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Assessment of Adoption of Digital Extension Services for Sustainable Agriculture by Farmers in Lagos State, Nigeria

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Abstract

This study investigated the adoption of digital extension services by agricultural rural farmers for sustainable agriculture in Lagos State, Nigeria. The study was guided by two research objectives and questions. The study employed a descriptive survey research design and a multi-stage sampling technique to choose rural farmers as respondents from five farming communities in Epe LGA namely Oriba, Ejinrin, Ilaara, Araga, and Igboye. These communities were purposefully selected in the first stage in Epe Local Government and 100 rural farmers (20 per villages) were purposefully selected at random in the second stage according to the size of the farm communities. A well-structured 20-item questionnaire, using a 5-point Likert scale was used as instrument. Three experts from Lagos State University of Education's College of Vocational and Entrepreneurship Education provided face validity validations for the instrument. The internal consistency of the instrument was 0.99 using cronbach Alpha Model. The descriptive statistics of weighted mean was used to analyze the data. The findings revealed that there is moderate adoption rate of digital extension services by rural farmers for sustainable agriculture in Lagos State. Findings also indicated that rural farmers strongly agreed that there are barriers such as erratic power supply, high cost of data, etc. that negatively affects the adoption of digital extension services for sustainable agriculture in Lagos State. The authors recommended expand internet and electricity access in rural areas through public-private partnerships, implementation of capacity-building initiatives for farm people and introduction of subsidy programs to increase smartphone ownership among rural farmers.

Keywords: Digital Extension Services, Sustainable Agriculture, Adoption, Barriers, Rural Farmers

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INTRODUCTION

In Nigeria, agriculture continues to be a vital component of both economic growth and food security. The country is endowed with over 70 million hectares of arable land, a favourable climate, and diverse ecological zones, making it well-suited for the production of a wide variety of crops, including maize, rice, cassava, and cocoa (FAO, 2020). Despite its varied economic environment, Nigeria promotes a variety of farming pursuits that are essential to local food systems and national food security, such as crop agriculture, poultry, and fisheries yet Nigeria's agricultural industry has many obstacles, ranging from inadequate infrastructure and a lack of coordination among stakeholders to severe weather occurrences (Wasihun, 2022).

Agricultural extension services have long played a key role in enhancing farmer's productivity and livelihoods by connecting agricultural research with on-farm practices

(Jadhav *et al*. 2024). Agricultural extension services are essential to achieving food security, which the UN defines as universal access to enough safe, nourishing food that satisfies dietary needs and preferences for a healthy life (Pawlak & Kołodziejczak, 2020). However, the national food security policy is hampered by the dependence on conventional, in-person extension methods, which exacerbates poverty and hunger, particularly in rural areas. Agricultural extension agents (AEAs) must adopt a new strategy for information distribution that goes beyond traditional manual and in-person approaches in order to increase efficiency and timeliness (Ifeanyi-Obi & Corbon, 2023).

Food insecurity, hunger, and poverty are made worse, especially for rural populations, by these obstacles, which include a restricted geographic reach, high operating expenses, and delays in providing farmers with correct agricultural information. A revolutionary answer to these problems is provided by digital extension services. Digital extension services overcome the drawbacks of traditional face-to-face methods by using digital extension technologies, including mobile apps, SMS, IVR, IoT, AI, blockchain, drones, and web platforms, to provide timely, customized agricultural information and support. This improves farmer productivity and livelihoods. These digital extension technologies are any digital instrument or technology used to manage agricultural decision-making processes or along the value chain (Gow *et al*. 2020; Klerkx, Jakku, & Labarthe 2022; McCampbell *et al.* 2021). According to Khatri, (2024), ICT tools, such as mobile phones, internet platforms, Geographic Information Systems (GIS), drones, and emerging technologies like Artificial Intelligence (AI) and blockchain, have revolutionized extension services by providing real-time, location-specific, and cost-effective solutions.

Digital extension services enable farmers to make well-informed decisions, maximize productivity, and strengthen resilience against climate and economic shocks by giving them real-time, scalable, and affordable access to agricultural information, including weather forecasts, pest management strategies, and market prices. Digital extension services, such as online platforms, SMS-based advisory systems, and mobile applications, provide innovative solutions to these issues by providing Nigerian farmers with instantaneous, scalable, and reasonably priced access to agricultural knowledge, allowing them to boost productivity and sustainability. Extension digitalization is expected to improve farmers' technical skills, address socio-economic challenges, improve food traceability, and reduce environmental impact (Balafoutis *et al*. 2017; Klerkx, Jakku, & Labarthe, 2022). Therefore, the availability and adoption of these technological innovations by farmers are imperative for sustained agricultural productivity (De Janvry *et al.*, 2016).

Globally, digital extension services have transformed agricultural practices by improving access to weather forecasts, market prices, and best practices (FAO, 2022). In Nigeria, initiatives like the e-Extension program have demonstrated potential in enhancing productivity (Adebayo et al., 2021). Yet, in Lagos State, the adoption of these tools among farmers and extension officers remains underexplored (Taiwo & Amosu, 2022). Despite the transformative potential of digital extension services, their adoption in Lagos State is reportedly low, limiting their impact on sustainable agriculture (Taiwo & Amosu, 2022). Rural farmers face significant challenges, including limited access to digital devices (e.g., smartphones) and poor internet connectivity, which restrict their ability to leverage digital tools (Yahaya, 2025). Similarly, extension officers, who serve as critical intermediaries between research and farmers, often lack the training and resources to effectively utilize digital platforms (Cynthia & Nwabugwu, 2016). Additional barriers, such as low digital literacy, high

costs of digital infrastructure, and socio-cultural factors, further complicate adoption. (Taiwo & Amosu, 2022).

Digital extension services have emerged as a critical tool for bridging the information gap in agriculture. These services leverage information and communication technologies (ICTs) to deliver timely and tailored advice to farmers. A global development initiative called Digital Green uses participatory videos to spread best practices in farming in Kenya. Up to 85% more farmers will adopt improved procedures as a result of having access to these movies via the internet or regional digital hubs (Mapiye *et al*., 2023). Real-time field condition monitoring is made possible by IoT devices like weather stations and soil sensors, which give farmers accurate information on pest activity, nutrient content, and moisture levels. With studies demonstrating yield increases of up to 25% in IoT-enabled farms, these technologies have dramatically increased efficiency and decreased input costs (Liang & Shah, 2023). Additionally, Esoko, a Ghanaian platform, employs mobile technology to give farmers crop advise, weather notifications, and real-time market prices. More than 1.5 million farmers in Africa have benefited from Esoko's services, which have helped them negotiate higher prices for their produce and adjust to the changing climate (Esoko, n.d.; International Fund for Agricultural Development (IFAD), 2020).

Diaz *et al.* (2021) reported that most farmers have not taken full advantage of the benefits of Digital extension services benefits, despite their benefits, the adoption of digital extension services in developing countries faces significant barriers. Poor infrastructure, a lack of ICT knowledge and financial capability, ineffective ICT policies, and inefficiencies in agricultural institutions are among the primary obstacles to smallholder farmers' adoption of digital extension technologies, according to Ayim *et al*. (2022). Ojo (2023) highlighted that low digital literacy and limited access to smartphones remain pervasive challenges in rural Nigeria. The efficient use of ICTs in developing nations is hampered by issues including a lack of knowledge and expertise in using mobile phones and applications, the inability to purchase mobile devices, the use of foreign languages in applications, and network issues, among other things (Emeana *et al.*, 2020; Hoang, 2020; Sadekur Rahman *et al.*, 2020).

The lack of empirical data on adoption levels and specific barriers in Lagos State creates a knowledge gap that hinders the design of targeted interventions. This study seeks to fill this gap by examining the levels of adoption and barriers to adopting digital extension services among registered extension officers and rural farmers in Lagos State. The findings aim to inform strategies for scaling digital agriculture to promote sustainable practices and enhance food security.

Research Objectives

The main objective of the study is to assess the adoption of digital extension services by agricultural rural farmers for sustainable agriculture in Lagos State, Nigeria. Specifically, it sought to:

1. determine the extent of usage of digital extension services in agricultural practices by agricultural rural farmers for sustainable agriculture in Lagos State, Nigeria.
2. identify the barriers hindering the adoption of digital extension services by agricultural rural farmers for sustainable agriculture in Lagos State, Nigeria.

Research Questions

The following two research questions guided the study:

1. What is the extent of usage of digital extension services in agricultural practices by agricultural rural farmers for sustainable agriculture in Lagos State, Nigeria?
2. What are the barriers hindering the adoption of digital extension services by agricultural rural farmers for sustainable agriculture in Lagos State, Nigeria?

METHODOLOGY

The study was conducted in Epe, Lagos State, Nigeria. The study employed a descriptive survey research design. The target population was made up of rural farmers in five farming communities in Epe LGA namely Oriba, Ejinrin, Ilaara, Araga, and Igboye which are all hamlet along the Lagos Lagoon's Epe axis. These communities were purposefully selected in the first stage in Epe Local Government and 100 rural farmers (20 per villages) were purposefully selected at random in the second stage according to the size of the farm communities. A well-structured 20-item questionnaire, using a 5-point Likert scale was used as instrument. Three experts from Lagos State University of Education's College of Vocational and Entrepreneurship Education provided face validity validations for the instrument. The internal consistency of the instrument was 0.99 using cronbach Alpha Model. The descriptive statistics of weighted mean was used to analyze the data. Any item with a calculated weighted mean of 3.40 and above was accepted as a positive finding (Agreed/Important), and any item with a weighted mean below 2.60 was rejected as a negative finding (Disagreed/Unimportant).

Weighted Mean Score Range	Interpretation
4.20 - 5.00	Very High
3.40 - 4.19	High
2.60 - 3.39	Moderate
1.80 - 2.59	Low
1.00 - 1.79	Very low

RESULTS

Research Question One

What is the extent of usage of digital extension services in agricultural practices by agricultural rural farmers for sustainable agriculture in Lagos State, Nigeria?

Table 1: Mean response of respondents on the extent is the usage of digital extension services in agricultural practices Lagos State

S/N	extent of usage of digital extension services in agricultural practices	X	Decision
1.	I regularly use SMS-based agricultural advice to make farming decisions (e.g., planting schedules, pest control).	3.5	High
2.	I have used a mobile app to access information about crop management or livestock care in the past six months.	2.7	Moderate

3.	I rely on online platforms (e.g., websites, social media groups) to get updates on market prices or farming techniques.	2.7	Moderate
4.	I use digital extension services to communicate with extension officers or agricultural experts.	2.8	Moderate
5.	I have adopted new farming practices based on information received through digital extension services.	3.3	Moderate
6.	I find digital extension services more convenient than traditional in-person extension services.	2.3	Moderate
7.	I use digital tools to access weather forecasts that guide my farming activities.	2.8	Moderate
8.	I share information from digital extension services with other farmers in my community.	3.2	Moderate
9.	I have used digital extension services to access financial or market opportunities (e.g., loans, buyers).	3.0	Moderate
10.	I actively use digital extension services (e.g., mobile apps, SMS advisories, or online platforms) to access agricultural information	3.1	Moderate
	Weighted Mean	**2.9**	**Moderate**

Table 1 reveals that rural farmers exhibit moderate usage (grand mean 3.28), with higher engagement in weather tools (3.6) and SMS (3.5). The weighted mean of 2.9 therefore indicate a moderate integration of digital tools into their work.

Research Question Two

What are the barriers hindering the adoption of digital extension services by agricultural rural farmers for sustainable agriculture in Lagos State, Nigeria?

Table 2: Mean response of respondents on the barriers hindering the adoption of digital extension services Lagos State

S/N	Barriers Hindering The Adoption Of Digital Extension Services By Agricultural Rural Farmers For Sustainable Agriculture Include	X	Decision
1.	Poor internet connectivity in my area prevents me from using digital extension services effectively.	3.5	High
2.	I find digital extension services difficult to use due to my limited knowledge of technology.	4.0	High
3.	I cannot afford a smartphone or other devices needed to access digital extension services.	3.2	Moderate
4.	I have not received adequate training on how to use digital extension services.	3.5	High
5.	Most digital tools are not having user friendly interface.	3.5	High
6.	The cost of data or internet services is too high for me to use digital extension services regularly.	4.0	High
7.	Erratic power supply affect usage of digital extension services.	4.0	High
8.	Cultural or social norms in my community discourage the use of digital tools for farming.	3.1	Moderate
9.	I face language barriers when using digital extension services (e.g., content not available in my local language).	2.7	Moderate
10.	High cost of electrical gadgets	3.5	High
	Weighted Mean	**3.5**	**High**

Table 2 reveals that rural farmers face high barriers (grand mean 3.5), such as internet connectivity (4.0), high cost of data or internet (4.0), erratic power supply(4.0), high cost of electrical gadgets and lack of training (3.5) being prominent, but lower scores for barriers like device affordability (3.2), language (2.7) and cultural or social norms etc. the weighted mean of 3.5 therefore shows respondents mostly agreed on the barriers in the item statements as hindering adoption of digital extension services.

Discussion

The result in Table 1 shows moderate usage of digital extension services in Lagos State and this finding aligns with findings of Adebayo and Ogunniyi (2023), who reported that rural farmers in south-western Nigeria were aware of digital tools, such as mobile apps and SMS-based advisory services, and utilized them moderately to access market information and improve linkages with buyers. This finding is also in concordance with the study of Mapiye *et al.,* (2023) that found out that nearly 40% of farmers in sub-Saharan Africa are unable to use even basic ICT applications, such as SMS services or smartphone apps. The reliance on SMS-based tools reflects infrastructural limitations, as internet-dependent platforms are less accessible and this is corroborated by the study of Ibe *et al*, (2023) who found that WhatsApp was one of the major digital tools utilized by agricultural practitioners in information dissemination because it is user friendly. Ikoyo-Eweto et al. (2023) found that rural farmers in Delta State are willing to adopt digital extension services but prioritize platforms with simple, user-friendly interfaces that deliver rapid, actionable insights to enhance farm productivity.

The result in Table 2 shows that there are many barriers such as internet connectivity (4.0), high cost of data or internet (4.0), erratic power supply (4.0), high cost of electrical gadgets and lack of training (3.5) being prominent, but lower scores for barriers like device affordability (3.2), language (2.7) and cultural or social norms, facing the adoption of digital extension services. This finding aligns with the finding of Adelekun *et al*, (2020) and Mustapha *et al*, (2018) who reported the cost of digital tools, poor internet connectivity, and poor electricity supply as the major constraints hindering the effective use of digital tools in Nigeria. The findings is also consistent with the study of Godson-Ibeji *et al,* (2018) who reported erratic power supply (100%), poor network coverage (100%) and high cost of electrical gadgets (77.5%) as the key challenges faced by agricultural extension personnel in the use of e-extension tools in Imo State. The findings on the high cost of electrical gadgets used in digital extension services is in agreement with Akrofi *et al*. (2019) who reported that the high cost of agricultural innovations and technology has hampered their implementation and also with the study of Senyolo *et al.* (2018) who found that smallholder farmers in Africa tended to avoid technology that required high upkeep costs. The findings on the access and cost of internet is further corroborated by the International Telecommunication Union (ITU) who revealed that less than 25% of rural areas in low-income countries have access to broadband internet (James, 2020).

CONCLUSION

This study successfully investigated the adoption of digital extension services (DES) for sustainable agriculture among rural farmers in Lagos State, Nigeria. The central finding reveals a moderate adoption rate of DES by rural farmers for sustainable agriculture in Lagos State. This indicates that while the digital tools hold potential, their current use is limited and not maximizing their impact. More significantly, this study concluded that the moderate adoption is primarily driven by substantial barriers. Rural farmers strongly agreed that pervasive challenges, such as erratic power supply and the high cost of data, severely and negatively affect their ability to utilize digital extension services. Therefore, the study concludes that enhancing DES adoption requires a targeted focus on mitigating these infrastructural and economic hurdles.

RECOMMENDATIONS

To enhance uptake, the following recommendations are proposed:

1. Expand internet and electricity access in rural areas through public-private partnerships.
2. Implement capacity-building initiatives for farmers and extension officers, focusing on digital literacy and platform navigation.
3. Introduce subsidy programs to increase smartphone ownership among rural farmers.

REFERENCES

Adebayo, A. A., et al. (2021). Mobile-based extension services and agricultural productivity in Nigeria. *Journal of Agricultural Extension*, 25(3), 45-56.

Akrofi, N.A., Sarpong, D.B., Somuah, H.A.S. & Osei-Owusu, Y. (2019), "Paying for privately installed irrigation services in Northern Ghana: the case of the smallholder Bhungroo Irrigation Technology", *Agricultural Water Management*, 216, 284-293, doi: 10.1016/j.agwat.2019.02.010.

Ayim, Claudia, Ayalew Kassahun, Chris Addison, & Bedir Tekinerdogan. 2022. "Adoption of ICT Innovations in the Agriculture Sector in Africa: A Review of the Literature." *Agriculture and Food Security* 11 (1): 1–16. https://doi.org/10.1186/S40066-022-00364-7/TABLES/9.

Balafoutis, Athanasios, Bert Beck, Spyros Fountas, Jurgen Vangeyte, Tamme van der Wal, Iria Soto, Manuel Gómez-Barbero, Andrew Barnes, & Vera Eory. 2017. "Precision Agriculture Technologies Positively Contributing to GHG Emissions Mitigation, Farm Productivity and Economics." *Sustainability* 9 (8), https://doi.org/10.3390/SU9081339.

Cynthia, E. N., & Nwabugwu, T. S. (2016). Challenges to adoption of information and communication technologies tools by agricultural extension workers in Anambra State, Nigeria. *Asian Journal of Agricultural Extension Economics and Sociology*, 10(4), 1–6.

De Janvry, A., Macours, K. & Sadoulet, E. (2016), "*Learning for adopting: technology adoption in developing country agriculture*", Policy Briefs from the Workshop Organised by FERDI and SPIA, Clermont - Ferrand, June 1-2, 2016, pp. 1-120.

Diaz, A.C., Sasaki, N., Tsusaka, T.W. & Szabo, S. (2021), "Factors affecting farmers' willingness to adopt a mobile app in the marketing of bamboo products", *Resources, Conservation and Recycling Advances*, 11, 200056,

Emeana, E.M., Trenchard, L. &Dehnen-Schmutz, K. (2020), "The revolution of mobile phone-enabled services for agricultural development (m-Agri services) in Africa: the challenges for sustainability. *Sustainability*, 12(2), 485-495. Doi: 10.3390/su12020485.

Esoko. (n.d.). *About us*. Retrieved November 19, 2025, from https://www.esoko.com/about

FAO. (2022). Digital agriculture for food security. Food and Agriculture Organization of the United Nations.

Godson–Ibeji, C. C., Ibe, M. N., Edet, A. I., & Ajaero, J. O. (2018). Agricultural Extension and Advisory Services Providers' Perception of the Use of E-Extension Tools for Services Delivery in Imo State Nigeria. *International Journal of Agricultural Science and Technology*, *2*(3), 1-9.

Gow, Gordon, Ataharul Chowdhury, Jeet Ramjattan, and Wayne Ganpat. 2020. "Fostering Effective Use of ICT in Agricultural Extension: Participant Responses to an Inaugural Technology Stewardship Training Program in Trinidad." *The Journal of Agricultural Education and Extension* 26 (4): 335–350.

IFAD (International Fund for Agricultural Development). (2020). *Digital solutions for smallholder farmers: The case of Esoko's digital farmer services in West Africa*. Rome, Italy.

Ifeanyi-Obi, C. C., & Corbon, B. L. (2023). Utilization of digital tools in extension service delivery amongst extension agents in Akwa Ibom State, Nigeria. *Journal of Agricultural Extension*, *27*(4), 67-76.

Ikoyo-Eweto, G. O., Adedokun, I. F., Archibong, J. P., & Okwuokenye, G. F. (2023). Rural farmers access to extension services: implications for increased adoption of improved farm technologies in Delta state, Nigeria. *Journal of Agriculture and Food Sciences*, *21*(2), 135-152.

James, J. (2020). *Geographies of the internet in rural areas in developing countries*. In Geographies of the Internet (pp. 93-114). Routledge.

Jadhav, A., Manohar, K. N., Rajesh, C. M., Prasad, R., Anil, K., Bhat, P. P., & Jagadeesh, V. (2024). Revolutionizing Farm Management with Modern Agricultural Extension Techniques: A Review. *Journal of Scientific Research and Reports*, 30(7), 1086-1099

Khatri, A., Lallawmkimi, M. C., Rana, P., Panigrahi, C. K., Minj, A., Koushal, S., & Ali, M. U. (2024). Integration of ICT in Agricultural Extension Services: A Review. *Journal of Experimental Agriculture International*, *46*(12), 394-410.

Klerkx, Laurens, Emma Jakku, and Pierre Labarthe. 2022. "A Review of Social Science on Digital Agriculture, Smart Farming and Agriculture 4.0: New Contributions and a Future Research Agenda." *NJAS: Wageningen Journal of Life Sciences* 90–91 (1): 1–16. https://doi.org/10.1016/J.NJAS.2019.100315.

Liang, C., & Shah, T. (2023). IoT in agriculture: The future of precision monitoring and data-driven farming. Eigenpub *Review of Science and Technology*, 7(1), 85-104

Mapiye, O., Makombe, G., Molotsi, A., Dzama, K., & Mapiye, C. (2023). Information and communication technologies (ICTs): The potential for enhancing the dissemination of agricultural information and services to smallholder farmers in sub-Saharan Africa. *Information Development*, 39(3), 638-658

McCampbell, Mariette, Julius Adewopo, Laurens Klerkx, and Cees Leeuwis. 2021. "Are Farmers Ready to Use Phone-Based Digital Tools for Agronomic Advice? Ex-Ante User Readiness Assessment Using the Case of Rwandan Banana Farmers." *The Journal of Agricultural Education and Extension* 29 (1): 29–51.

Ojo, K. (2023). Barriers to digital extension services in rural Nigeria. *Journal of Rural Development*, 42(2), 89-102.

Sadekur Rahman, M., Enamul Haque, M. and Safiul Islam Afrad, M. (2020), "Utility of mobile phone usage in agricultural information dissemination in Bangladesh", East African Scholars *Journal of Agriculture and Life Sciences*, 4472, Doi: 10.36349/EASJALS.2020.v03i06.020.

Senyolo, M.P., Long, T.B., Blok, V. and Omta, O. (2018), "How the characteristics of innovations impact their adoption: an exploration of climate-smart agricultural innovations in South Africa", *Journal of Cleaner Production*, 172, pp. 3825-3840, doi: 10.1016/j.jclepro.2017.06.019.

Taiwo, A. M., & Amosu, A. O. (2020). The use of ICTS among agricultural extension personnel in Lagos State. *PAT*, *16*(2), 80-89.

Wasihun, A. (2022). Agricultural Research and Extension Linkage: Review on Roles in an Improved Agricultural Technology Transfer in Ethiopia. *Journal of Natural Sciences Research,* 13(4), 8-11.

World Bank. (2023). Digital technologies in agriculture: A global perspective. World Bank Group.

Yahaya, I. (2025). Technology Tracks Tradition: Investigating the Obstacles to Digital Agriculture in Rural Nigeria. *African Journal of Sustainable Agricultural Development*| *ISSN: 2714-4402*.