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# Deploying Digital Tools for Agricultural Information Dissemination on Family Farming in Southwest Nigeria

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## ABSTRACT

In recent years, digital tools and services have become increasingly crucial for smallholder farming operations, particularly in underdeveloped countries. These technologies are invaluable in offering services such as advisory services, weather forecasts, and market updates to farmers. The study assessed the deployment of digital tools for agricultural information delivery on family farms, determined farmers' knowledge, and the level of farmers' perception of digital tools in disseminating information on family farming, as well as the level of utilization and constraints to their use. Three hundred farmers were randomly selected through a multi-stage sampling procedure across the selected States of southwestern Nigeria. Descriptive statistical tools were utilized to organise and describe the data. Multiple regression model was used for hypothesis testing. The results indicated a high level of farmers' knowledge in Facebook, video calls, WhatsApp, and Dropbox utilization. The results further show that farmers in the study area had sufficient expertise in utilizing Facebook for social engagement (mean = 2.11), WhatsApp for obtaining information on agricultural techniques (mean = 2.19), and Zoom for personal communication (mean = 2.17). The majority of the farmers had moderate utilization of Facebook, WhatsApp, and Zoom. A significant percentage had never utilized digital tools like Wikis, Instagram, and YouTube. Several challenges limit farmers' use of digital tools, including unreliable internet, inconsistent electricity supply, inadequate knowledge and skills, and the high costs of the tools. Furthermore, the study found that farmers in the three states did not differ significantly in their use of digital tools. The study recommends that farmers receive training on nearly all of the digital tools identified. This training is essential if these tools are to truly empower family farmers and help promote sustainable agricultural production across Nigeria.

**Keywords:** Communication, Digital tools, Internet, Mobile networks, Utilization, Training

## 1. INTRODUCTION

Family farming is a set of agricultural activities involving the use of family labour. It an all-encompassing activity including forestry, fisheries, pastoral and aquaculture

(Food and Agriculture Organization, 2024). A family farm as defined by The United States Department of Agriculture Economic Research Service's (USDESA) 2021 as one in which all the decision making and activities are carried out by the owner and the members of his household. Chiaka et al., (2022) in their study highlight that smallholder family farms in Nigeria contribute greatly to local food production but often operate with limited resources and face obstacles such as inadequate access to credit and modern technologies, which constrain their productivity and food production. Family farming produces between 70 and 80% of food worldwide. It plays a great role in sustainable agricultural production as well as rural employment, income generation, and the proper management of its natural resources (Food and Agriculture Organization (FAO) of the United Nations, 2014). The United Nations General Assembly at its Thirty-seventh session in 2011 asserted 2014 as the International Year of Family Farming (IYFF). FAO believes that family farmers play a crucial role in achieving a world free from hunger and poverty. (Food and Agriculture Organization of the United Nations, 2014).

The world's population is expected to rise from 7.6 billion in 2018 to 9.8 billion by 2050, putting more pressure on farmers and food systems to feed everyone (United Nations Department of Economic and Social Affairs, 2017). Information dissemination about improved farm practices to small scale farmers seems a mirage in developing countries. Conventional methods such as in-person meetings or radio programming, can be expensive to offer general information.

How do we solve this problem?. Digital tools usage is the answer. Singh et al (2022) highlighted how digital tools have revolutionized the information delivery system by improving efficiency, accessibility, and sustainability, especially for family farms.

Farmers, extension agents, and policymakers now have a lot of tools and applications at their disposal, which will empower them to make reasonable choices for increased agricultural productivity and sustainability.

Digital tools have completely changed the way farmers received information on market prices, crop cultivation, pest control, and weather forecasts from extension agents. Digital tools used by extension agents and farmers include Facebook, Twitter, YouTube, Google, WhatsApp, blogging, LinkedIn, Zoom, Telegram, Skype, Instagram, Google Meets Smart Radio, Smart Television, Geographic Information Systems [GISs](Imagery, Coordinates, and Geospatial data) (Matt, 2015).

Despite the importance of digital tools in promoting agricultural development, how well are farmers acquainted with the use of these digital tools?

Therefore, the research assessed the efficacy of using digital devices to disseminate agricultural messages on family farming. The specific objectives included identifying the digital tools that extension workers use to disseminate information to farmers, assessing the accessibility of farmers to digital tools, the extent of utilization of digital tools for agricultural information dissemination on Family Farming, perception of digital tool utilization, and constraints militating against the utilization of digital tools.

## 2. MATERIALS AND METHODS

The survey in Southwest Nigeria. The population of this study consisted of farmers who engage in family farming across Nigeria. A random sampling method was used in selecting 300 family farmers across various States, ensuring representation from diverse agro-ecological zones. The first step involved random selection of three states in Nigeria (Ekiti, Osun, and Oyo States), giving family farmers a fair chance of being chosen for the study. At the second stage, one agricultural development zone (ADP) was selected from each of the states. The third stage involved the random choosing of 300 respondents (Ekiti State: 60, Osun State: 114, and Oyo State: 126) who practice family farming. The data were gathered through semi-structured interviews to explore farmers' experiences and perceptions regarding digital tools for agricultural information dissemination. To assess farmers' utilization of digital devices for information dissemination, a 3-point rating scale was used (Always = 3, Seldom = 2, and Never).

The research employed descriptive analytical tools, which are frequency counts and percentages. The inferential statistics were analyzed using a multiple regression model for the research hypotheses.

## 3. RESULTS AND DISCUSSION

Table 1 indicated that about 55.9% and 44.1% sampled were males and females. It is an indication that males were the dominant stakeholders in family farming, which might be due to the laborious nature of their farm work. Findings align with Acharya, Huque, and Ghoshal (2020) that farming in India was rigorous and therefore involved high involvement of males. In contrast to Oseni, Goldstein, and Utah (2013) report that women are to a great extent involved in the production of arable crops in Nigeria. Furthermore, findings indicate that the mean age of the family farming households was 49 years. The majority (83%) were between the ages of 30 and 60 years. The farmers practicing family farming in the study area were still actively involved in farming operations. It is an indication

that they had the energy and willingness to work on their farms and embrace new technological innovations that could help them in their farming activities.

Moreover, Table 1 showed that the mean farmers' year of schooling was 11, and 28.8% of the respondents had less than 6 years of formal education, 49.4% had between 7 and 12 years of schooling, while about 41.8% had 13 years and above. The findings show that sampled family farmers in the survey area had a moderate level of education. The findings indicate that farmers can easily learn and utilize digital tools in their farming transactions, as Oladeebo and Masuku (2013) submitted that schooling was among the crucial factors in determining the efficiency of farmers in crop production.

Results in Table 1 show that 81.3% were married, 4.3% were single, and 13.4% were divorced. The findings showed that majority of those surveyed were married. It indicated that married farmers may utilize digital tools more, based on findings of Itari, Anthony, and Okeme (2015), who reported that married respondents utilized information than other categories of respondents. It implies that being married could enhance technology utilization among farmers, and web-based tools could facilitate innovations in farming operations.

Results show that an average annual income of the respondents was approximately ₦760,881.81. Specifically, 43.1% earned less than ₦360,000.00, and 19.7% earned between ₦660,001 and ₦960,000.00. The findings show that a high proportion of the respondents earned less than the average annual minimum wage in Nigeria. However, a reasonable proportion of the farmers still earn above the minimum wage of ₦360,000.00. The finding implies that farmers who earn above the minimum wage may be comfortable, and such farmers would be able to favourably compete with those who earn a monthly government-based minimum wage of N30,000.00.

Farmers' average years of experience was 15. The findings demonstrated that farmers have enough expertise to know the value of digital technologies in crop and animal production

**Table 1:** Socio-economic characteristics of farmers

Variables	Deviation	Freq.	Percentage	Mean	Std. Dev.
Sex					
Male		197	55.9		
Female		102	44.1		
<b>Age (years)</b>					
<30		8	2.7		
30 - 44		110	36.8	49.36	10.07
45 - 59		139	46.5		
60 +		42	14		
<b>Years of formal schooling</b>					
< 6.00		86	28.8		
7 - 12		88	29.4	13.85	5.89
13+		125	41.8		
<b>Highest Educational qualification</b>					
No formal education		62	20.7		
Primary		140	46.8		
Secondary		81	27.1		
Post-secondary		16	5.4		
<b>Marital status</b>					
Single		13	4.3		
Married		243	81.3		
Divorced		40	13.4		
Separated		3	1		
Widowed					
<b>Your average income per annum</b>					
<= 360000.00		129	43.1		
360001.00 - 660000.00		82	27.4	760881.81	146552
660001.00 - 960000.00		59	19.7		

960001.00+	29	9.7		
<b>Experience (Years)</b>				
<= 10.00	130	43.5		
11.00 - 20.00	91	30.4	15.1	7.4
21.00+	78	26.1		

Source: Field Survey, 2024

**Knowledge of digital tools among farmers**

Results in Table 2 indicated that farmers knowledge was low in almost all the web tools except in the knowledge about usage of Smart Radio(Mean=2.56), usage of smart Television(Mean=2.48), usage of WhatsApp in the teaching and learning agricultural practices (Mean = 2.50), use of Facebook for social interactions (Mean = 2.32), the utilized Zoom for interpersonal communication (Mean = 2.17), and Google (Mean = 2. 27). This implies that farmers may be less likely to seek out information on improved crop and animal production management strategies if they are not familiar with many digital tools

However, farmers who practice a family farm may find it difficult to initiate conversations about the use of digital tools unless agricultural extension workers introduce them to it. The low level of knowledge may be due to extension agents' inability to introduce farmers to some of the online resources.

**Table 2:** Distribution of farmers according to their knowledge of the digital tools’ usage

Knowledge of digital tools	Mean	Std. Dev
Using Twitter for effective agricultural information	1.36	14 <sup>th</sup>
Instagram for sharing images of farm inputs and products	1.43	13 <sup>th</sup>
Using Soundation can allow Extension Agents to record	1.53	12 <sup>th</sup>
Using YouTube for an effective presentation.	1.72	9 <sup>th</sup>
Wikis enable me to create collaborative knowledge bases	1.67	10 <sup>th</sup>
Using Blogs for creating agricultural websites	1.57	11 <sup>th</sup>
Using Google sheet for analyzing agricultural data	1.93	6 <sup>th</sup>
Using Facebook as a social networking tool	2.32*	4 <sup>th</sup>
Using Research Gate as a social networking tool	1.89	8 <sup>th</sup>
Usage of Skype for web conferencing tool	1.92	7 <sup>th</sup>
Usage of Smart Radio	2.56*	1 <sup>st</sup>
Usage of Smart television	2.50*	2 <sup>nd</sup>
Usage of What-sap	2.48*	3 <sup>rd</sup>
Usage of Zoom	2.17*	5 <sup>th</sup>

Grand Mean = 2.0

**Access to digital tools**

Table 3 showed that farmers who operate family farms claimed that WhatsApp (Mean = 2.94) and Facebook (Mean = 2.65) were the most highly accessed platforms, followed by smart radio (Mean = 2.26), smart television (Mean = 2.18), and Google (Mean = 2.15). All these values were above the benchmark mean of 2.0, indicating relatively high accessibility in the study area, whereas a majority had low access to other digital devices, with a mean lower than the benchmark. Accessibility to these tools influenced various factors, which include the type of mobile devices available, network coverage, data affordability, and the geographical location of the farmers. Findings are in line with Aleke et al. (2011) who reported that ICT tools had a considerable positive impact on agricultural productivity in areas with reliable network access. Therefore, farmers may find it more challenging to get the essential agricultural information and updates they need to increase their output if they have limited access to a variety of internet tools.

**Table 3:** Distribution of respondents according to access to digital tools

Accessibility to web tools	Mean	Rank
Whatsapp	2.94*	1 <sup>st</sup>
Facebook	2.65*	2 <sup>nd</sup>
Smart Radio	2.26*	3 <sup>rd</sup>
Smart Television	2.18*	4 <sup>th</sup>
Zoom	2.18*	4 <sup>th</sup>
Google doc	1.94	6 <sup>th</sup>
Twitter	1.79	7 <sup>th</sup>
Telegram	1.72	8 <sup>th</sup>
Wikis	1.71	9 <sup>th</sup>
Instagram	1.68	10 <sup>th</sup>
Video calls	1.65	11 <sup>th</sup>
Blogs	1.61	12 <sup>th</sup>
Global Positioning System (GPS)	1.25	13 <sup>th</sup>
Linkedln	1.25	13 <sup>th</sup>
Google Meet	1.21	14 <sup>th</sup>
Artificial Intelligence(AI)	1.11	15 <sup>th</sup>

Grand Mean =2.0

### Usage of Digital Tools

As shown in Table 4, WhatsApp (Mean = 2.94), Facebook (Mean = 2.70), and Google (Mean = 2.13) had highest ranking among the respondents. This implies that although certain digital platforms are highly utilized, the broad usage is still fairly limited. This may be due to other factors. Ezeh (2013) and Akintonde et al. (2021), identified the factors influencing adoption rates to include perceived usefulness, affordability, accessibility, and availability. These challenges are often accentuated by lack of knowledge of digital tools, limited infrastructure, and financial constraints in rural areas.

Moreover, a strong determinant of farmers usage of digital tool is the technical capability of the farmers which influences whether they are effectively used. It is noteworthy that many digital tools require certain levels of literacy, without which users may find them unusable. Olowu and Ireferin (2020), affirmed that the effectiveness of ICT tools in agricultural extension work rests on users' competence and experience. Importantly, digital proficiency is not a one-off achievement it requires ongoing training and support, especially as technology continues to evolve. Akinyemi and Idowu (2023) thought that building farmers' capacity to use digital tools should be a continuous investment, not a one-time intervention.

**Table 4:** Distribution of respondents according to usage of digital tools by family farm households

Usage of digital tools	Mean	Rank
WhatsApp	2.94	1 <sup>st</sup>
Facebook	2.70	2 <sup>nd</sup>
Google plus	2.13	3 <sup>rd</sup>
Smart Radio	2.05	4 <sup>th</sup>
Zoom	2.00	5 <sup>th</sup>
Smart Television	1.98	6 <sup>th</sup>
YouTube	1.97	7 <sup>th</sup>
Telegram	1.88	8 <sup>th</sup>

### Constraints to the use of digital tools among family farm households

As presented in Table 5, nearly all the identified constraints to the utilization of digital tools were rated as severe by the respondents. However, there are some identifiable exceptions, these includes the complexity of using the tools (mean = 1.99), the requirement for specialized training (mean = 1.97), and the possible decline in family physical interaction and human relationships (mean = 1.72).

Undoubtedly, farmers and rural communities encounter certain obstacles in the quest to adopting digital tools. Major obstacles to digital utilization include limited internet access, low awareness level of available digital resources, frequent power interruptions or total absence of electricity, combined with the high cost of devices and data plan.

These challenges reflect underlying systemic problems that hinder the digital transformation of farming communities. This is in alignment with the report of Agbo (2015), Adedokun et al. (2020), Umar et al. (2015), and Mustapha et al. (2018), that high cost of digital tools, inadequate internet infrastructure, unreliable electricity supply, and limited technical expertise are barriers to ICT adoption in Nigeria's rural communities. A recent study by Ifeanyi-obi and Corbon (2023) emphasized that while digital tools have the potential to revolutionize agricultural extension and improve productivity, the digital divide in rural Nigeria remains a significant challenge. It is essential to address the gaps in infrastructure, such as reliable internet, electricity, and affordable devices, and provide proper training and skills so as to maximize the benefit of digital tools.

**Table 5:** Constraints to the use of digital tools

Constraints	Mean	Std. Dev
Inadequate coverage of the internet in the study area	1.87	0.96
Low level of awareness of the available information sources	1.83	0.99
Language barriers	2.10	0.92
Electricity/power failure	2.04	0.88
Complex to use	2.06	0.83
Limited knowledge and skills in digital tools	2.01	0.84
High cost of digital devices	2.00	0.85
It requires peculiar types of hardware to utilize some of the digital tools	2.13	0.78
Availability of irrelevant/ undesirable content	2.08	0.78
Digital tools need special training to use them	1.98	0.82
Hackers frequently gain access to accounts when using digital tools.	2.11	0.81
Virus attack on files can cause a lot of damage	1.88	0.86
There may be a delay in message delivery at times.	1.96	0.82
Malfunctioning of digital devices	1.83	0.77
It is reducing interpersonal contact	1.80	0.78

Mean > 2.0 = Severe

Ho: There is no significant relationship between the farmers' perceptions of digital tools and their usage in disseminating agricultural information.

Results in Table 6 show that a positive relationship exists between respondents' perception ( $t = 4.946$ ) and the usage of web tools at the 0.01 level of significance. The Durbin-Watson statistic of 1.915 suggests that the variables in the model have a positive correlation. It means an important factor identified by the model can reliably predict the outcome of the study. In this context, the respondents' perceptions can effectively forecast how digital tool usage will change. The results indicate that those with a favourable attitude towards digital tools are more likely to utilize them frequently to share agricultural information compared to those with an unfavorable attitude. These findings align with the studies of Collins and Hide (2010) and Mohammad (2011) that reported the relevance of disposition toward the use of technology and digital technology in Nigeria.

**Table 6:** Relationship between the family farm farmers' perception of digital tools and the usage digital tools in disseminating agricultural information

Regressors	B	Std. Error	Beta	t	Sig.
(Constant)	57.884	9.216		6.281	0.000
Perceptual scores	0.277	0.056	0.041	4.946	0.000

R-squared = 0.459

Durbin-Watson = 1.915

#### 4. CONCLUSION

It is noteworthy that majority of the farmers have a moderate access to digital tools such as WhatsApp and Facebook, however, limited internet connectivity and inadequate infrastructure constitute a restriction to a more broad utilization of digital tools. While digital tools such as WhatsApp, Facebook, and Google, are highly utilized, lack of competence and experience are a limitation to their broad usage. Significant challenges like poor internet connections, unreliable electricity, and the high cost of devices and data plans make it difficult for farmers to take full advantage of digital tools. It highlights a pressing need to improve infrastructure and make digital tools more affordable to help close the digital disparity within rural areas.

#### Recommendations

The family farm farmers' knowledge of digital tools needs to be strengthened through regular training by extension workers and Non-Governmental Organizations. Also, internet access and improved power supply should be provided by the Federal Government of Nigeria. To have a sustainable agricultural productivity, agricultural information dissemination need be improved through effective usage of digital tools. By embracing these innovations, farmers and agricultural workers can access timely and relevant information, improving their practices and outcomes while ensuring that food production becomes more efficient and environmentally friendly.

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#### Authors contribution

Ogunjimi SI conceived the idea and written the paper and Adara CT administered the interview schedule and analyzed the data.

#### Informed consent

Oral informed consent was obtained from individual participants included in the study.

#### Conference Presentation

Paper presentation at Rural Sociological Society United State of America 2024.

#### Conflicts of interests

The authors declare that they have no conflicts of interests, competing financial interests or personal relationships that could have influenced the work reported in this paper.

#### Ethical approval & declaration

The study was done in conformity with ethical guidelines. Participation was entirely voluntary, and all respondents provided informed consent. The participants' anonymity and confidentiality were ensured, and the data obtained were utilized purely for the study. The ethical guidelines for Human Subjects are followed in the study.

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**Data and materials availability**

All data associated with this study are presented in the paper.

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