

Factors influencing digital financial services adoption among smallholder farmers in Kwara State, Nigeria

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Paper History

Received: 01st October, 2025

Accepted: 15th October, 2025

Published: October, 2025

Abstract:

Digital Financial Services (DFS) have the potential to improve financial inclusion and agricultural productivity among smallholder farmers in Nigeria. However, adoption remains uneven, particularly in rural areas. This study examined the factors influencing DFS adoption among smallholder farmers in Kwara State. A multistage sampling procedure was employed to select 237 respondents. Primary data were collected and analysed using descriptive statistics and binary logistic regression. Findings revealed that most respondents were male, married, and educated, owned a mobile phone, and had internet access. Key determinants of DFS adoption were education ($\beta = 1.772$; $p \leq 0.01$), income ($\beta = 0.631$; $p \leq 0.05$), and farming experience ($\beta = -1.059$; $p \leq 0.01$). Education and income had a positive influence on adoption, while longer farming experience reduced the likelihood of adoption. Policies should promote digital literacy and adult education, provide farmer-friendly DFS products, expand rural internet infrastructure, and offer incentives to encourage wider DFS uptake among smallholder farmers.

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Keywords: Digital Financial Services, Financial Inclusion, Technology Adoption

1. Introduction

Agriculture remains the primary livelihood for a large share of Nigeria's population and a key driver of food security and rural incomes, yet smallholder farmers continue to face structural constraints, limited access to formal finance, market frictions, and vulnerability to shocks that constrain productivity and resilience (Amankwah, 2023; Ali *et al.*, 2023). These barriers to finance reduce farmers' ability to purchase inputs, invest in productivity-enhancing technologies, and smooth consumption during shocks, thereby perpetuating low productivity and poverty in rural areas (World Bank, 2024)

Digital Financial Services (DFS), including mobile money, agent banking, USSD payment channels, digital wallets, and bank-led mobile banking, promise to expand access to affordable, convenient financial services for rural populations by lowering transaction costs, reducing distance-to-service, and enabling new service bundles (payments, savings, credit, insurance) tailored to agricultural cash flows (Agbaeze *et al.*, 2023; Aliu 2023). Empirical and programmatic work suggests that DFS can improve farmers' ability to receive payments, access inputs, and save securely, which in turn can strengthen market participation and resilience. However, adoption among rural smallholders often lags behind national-level

DFS uptake because of sector- and place-specific barriers (MIT, 2020)

In Nigeria, the national financial inclusion landscape has shifted rapidly in recent years: digital service uptake has been identified as a key driver of rising inclusion rates, yet significant gaps remain; roughly a quarter to one-third of adults remain unbanked in recent surveys, and rural and agricultural populations are disproportionately excluded from formal services. These national dynamics are an important context for understanding DFS adoption among farmers at the subnational level. (Central Bank of Nigeria, 2022)

Kwara State illustrates many of the challenges and opportunities facing Nigerian smallholders. Recent empirical work in Kwara documents limited access to formal credit for smallholder farmers, heavy reliance on informal borrowing, and significant heterogeneity in welfare outcomes tied to credit access and household characteristics. These findings underscore the potential for improved financial access, digital or otherwise, to influence agricultural investment and livelihoods in the state, while also indicating that credit access alone does not resolve other social and structural constraints (Osasona *et al.*, 2024)

Despite promise, adoption of DFS by smallholder farmers is shaped by multiple interacting factors: (1)

demand-side characteristics such as digital literacy, financial literacy, perceived usefulness and trust in providers; (2) supply-side constraints including agent network density, mobile/internet network coverage, product design fit, and costs/fees; and (3) contextual institutional and social factors such as gender norms, land tenure, cooperative membership, local market structures, that mediate use. Studies and program evaluations emphasize that the mere availability of digital channels is insufficient without product tailoring, user education and last-mile distribution (agents and trusted intermediaries) (MIT, 2020). There are important empirical gaps. While macro-level reports and pilot projects document the technical feasibility and some aggregate impacts of DFS, few studies systematically examine the relative importance of multi-dimensional factors (infrastructure, literacy, trust, product fit, and contextual social factors) that drive adoption decisions specifically among smallholder farmers at the state level in Nigeria. Moreover, subnational heterogeneity variations in extension services, local credit markets, and agrarian systems suggest that national-level averages mask important local dynamics relevant for policy and design (World Bank, 2024).

This study addresses these gaps by investigating the factors that influence DFS adoption among smallholder farmers in Kwara State, Nigeria. The specific objectives of the study are to:

- a. Identify the socioeconomic characteristics of the smallholder farmer in the study area
- b. Examine the determinants of digital financial services among the smallholder farmers in the study area
- c. Recommend policy and programmatic interventions aimed at improving the adoption of digital financial services among smallholder farmers in the study area.

1.1 Hypothesis of the study

H0: Socioeconomic characteristics do not significantly influence the adoption of DFS among smallholder farmers.

2. Methodology

2.1 The study area

The research was conducted in Kwara State, Nigeria. The state was created in May 1967 by the Federal Government of Nigeria. Geographically, Kwara lies between latitudes 8°30' and 8°50' N and longitudes 4°20' and 4°35' E. It shares boundaries with the Republic of Benin to the west, Kogi State to the east, Oyo, Ekiti, and

Osun States to the south, and Niger State to the north (Kwara State Government, 2019).

According to the 2006 National Population Census, the state had a population of approximately 2,365,353 people. Using Nigeria's estimated annual population growth rate of 2.6%, the projected population for Kwara State in 2022 is estimated at 3.55 million (National Bureau of Statistics, 2017).

Kwara experiences two distinct climatic seasons: the dry season, formerly spanning October to March but now slightly extended due to climatic variability, and the rainy season, which typically begins in March and lasts until early September. The state records an annual rainfall range of 1,100–1,500 mm (Oloyede et al, 2021). Temperatures remain relatively high throughout the year, ranging from 25–30 °C during the wet season and 33–34 °C in the dry months.

Agriculture constitutes the main economic activity in Kwara State. The majority of residents are subsistence farmers engaged in rain-fed cultivation of cereals, legumes, and tubers. The fertile soil, favourable vegetation, and moderate climate support the production of both annual and perennial crops, including millet, guinea corn, rice, soybean, cowpea, cassava, and yam. Recent increases in maize productivity have enhanced the state's capacity to produce over 200 metric tonnes of maize annually (KWWSG, 2019). Farming, particularly maize cultivation, employs about 75–80 percent of the population, encompassing both commercial and smallholder systems.

For administrative efficiency and to align with ecological and cultural characteristics, the Kwara State Agricultural Development Project (ADP) divides the state into four agricultural zones, each serving as a focal point for agricultural planning, input distribution, and extension service delivery.

2.2 Sampling technique and sample size

A multistage sampling procedure was employed to select respondents for this study. In the first stage, two agricultural zones were randomly selected from the state's four zones (Zone B and Zone C), representing 50% of the zones. In the second stage, 20% of extension blocks were randomly selected from each of the chosen zones. At the third stage, 20% of cells were randomly drawn from the selected blocks. Finally, proportionate sampling was used to select registered farmers from each cell, based on the total number of farmers in the sampling frame. This yielded a sample size of 237 respondents, as shown in Table 1

Table 1: Sampling procedure.

Selected states	50% of zones from each state	20% of blocks from selected zone	20% of cells from selected block	Total number of registered farmers in selected cell (Sample frame)	Sample size (n=N/1+N(e ²))
Kwara	Zone B	Lafiaji	Lafiaji	97	41
		Lade	Lade	83	35
	Zone C	Iporin	Oke Oyi	98	41
			Oke Ose	87	37
		Shao	Agbeyangi	96	40
			Sobi	103	43
TOTAL			Total= 564	= 237	

2.3 Data Collection

Primary data were collected through the administration of structured questionnaires.

2.4 Model Specification

The study employed a binary logistic regression model to examine the determinants of Digital Financial Services (DFS) adoption among smallholder farmers in

Kwara State, Nigeria. The dependent variable, DFS adoption, was measured as a binary outcome, where 2 = high adoption and 1 = low adoption. The model assumes that the probability of high DFS adoption is a logistic function of several socio-economic and technological variables.

Mathematically, the model is specified as shown in equation 1:

$$\ln(P_i / (1 - P_i)) = \beta_0 + \beta_1(\text{Age}) + \beta_2(\text{Sex}) + \beta_3(\text{Marital Status}) + \beta_4(\text{Household Size}) + \beta_5(\text{Education}) + \beta_6(\text{Farming Experience}) + \beta_7(\text{Income}) + \beta_8(\text{Mobile Phone Ownership}) + \beta_9(\text{Internet Access on Device}) + \mu_i \quad (1)$$

Where P_i = Probability of high DFS adoption by the i -th farmer, $(P_i / (1 - P_i))$ = Odds of DFS adoption, β_0 = Constant term, $\beta_1 - \beta_9$ = Coefficients of the explanatory variables, and μ_i = Error term

2.5 Data analysis

Data analysis was carried out using descriptive and inferential statistical methods using SPSS. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the socioeconomic characteristics of the respondents.

To identify the determinants of digital financial service adoption, a binary logit regression was employed.

3. Results and discussion

3.1 Socioeconomic characteristics

Table 2 reveals the socio-economic characteristics of the respondents. The results show that the majority of respondents were male (88.6%), indicating a gender imbalance in agricultural participation and decision-making. This finding aligns with the observation of Abdulraheem and Yusuf (2021) and Ogunfolaju et al. (2025) that men dominate farming and financial decision spaces in rural Nigeria, while women often face barriers to land ownership and access to productive resources, which may also influence DFS adoption patterns.

The mean age of 50.53 years suggests that smallholder farmers in Kwara State are largely middle-aged, a demographic that is still economically active but may exhibit moderate exposure to digital technologies. This is consistent with the findings of Oladapo, et al. (2022), who reported that the adoption of digital tools among smallholder farmers decreases with age, as younger farmers tend to be more technologically adaptable.

Most respondents were married (95.8%) and had relatively large household sizes, reflecting the typical extended family system prevalent in rural Nigeria. Similar findings were reported by Okeke, et al. (2021), who noted that large household sizes contribute to labour availability but can also increase household consumption pressures, influencing financial behaviour and the need for efficient payment systems such as mobile money. In terms of education, 78.5 percent of respondents have above primary education, suggesting a relatively high literacy level among farmers in the area. Higher educational

attainment has been linked to improved capacity to understand and adopt digital innovations (Ogbemudia, 2024). Therefore, this may positively influence awareness and use of DFS among smallholders.

The respondents' average farming experience of 14.65 years indicates considerable practical knowledge of agricultural practices. However, farm sizes averaged 2.61 hectares, confirming the predominance of smallholder farming systems, consistent with national patterns where smallholders cultivate less than 3 hectares on average (FAO, 2022). Small farm sizes and modest monthly incomes, mostly below ₦300,000, suggest limited capital accumulation and a reliance on short-term credit, potentially making digital financial tools attractive for improving access to financial services.

Nearly all respondents owned mobile phones (98.7%), a positive indicator for DFS readiness. This aligns with GSMA (2023) findings that mobile penetration in Nigeria has significantly increased, providing a foundation for scaling digital finance in rural areas. Land ownership (82.3%) further strengthens farmers' financial stability and collateral potential, which may facilitate engagement with formal financial channels.

3.2 Determinants of DFS Adoption

The binary logit regression results in Table 3 show that education, farming experience, and income significantly affected the adoption of Digital Financial Services (DFS) among smallholder farmers in Kwara State. Educational level had a positive and highly significant impact ($\beta = 1.772$; $p \leq 0.01$), indicating that farmers with higher education are more likely to adopt DFS. This supports Ogbemudia (2024), who reported that education increases awareness, digital literacy, and the ability to navigate mobile financial platforms among rural users in Nigeria.

Farming experience exhibited a negative and significant relationship with DFS adoption ($\beta = -1.059$; $p \leq 0.01$). This suggests that farmers with longer years of farming experience tend to rely more on traditional financial systems, possibly due to entrenched habits and lower willingness to change, a pattern also observed by Gizachew, et al. (2024), who noted that older and more experienced farmers often perceive digital platforms as complex or risky.

Table 2: Socioeconomic Characteristics of the Respondents

Variables	Frequency (n=237)	Percentage	Mean (Std Dev.)
Sex			
Male	210	88.6	
Female	27	11.4	
Age (years)			50.53 (9.99)
20 – 34	10	4.2	
35 – 49	107	45.1	
50 - 64	93	39.2	
65-79	27	11.4	
Marital Status			
Single	4	1.7	
Married	227	95.8	
Widow	5	2.1	
Divorced	1	0.4	
Level of Education			
No formal education	23	9.7	
Primary education	28	11.8	
Secondary education	118	49.8	
Tertiary education	68	28.7	
Household size (persons)			7.81 (2.80)
1 – 4	19	8.0	
5 – 7	94	39.7	
8 – 12	115	48.5	
13 and above	9	3.8	
Farming Experience (years)			14.65 (10.20)
1 – 10	41	17.3	
11 – 20	90	38.0	
21 – 30	68	28.7	
Above 30	38	16.0	
Farm size (Hectares)			
Less than 1.0	72	30.4	
1.1 – 2.0	75	31.6	
2.1 – 3.0	21	8.9	
3.1 – 4.0	5	2.1	
4.1 – 5.0	64	27.0	
Monthly Income (Naira)			2.61 (1.60)
5,000 – 50,000	48	20.3	
51,000 - 150,000	33	13.9	
151,000 – 300,000	56	23.6	
301,000 – 500,000	88	37.1	
501,000 – 600,000	12	5.1	
Land Ownership			
Yes	195	82.3	
No	42	17.7	
Mobile phone ownership			
Yes	234	98.7	
No	3	1.3	

Table 3: Factors Influencing Adoption of DFS among Smallholder Farmers

Variables	Coef. (β)	Std. Error	t-value	P> t	Decision Ho
Age	0.917	0.443	4.276	0.039	Accept Null
Sex	0.583	0.651	0.803	0.370	Accept Null
Marital Status	-0.844	0.901	0.876	0.349	Accept Null
Household Size	-0.615	0.401	2.349	0.125	Accept Null
Education	1.772	0.492	12.985	0.000*	Reject Null
Farming Experience	-1.059	0.262	16.299	0.000*	Reject Null
Income	0.631	0.219	8.285	0.004**	Reject Null
Mobile phone Ownership	-1.162	22150.59	0.000	1.000	Accept Null
Internet Access on Device	17.043	6388.146	0.000	0.998	Accept Null
(Constant)	-21.247	21209.439	0.000	0.999	
Model Summary					
Number of observations =	237				
Cox and Snell R2 =	0.297				
Log likelihood = 140.879; Significant at $p \leq 0.01^*$, $p \leq 0.05^{**}$					

Income was positively and significantly linked to DFS adoption ($\beta = 0.631$; $p \leq 0.05$), showing that higher-income farmers are more capable of affording smartphones, data plans, and transaction fees related to digital services. This supports Oyelami, et al. (2020), who highlighted that disposable income is a strong predictor of financial technology use in rural Nigeria. Moreover, other variables, age, sex, marital status, household size, mobile phone ownership, and internet access, were statistically insignificant, implying that while these factors may influence DFS awareness, they do not independently determine adoption in this context. This aligns with GSMA (2023) findings that, beyond connectivity, socio-economic and literacy factors primarily drive sustained DFS usage among smallholder farmers.

4. Conclusion

The study examined the factors influencing Digital Financial Services (DFS) adoption among smallholder farmers in Kwara State, Nigeria. Results from the binary logit regression revealed that education, farming experience, and income significantly determined DFS adoption. Education and income positively influenced adoption, while farming experience had a negative effect, indicating that more educated and financially stable farmers were more likely to adopt DFS, whereas older and experienced farmers showed reluctance toward digital platforms.

Recommendations

The study recommends the following:

- a. Capacity Building: Implement targeted digital and financial literacy programs for smallholder farmers, especially the less educated and older groups, to enhance confidence in DFS use.
- b. Inclusive DFS Design: Financial service providers should develop user-friendly and localized digital platforms that cater to farmers with low literacy levels.
- c. Supportive Infrastructure: Government and private sector investment in rural connectivity and mobile network expansion is essential to improve DFS accessibility.
- d. Income-Responsive Policies: Introduce affordable, low-fee digital services and credit products tailored to smallholders' income levels to encourage sustained adoption.

5. Acknowledgment

The authors hereby acknowledge the extension officers of the Agricultural Development Programme (ADP) in Kwara State for their guidance during the data collection for the study.

6. References

Agbaeze, Clifford Chilasa, Chukwu Peter Damian Ezechi & Irem Collins Okechukwu (2023). Impact of Digital Finance on Agricbusiness Development in Nigeria. *Journal of Risk and Financial Studies*, 4(1), 107-133. <https://DOI:10.47509/JRFS.2023.v04i01.06>

- Ali, M. A., Garba, A., & Sani R. M. (2023). Socio-economic characteristics and constraints of small-scale rice farmers participation in anchor borrower programme in Jigawa State, Nigeria. *Nigerian Journal of Agric. and Agricultural Technology*, 3(2), 235-245. <https://doi.org/10.59331/njaat.v3i2.555>
- Aliu, I. O. (2024). A Literature Review on the Usage of Mobile Financial Services for Smallholder Farming. *Transactions on Quantitative Finance and Beyond*, 1(1), 114-131. <https://doi.org/10.22105/tqfb.v1i1.31>
- Amankwah, A. (2023). Climate variability, agricultural technologies adoption, and productivity in rural Nigeria: a plot-level analysis. *Agriculture & Food Security*, 12(7), 1-16. <https://doi.org/10.1186/s40066-023-00411-x>
- Central Bank of Nigeria (2022). *Digital Financial Services and Financial Inclusion in Nigeria: Milestones and New Directions*, Central Bank of Nigeria Economic and Financial Review, Vol. 60, No. 4, Abuja, Nigeria. <https://www.cbn.gov.ng/Out/2024/RSD/Digital%20Financial%20Services%20and%20Financial%20Inclusion%20in%20Nigeria,%20Milestones%20and%20New%20Direction.pdf>
- Gizachew F, Kuma B, Tafesse A and Lambamo A (2024) Digital tools and welfare: adoption determinants among ginger producers in Southern and Central Ethiopia. *Front. Sustain. Food System*, 8, 1443775. <https://doi.org/10.3389/fsufs.2024.1443775>
- GSMA (2023). *The mobile economy sub-Saharan Africa 2023*, GSM Association, London. <https://www.gsma.com/mobileeconomy/sub-saharan-africa/>
- MIT D-Lab (2020). *Digital Financial Services for Smallholder Farmers* (project overview), Cambridge. Retrieved from https://d-lab.mit.edu/research/mit-d-lab-cite/digital-financial-services-smallholder-farmers_d-lab.mit.edu
- National Bureau of Statistics. (2017). *Demographic Statistics Bulletin: Federal Republic of Nigeria*, National Bureau of Statistics, Abuja, Nigeria. <https://nigerianstat.gov.ng/elibrary/read/775>
- Ogbemudia Benedict, I., Wilson, E., Ugwu, C. N. and Benjamin Ibe, C., (2024). Investing in Rural Agriculture in the Face of Innovative Financial Services: Does Financial Literacy Matter in Nigeria? *Sage Open*, 14(2), 1-14. <https://doi.org/10.1177/21582440241244685>
- Ogunfolaju M.O., Kolawole A. E., Akangbe, J. A., Onyemenam J., Okonta O.W., Ojo I.E. (2025). Determinants of Digital Financial Service Usage Among Smallholder Farmers in North Central Nigeria. *JZU Natural Science*, 56(11), 10–19. <https://doi.org/10.5996/jzund.2025.v56i11.233467>
- Oloyede, W., Muhammad-Lawal, A., Amolegbe, K., Olaghere, I. and Joseph, I., (2021). Comparative analysis of the profitability of rice production systems in Kwara State, Nigeria, *Agrosearch*, 20(2), 82-101. <https://doi.org/10.4314/agrosh.v20i2.7>
- Osasona, K. K., Salami, M. F., Rotimi, O. F. and Belewu, K. Y., (2024). *Credit access and welfare status of*

- smallholder: Evidence from farmers in Kwara state, Nigeria.* Revista Perspectivas Rurales, 22(44), 1-21.
<https://doi.org/10.15359/pme.22-44.1>.
- Oyelami, L. O., Adebisi, S. O., & Adekunle, B. S. (2020). Electronic payment adoption and consumers' spending growth: Empirical evidence from Nigeria. *Future Business Journal*, 6(1), 1-14
- <https://doi.org/10.1186/s43093-020-00022-z>
World Bank (2024). *Nigeria Development Update (NDU)*.
World Bank, Abuja.
<https://www.worldbank.org/en/country/nigeria/publication/nigeria-development-update-ndu>