

Leveraging Information and Communication Technology (ICT) for Credit Access by Smallholder Farmers in Enugu State, Nigeria

¹Ozioma Faith Orazulike; ²Benjamin Chiedozie; Okpukpara; ³Angela Ebere Obetta and ⁴Nwando Gladys Uyanwa

¹²³⁴Department of Agricultural Economics, University of Nigeria, Nsukka.; ozioama.orazulike@unn.edu.ng (O. F. Orazulike)

Abstract

Credit access remains a persistent barrier for smallholder farmers in Nigeria. This study investigated the role of Information and Communication Technologies (ICTs) among 120 small household farmers in improving credit access in Enugu State, Nigeria. Using multistage sampling and regression analysis, results revealed that farmers were predominantly middle-aged males with low formal education and modest income. Most relied on informal credit sources such as moneylenders (40%) and personal savings (35%), while formal institutions remained underutilized due to collateral requirements. Mobile phones, radio, and basic management information systems were the primary ICT tools employed, though advanced technologies like ATMs and digital platforms had limited use. Important variables that significantly impacted how much these small-scale farmers used ICT to obtain credit information were group membership ($p < 0.05$) and marital status ($p < 0.1$), both of which had a negative significant influence, but occupation ($p < 0.05$) and education ($p < 0.1$) had a substantial positive influence. The study concludes that ICT adoption alone is insufficient without supportive infrastructure and training. It recommends expanding rural ICT facilities, offering digital literacy programs, and developing collateral-light credit products to enhance financial inclusion and agricultural sustainability.

KEYWORDS: ICT, Small-scale farmers, Credit Information, Access

Introduction: Access to agricultural finance is one of the most critical drivers of smallholder productivity and poverty reduction in Nigeria. Credit enables farmers to purchase inputs, adopt improved technologies, and expand production, yet many remain credit-constrained due to collateral requirements, high interest rates, and limited access to information (Balana & Oyeyemi, 2022). Recent evidence shows that about one quarter of Nigerian smallholder households face credit constraints, with demand-side barriers such as lack of information and weak digital connectivity compounding the problem (Balana & Oyeyemi, 2022). Information and Communication Technologies (ICTs) have emerged as promising tools for addressing these constraints. ICTs including mobile phones, internet platforms, and radio, reduce transaction costs, improve information flow, and facilitate innovative digital credit solutions (Obayelu et al., 2023). Empirical evidence demonstrates that mobile-based ICT adoption significantly improves farm decision-making and efficiency in Nigeria, while experimental studies from sub-Saharan Africa show that targeted agricultural information provision enhances technology adoption and yields, thereby improving farmers' creditworthiness (Waje et al., 2024). In Enugu State, studies indicate that farmers are generally aware of ICT tools such as mobile phones, radio, and television, but their effective use for accessing agricultural credit remains constrained by limited digital literacy, infrastructural challenges, and weak

integration between ICT platforms and financial institutions (Ogbonna et al., 2022). This suggests that while ICT penetration is increasing, its potential to expand agricultural finance has not been fully realized. Despite the global and national evidence linking ICT with agricultural productivity and financial access, little is known about how smallholder farmers in Enugu State specifically leverage ICT to access credit. This study therefore seeks to fill this gap by examining farmers' socio-economic characteristics as determinants of ICT use for credit access, identifying sources of agricultural credit, analyzing the ICT tools employed, and exploring the challenges limiting their effective use. Smallholder farmers in Nigeria continue to face significant challenges in accessing agricultural credit, which limits their ability to invest in improved inputs, adopt innovations, and expand production. Despite government and private-sector initiatives, evidence shows that nearly one-quarter of smallholder households remain credit-constrained, largely due to collateral requirements, high transaction costs, and weak access to timely information (Balana & Oyeyemi, 2022). Information and Communication Technologies (ICTs) have emerged as important tools for overcoming these barriers by facilitating access to financial services, disseminating information on credit opportunities, and reducing costs of interaction between farmers and lenders. Studies have demonstrated that mobile phones and digital platforms can improve

Leveraging Information and Communication Technology (ICT) for Credit Access by Smallholder Farmers in Enugu State, Nigeria

production efficiency and enhance farmers' capacity to engage with credit providers (Obayelu et al., 2023; Waje et al., 2024). However, the benefits of ICT for financial inclusion are unevenly distributed, and rural smallholders in particular often lack the digital literacy, infrastructure, and institutional support needed to fully leverage these tools. In Enugu State, where smallholder farmers dominate agricultural production, awareness of ICT tools such as mobile phones and radios is relatively high, yet their application in accessing agricultural credit remains limited due to structural and socio-economic constraints (Ogbonna et al., 2022). While prior research has examined credit access and ICT adoption separately, little is known about the intersection between the two—specifically, how ICT is being leveraged to access credit and which socio-economic characteristics influence its use. This knowledge gap creates a problem for policy and practice: without a clear understanding of the role ICT plays in smallholder farmers' access to credit in Enugu State, interventions risk being poorly targeted or ineffective. Therefore, a focused study is required to analyze how smallholder farmers in Enugu State use ICT for credit access, the socio-economic determinants of its adoption, and the constraints limiting its effectiveness.

Methodology: Sampling Procedure: The study was conducted in Enugu State, situated in southeastern Nigeria. The state lies between latitudes 6°30'N and 7°10'N and longitudes 6°35'E and 7°30'E, encompassing a tropical rainforest zone with elevations ranging from 1,700m to 2,900m above sea level. Enugu State is divided into three agricultural zones: Enugu, Awgu, and Nsukka, based on similarities in soil characteristics and meteorological

properties. For this research, 120 small-scale farmers were selected from the Nsukka Agricultural Zone (Nsukka Agricultural Zone) using multistage sampling process. This was purposefully chosen in the first stage, because the researcher has extensive knowledge of the area. Furthermore, in this agricultural zone, there has been little or no research on the use of ICT to get financing. From the selected zone, two (2) LGAs were randomly selected in the second stage. Two Communities were chosen at random from each of the two LGAs in the third stage. Finally, 34 and 26 farm Households were chosen at random from each of the communities, respectively. Summary of the sampling procedure can be seen in table 1. Primary data were collected through a questionnaire and analyzed using descriptive and inferential statistics, including Poisson Regression.

Model Specification: Specification of Poisson regression model: Poisson regression is a generalized linear model form of regression analysis used to model count data and contingency tables. Poisson regression assumes the response variable Y has a Poisson distribution, and assumes the logarithm of its expected value can be modeled by a linear combination of unknown parameters. Abu and Asember (2011), Akpan, et.al (2012), Mahfoudh (2013) and Xaba and Masuku (2013) examined the factors affecting the Productivity and Profitability of Vegetable marketing using descriptive and poisson regression to analyze their data. The study aimed at identifying factors affecting productivity and profitability of vegetable marketing. The purpose of regression analysis is to arrive at a set of values called coefficient for independent variables (Barbara & Linda, 2013). The regression result is a generalization of equations that signify the best predictions of dependent variables from several continuous independent variables.

$\mathbf{x} \in \mathbb{R}^n$
If $\mathbf{x}$ is a vector of independent variables, then the model takes the form
$$\log(E(Y | \mathbf{x})) = \alpha + \beta' \mathbf{x},$$

where $\alpha \in \mathbb{R}$ and $\beta \in \mathbb{R}^n$. Sometimes this is written more compactly as
$$\log(E(Y | \mathbf{x})) = \theta' \mathbf{x},$$

where $\mathbf{x}$ is now an $(n + 1)$ -dimensional vector consisting of n independent variables concatenated to a vector of ones. Here θ is simply α concatenated to β .

Thus, when given a Poisson regression model θ and an input vector $\mathbf{x}$, the predicted mean of the associated Poisson distribution is given by

$$E(Y | \mathbf{x}) = e^{\theta' \mathbf{x}}.$$

If Y_i are independent observations with corresponding values $\mathbf{x}_i$ of the predictor variables, then θ can be estimated by maximum likelihood. The maximum-likelihood estimates lack a closed-form expression and must be found by numerical methods. The probability surface for maximum-likelihood Poisson regression is always concave, making Newton–Raphson or other gradient-based methods appropriate estimation techniques.

Poisson regression analysis can be stated either in the implicit or explicit forms as follows:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, \dots, X_n, e)$ (implicit form)

$Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + \dots + b_n X_n + e$ (explicit form)

Where:

Y = dependent variable

Leveraging Information and Communication Technology (ICT) for Credit Access by Smallholder Farmers in Enugu State, Nigeria

bo=intercept
b₁-b_n=regression coefficients
X₁-X_n=independent variables.

Poisson regression is used in this study because diagnostic tests revealed the absence of overdispersion and under dispersion. Following Wooldridge (2002) and Greene (2003; 2008), the density function of the Poisson regression model is given by:

$$f(y_i|x_i) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{\Gamma(1+y_i)} \dots\dots\dots(1)$$

Where; $\lambda_i = \exp(\alpha + X_i'\beta)$ and $y_i = 0, 1, \dots, i$ is the number of times a youth uses ICT tools per week, X = a vector of predictor variables and α and β are the parameters to be estimated.

Greene (2003; 2008) show that the expected number of events y_i (in this case, number of times of ICT use) is given as;

$$E(y_i|x_i) = \text{Var } y_i \quad x_i = \lambda_i = \text{Exp } \alpha + X_i'\beta \text{ for } i = 1, 2, \dots, n \dots\dots\dots (2)$$

The Poisson regression model is implicitly displayed below:
ICT tool usage frequency = f (age, gender, married status, education, occupation, transportation cost log, market distance log, electricity distance log, income, number of agricultural value chains, group membership, land size, credit availability, extension) + e

X₁ = age of the farmer (years)
X₂ = gender (dummy, 1 if male, 0 otherwise)
X₃ = marital status (dummy, 1 if married, 0 otherwise)

Results and Discussion of Findings: Socio-Economic characteristics of small-scale farmers::

The result in Table 1 shows that majority of farmers were male who were in their middle age (33.3%) without any formal education (59%). Majority (33.3%) of these small-scale farmers had farming experience of 20 years and above engaged in both crop and animal farming (50%), with 1-3 hectares of land (61.8 %). 50 % of the farmers earned between ₦81,000-₦100,000 as their annual income. Ogbonna, Okoye, and Onwubuya (2022) similarly reported that smallholder farmers in Enugu State demonstrate awareness of ICT but that limited education and low income constrain effective utilization. These socio-demographic factors reduce both capacities to adopt ICT and ability to meet financial institutions' creditworthiness requirements, thereby reinforcing exclusion from formal credit markets (Ogbonna et al., 2022).

Sources of agricultural credit by small scale farmers: Table 4.2 disclosed that majority (35% and 40%) of the farmers obtained credit from personal savings and money lenders respectively, while 15% and 10% obtained credit from friends and relatives respectively. More so, 50% of farmers secured their credit from commercial banks, 30% from co-operative banks and majority (20%) from development bank example BOA. This mirrors national-level evidence, where Balana and Oyeyemi (2022) found that rural farmers in Nigeria access most of their credit from informal channels due to collateral demands and the weak rural presence of financial institutions. The dominance of informal credit in the present study therefore illustrates how structural constraints in the formal financial system force smallholders to rely on high-cost informal alternatives (Balana & Oyeyemi, 2022). **Types of ICTs used in sourcing and disbursing of credit to small scale farmers:** Table 4.3 showed that 20% of small-scale farmers were using management and information system (MIS), mobile phones and radio. This signifies their important roles in sourcing credit. More so, only 17% make use of the ATM while 5% and 20% makes use of personal digital assistant and

electronic point of scale respectively. Meanwhile, 13% were recorded using television. This pattern aligns with broader findings that smallholder farmers in Africa primarily use simple, accessible technologies, while adoption of advanced fintech services lags behind due to poor infrastructure, low literacy, and product inaccessibility (Krishna & Qaim, 2020; Obayelu et al., 2023). The results thus reinforce the argument that ICT adoption is tiered, with basic information tools spreading more widely than financial innovations.

Factors affecting the use of ICT in accessing credit information:

The Pseudo R² of 0.2452 on Table 4.4, showed that 24% variation in the extent of use of ICT in accessing information by the respondents is as a result of the variation in the included variables. The study indicates that age has a positive relationship with the extent of ICT usage among small-scale farmers in Enugu State, suggesting that older farmers are more open to adopting new technologies compared to their younger counterparts. This aligns with findings by Wawire et al. (2017) and Okello et al. (2012), who observed that older farmers often have greater access to resources and experience, facilitating the adoption of ICT tools. Conversely, marital status showed a negative effect on ICT usage, implying that married farmers are less likely to utilize ICTs for agricultural purposes. This may be due to increased household responsibilities and a preference for traditional farming methods. However, this contrasts with Nyamba and Mlozi (2012), who found that married individuals in agricultural activities used mobile phones more than their single counterparts. Occupation also positively influenced ICT usage, with farmers engaged in other occupations more likely to use ICT tools, possibly due to higher income levels. This is consistent with Okello et al. (2014), who suggested that increased income enhances the use of ICT-based market information services. Additionally, income levels were positively correlated with ICT usage, indicating that wealthier farmers are more likely to adopt ICT tools for accessing credit information. This underscores

the importance of socio-economic factors in determining the extent of ICT adoption among small-scale farmers.

Problems encountered in the use of ICT in accessing credit information: Table 4.5 showed that lack of knowledge of ICT (4.2), Inadequate government digital service centers & facilities (4.0), Lack of Information/training (3.9), Lack of skills (3.84), Lack of awareness towards the benefits of ICT in accessing credit (3.77), Expensive to use (3.65), were the major problems encountered by small scale farmers in accessing credit information. Ogbonna et al. (2022) highlighted similar limitations among farmers in Enugu, while regional syntheses emphasize that inadequate digital literacy, infrastructure gaps, and affordability challenges remain the most persistent constraints (Obayelu et al., 2023). The ranking of barriers in the present study emphasizes that capacity building and awareness creation are as critical as infrastructural investment in enabling effective ICT use.

Conclusion and Recommendations: This study demonstrates that while smallholder farmers in Enugu State are aware of ICT tools, their use in accessing agricultural credit remains minimal and largely shaped by socio-economic characteristics. The heavy reliance on informal credit sources reflects persistent structural barriers in the formal credit system, particularly the collateral requirements that exclude many small-scale farmers. ICTs, when effectively leveraged, can bridge the information gap, reduce transaction costs, and enhance financial inclusion, yet their adoption is constrained by low literacy, inadequate infrastructure, and affordability issues. To address these challenges, targeted interventions are needed, including ICT capacity-building programs, government-supported digital service centers, and the integration of ICT platforms with rural financial institutions. Strengthening digital financial ecosystems tailored to the realities of smallholder farmers will not only improve credit

access but also enhance productivity, income, and overall rural development in Enugu State.

The study recommended the following: **Expand Digital Literacy and Training Programs** Government agencies, NGOs, and extension services should establish regular training for farmers on how to use ICT tools (mobile apps, ATMs, digital platforms) for accessing credit. This would address the lack of knowledge and skills identified in the study. **Strengthen Rural ICT Infrastructure**

Investment in rural internet connectivity, mobile network coverage, and affordable digital service centers is necessary to overcome infrastructural barriers that limit effective ICT use in credit access. **Promote Collateral-Light Credit Products**

Financial institutions should design innovative loan schemes such as group lending, mobile-based credit scoring, or warehouse receipt financing, that reduce reliance on traditional collateral, which excludes most smallholders. **Leverage Cooperatives and Farmer Associations**

Strengthening farmer cooperatives can improve collective bargaining power, reduce transaction costs, and enhance farmers' ability to access both ICT-based platforms and formal credit facilities. **Public-Private Partnerships for Inclusive FinTech**

Collaboration between government, fintech companies, and development banks can create tailored digital financial services that integrate local realities, ensuring affordability and trust among smallholders. **Awareness Campaigns on Benefits of ICT in Finance** Regular sensitization through radio, mobile platforms, and local community meetings can improve awareness of ICT's role in enhancing credit access and encourage adoption among reluctant groups.

List of Tables

Table 1: Sampling procedure and the selected areas

Agricultural Zones	Local Government Areas	Communities	Farm Households
1	Nsukka	Nsukka	34
		Lejja	26
	Igbo Eiti	Ohodo	34
		Aku	26
	2	4	120

Table 4.1 Socioeconomic Characteristics of the Respondent

Variables (n = 60)		Frequency	Percentage	Mean
Gender	Male	80	66.7	
	Female	40	33.3	
	Total	120	100	

Leveraging Information and Communication Technology (ICT) for Credit Access by Smallholder Farmers in Enugu State, Nigeria

Age	≤20 years	10	8.3	
	21-30	24	20	
	31-40	40	33.3	
	41-50	32	26.7	
	51 & above	14	11.7	
	Total	120	100	
Educational Level	No education	10	8.3	
	Primary	32	26.7	
	Secondary	70	58.3	
	Tertiary	8	6.7	
	Total	120	100	
Marital status	Single	50	41.7	
	Married/Living together	60	50.0	
	Separated	10	8.3	
	Total	120	100	
Experience (years)	1-5	06	5.0	
	6-9	10	8.3	
	10-14	20	16.7	
	15-19	24	20.0	
	20 & above	60	33.3	
	Total	120	100	
Type of Farming	Crop Farming	32	28.3	
	Animal Farming	26	21.7	
	Both Crop & Animal	60	50.0	
	Total	120	100	
Annual Income	≤N40,000	10	8.3	20.47
	N41,000-N60,000	18	15.0	
	N61,000-N80,000	28	23.3	
	N81,000-N100,000	60	50.0	
	N101,000 & above	04	3.3	
	Total	120	100	
Farm size category	< 1 ha	18	15.8	2.24
	1-3 ha	74	61.8	
	Above 3 ha	26	22.4	
	Total	120	100	

Source: Field Survey (2024).

Table 4.2 Distribution of respondents according to the sources of credit used

Sources	Types	Frequency	Percentage
Formal	Commercial banks	60	50
	Co-operatives	40	30
	Development banks (B.O.A)	20	20
Informal	Friends	10	15
	Relatives	15	10
	Personal savings	20	35
	Money lenders (e.g isusu & thrift)	75	40

Source: Field Survey (2024).

Table 4.3 Distribution according to ICT usage by small scale farmers in sourcing credit

Types of ICT in used	Frequency	Percentage
----------------------	-----------	------------

Leveraging Information and Communication Technology (ICT) for Credit Access by Smallholder Farmers in Enugu State, Nigeria

Management and Information System (MIS)	30	20
Personal Digital Assistant (PDA)	5	5
Automated Teller Machine (ATM)	15	17
Mobile Phones	30	20
Electronic Point of Scale (ePOS)	5	5
Radio	30	20
Television	5	13

Source: Field Survey (2024)

Table 4.4 Poisson regression of the intensity of use of ICT

Independent variables	Poisson Regression			Marginal Effects		
	Co-efficient	Std. Error	P-value	Co-efficient	Std. Error	P-value
Constant	1.043196***	.289533	0.000			
Age	.0141096	.0097405	0.147	.043391	.02987	0.146
Gender	-.0430716	.0436041	0.323	-.1324575	.13396	0.323
Marital status	-.0635739**	.0293786	0.092	.1521146**	.09008	0.091
Occupation	0.7994**	.0288576	0.028	-.195508**	.08827	0.027
Education (no. of years)	.1029552*	.0538426	0.056	.3166168*	.16485	0.055
Log transport cost	1.58e-06	2.78e-06	0.571	4.84e-06	.00001	0.570
Log distance to market	.1734464	.2229712	0.437	.5333975	.68512	0.436
Income	1.57e-07	2.37e-06	0.947	4.82e-07	.00001	0.947
Agricultural value chains (number of AVCs participates in)	.0509193	.0465928	0.274	.1565915	.14304	0.274
Group membership	-.0803012**	.0441401	0.069	-.246949**	.13514	0.068
Land size	.00002	.0000281	0.478	.0000614	.00009	0.478
Credit	-.0703308	.1115447	0.528	-.2174762	.34667	0.530
Extension	-.1734658	.2229722	0.437	-.5334573	.68512	0.436

Pseudo R² = 0.2452, Prob> Chi2 = 0.0394, Log likelihood = -195.96831

Note: ***, **, * significant at 1%, 5% and 10% respectively

Source: Field Survey (2024)

Table 4.5: Distribution of respondents according to the problems encountered in the use of ICT in accessing credit information

Problems or constraints	Mean	Rank Order
Lack of knowledge of ICT	4.2	1
Inadequate government digital service centers & facilities	4.0	2
Lack of Training	3.9	3
Lack of Information	3.9	4
Lack of skills	3.84	5
Lack of awareness of the benefits of ICT in accessing credit	3.77	6
Expensive to use	3.65	7
Apathy towards new technology	3.52	8

Leveraging Information and Communication Technology (ICT) for Credit Access by Smallholder Farmers in Enugu State, Nigeria

Lower Internet speed	3.25	9
Inadequate number of e-agriculture-related programs in electronic media	3.20	10
Miserable electricity connections	3.11	11
Lack of relevant customized content	3.09	12

Source: Field Survey (2024)

References

- Abu, O., & Asember, N. (2011). Analysis of the impact of capital formation on the growth of Nigerian economy. *Journal of Social Sciences and Public Policy*, 3(1), 35–42.
- Akpan, S. B., Udoh, E. J., & Nkanta, V. S. (2012). Factors influencing fertilizer demand among smallholder rice farmers in South-East Nigeria: A Poisson regression approach. *Journal of Agricultural Science*, 4(5), 139–147. <https://doi.org/10.5539/jas.v4n5p139>.
- Balana, B. B., & Oyeyemi, M. A. (2022). Agricultural credit constraints in smallholder farming in developing countries: Evidence from Nigeria. *World Development Sustainability*, 1, 100012. <https://doi.org/10.1016/j.wds.2022.100012>
- Barbara, G. E., & Linda, M. (2013). *Applied regression analysis and generalized linear models* (3rd ed.). SAGE Publications.
- Greene, W. H. (2003). *Econometric analysis* (5th ed.). Prentice Hall
- Greene, W. H. (2008). *Econometric analysis* (6th ed.). Prentice Hall.
- Krishna, V. V., & Qaim, M. (2020). Mobile phones and economic development in rural Africa. *Proceedings of the National Academy of Sciences*, 117(27), 15530–15537. <https://doi.org/10.1073/pnas.2005484117>
- Mahfoudh, A. (2013). Factors affecting vegetable marketing in Libya: An application of Poisson regression model. *International Journal of Agricultural Economics and Extension*, 1(7), 117–124.
- Munyegera, G. K., & Matsumoto, T. (2016). Mobile money, remittances, and household welfare: Panel evidence from rural Uganda. *World Development*, 79, 127–137. <https://doi.org/10.1016/j.worlddev.2015.11.006>
- Namisiko, P., Mwangi, M., & Orwa, G. (2021). Factors influencing the adoption of mobile-based agricultural credit services by smallholder farmers in Kenya. *Journal of Agricultural Informatics*, 12(2), 45–57. <https://doi.org/10.17700/jai.2021.12.2.643>
- Nyamba, S. Y., & Mlozi, M. R. S. (2012). Factors influencing the use of mobile phones in communicating agricultural information: A case of Kilolo District, Iringa, Tanzania. *International Journal of Information and Communication Technology Research*, 2(7), 558–563.
- Obayelu, A. E., Oginni, O. M., & Awoyemi, T. T. (2023). Impact of adoption of mobile-based information communication technologies on production efficiencies among smallholder farmers in the southwest of Nigeria. *Tropical Agriculture*, 100(1), 45–58.
- Obayelu, A. E., Ogunlade, I., & Oladejo, A. (2023). Digital technologies in African agriculture: Adoption, impacts and policy implications. *Technology in Society*, 72, 102152. <https://doi.org/10.1016/j.techsoc.2022.102152>
- Ogbonna, K. E., Okoye, C. U., & Onwubuya, E. A. (2022). Awareness and utilization of ICT tools among smallholder farmers in Enugu State, Nigeria. *Journal of Agricultural Extension*, 26(3), 46–57. <https://doi.org/10.4314/jae.v26i3.5>
- Ogbonna, N. O., Emeka, C. P. O., Agoda, S., Odum, F. N., & Olaolu, M. O. (2022). Information and communication technology (ICT) tools usage and constraints among rural farmers in Enugu State, Nigeria. *Journal of Agriculture and Food Environment*, 9(3), 33–40.
- Okello, J. J., Kirui, O. K., Gitonga, Z. M., Njiraini, G. W., & Nzuma, J. M. (2014). Determinants of awareness and adoption of ICT-based market information services in developing countries: Evidence from Kenya. *Agricultural Economics*, 45(6), 747–761. <https://doi.org/10.1111/agec.12105>
- Okello, J. J., Okello, R. M., & Owuor, G. (2012). Impact of ICT-based market information services on smallholder farm input use and productivity: The case of Kenya. *World Development*, 40(2), 358–371. <https://doi.org/10.1016/j.worlddev.2011.05.004>
- Steel, W. F., Aryeetey, E., Hettige, H., & Nissanke, M. (1997). *Informal financial markets under liberalization in four African countries*. World Bank.
- Waje, I. A., Adepoju, A. A., & Ojo, T. O. (2024). Mobile-based ICT adoption and smallholder farmers' efficiency in Nigeria. *Journal of Rural Studies*, 105, 173–184. <https://doi.org/10.1016/j.jrurstud.2023.11.012>
- Waje, S. S., Shano, B. K., Walelign, S. Z., & Kassie, W. A. (2024). The effect of agricultural information provision on smallholders' technology adoption and yield: Experimental evidence from Ethiopia. *Frontiers in Sustainable Food Systems*, 8, 1421442. <https://doi.org/10.3389/fsufs.2024.1421442>
- Wawire, N. H. W., Sakwa, M., & Wanjohi, J. (2017). Determinants of ICT adoption and usage by smallholder farmers in Kenya: A case of lower Yatta sub-county, Kitui County. *International Journal of Education and Research*, 5(12), 145–160.
- Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. MIT Press.

Leveraging Information and Communication Technology (ICT) for Credit Access by Smallholder Farmers in Enugu State, Nigeria

Xaba, B. G., & Masuku, M. B. (2013). Factors affecting the productivity and profitability of vegetables production in Swaziland. *Journal of Agricultural Studies*, 1(2), 37–52.
<https://doi.org/10.5296/jas.v1i2.37>