

A Comparative Analysis of Traditional Vs. Digital Adult Literacy Models in Enhancing Agripreneurial Competencies Among Small-Scale Farmers in Lagos State, Nigeria

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Abstract

The study evaluated the efficiency of using conventional models, which involve face-to-face and paper-based methods, against those using technological platforms to improve agripreneurial skills among smallholder farmers in Lagos State, Nigeria. As rural regions become more urbanized, and demands in the market increase, it is important to determine whether digital models will help farmers develop skills. A descriptive survey design was adopted. Two hundred questionnaires were distributed to purposively selected farmers across five communities (Ikorodu, Badagry, Epe, Agege, and Ajah) representing the IBILE divisions, with 98 valid responses (49 per group) analysed. Data were collected using a structured questionnaire with simple farmer-friendly language (validated by three experts from the Agricultural and Adult education Departments with a reliability coefficient of 0.87 using Cronbach's Alpha) and analysed with descriptive statistics (mean and standard deviation) and independent samples t-test via SPSS version 27. Results showed that farmers exposed to the digital-first model acquired significantly higher agripreneurial competencies (Grand Mean = 3.40, SD = 0.66) compared to those in the traditional model (Grand Mean = 2.34, SD = 0.83). The independent samples t-test confirmed a statistically significant difference ($t = -8.15$, $p < 0.001$), with the digital-first model proving superior across all domains. The study concludes that digital-first adult literacy models are markedly more effective in building modern agripreneurial competencies. It recommends the adoption of hybrid or digital-first programmes, investment in rural digital infrastructure, and training of extension agents in digital facilitation skills to enhance small-scale farmers' competitiveness in Lagos State.

Keywords: Agripreneurship, digital-first literacy, traditional literacy, agricultural extension, smallholders, Lagos state.

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INTRODUCTION

Agripreneurship has been advocated as a means through which one could migrate from subsistence farming to commercial agriculture business ventures in Nigeria. Agripreneurship has evolved to become a powerful instrument in transforming subsistence farming to agribusiness, particularly within smallholder farmers in Nigeria (Adeyanju et al., 2023; Kazungu, 2023; Amaran, 2025; Sharma, 2025; Ismail, 2025). Nevertheless, low literacy levels and digital literacy are likely to pose challenges to achieving this end. Digital technology and

adult learning programmes have been proposed as solutions to address this challenge, but many farmers face barriers to accessing training.

Competencies such as opportunity recognition, market orientation, and decision making that are related to agritainment and entrepreneurship play an important role in enhancing the performance of agro-based SMEs in Nigeria (Stephen et al., 2017) and increase farm income in combination with training and networking platforms (Ayanwale et al., 2023). Innovations such as farmer field schools and extension services enhance productivity and resilience in farmers by imparting useful skills and knowledge (Raji et al., 2024; Ogedengbe et al., 2024). Digitalization in agriculture can be considered revolutionary in transforming smallholder agriculture because of increased access to information, markets, finance, and training (Mollel et al., 2025; Magesa et al., 2023).

Agricultural capability is now understood to encompass adult literacy and digital literacy. In Africa, it has been revealed that most small-scale farmers have fairly developed digital literacy, with higher skills in accessing information and communicating information but lower skills in managing information, evaluating information, and creating information (Mollel et al., 2025). In Nigeria, it was established that agricultural extension workers lack digital literacy skills even though they use smartphones at very high rates (Alarape et al., 2019). In Lagos State, due to rapid urbanization, shortage of arable land, and opportunities presented by the markets, agripreneurial skills through adult literacy programs become more significant (Archibong, 2025; Ani, 2025; Roy, 2025). Most rural adults in Nigeria have large deficits in digital literacy and technical skills, and it is recommended that adult education adopts flexible technological methods to address the challenge (Khatri, et al., 2024). The traditional model of adult literacy learning emphasizes face-to-face teaching and learning using printed materials, while the digital-first model makes use of apps, digital platforms, and interactive digital content (Wang, 2025; Daum, 2025; Lu, 2024; Xu, 2026).

Both digital and financial literacy improve strategic decision-making and sustainable performance among Nigerian agribusiness entrepreneurs (Hamzat et al., 2024). Conventional methods such as face-to-face extension programs, radio broadcast, and print materials are still very important but not scalable and have limited reach (Alarape et al., 2019). The approach that is more effective and scalable makes use of mobile phones, smartphone applications, short message services/invoice verification, online platforms, and video communication. Information can be delivered in a timely manner using e-extension and ICT-based advisory methods to improve farmers' knowledge, practices, and markets (Raji et al., 2024; Ogedengbe et al., 2024). Studies conducted recently suggest that digital literacy improves farmers' ability to access market information and make financial decisions (Abdelaziz, 2025; Aranguri, 2025; Choruma, 2024; Widiyanti, 2026).

In addition, gender-sensitive digital extension services have also enhanced women's access to information, decision-making, and improved agricultural practices (Ragetlie et al., 2022). However, the inability to comprehend digital technologies, inadequate access to devices, poor connectivity, and difficulties in navigating through the digital space pose significant barriers in sub-Saharan Africa (Mollel et al., 2025). The problem is more pronounced in Lagos State due to land shortages, fierce competition, and urbanization. The literature underscores the need for contextually appropriate blended learning strategies that integrate conventional and digital methods (Joel et al., 2025).

Despite various adult education initiatives, many smallholder farmers in Lagos State exhibit insufficient agripreneurial skills, resulting in poor productivity, ineffective market engagement, and low earnings (Kazungu, 2023; Ismail, 2025; Adeyanju et al., 2023).

Traditional models may be constrained by geographical reach and applicability, whereas digital-only models encounter issues such as inadequate internet infrastructure and digital divides (Wang, 2025; Roy, 2025; Daum, 2025; Hosman, 2025). Few studies have compared the efficacy of such models in Lagos State.

Recent studies underscore that agripreneurial competencies, including opportunity recognition, financial management, marketing, innovation, and risk management, are essential for transitioning small-scale farmers from subsistence to market-oriented production. Sharma (2025) analysed the dynamics of agripreneurship and concluded that these competencies significantly enhance the performance of small agribusinesses in developing economies. In addition, Hasan et al. (2025) further proved that sustainable agricultural knowledge-based entrepreneurship literacy is one of the most crucial factors for the resilience and success of agricultural SMEs during climate and market turbulence. Digitalization is considered an innovative approach within the sphere of agricultural extension.

Specifically, Aranguri (2025) analyzed the role of digital literacy and technology in agriculture and revealed that digital literacy is a predictor of precision tool usage, e commerce implementation, and data analysis for smallholders. Yang et al. (2025) explored the impact of digital literacy on farmland scale operations and claimed that it contributes to land transfers, efficiency, and commercial focus by providing more opportunities for information and risk management evidence about sub-Saharan African practices supports these views Choruma et al. (2024) carried out a scoping review about the impact of digitalisation in sub-Saharan African agriculture, concluding that digital tools enhance information access, marketisation, and technology use while digital literacy is still a challenge. Wonor et al. (2026) revealed the potential of combining digital literacy, AI and young population in agripreneurship to increase food security in Nigeria.

Research conducted in Nigeria also lends credibility to the necessity of taking a digital-first approach. The findings of Archibong (2025) on the relationship between digital literacy and engagement with agriculture among the youth of sub-Saharan Africa revealed a high positive relationship between digital literacy and entrepreneurship behavior, particularly among peri-urban communities such as Lagos State. In research conducted by Makinde (2025), the key constraints faced by digital extension in Nigeria included low digital literacy levels and infrastructural gaps. Comparative perspectives between traditional and digital models are gaining attention. Widiyanti (2026) evaluated agricultural extension workers' strategies for improving digital literacy and recommended shifting toward digital-first training for superior scalability and outcomes. Daum (2025) reviewed digitalization and skills development in agriculture and advocated for flexible, learner-centred adult education models that integrate digital tools with practical agripreneurial content, noting that purely traditional approaches often fail to build the dynamic competencies required in modern agriculture.

Constraints to digital adoption have been thoroughly documented. Guo and Ogobodo (2026) analysed digital divides in rural Africa (with emphasis on Nigeria) and identified persistent gaps related to gender, education level, connectivity, and device ownership that undermine purely digital interventions. Similarly, a scoping study on making digital tools work for farmers emphasised that low digital literacy and infrastructural barriers necessitate blended (hybrid) models rather than fully digital-first approaches in many rural and peri-urban contexts (D'Anglejan et al., 2025). Xu (2026) provided robust evidence that digital literacy is a significant predictor of agricultural technology adoption and entrepreneurial success, while Wang (2025) linked farmers' digital literacy to increased enthusiasm for market-oriented farming practices and grain cultivation expansion.

These research findings justify an empirical evaluation of traditional and digital first models of adult literacy in enhancing agripreneurial competences among small scale farmers in Lagos State since adults in rural Nigeria have significant inadequacies with digital and technical knowledge, and adult literacy programs should incorporate flexible, ICT-enabled models to fill this gap (Ogbu, 2025). It can be seen that the development of agripreneurial competences takes place in the confluence of entrepreneurship/financial literacy, digital literacy and ICT-enabled extension, and advanced adult literacy approaches which are relevant in the case of urbanization, as in Lagos.

Collectively, these recent studies reveal a consistent pattern: traditional adult literacy models remain useful for foundational manual and local knowledge skills but are inadequate for preparing small-scale farmers for the demands of the digital economy and market-oriented agripreneurship. Digital-first models consistently yield higher agripreneurial competencies when infrastructural and foundational literacy barriers are addressed. However, very few studies have conducted direct empirical comparisons in peri-urban Nigerian contexts such as Lagos State. The present study addresses this gap by comparing the effectiveness of traditional versus digital-first adult literacy models among small-scale farmers across the five IBILE divisions of Lagos State.

Purpose of the Study

The primary purpose of this study was to examine the impact of literacy frameworks on the business success of farmers. The study specifically sought to:

1. assess the level of agripreneurial competencies acquired through traditional literacy models among smallholder farmers in Lagos State.
2. evaluate the level of agripreneurial competencies acquired through digital-first literacy models among smallholder farmers in Lagos State.
3. compare the effectiveness of both models in enhancing overall agripreneurial performance among smallholder farmers in the study area.

Research Questions

The following research questions guided the study:

1. What is the level of agripreneurial competencies acquired by farmers through traditional literacy models in Lagos State?
2. What is the level of agripreneurial competencies acquired by farmers through digital-first literacy models in Lagos State?
3. How do traditional and digital-first literacy models compare in enhancing overall agripreneurial performance among smallholder farmers in Lagos State?

METHODOLOGY

This study adopted a descriptive survey and comparative research design, targeting a purposively selected sample of 100 small-scale farmers across the IBILE divisions of Lagos State, including Ikorodu, Badagry, Epe, Agege, and Ajah. From each of these five communities, 20 participants were drawn, evenly split with 10 farmers from traditional literacy models and 10 from digital-first models. Agripreneurial competencies were measured using a structured questionnaire designed with simple language for accessibility and rated on a 5-point Likert scale ranging from Very Low (1) to Very High (5). The research instrument

demonstrated high internal consistency with a reliability coefficient of 0.87 using Cronbach's Alpha after a pilot study was carried out which included 20 respondents from the study area and the resulting data were processed using Mean, Standard Deviation, and Independent Samples t-test via SPSS version 27. To ensure objective data interpretation, specific statistical decision rules were established. The Mean ($\bar{x}$) was used to categorize competency levels, where scores from 1.00–2.49 indicate Low levels, 2.50–3.49 represent Moderate levels, and 3.50–5.00 signal High to Very High competencies; a lower Standard Deviation was interpreted as higher consistency among respondents. For the comparative analysis in RQ3, an Independent Samples t-test was employed, with the null hypothesis being rejected if the p-value was less than 0.05, signaling a significant difference in model effectiveness. Finally, the reliability of the instrument was confirmed against a threshold where a Cronbach's Alpha (α) of 0.70 or higher was required to deem the tool suitable.

RESULTS

Research Question One: Level of Agripreneurial Competencies Acquired Through Traditional Literacy Models

Table 1: Agripreneurial Competencies via Traditional Literacy Models (n = 49)

S/N	Item Statement (Abbreviated)	Mean ($\bar{x}$)	SD	Remark
1	Basic ability to do math on paper	2.65	0.82	Moderate
2	Farm ledger bookkeeping skills	2.82	0.79	Moderate
3	Insight into seasonality of markets locally	2.45	0.71	Low
4	Communication with local middlemen verbally	2.71	0.68	Moderate
5	Calculations on papers for ratio of inputs/outputs	2.55	0.85	Low
6	Ability to identify pests and diseases locally	2.78	0.74	Moderate
7	Digital banking use for farm payments	1.65	0.92	Very Low
8	Researching online to find prices globally	1.48	0.81	Very Low
9	Use of social media for branding products	1.55	0.88	Very Low
10	Electronic tracking of inventory	1.71	0.90	Very Low
	Grand Mean	2.34	0.83	Low

Table 1 showed that farmers who participated in the traditional literacy model recorded a low overall mean score of 2.34. They performed relatively better in basic manual skills such as maintaining physical ledgers and identifying local pest/disease symptoms. However, they showed very low competencies in digital-related skills (items 7–10), which are increasingly essential for modern agripreneurship.

Research Question Two: Competencies in Digital-First Literacy Models

Table 2: Agripreneurial Competencies via Digital-First Literacy Models (n = 49)

S/N	Item Statement (Abbreviated)	Mean ($\bar{x}$)	SD	Remark
1	Mobile payment systems proficiency	3.65	0.58	High
2	Utilization of smartphones to keep records	3.55	0.61	High
3	Analysis of digital indices in real time	3.41	0.67	High
4	Using social media for direct consumer sales	3.71	0.55	High
5	Utilizing GPS/mapping technology for business planning on farm acreage	3.18	0.72	Moderate-High
6	Virtual extension advisory platforms accessibility	3.49	0.64	High
7	Digitized branding and logo design for the products	3.29	0.69	Moderate-High
8	Membership in electronic agriculture platforms	3.61	0.60	High

9	E-contracts management with agricultural businesses	3.12	0.74	Moderate-High
10	AI-based crop yields prediction	2.98	0.81	Moderate
Grand Mean		3.40	0.66	High

Table 2 revealed that farmers who participated in the digital-first literacy model recorded a high overall mean score of 3.40. They demonstrated strong competencies in mobile payments, social media marketing, record-keeping apps, and participation in e-agriculture networks. The relatively lower score in the use of AI tools for yield forecasting suggests that more advanced digital skills still require further training.

Research Question Three: Comparative Analysis of Effectiveness

Table 3: Independent Samples t-test Comparison of Traditional vs Digital-First Literacy Models on Agripreneurial Competencies (N = 98)

Group	N	Mean	SD	t-value	p-value	Decision
Traditional	49	2.34	0.83	-8.15	< 0.001	Significant difference
Digital-First	49	3.40	0.66			Digital-First is significantly superior

Table 3 indicated that there is a statistically significant difference between the two literacy models ($t = -8.15$, $p < 0.001$). Farmers exposed to the digital-first literacy model demonstrated substantially higher agripreneurial competencies than those who participated in the traditional literacy model.

Discussion of Findings

As can be observed from the data provided in Table 1 above, the grand mean of the farmers participating in the conventional literacy program is quite low, at 2.34.. They did average well in manual literacy skills like managing physical farm records ($M=2.82$) and recognizing pests/diseases on their farms ($M=2.78$), yet they exhibited poor competence in all areas of digital literacy skills (M ranging from 1.48 to 1.71). From this finding, it can therefore be deduced that face-to-face and print-based literacy programs for adult learners have been ineffective in meeting modern agripreneurship demands because they fail to develop the necessary modern entrepreneurial and digital capabilities required in the contemporary agrarian business environment. In this regard, this result corroborates the study findings of Demissie (2025) who found that traditional delivery approaches to integrated functional adult education in Ethiopia achieved little success in cultivating the entrepreneurial skills of the targeted adult farmers. Choruma (2024) also noted that paper-based extension methods in sub-Saharan Africa were obsolete due to the changing market conditions and technologies.

By way of contrast, Table 2 revealed that the farmers that received training via the digital-first model demonstrated a high grand mean of 3.40, with especially good results in mobile payments proficiency ($M = 3.65$), social media selling direct to customers ($M = 3.71$), and participation in e-agricultural discussions ($M = 3.61$). Even the lowest-rated category, AI crop yield forecasting ($M = 2.98$), performed above the scale's baseline average. Such findings clearly illustrate that it is far more effective to use digital immersion techniques to foster technological and business literacy in small-scale farming. Indeed, according to the study by Wang (2025), digital literacy significantly raises farmers' motivation to engage in marketing-oriented activities in China. Analogous results were obtained in another study by Lu (2024), who stated that digital literacy interventions positively influence farmers' environmental consciousness and engagement in market-related processes associated with sustainable food systems. As was established by Xu (2026), digital literacy is a critical variable in explaining farmers' use of technological innovations and entrepreneurship. Arangurí (2025) also showed that technology adoption and direct market presence are greater in farmers that underwent

literacy training via a mobile application. Likewise, a study by Abdelaziz (2025) proved this using a randomized intervention in Egypt.

In Table 3, which presented the results for the independent samples t-test, there was an important statistical difference between the two models ($t = -8.15$, $p < 0.001$), with the digital-first model outperforming the traditional model by a large percentage (Grand Mean 3.40 versus 2.34). This clearly indicates that there is enough empirical evidence to prove that digital-first adult literacy models are more effective in improving the performance of agripreneurs in smallholder farms in Lagos State. The findings are consistent with Roy (2025), who proved that the provision of agri-tech entrepreneurship training using digital platforms was more effective in terms of developing competencies when compared to traditional extension services. Daum (2025) also came up with a similar finding following his analysis of a number of countries in a review paper. In this case, he observed that digitalisation, as well as skill development initiatives, were more superior in promoting entrepreneurial activities in agriculture when compared to the traditional models. According to Ismail (2025), the levels of green absorptive capacity and digital skills gained from new literacy models have a predictive effect on the use of precision agriculture and business performance.

CONCLUSION

Based on this research, there is enough convincing data demonstrating that digital first literacy practices have greater effectiveness compared to conventional face-to-face learning practices in developing competencies associated with agricultural entrepreneurship among small-scale farmers in Lagos State, Nigeria. Despite the fact that conventional practices help to develop certain manual and local knowledge-related skills of small-scale farmers, they do not prepare individuals for a digitally driven economy and advanced market agriculture. On the contrary, digital-first practice resulted in the development of extremely high levels of competencies in mobile payments, marketing using social media platforms, real-time market analysis, and use of e-platforms, which can be used by small-scale farmers to convert their agricultural production processes into profitable agribusinesses.

Being conducted within the framework of research activities across five IBILE divisions of Lagos State, this study shows the need to introduce new methods of delivering extension services in peri-urban and fast-urbanizing regions. In this way, it is possible to ensure success in metropolitan markets. Digital literacy practices not only provide an opportunity to increase the competence level but also contribute to achieving such goals as food security and economic development of rural communities.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

1. The authorities of the Lagos State Agricultural Development Authority and the Ministry of Agriculture must scale up the programs for increasing digital literacy of farmers through hybrid and mobile-app-based training modules.
2. Government and development partners must invest in rural digital infrastructure, including subsidised smartphones, affordable data bundles, and community internet hubs, particularly in the IBILE farming communities of Lagos State.
3. Training programs focused on building capacity should be geared towards agricultural extension workers to ensure that they have the ability to facilitate the adoption of digital learning platforms by farmers.

References

- Abdelaziz, F., & Ayalew, K. (2025). Digital literacy training to promote diffusion of digital agricultural tools to smallholder farmers: Evidence from a randomized intervention in Egypt. IFPRI Discussion Paper 02359.
- Adeyanju, D., Mburu, J., Gituro, W., Chumo, C., Mignouna, D., Mulinganya, N., & Ashagidigbi, W. (2023). Can young agripreneurs improve their skills through agripreneurship empowerment programmes? Evidence from Africa. *Heliyon*, 9(1).
- Alarape A., B., AdedokunS., A., SulaimanO., N., OlunloyoA., A., & OgunsolaJ., O. (2019). Level of Respondents' Awareness about Extension Activities in Ido Local Government Area of Oyo State, Nigeria. *International Journal of Scientific Research in Science, Engineering and Technology*. <https://doi.org/10.32628/ijrsrset196514>.
- Amaran, K., Krishnamoorthy, A., & Shobana, P. (2025). Fostering the future: Agripreneurship intentions among Indian agricultural students. *Heliyon*, 11(3).
- Arangurí, M., Mera, H., Noblecilla, W., & Lucini, C. (2025). Digital literacy and technology adoption in agriculture: A systematic review of factors and strategies. *AgriEngineering*, 7(9), 296.
- Archibong, E. M. (2025). Digital literacy and agricultural engagement among youth in Akwa Ibom State, Nigeria: A study using the Digital Competence Framework. *Indian Res. J. Ext. Edu*, 25(4), 33-41.
- Ayanwale, A., Adekunle, A., Kehinde, A., & Oluwole, F. (2023). Networking and training for IMPROVEMENT of farm income: A case of lifelong learning (L3F) approach in West Africa. *Heliyon*, 10. <https://doi.org/10.1016/j.heliyon.2023.e23363>.
- Charatsari, C., Michailidis, A., Lioutas, E. D., Bournaris, T., Loizou, E., Paltaki, A., & Lazaridou, D. (2023). Competencies needed for guiding the digital transition of agriculture: Are future advisors well-equipped?. *Sustainability*, 15(22), 15815.
- Choruma, D. J., Dirwai, T. L., Mutenje, M. J., Mustafa, M., Chimonyo, V. G. P., Jacobs-Mata, I., & Mabhaudhi, T. (2024). Digitalisation in agriculture: A scoping review of technologies in practice, challenges, and opportunities for smallholder farmers in sub-saharan africa. *Journal of agriculture and food research*, 18, 101286.
- Daum, T. (2025). Digitalization and skills in agriculture. *Outlook on Agriculture*, 54(2), 171-181.
- D'Anglejan, L., Lepine, V., Thompson, W., & Trabelssi, A. (2024). *Making digital tools work for farmers: IDRC-scoping study*. IDinsight; International Development Research Centre. idinsight.org.
- Demissie, E. B., Asaro, A., Thuo, M. W., Labiso, T. O., & Lachebo, G. C. (2025). Effectiveness of the integrated functional adult education program: Insights on the management process in Southern Ethiopia. *Social Sciences & Humanities Open*, 11, 101561.
- Guo, D., & Ogbodo, J.N. (2026). Bridging the digital divide: a comparative study of digital literacy and access in rural communities in China and Nigeria. *Humanit Soc Sci Commun* 13, 243. <https://doi.org/10.1057/s41599-026-06553-0>

- Hamzat, L., Abiodun, D., & Joseph, A. (2023). Empowering entrepreneurial growth through data- driven financial literacy, market research, and personalized education tool. *World Journal of Advanced Research and Reviews*, 19(2), 1692-1711.
- Hasan, M., Supatminingsih, T., Tahir, T., Guampe, F. A., Huruta, A. D., & Lu, C. Y. (2025). Sustainable agricultural knowledge-based entrepreneurship literacy in agricultural SMEs: Triple bottom line investigation. *Journal of Open Innovation: Technology, Market, and Complexity*, 11(1), 100466.
- Hosman, L., & Nova, R. (2025). Offline solutions for agricultural extension: Integrating digital libraries into train-the-trainer programs. *Advancements in Agricultural Development*, 6(1), 5-18.
- Ismail, I. J. (2025). The influence of green absorptive capacity on agripreneurs' adoption of precision agriculture technologies: Mediating effects of green innovations. *Innovation and Green Development*, 4(3), 100248.
- Joel, A. F., Bamidele, J., Oyediji, B. I., Olaitan, M. A., Princess, U., Eleke, O. J. J., ... & Sennuga, S. O. (2025). Effectiveness of ICTs in extension service delivery among smallholder farmers in Kwali Area Council, Abuja, Nigeria. *Global Academic Journal of Agriculture and Bio Sciences*, 7(1), 8-17.
- Kazungu, I. (2023). Agripreneurship as a panacea for food security in Tanzania: A systematic review. *Heliyon*, 9(2), Article e13305. <https://doi.org/10.1016/j.heliyon.2023.e13305>
- Khatrri, A., Lallawmkimi, M. C., Rana, P., Panigrahi, C. K., Minj, A., Koushal, S., & Ali, M. U. (2024). Integration of ICT in agricultural extension services: A review. *Journal of Experimental Agriculture International*, 46(12), 394-410. <https://doi.org/10.9734/jeai/2024/v46i123146>.
- Lu, S., Sun, Z., & Huang, M. (2024). The impact of digital literacy on farmers' pro-environmental behavior: an analysis with the Theory of Planned Behavior. *Frontiers in Sustainable Food Systems*, 8, 1432184.
- Magesa, M., Jonathan, J., & Urassa, J. (2023). Digital literacy of smallholder farmers in Tanzania. *Sustainability*, 15(17), 13149. <https://doi.org/10.3390/su151713149>.
- Makinde, O. O., Ogunlade, I., Abidemi, A. O., Shuaib, A. A., & Oladele, O. I. (2025). Knowledge and attitude of extension educators towards digitising agricultural extension services in Kwara State, Nigeria. *Problems of World Agriculture/Problemy Rolnictwa Światowego*, 25(2), 33-48.
- Mollel, M., Quiroz, L. F., Varley, C., Firestine, A., McLoughlin, M. E., Kafunah, J., & Spillane, C. (2025). Digital technologies to accelerate the impact of climate smart agriculture by next-generation farmers in Africa. *Frontiers in Sustainable Food Systems*, 9, 1462328. <https://doi.org/10.3389/fsufs.2025.1462328>.
- Ogbu, E. (2025). Re-skilling for the future: An innovative approach in the nigerian adult education for sustainable development in the era of automation. *Journal on Innovation and Sustainability RISUS*, 16(1), 04-17. <https://doi.org/10.23925/2179-3565.2025v16i1p04-17>.

- Ogedengbe, C. T., Akanji, N. E., Malomo, O. J., & Akanji, K. A. (2024). The potentials of e-extension for sustainable agricultural development in Nigeria. *Journal of Agricultural Extension*, 29(1), 270-278. <https://doi.org/10.4314/jae.v29i1.30s>.
- Ragetlie, R., Najjar, D., & Oueslati, D. (2022). “Dear Brother Farmer”: Gender-Responsive Digital Extension in Tunisia during the COVID-19 Pandemic. *Sustainability*, 14(7), 4162. <https://doi.org/10.3390/su14074162>.
- Raji, E., Ijomah, T. I., & Eyieyen, O. G. (2024). Improving agricultural practices and productivity through extension services and innovative training programs. *International Journal of Applied Research in Social Sciences*, 6(7), 1297-1309. <https://doi.org/10.51594/ijarss.v6i7.1267>.
- Roy, M., & Medhekar, A. (2025). Transforming smart farming for sustainability through agri-tech Innovations: Insights from the Australian agricultural landscape. *Farming System*, 3(4), 100165.
- Sharma, A., Singh, S., Singh, A., Bhooshan, N., & Srinivasa, A. K. (2025). Beyond Fields: Unveiling the dynamics of agripreneurship and agri-startups in India’s agricultural landscape. *Journal of the Knowledge Economy*, 16(5), 16365-16393.
- Stephen, I. A., Ayodele, O. M., & Oluremi, O. A. (2017). Enhancing the performance of agro-based SMES: The role of entrepreneurship competencies. *Covenant Journal of Entrepreneurship*.
- Sugihono, C., Hariadi, S. S., & Wastutiningsih, S. P. (2024). Digital literacy among agricultural extension agents in North Maluku, Indonesia. *Asian Journal of Agricultural Extension, Economics & Sociology*, 42(6), 417-429.
- Wang, Z., Song, Y., Xie, H., Li, C., Hu, Y., Wu, Z., & Chen, J. (2025). The impact of farmers’ digital literacy on farmers’ enthusiasm for grain cultivation: Findings from the “Double Hundred and Thousand” farmers in Jiangxi province. *PLoS One*, 20(12), e0334437.
- Widiyanti, E., Ihsaniyati, H., Utami, B. W., Padmaningrum, D., Suminah, S., & Wahyuni, A. A. (2026). Promethee: Agricultural Extension Workers’ Strategy to Strengthen Their Identity for Sustainable Food Production. In *BIO Web of Conferences* (Vol. 219, p. 07004). EDP Sciences.
- Wonor, A. I., Chigbu, G., Oghogho, M. Y., & Osazuwa, O. M. C. (2026). Strengthening Food Security Through Digital Agriculture and Youth Empowerment in Nigeria. *Emerging Frontiers Library for the American Journal of Agriculture and Biomedical Engineering*, 8(03), 43-59.
- Xu, A., Radzi, N. A. M., Liu, Y., & Sieng, L. W. (2026). The Role of Digital Literacy in Agricultural Technology Adoption and Efficiency: A Systematic Literature Review. *Sustainability*, 18(2), 1138.
- Yang, L., Yu, S., & Liu, B. (2025). The impact of digital literacy on farmland scale operations: exploring the mediating and moderation roles of land transfer and land dependence. *Frontiers in Sustainable Food Systems*, 9, 1546024.