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Farmers' willingness to use digital tools in sourcing agricultural information in Kaduna State, Nigeria

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Okwuokenye, Goddey Folunsho[1]*, Akumabor, Stella[2] and Ikoyo-Eweto, Gloria Omogho[3]

[1]Department of Agricultural Economics and Extension, Faculty of Agricultural Sciences, National Open University of Nigeria
[2]Department of Agricultural Economics and Extension, Faculty of Agriculture, University of Delta, Agbor, Delta State, Nigeria.
[3]Nigeria Institute for Oceanography and Marine Research, Victoria Island, Lagos, Nigeria
*Corresponding and presenting author: ofolunsho@noun.edu.ng; +2348037568724),
[2]stella.akumabor@unidel.edu.ng, +07036545149
[3]omogho4@yahoo.com, +08037470900

Abstract
This study examined crop farmers' use of digital tools for sourcing agricultural information in Kaduna State, Nigeria. Multi-stage sampling procedure was employed to select two hundred and twenty-eight (228). Data were collected using questionnaires and analysed with percentage, binomial test, and Spearman's Rank Correlation. Findings revealed that mobile phones (92.54%), radio (89.47%), SMS (79.82%), and WhatsApp (75.88%) were the most used digital tools. Farmers' willingness to adopt digital tools was generally high (79.82%). Major constraints to the utilisation of digital tools included high costs, inadequate digital skills, and poor internet access, amongst others. A strong positive relationship existed between digital tool usage and the benefits derived. The study recommended that the government and other stakeholder's partners provide subsidies or financial support to reduce the high cost of acquiring and maintaining digital tools.

Keywords: *Digital tools, agricultural information, willingness*

Introduction

The agricultural sector plays a vital role in many economies around the world serving as a major source of food, employment, and raw materials for various industries (Attamah et al., 2025). However, farmers and other agricultural stakeholders face numerous challenges, including climate change, pest and disease outbreaks, market fluctuations, and the growing demand for sustainable farming practices. These challenges often limit the sector's ability to fully realise its potential and meet the growing food needs of the population (Touch et al., 2024). To address these constraints, access to timely, accurate, and relevant agricultural information is essential for enhancing productivity, reducing risks, and ensuring food security (Yusuf et al., 2021). In recent years, digital tools have emerged as effective means of disseminating agricultural knowledge to farmers, extension agents, researchers, and policymakers.

Digital tools encompass a wide range of technologies, including mobile applications, SMS-based services, social media platforms, e-learning portals, and decision-support systems (Rafiq et al., 2024). These technologies facilitate real-time communication, knowledge sharing, and data-driven decision-making in agricultural production. Compared with conventional information dissemination approaches such as face-to-face training, printed publications, and radio broadcasts, digital tools offer broader coverage, enhanced interaction, and increased cost-effectiveness. However, the effectiveness of these tools depends on factors such as digital literacy, internet accessibility, cultural barriers, and the relevance of the information provided to farmers (Yusuf et al*.,* 2021).

Assessing the effectiveness of digital tools in agricultural information dissemination is therefore important for maximizing their benefits and improving agricultural productivity. In view of this, the study examined the digital tools commonly used by farmers in sourcing agricultural information in the area. It further explores the benefits derived from the use of digital tools, determines farmers' willingness to use these tools for agricultural information sourcing, and identifies the challenges limiting their effective utilization among farmers.

H_{01}: There is no significant relationship between the use of digital tools and the benefits derived by farmers in agricultural production.

H_{02}: There is no significant difference between farmers who are willing and those not willing to effectively use digital tools in sourcing agricultural information.

Methodology

The study was conducted in Kaduna State. The state lies approximately between latitude 10.38°N and longitude 7.71°E. Kaduna State has 23 local government areas (LGAs) and covers a land area of about 6,053 km², ranking ninth in Nigeria in terms of number of LGAs. The projected population of the state in 2024 was about 9,800,000, making it the fourth most populous state in Nigeria (Report of Kaduna State, Population Statistics).

A multi-stage sampling procedure was used to select respondents for the study. In the first stage, Kaduna North Agricultural Zone was purposively selected as the study area. In the second stage, two local government areas (Zaria and Sabon-Gari) were randomly selected from the zone. In the third stage, two communities were randomly selected from each local government (Basawa Samaru, Dogarawa and Muchiya) making a total of four communities for the study. However, 228 questionnaires were properly completed and considered suitable for analysis in the study.

The research instrument was validated using the face content validation method by presenting the questionnaire to experts in agricultural economics and extension for critical review, ensuring that it adequately addressed the objectives and hypotheses of the study.

Data were analysed using percentages and inferential such as Spearman's Rank Correlation Coefficient (r) and Binomial test statistics. Likert-type scale was used to examine the key challenges limiting farmers' effective use of ICT tools in the area. The scale was graded from strongly agree (4), agree (3), disagree (2) and strongly disagree (1). This yielded a mean value of 2.50. Factors with means greater than or equal to 2.50 were considered limiting factors.

Spearman's Rank Correlation Coefficient (r) was used to measure the association between farmer's use of digital tools (X) and the benefits (Y) derived in agricultural production.

Binomial test statistics were used to analyse hypothesis two by determining whether a significant difference existed in the proportion of farmers who are willing to use digital tools in sourcing agricultural information from those who are not willing to use them.

Results and Discussion

Digital Tools Commonly Used by Farmers in Sourcing Agricultural Information

Table 1 shows that mobile phones (92.54%), radio (89.47%), short message service (SMS) (79.82%) and WhatsApp (75.88%) were commonly used by farmers in the study area. The result implies that the farmers are not only aware of the existence of different types of digital tools but, they also use them for sourcing various types of agricultural information which are being used in farming operations. This assertion was confirmed by findings of Shehrawat et al. (2024) that farmers are increasingly aware of and actively utilising digital tools to source information on market prices, weather forecasts, and pest control, directly integrating these insights into farming operations to increase productivity and optimise inputs.

Table 1: Digital tools commonly used by farmers in sourcing agricultural information

	Digital tools commonly used	Percentage
i.	Mobile phones	92.54
ii.	Radio	89.47
iii.	SMS	79.82
iv.	WhatsApp	75.88
v.	Television	64.04
vi.	Video player	53.07
vii.	Facebook	51.75
viii.	Audio visual aids	51.75
ix.	Computers, laptops and tablets	35.67
x.	YouTube	32.02
xi.	Instagram	30.70

Source: Field survey, 2025

Benefits Derived from the Use of Digital Tools

Table 2 shows that enhanced farm output/productivity (96.49%) was a prominent benefit of using digital tools. This implies that digital tools have improved farming efficiency by enabling modern practices, proving timely information and support better decision-making. Closely following this was improved income, with which a good fraction (95.61%) of the respondents indicated that digital tools contributed to increased earnings, likely through better market access, reduced losses, and improved production levels.

A large proportion of farmers (92.54%) reported increased knowledge of farm practices, highlighting the role of digital tools in agricultural education and extension service delivery. Similarly, access to financial services (88.60%) and access to agricultural information (85.09%) show that digital platforms helped farmers connect with credit providers, mobile banking, and advisory services. Digital tools also helped farmers establish linkages with input providers (83.77%), enabling easier access to seeds, fertilisers, and other farm inputs.

Other benefits include improved knowledge on handling and protecting crops (75.88%), access to better market prices (72.81%), and information on regulating market supply (67.11%) and where to transport and sell produce (64.47%). These findings demonstrate that digital tools play a critical role in strengthening market participation and post-harvest management. The result was supported by Nwangwu et al. (2024) and Kiwelu and Ngulube (2025), who observed that digital tools play a critical role in improving farmers' productivity, income, knowledge, farm practices and overall market participation and post-harvest management.

Table 2: Benefits derived from the use of digital tools

Benefits derived	Percentage
- Enhanced farm output/productivity	96.49
- Improved income	95.61
- Increased knowledge of farm practices	92.54
- Access to financial services	88.60
- Access to agricultural information	85.09
- Facilitated linkage to input providers	83.77
- Information on how to mitigate climate change effects	81.14
- Information on handling and protecting crops	75.88
- Access to improved market prices	72.81
- Information on how to regulate supplies to the market	67.11
- Information on ideal place to transport and sell produce	64.47
- Information on how to avoid farm losses	42.11

Source: Field survey, 2025

Farmers' Willingness to Use Digital Tools in Sourcing Agricultural Information

Table 3 shows that 49.12% were willing to use digital tools. Overall, the results indicate a generally positive willingness among farmers to adopt digital tools for accessing agricultural information, likely due to perceived benefits of their use. This result aligns with Ikuerowo and Tehinloju (2021) and Cao et al. (2025), who noted that the perceived

ease of use of digital technology positively influences perceived usefulness, intention and willingness to adopt the technology for sourcing agricultural information to improve farm productivity.

Table 3: Farmers' willingness to use digital tools in sourcing agricultural information

Willingness	Percentage
- Very willing	14.91
- Just willing	49.12
- Moderately willing	19.74
- Fairly willing	9.21
- Unwilling	7.02

Source: Field survey, 2025

Challenges Limiting Farmers' Effective Use of Digital Tools for Sourcing Agricultural Information

Table 4 shows that the high cost of digital tools (mean = 3.13), high maintenance cost of digital tools (mean = 3.07), lack of digital skills (mean = 2.92) and insufficient digital tools for farm operations (mean = 2.83) were challenges limiting farmers' effective use of digital tools in sourcing agricultural information. This implies that the challenging factors agreed upon by the farmers are numerous and limit their effective use in several ways. Nyakudya et al. (2024) reiterated that low digital literacy skills among smallholder farmers, inadequate digital infrastructure, the digital gender divides and financial costs associated with digital technologies were constraints to effective use of digital tools for sourcing agricultural information.

Table 4: Challenges limiting farmers' effective use of digital tools for sourcing agricultural information

Challenges limiting farmers' effective use of digital tools	Mean	Standard Deviation
- High cost of digital tools	3.13*	0.71
- High maintenance cost of digital tools	3.07*	0.65
- Lack of digital skills	2.92*	0.55
- Insufficient digital tools for farm operations	2.83*	0.66
- Poor access to internet	2.77*	0.64
- Poor level of awareness of the functionality of digital technologies	2.75*	0.61
- Poor rural infrastructure	2.60*	0.67
- Lack of compatibility with current farm practice	2.53*	0.64
- Lack of training on how to use digital tools for agricultural purpose	2.51*	0.71
- Negative attitude of household members towards digita technologies	1.68	0.74
- Provision of insufficient information by digital tools	1.58	0.81
- Fear of loss of privacy and data over the interne	1.51	0.84

Source: Field survey, 2025

Relationship between the Use of Digital Tools and the Benefits Derived by Farmers in Agricultural Production

Table 5 shows positive significant relationship between farmers' use of digital tools and farm output (derived benefits) (0.68, $p < 0.01$). Similarly, a strong positive association was observed between the use of digital tools and the benefits derived from agricultural production ($rs = 0.68$, $p = 0.01$).

These findings indicate that increased use of digital tools for sourcing agricultural information is linked with greater benefits in agricultural production, underscoring the important role of technology in improving farm productivity and outcomes. Mulungu et al. (2025) supports this result, indicating that the use of digital tools for sourcing agricultural information leads to multiple benefits, including improved productivity, increased income, and enhanced overall well-being.

Table 5: Relationship between use of digital tools and the benefits derived by farmers in agricultural production

Variables	rs
Use of digital tools and the benefits derived by farmers	0.68*

Farmers' Willingness towards Effective Use of Digital Tools in Sourcing Agricultural Information

Table 6 shows that the majority of farmers (84.65%; n = 193) demonstrated a high level of willingness to effectively use digital tools for sourcing agricultural information, while a smaller proportion (15.35%) demonstrated a high level of unwillingness to effectively use digital tools for sourcing agricultural information, while 15.53% indicated unwillingness. This distribution suggests that the overall result was skewed toward farmers' willingness to adopt digital tools in their farm activities. The result was significant at 1% level, hence the null hypothesis was rejected. The high level of willingness observed among farmers may be linked to the ease of accessing and applying agricultural information through digital platforms, as well as the tangible benefits, including improved productivity and increased farm income. This finding aligns with Abioye et al. (2025), who reported a significant difference between farmers willing and unwilling to use digital tools for sourcing agricultural information, with willingness influenced by farmers' socio-economic characteristics.

Table 6: Farmers' willingness towards effective use of digital tools in sourcing agricultural information

Variables	Category	n	Observed proportion	Test Proportion	Chi-square
Willingness towards effective use of digital tools	Willing (score: > 18)	182	0.80	0.50	341.0*
	Unwilling (score: 18 & below)	46	0.20		
	Total	228	1.00		

≤0.05; Source: Field survey, 2025

Conclusion and Recommendations

The widespread use of mobile phones, radio, SMS, and WhatsApp shows that farmers are not only aware of these technologies but have incorporated them into their daily agricultural activities for communication, learning, and decision-making. Their popularity reflects their accessibility, affordability, and ease of use in rural farming communities.
In addition, digital tools enhanced farmers' access to financial services, market information, and input suppliers, thereby strengthening the delivery of extension services and supporting better farm management and climate adaptation strategies.
Farmers demonstrated a strong willingness to use digital tools to access agricultural information. The majority expressed readiness to adopt these technologies, and a significant relationship between the use of digital tools and the benefits derived from agricultural production. This indicates that increased utilisation of digital platforms leads to improved farm outcomes and livelihoods.
High device and maintenance cost, limited digital skills, poor internet connectivity, and inadequate training were identified as major barriers to the effective use of digital tools.
Government and other relevant stakeholders to implement subsidy programs, soft loans, or cooperative purchasing arrangements to lower the cost of acquiring and maintaining digital devices. By doing so, the financial burden associated with smartphones and related technologies will be reduced, thereby encouraging more farmers to adopt and consistently use them to source information for their agricultural activities.

Agricultural extension services, non-governmental organisations, and training institutions to provide continuous training, hands-on workshops, and field demonstrations. This will help strengthen farmers' digital competencies, thereby increasing awareness and practical knowledge of digital platforms, enabling farmers to effectively access, interpret, and apply agricultural information.
The government also need to invest more in rural telecommunication networks to provide stable and affordable internet connectivity in farming communities. Expanding broadband services and ensuring a reliable electricity supply will make it easier for farmers to utilise mobile applications, online advisory platforms, and other digital services without interruption.
Greater collaboration between technology developers and agricultural service providers should be ensured to create digital applications that align with local farming systems. This will ensure easy navigation and provision of programmes in local languages. Designing tools that match farmers' literacy levels and practical needs will enhance their acceptance, usability, and overall effectiveness in delivering agricultural information.

References

Abioye, D.O., Fadare, D.A. and Omitoyin, S. (2025). Adoption impact and heterogeneity of mobile agricultural advisory technologies among smallholder farmers in Nigeria. *Discover Agriculture,* **3**, 251 (2025). https://doi.org/10.1007/s44279-025-00427-w

Aminu, R.O., Oyawole F.P., Arowolo, A.O. and Ibrahim S.B. (2025). Relationship between Access to Agricultural Extension Services and Financial Inclusion

Status of Agricultural Households in Nigeria. *Journal of Agricultural Extension,* 29(2). 163-173. https://dx.doi.org/10.4314/jae.v29i3.16

Attamah, C.O., Bosompem, M. and Von Abubakari, F. (2025). The impact of the anchor borrowers' programme on the livelihoods of smallholder farmers in Southeast, Nigeria. *Journal of Agricultural Extension,* 29(2),22-38. https://dx.doi.org/10.4314/jae.v29i2.3

Cao, A., Guo, L., & Li, H. (2025). Understanding farmer cooperatives' intention to adopt digital technology: mediating effect of perceived ease of use and moderating effects of internet usage and training. *International Journal of Agricultural Sustainability*, *23*(1). https://doi.org/10.1080/14735903.2025.2464523 DOI:10.33545/26180723.2024.v7.i11Sc.1366

Ikuerowo, J. O., & Tehinloju, A. O. (2021). Factors influencing arable crop farmers' willingness to adopt bio-organic technology in Ondo State, Nigeria. *Journal of Agricultural Extension, 25*(1), 21–30. https://doi.org/10.4314/jae.v25i1.3

Kaduna (State, Nigeria) – Population Statistics, Charts, Map. Retrieved at: City Population. *https://citypopulation.de › admin › NGA019__kaduna.* On 15th June, 2026

Kaduna Climate Data. Average Temperature, Weather. Retrieved from: https:// en.climate-data.org/africa. On: 12th September, 2025.

Kiwelu, J.E.M. and Ngulube, P. (2025). Enhancing food security sustainability through digital information extension services in rural Uganda: Maize postharvest evidence-based strategies. *PLoS One*. 20(11):e0336105. doi: 10.1371/journal.pone.0336105. PMID: 41196857; PMCID: PMC12591458

Mulungu, K., Kassie, M., & Tschopp, M. (2025). The role of information and communication technologies-based extension in agriculture: application, opportunities and challenges. *Information Technology for Development*, *31*(4), 1117–1146. https://doi.org/10.1080/02681102.2025.2456232

Nwangwu, K.N., Onyenekwe, C., Opata, P., Ume, C. and Ume, N.C. (2024). Can digital technology promote market participation among smallholder farmers? *International Food and Agribusiness Review*, 27(4):706-728. DOI:10.22434/ifamr2023.0065

Nyakudya, S., Jambo, N., Madududu, P., & Manyise, T. (2024). Unlocking the potential: challenges and factors influencing the use of ICTs by smallholder maize farmers in Zimbabwe. *Cogent Economics & Finance*, *12*(1). https://doi.org/10.1080/23322039.2024.2330431

Rafiq, S., Iqbal, S. and Afzal, A. (2024). The Impact of Digital Tools and Online Learning Platforms on Higher Education Learning Outcomes. *Al-Mahdi Research Journal*, 5(4), 359 - 369

Shehrawat, P.S., Aditya, S., Singh, S. and Arulmanikandan, B. (2024). Farmers' awareness level and adoption regarding usage of ICT for crop production. International *Journal of Agriculture Extension and Social Development,* 07(11):167-173.

Touch, T., Tan, D.K.Y., Cook, B.R., Cross, D.L.L., Tran, R.T.A., Utomo, A., Yous, S., Grunbuhel, C. and Cowie, A. (2024). Smallholder farmers' challenges and opportunities: Implications for agricultural production, environment and food security, *Journal of Environmental Management*, Volume 370, 122536, ISSN

0301-4797, https://doi.org/10.1016/j.jenvman.2024.122536. Retrieved at: (*https://www.sciencedirect.com/science/article/pii/S0301479724025222*) On 14th December, 2024.

Yusuf, S.K., Adio, E.O., Wwalmam, S.Z. and Suberu, S.B. (2021). Challenges in Accessing Agricultural Information Sources and Services by Farmers in Edu Local Government Area of Kwara State. Library Philosophy and Practice (e-journal). 6192. https://digitalcommons.unl.edu/libphilprac/6192