder farmers.

Inadequate training programs on ICT usage (66% agreement) and unreliable market information (67% agreement) rank third and fourth, respectively, showing that both capacity building and trust in the information quality are vital for effective ICT utilization. This aligns with the study of Alam and Shaba (2023), emphasizing the need for continuous farmer education to boost ICT skills.

Limited availability of relevant ICT content (81% agreement) and poor internet connectivity (77% agreement) are also notable challenges, indicating infrastructural and content-related deficiencies that hinder user engagement, consistent with findings by Mapiye *et al.,* (2023).

Other challenges include the lack of timely dissemination of market information (70% agreement), which suggests that even when ICT tools are available, delays reduce their effectiveness. Low technical skills (39% agreement) and lack of interest in ICT tools (31% agreement) rank lower but still indicate barriers related to user readiness and motivation. Language barriers in ICT content received the lowest concern (32% agreement), suggesting that this is a less pressing issue compared to cost and infrastructure.

The results affirm that economic and infrastructural challenges dominate the barriers to ICT adoption among smallholder soybean farmers, confirming similar patterns reported in previous research by Sennuga *et al.,* (2020). Addressing these issues is crucial for enhancing ICT-driven market access in the study area.

Table 3. Challenges Hindering Use of ICTs to Access Market Information Among the Respondents

S/N	Challenges	Agree (%)	Strongly Agree (%)	Diagree (%)	Strongly Disagree (%)	Mean ($\bar{x}$)	Rank
1.	High cost of internet data	41.0	39.0	10.0	10.0	3.09	1st
2.	High cost of ICT devices	55.0	28.0	9.0	8.0	3.03	2nd
3.	Inadequate training programs on ICT usage	18.0	48.0	21.0	13.0	3.01	3rd
4.	Unreliable market information	21.0	46.0	19.0	14.0	2.99	4th
5.	Limited availability of relevant ICT content	61.0	20.0	11.0	8.0	2.93	5th
6.	Poor internet connectivity	50.0	27.0	10.0	13.0	2.91	6th
7.	Lack of timely dissemination of market information	56.0	14.0	22.0	8.0	2.76	7th
8.	Low levels of technical skills among farmers	19.0	20.0	56.0	5.0	2.54	8th
9.	Lack of interest in using ICT tools	18.0	13.0	51.0	18.0	2.26	9th
10.	Language barriers in ICT content	16.0	16.0	35.0	33.0	2.15	10th

Source: **Field Survey, 2024**.

3.4 Enhancing ICT Adoption for Market Information Access Among Smallholder Soybean Farmers

Table 4 presents the adoption strategies perceived by respondents as critical to enhancing the use of ICT for market information. The most favored strategy is the provision of affordable devices and data, endorsed by 85% of respondents. This highlights the importance of reducing financial barriers to ICT access, corroborating findings by Alam and Shaba (2023) who emphasized cost as a key impediment to technology adoption in rural farming communities.

More so, training and capacity building follow closely with 82%, emphasizing the need for skills development to enable farmers to effectively utilize ICT tools. This is consistent with study of Sennuga (2019), who reported that education and continuous

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training are essential for ICT uptake and sustainable use in agricultural settings.

However, the availability of localized and relevant content (78%) is also pivotal, reflecting the necessity for ICT platforms to offer context-specific information that aligns with local languages and farming practices. This supports the argument by Bitrián *et al.*, (2021) that relevant content enhances user engagement and practical application.

Furthermore, improving internet connectivity (75%) and collaboration with extension agents (70%) are similarly important, suggesting that infrastructure development and support from agricultural experts are vital for successful ICT integration. These findings align with Sennuga (2019), who noted infrastructure and extension services as critical enablers of ICT use.

Other strategies such as developing user-friendly ICT platforms (68%), leveraging farmer groups and cooperatives (65%), government support and policies (62%), awareness campaigns (60%), and establishing monitoring and feedback mechanisms (55%) also received considerable support. These highlight the multi-dimensional approach required for effective ICT adoption, consistent with the comprehensive

Table 3: Strategies for Enhancing ICT Adoption Among Smallholder Soybean Farmers

S/N	Adoption strategies	Frequency (N)	Percentage (%)
1	Affordable Devices & Data	85	85.0
2	Training & Capacity Building	82	82.0
3	Localized & Relevant Content	78	78.0
4	Improved Internet Connectivity	75	75.0
5	Extension Agent Collaboration	70	70.0
6	User-Friendly ICT Platforms	68	68.0
7	Farmer Groups & Cooperatives	65	65.0
8	Government Support & Policies	62	62.0
9	Awareness Campaigns	60	60.0
10	Monitoring and Feedback mechanism	55	55.0

Source: Field Survey, 2024.

4.0 Conclusion

The study reveals that smallholder soybean farmers in the study area predominantly belong to the middle-aged and older adult groups, indicating a farming population with considerable experience and capacity to engage in agricultural activities. The demographic characteristics, characterized by a majority male and married population with varied educational backgrounds and farm sizes, reflects both the strengths and challenges in agricultural production and technology adoption. ICTs usage among these farmers demonstrates clear benefits, including improved income, access to valuable market information, and enhanced communication with buyers, which collectively contribute to better market decisions and production planning. However, challenges such as the high cost of internet data and ICT devices, inadequate training, poor internet connectivity, and limited availability of relevant content hinder optimal ICT adoption.The adoption strategies preferred by respondents emphasize the need for affordable ICT access, capacity building, localized content, infrastructure improvement and collaboration with extension agents.

4.1 Recommendation

Based on the study findings, the following recommendations are made:

i. **Government and telecom providers** should reduce the cost of ICT devices and data through subsidies and rural tariffs to improve affordability for farmers.

ii. **Extension services and NGOs** need to provide regular, targeted training to enhance farmers' ICT skills.

iii. **Content developers and extension agents** must produce localized, easy-to-understand ICT content in local languages.

iv. **Telecom companies and policymakers** should improve rural internet infrastructure to ensure reliable connectivity.

v. **Extension agents and ICT providers** should collaborate to integrate ICT tools into extension services and offer technical support.

vi. **Farmer groups and cooperatives** should be supported to promote collective access and knowledge sharing of ICTs.

vii. Government policymakers must create supportive policies and collaborate with extension services to increase awareness campaigns on the benefits of ICT in agriculture using various media platforms.

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