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Assessment of Digital Literacy among Women Crop Farmers in Kebbi State, Nigeria

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Ibrahim, S[1*]., Godiya, T[1*]., H. A. Muhammad[2], Illo, A. I[3]., and Bamijoko, O. M[4].

[1,1,2, 3]Department of Agricultural Economics and Extension, Faculty of Agriculture, Abdullahi Fodio University of Science and Technology, Aliero, Nigeria (AFUSTA)
[4]Department of Agricultural Economics and Extension, Faculty of Agriculture, Federal University of Agriculture, Zuru, Nigeria (FUAZ)
*Corresponding author's Email: sani.ibrahimsenchi@ksusta.edu.ng ; +2348033646611,[1]tankogodiyazuru@gmail.com, +2348060196354, [2]hajarualierom@gmail.com, +2347032589200, [3]abdullahi.ibrahim@ksusta.edu.ng, +2347036200348, [4]bamsonmoses@gmail.com, +2347069285662

Abstract

The study assessed digital literacy among women crop farmers in Kebbi State, Nigeria, focusing on their literacy levels, factors influencing their digital literacy, awareness of mobile agricultural apps, and their influence on agricultural productivity. Using a multi-stage sampling approach, 150 women crop farmers. Mean score, standard deviation and multiple regression were employed for data analysis. The results showed that digital literacy among women farmers was generally low to moderate, with many confident in sending SMS messages (Mean=3.27); and WhatsApp messages (Mean -3.09) expressing only slight confidence in using digital devices for farming-related tasks. Cultural barriers (Mean =3.70), safety concerns (Mean =3.90), and limited time due to family responsibilities were identified as major obstacles to digital technology adoption (Mean =3.88). Although the overall regression model assessing agricultural productivity was significant, digital literacy (β=-0.009; p=0.399) did not have a statistically significant impact on agricultural productivity unless supported by relevant digital applications and infrastructure. Access to extension (β=0.270 p=0.001), had a statistically significant impact on agricultural productivity. The study concludes that while digital literacy has the potential to enhance agricultural practices, and it's recommended that targeted interventions such as awareness campaigns, and improved extension services be provided by government.

Keywords: Digital literacy; women farmers; agricultural productivity

Introduction

Agriculture is increasingly becoming digitalized through the application of information and communication technologies (ICTs) such as mobile phones, agricultural mobile applications, digital advisory platforms, remote sensing technologies, social media platforms, and online market information systems (Mollel et al., 2025). These technologies have transformed the way agricultural information is generated, disseminated, and utilised by farmers. Digital agriculture has the potential to improve farm productivity, enhance food security, strengthen climate resilience, and improve rural livelihoods by facilitating access to timely and relevant agricultural information (Mollel et al., 2025). Consequently, governments, development agencies, and

agricultural stakeholders are promoting the integration of digital technologies into agricultural production systems, particularly among smallholder farmers (Mollel et al., 2025).

Among the various digital technologies available to farmers, agricultural mobile applications have emerged as important tools for information dissemination and decision-making. These applications provide farmers with access to weather forecasts, pest and disease management information, market prices, input recommendations, and best agronomic practices (Owiti et al., 2023). However, the benefits associated with agricultural mobile applications can only be realized when farmer s are aware of their existence and understand their potential usefulness. Awareness therefore serves as a critical first step in the adoption and utilisation of digital agricultural technologies. Despite increasing investments in digital agriculture, awareness of agricultural mobile applications among rural farmers, especially women, remains relatively low in many developing countries (Godiya, 2025). Effective utilisation of digital technologies requires more than mere awareness; it requires adequate digital literacy. Cheng et al (2025) posit that agricultural digital literacy is the capacity to comprehend, utilise, and apply technology to enhance crop monitoring, productivity, and decision-making. Farmers with higher levels of digital literacy are better positioned to access digital advisory services, communicate with extension agents, obtain market information, and adopt improved farming practices. Previous studies have shown that digital technologies can improve agricultural productivity, market participation, and farm income through enhanced access to information and improved decision-making (Abdulai et al., 2023; Yekinni et al., 2024; Komba and Lowokelo, 2025). Nevertheless, the ability of farmers to benefit from these technologies depends largely on their digital literacy competencies. Women farmers constitute a significant proportion of the agricultural workforce in Nigeria and contribute substantially to crop production, processing, distribution, and marketing activities (IITA, 2024). Their contributions are critical to household food security, poverty reduction, and rural economic development. Despite their important role in agricultural production, women often face greater challenges than men in accessing productive resources, education, extension services, and digital technologies. These constraints frequently limit their participation in digital agricultural initiatives and reduce their opportunities to benefit from emerging agricultural innovations.

Cultural factors further influence women's access to and utilisation of digital technologies. In many rural communities, prevailing gender norms, restrictions on mobility, limited decision-making power, unequal control over household resources, and lower educational attainment can affect women's opportunities to acquire digital skills and utilise ICT-based agricultural services (Mutuku et. al., 2026). Such cultural barriers may reduce women's access to smartphones, internet-enabled devices, and digital training opportunities, thereby constraining their digital literacy development. Understanding these cultural factors is essential for designing inclusive digital agriculture programmes capable of addressing gender-specific challenges.

The need to strengthen digital literacy among women farmers is particularly important given the limitations of conventional agricultural extension systems. In Nigeria, public extension services continue to face challenges such as inadequate staffing, poor funding, insufficient logistics, and limited mobility (Chekene and Shehu, 2025). In recent years, insecurity in several rural areas has further constrained face-to-face interactions between extension personnel and farmers (Federal Ministry of Agriculture and Food

Security, 2025). Recognising these challenges, the Federal Government of Nigeria recently launched the National Electronic Extension Platform (NEEP) to provide farmers with real-time access to agricultural information, strengthen research-extension-farmer linkages, and improve extension service delivery across the country (Federal Ministry of Agriculture and Food Security, 2025).Digital extension approaches offer opportunities to complement conventional extension services by facilitating rapid dissemination of agricultural information to large numbers of farmers at relatively low cost. Through mobile applications and other digital platforms, extension messages can reach thousands of farming households within a short period, thereby reducing information gaps and improving access to agricultural knowledge.

Recent studies have highlighted the growing adoption of digital technologies in agriculture and their contribution to improved agricultural outcomes (Khidir et al., 2019; Yekinni et al., 2024; Cheng et al., 2025). However, much of the existing literature focuses on technology adoption and access to ICT tools, with relatively limited attention given to farmers' awareness of agricultural mobile applications, their digital literacy competencies, and the cultural factors influencing digital literacy acquisition. Furthermore, empirical evidence regarding the relationship between digital literacy and agricultural productivity among women crop farmers in North-Western Nigeria remains scarce. This knowledge gap limits the development of effective interventions aimed at promoting digital inclusion and improving agricultural productivity among women crop farmers.

It is against this background that this study was undertaken to evaluate the awareness of agricultural mobile applications among women crop farmers, assess their digital literacy levels, identify the factors influencing digital literacy, and examine the influence of digital literacy on agricultural productivity among women farmers. The findings of the study are expected to provide useful information for policymakers, extension organisations, development agencies, and other stakeholders involved in promoting inclusive digital agriculture and strengthening the livelihoods of rural women.

Methodology

The study was carried out in Kebbi State, Nigeria. The state is in Northwest Nigeria. Kebbi state lies between latitudes 10^0 8’ N- 13^0 15’N and longitude 3^0 30’E – 6^0 30’E. With a population of about 3,238,628 (National Population Commission, 2006), the population was projected to be 3,952,766 in 2012 (United Nations Parliamentary Assembly, 2012). Kebbi State occupies a land area of 36,229 square kilometres.

A multistage sampling procedure was used in selecting respondents for the study. The first stage involves purposive selection of two agricultural (Yauri and Zuru) zones. It was done because of the preponderance of women farmers in these zones. In the second stage, two Local Government Areas (Zuru and Sakaba) were randomly selected from Zuru Zone. In the third stage, Manga and Dabai villages were randomly selected from Zuru LGA, while Diri and Gelwasa were chosen from Sakaba LGA. In the fourth stage, Yauri LGA was randomly selected from Yauri Zone, and five villages, Zamare, Gungun Sarki, Tondi Gada, Tondi Tsamiya, and Jijima were selected. Respondents were proportionately drawn from each selected village, with approximately 14% of the total sample taken from each community, giving a total of 150 respondents across the selected zones. Data was collected using a validated and pretested questionnaire. The data generated was analysed using percentage mean score and standard deviation,

and multiple regression. The general form of the model was specified as: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_n X_n + \epsilon$

Where

Y= Agricultural productivity (dependent variable)

$X_1, X_2, X_3, \ldots, X_n$= Socio-economic and digital literacy variables (independent variables)

β_0= Constant term

$\beta_1, \beta_2, \beta_3, \ldots, \beta_n$= Regression coefficients

ϵ= Error term

A structured questionnaire obtained information on digital literacy level which comprised the following; I am confident in sending SMS messages; I am confident in sending WhatsApp messages; I use digital tools to check weather updates among others. It was measured using a 5-point Likert type scale of (1) = not confident, (2)= slightly confident, (3)= moderately confident, (4) = very confident, (5) = extremely confident. A mean of 3.0 was obtained, and it was used to rate respondents' digital literacy into high/moderately /low. Information on factors influencing women crop farmers' digital literacy was measured on a 5-point Likert type scale of (1) = not at all, (2) = slightly, (3) = moderately, (4)= very much, (5)= completely. The benchmark mean of 3.00 was used for decision-making. Scores less than 3.00 were not regarded as a factor, while any mean score that is equal to or greater than 3.0 was regarded as a factor. Information on women farmers' awareness of mobile agricultural applications, and the respondents were presented with the following mobile agricultural apps to gauge their awareness: Agriple app; Farmcrowdy; Releaf NG; RiceAdvice; Compare the market; Farmer's wallet; MKisan; Acretrader; and ThriveAgric. Awareness was measured on a 5-point Likert type scale of extremely aware (5), very aware (4), neither aware/unaware (3), slightly aware (2) and not aware (1). A mean score of 3.0 was obtained and was used to rate respondents' awareness of agricultural applications into highly aware, moderately aware, not aware.

Results and Discussion

Awareness of Mobile Phone Agricultural Applications Among Women Crop Farmers

Table 1 shows women farmers' awareness of mobile phone agricultural apps. Releaf NG ($\bar{x}$=1.54), Farmcrowdy ($\bar{x}$=1.52); RiceAdvice($\bar{x}$=1.48), Agriple ($\bar{x}$=1.33); Farmer's wallet ($\bar{x}$=1.33) and MKisan ($\bar{x}$=1.29). This implies that the women farmers are less or not aware of these mobile phone agricultural apps, either for farming or agribusiness-related activities, as the grand mean is far below the 3.0 benchmark mean. The grand mean of 1.39 further indicates that the respondents were generally unaware of the listed agricultural applications. This suggests limited exposure of women farmers to digital agricultural innovations capable of enhancing access to extension services, market information, weather forecasts, and farm management support. The result was contrary to the result of Khidir et al. (2020), which showed that most farmers were aware of and

used SMS mobile apps. Awareness of available technologies and their benefits affect digital literacy development among farmers. A lack of knowledge about digital platforms and scepticism towards online transactions can discourage farmers from engaging with digital tools (Jongebloed et al., 2024; Hanan et al., 2025). The low awareness observed may be attributed to inadequate digital literacy, limited extension contacts, poor dissemination of information on agricultural technologies, and constraints in smartphone ownership and internet access among rural women farmers. Awareness is a prerequisite for the adoption and effective utilization of digital agricultural technologies. This finding is consistent with the study of Sa'adu et al. (2022), which reported that awareness significantly influenced the adoption of information and communication technologies among agricultural stakeholders. Similarly, a study on the utilization of ICTs among rural dwellers in Southwestern Nigeria found that inadequate funds, limited education, and poor perceptions constrained the use of digital technologies, particularly among female users (Yekini et al., 2024).

Table 1: Awareness of mobile phone agricultural applications among women crop farmers

Agricultural apps	x̄	SD
ReleafNG	1.54	0.75
Farmcrowdy	1.52	0.69
RiceAdvice	1.48	0.73
Agriple	1.33	0.67
Farmers wallet	1.33	0.62
Compare the market	1.29	0.61
MKisan	1.29	0.59
Grand mean	**1.39**	

Source: Field survey, 2025

Digital Literacy Levels of Women Crop Farmers

Table 2 presents the digital literacy levels of women crop farmers. The results show that the respondents were confident in sending SMS messages (Mean = 3.27) and WhatsApp messages (Mean = 3.09), indicating a relatively high level of competence in the use of basic mobile communication tools. This corroborated the finding of Khidir et al. (2020), who reported that most respondents were confident in sending SMS. Moderate levels of digital literacy were observed in the use of farming-specific mobile applications such as Agriple and Farmcrowdy (Mean = 2.92), the ability to identify credible digital information sources (Mean = 2.54), and searching for farm-related information online (Mean = 2.47). Lower mean scores were recorded for the use of the internet to solve farming challenges (Mean = 2.37), the use of mobile banking and digital payment platforms for farming transactions (Mean = 2.32), and the use of digital tools to obtain weather information (Mean = 2.21). The findings suggest that while the respondents possess basic digital communication skills, their capacity to utilize more advanced digital technologies for agricultural decision-making remains limited. The grand mean of 2.64 indicates a moderate level of digital literacy, with competence concentrated mainly in social communication rather than in the productive use of digital technologies for agricultural purposes. This pattern implies that women farmers may be able to communicate through mobile devices but are less equipped to leverage digital platforms for accessing extension information, weather forecasts, market intelligence, financial services, and farm management solutions. The finding is consistent with studies that have reported a gap between ownership and use of mobile phones for communication and the effective utilisation of digital technologies for agricultural

development. For instance, Yekinni et al. (2024) found that rural dwellers were more proficient in basic ICT functions than in specialised digital applications. Similarly, recent studies on digital agriculture in sub-Saharan Africa have shown that limited digital skills, inadequate training, and poor access to relevant digital content constrain farmers' effective use of agricultural technologies. The observed low utilisation of digital tools for weather information, online agricultural information search, and digital financial transactions may also reflect infrastructural limitations such as poor internet connectivity, high data costs, and inadequate digital extension support. Strengthening digital literacy through targeted training programmes, particularly on the use of agricultural applications, digital financial services, and online agricultural information sources, could improve women's participation in digital agriculture and enhance farm productivity.

Table 2: Digital Literacy Levels of Women Crop Farmers

Digital literacy statements	Mean	SD
I am confident in sending SMS messages.	3.27	1.38
I am confident in sending WhatsApp messages.	3.09	1.34
I use farming-specific mobile apps or platforms (e.g., Agriple, Farmcrowdy).	2.92	1.09
I am confident in choosing credible sources of information online (e.g., trustworthy apps or websites).	2.54	1.34
I am confident in searching for farm-related information online.	2.47	0.97
I use the internet to find solutions to farming challenges (e.g., pest control, planting techniques)	2.37	1.22
I am confident in using mobile banking apps or digital payment platforms for farming transactions.	2.32	1.42
I use digital tools to check for weather updates.	2.21	0.89
Grand mean	**2.65**	

Source: Field survey, 2025. SD=Standard deviation

Factors Influencing Digital Literacy among Women Farmers

Table 3 presents the factors influencing the digital literacy of women crop farmers. The findings reveal that safety concerns associated with the use of digital tools (i.e., online scam, online bullying) (Mean = 3.90) constituted the most important factor influencing digital literacy among the respondents. Household responsibilities that limit the time available for ICT use (Mean = 3.88), cultural barriers and social norms that restrict access to ICT tools (Mean = 3.70), and inadequate access to digital tools (Mean = 3.34) were also identified as important factors. Since all the mean scores exceeded the benchmark mean of 3.00, the respondents perceived these variables as factors influencing their digital literacy. The finding that inadequate access to digital tools influences digital literacy is consistent with the study by Okoronkwo et al., (2025), who reported that access to digital technologies significantly influenced their utilisation among rural farmers in Imo State. The study further identified the high cost of digital technologies and low income as major constraints to effective use of digital tools among farmers. The result also supports the findings of Yekinni et al. (2024), who found that inadequate funds and other socioeconomic constraints limited ICT utilisation among rural dwellers, with female respondents experiencing greater constraints than their male counterparts. The authors concluded that constraints associated with ICT access and utilisation reduced the benefits derived from digital technologies.

Furthermore, the observed influence of cultural barriers and household responsibilities aligns with evidence that gender-related factors shape women's access to and utilization of ICTs in rural communities. Yekini et al. (2024), reported that educational opportunities, social circumstances, and access-related constraints significantly influence ICT utilisation among rural populations.

The grand mean of 3.70 indicates that the identified factors influenced the digital literacy of women farmers to a considerable extent. The high mean score for safety concerns suggests that fears relating to online fraud, cybercrime, privacy violations, and misuse of personal information may discourage women from utilising digital technologies. Household responsibilities were also perceived as a major constraint, reflecting the multiple domestic and agricultural roles performed by women, which reduce the time available for acquiring and practicing digital skills. Furthermore, cultural barriers and prevailing social norms may limit women's access to digital devices, training opportunities, and information networks. Inadequate access to digital tools further restricts opportunities for skill development and effective participation in digital agriculture.
The findings imply that improving digital literacy among women farmers requires interventions that address not only technological access but also sociocultural and gender-related constraints. Efforts such as gender-sensitive digital literacy programmes, improved access to affordable digital devices, enhanced internet connectivity, and awareness campaigns on digital safety could substantially improve women's participation in digital agriculture.

Table 3: Factors Influencing Women Crop Farmers' Digital Literacy

Factors	Mean	SD
Safety concerns (such as online scam, cyber-bullying).	3.90	0.63
Household responsibilities.	3.88	0.66
Cultural barriers or social norms.	3.70	0.65
Inadequate access to digital tools.	3.34	0.83
Grand mean	**3.70**	

source: Field survey, 2025; SD= Standard deviation

Influence of Digital Literacy on Agricultural Productivity among Women Crop Farmers

Evidence presented in Table 4 show that digital literacy did not significantly influence agricultural productivity (B=-0.080, β=-0.009, t=-0.106, p=0.916). This indicate that farmers with higher digital literacy scores, did not obtain significant crop yields than those with lower scores after controlling for other explanatory variables. The absence of a significant effect suggests that possessing digital literacy alone may not translate into improved agricultural productivity. Although digitally literate farmers may be better able to access agricultural information, higher yields also depend on complementary factors such as timely adoption of recommended practices, access to quality inputs, favourable weather conditions, and adequate financial resources. This finding contradicts the findings of Komba and Lowokelo (2025), who found that the use of

agricultural digital tools like mobile weather forecasting applications and precision agriculture resulted in significant productivity gains, notably a 64.8% increase in maize yield.

Table 4: Influence of Digital Literacy on Agricultural Productivity among women Crop Farmers

Variables	B	SE	β	t	*p*
Constant	2.016	0.481		4.187	0.001
Digital literacy	-0.001	0.014	-0.009	-0.106	0.916
Age	0.009	0.012	0.083	0.761	0.448
Years of farming experience	0.015	0.014	1.116	1.080	0.282
Farm size	0.394	0.312	0.088	1.116	0.266
Access to extension	0.580	0.171	0.270	3.391	0.001***
Access to credit	0.116	0.184	0.054	0.632	0.528

Source: Field survey, 2025

Conclusion and Recommendations

Women farmers generally showed low digital literacy levels. Factors such as safety concerns and reduced time due to household responsibilities significantly influence digital literacy. Awareness of mobile agricultural apps was grossly inadequate among women farmers. Based on the findings the study recommends that; Kebbi State government through Kebbi Agricultural and Rural Development Authority should launch Digital literacy campaign targeting women crop farmers. There should be collaboration between network service providers and the ministry for Digital economy to design mobile phone agricultural apps suitable for women crop farmers. Training session should be organised by NGOs to train the women crop farmers on how to be safe online and be able to identify scam messages. Communities' leaders should be educated on the need to allow women utilise digital platforms in order to acquire new knowledge.

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