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Training Needs of Agricultural Extension Personnel on Smart Agricultural Practices in Ogun State Agricultural Development Programme

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[1]Bolarinwa, K. K., [2]Lowen, S. A. [3]Adebayo, O. A. and [1] Adejumo, D. A.

[1]Department of Agricultural Administration, Federal University of Agriculture, Abeokuta
[2]Department of Agricultural Economics, Venite University, Iloro-Ekiti, Ekiti State Nigeria
[3]Department of Agricultural Technology, Oyo State College of Agriculture and Technology, Igboora Oyo State Nigeria
Correspondent Email Address and Phone number: bolarinwakk@funaab.edu.ng; 08058048158

Abstract

The study assessed the training needs of agricultural extension personnel in smart agricultural practices within the Ogun State Agricultural Development Programme (OGADEP), Nigeria. A descriptive survey design was adopted. Using a multistage sampling procedure 101 extension personnel were randomly sampled out of 143. Data were collected using a questionnaire and structured interview schedule. Data were analyzed with means, frequencies, percentages, Chi-square and Pearson Product Moment Correlation at 5% significance level. Findings revealed that although respondents demonstrated moderate familiarity with ICT tools ($\bar{x}$ = 3.41) and mobile advisory applications ($\bar{x}$= 3.50), there were notable gaps in advanced competencies, such as automated irrigation systems ($\bar{x}$= 3.01) and drone applications ($\bar{x}$ = 3.40). Data collection and analysis for smart farming emerged as the highest-ranked training need ($\bar{x}$= 3.46). Knowledge of smart agriculture was positively correlated with training received (r = 0.276, p < 0.01). The study concludes that strengthening extension innovation systems in Ogun State requires structured, competency-based, and continuous professional training in smart agriculture. Institutional collaboration, policy support, and digital infrastructure development are recommended to enhance development impacts.

Keywords: Extension innovation system, training needs, Ogun State Agricultural Development Programme

Introduction

Agriculture plays a strategic role in economic growth, rural employment, poverty reduction, and food security across sub-Saharan Africa (Owoade et al., 2025). In Nigeria, the sector contributes significantly to national GDP and provides employment and support livelihoods, while contributing to national economic growth (World Bank, 2023). Beyond its economic contribution, agriculture remains central to achieving the Sustainable Development Goals (SDGs), particularly zero hunger, poverty reduction, and climate action. However, the sector faces increasing structural and environmental pressures. According to (FAO, 2022a), climate variability, land degradation, soil fertility decline, rapid population growth, and market volatility have intensified production risks. These challenges expose the limitations of conventional, input-intensive, and experience-based farming systems that dominate much of Nigeria's agricultural landscape.

Globally, agricultural transformation is increasingly driven by digital and smart technologies. Smart agriculture, also described as digital or precision agriculture, integrates the Internet of Things (IoT), big data analytics, artificial intelligence, drones,

remote sensing, Geographic Information Systems (GIS), and automated irrigation systems to enhance productivity and resource-use efficiency (Rachmat & Syarifah, 2020). These technologies enable real-time monitoring, predictive analytics, climate adaptation planning, and optimised input application. The FAO strategy on digital agriculture 2022–2031 emphasises the importance of digital transformation in building resilient and inclusive agricultural food systems (FAO, 2022b). Despite these global advancements, the adoption of smart agricultural technologies in Nigeria remains uneven. Mutambara and Mudhara, (2022) confirmed in their study that inadequate digital literacy, limited infrastructure, weak institutional capacity, and insufficient training among extension personnel hinder widespread technology adoption. Agricultural extension systems play a pivotal role in bridging the gap between research innovations and farmer adoption.

Traditional extension models focused largely on technology transfer; however, modern Agricultural Innovation Systems (AIS) frameworks emphasize interactive learning, co-creation of knowledge, and the facilitation of innovation networks (Joseph, 2026). Within this framework, extension personnel must possess competencies not only in agronomy but also in digital tools, data interpretation, climate advisory services, and innovation facilitation. In Ogun State, agricultural extension services are delivered primarily through the Ogun State Agricultural Development Programme (OGADEP), which operates under a unified extension system. While OGADEP has contributed significantly to technologies dissemination, however, there is no clear empirical evidence on empowerment of extension personnel with the needed training for disseminating smart agricultural practices to farmers. Access to digital devices alone does not guarantee effective utilization. Joseph (2026) shows that competence in data analytics, drone applications, GIS interpretation, and digital market platforms require structured and continuous professional development. Without a targeted training needs assessment (TNA), extension innovation systems may struggle to achieve measurable development impacts. Strengthening Agricultural Extension Innovation Systems (AEIS), requires building the technical and digital capacities of extension agents to ensure measurable development outcomes (Isaac et al., 2025). This study, therefore examines the training needs of extension personnel on smart agriculture practices within OGADEP. The specific objectives of the study were to:

i. examine types of training received by extension personnel since employment;
ii. assess extension personal knowledge of smart agriculture practices; and
iii. ascertain specific area of smart agricultural skills they need training.

The study hypothesized that there is no significant relationship between knowledge of smart agricultural practices and training needs of extension personnel on specific smart agricultural skills

Methodology

The research was conducted in Ogun State. It is located at latitude range: 6° 20′ N to 7° 50′ N,longitude range: 2° 45′ E to 4° 45′ E The population of the study comprised all agricultural extension personnel working under the Ogun State Agricultural Development Programme. These extension agents serve as the primary link between research institutions and farmers, facilitating technology dissemination, advisory services, and innovation uptake across Ogun State. According to OGADEP records (2024), the total number of extension personnel in the 2 selected operational zones was 143.

A two-stage sampling procedure was employed in selecting extension personnel for the study. Stage one involved the use of a simple random sampling technique to select two of the four operational zones of OGADEP. Abeokuta and Ijebu-Ode zones were selected. Stage two was a proportionate sampling of 70% of extension personnel from the selected zones. This is done to enhance statistical precision and ensured proportional representation of respondents across the 2 zones. The sampling procedure resulted in a total sample size of 101 extension personnel, representing approximately 70% of the accessible population within the selected zones. Primary data were collected using a questionnaire, complemented with a well structure interviews schedule where necessary. The questionnaire consisted of both closed- and open-ended questions content validation was conducted and the instrument reliability coefficient was Rho (0.81).

Frequency of training received as indicated in Table1 was measured using a three-point scale of Often = 3, occasionally =2, and Not at all = 1. Respondents indicated how frequently they received each type of training. Knowledge of smart agricultural practices was measured using a four-point Likert scale of Very familiar =4. Familiar =3, Less familiar =2, and Not familiar =1. Respondents indicated their level of familiarity with technologies such as the Internet of Things (IoT), drones, and precision farming. Smart agriculture specific training needs was measured using a four-point Likert type scale of Strongly agree =4, Agree =3 Disagree=2, Strongly disagree =1. Negatively worded items were reversely coded during analysis. Respondents indicated their level of training need across various smart agriculture competencies. Moreover, a cut-off point was computed by dividing sums of the scores by total number of the respondents for each scale in order to categorize the extent to which each variable manifested during analysis. Frequency counts, percentages, means, and Pearson Product Moment Correlation (PPMC) were used to analyse the data. .

Results and Discussion

Frequency of Training Received by Extension Personnel since Employment

Table1 shows that extension personnel had relatively high exposure to various types of training since employment, with mean scores ranging from 2.41 to 2.57 on a three-point scale, all above the cut-off point of ($\bar{x}$ = 2.0). As shown in the Table1, foundation training recorded the highest mean score ($\bar{x}$ = 2.57), followed by career development training ($\bar{x}$ = 2.52) and technical skills training ($\bar{x}$ = 2.49). This indicates that extension personnels frequently participated in structured and formal training programmes. This is further supported by the proportion of extension personnels (62.4%) who reported “often” participating in these trainings, particularly foundation training and career development training (55.4%). In contrast, on-the-job training recorded moderately low mean score ($\bar{x}$ = 2.41), despite 44.6% of respondents indicating frequent participation in it. This suggests a comparatively lower emphasis on experiential and field-based learning. Induction training ($\bar{x}$ = 2.44) and research methodology training ($\bar{x}$ = 2.46) also reflected moderate participation levels. These findings reveal that while there is moderate participation in various training types, practical, field-oriented trainings such as On-the-Job and Induction Training require more strategic emphasis to ensure balanced capacity development across technical and operational areas. This finding is consistent with Elapata (2023), who observed that extension systems in Sub-Saharan Africa often prioritise formal training over continuous field-based professional development. However, the FAO Climate-Smart Agriculture Training Manual emphasizes that effective capacity building should

integrate both formal instruction and practical field-oriented learning to enhance technology dissemination Elapata, 2023). Similarly, Isiwu and Adejoh (2023) highlighted that intensified extension visits and continuous training are critical for improving the adoption of climate-smart agricultural practices. Therefore, the relatively lower emphasis on on-the-job training observed in this study may limit the ability of extension personnel to effectively translate knowledge into practice, thereby affecting technology adoption among farmers

Table 1: Frequency of training received by extension personnel since employment

Type of training received	NAL (%)	OC (%)	OF (%)	Mean	STD
Foundation training	6.90	29.70	62.40	2.57	0.638
Career development training	3.00	41.60	55.40	2.52	0.558
Technical skills training	2.00	47.50	50.5	2.49	0.541
Research methodology training	6.9	43.60	45.5	2.46	0.671
Induction training	9.9	36.60	53.5	2.44	0.670
On-the-job training	5.9	48.5	44.6	2.41	0.619

Cut-off point = 2.00; n = 101
Source: Field survey (2025).

Extension Personnel Knowledge of Smart Agricultural Practices

Table 1 shows that extension personnel demonstrated a generally high level of knowledge of smart agricultural technologies, with mean scores ranging from 3.01 to 3.50 on a four-point scale, all above the cut-off point of ($\bar{x}$ = 2.50) As indicated in the Table 2, the use of mobile applications for agricultural advisory services recorded the highest mean score ($\bar{x}$ = 3.50), suggesting a very high level of familiarity with mobile-based digital platforms. This is supported by the higher proportion 91.1%of extension personals who reported that they are with mobile applications. Similarly, ICT tools for agricultural extension services also recorded a high mean score ($\bar{x}$= 3.41), with higher proportion 95.0% of extension personals indicating that they were familiar, reflecting the increasing integration of digital communication tools in extension service delivery.

Furthermore, remote sensing and GIS technologies (x̄= 3.27) and climate-smart technologies ($\bar{x}$= 3.21) also recorded high mean scores, indicating substantial awareness and exposure among extension personnel. For instance, 87.2% of extension personnels were familiar with remote sensing and GIS, while 91.1% reported high familiarity with climate-smart technologies. Precision agricultural techniques also showed a high level of knowledge ($\bar{x}$ = 3.19), further reinforcing the growing relevance of modern agricultural innovations.

However, automated irrigation systems recorded the lowest mean score ($\bar{x}$ = 3.01), despite 73.1% of extension personnels indicated that they were familiar with automated irrigation. This suggests comparatively lower knowledge of more advanced and specialised technologies. Overall, the Table reveals that extension personnel possess strong knowledge for digital tools, most especially mobile and ICT systems for disseminating smart agricultural practices This finding aligns with Mutambara and Mudhara (2022), who reported increasing use of mobile technologies for delivering agricultural information in developing countries. It also supports global perspectives highlighted by the FAO (2022) and the World Bank (2023), which emphasise the

growing role of digital technologies in transforming agricultural extension systems. However, high knowledge levels do not necessarily translate into effective adoption at the farmer level. Isiwu and Adejoh (2023) noted that the adoption of climate-smart agricultural practices remains low due to limited technical support and weak extension delivery systems. This suggests that although extension personnel are knowledgeable, there is a need to strengthen their practical competencies and communication skills to transfer knowledge to farmers effectively. Therefore, bridging the gap between knowledge and practical application through targeted training and improved extension strategies remains essential for enhancing the adoption of smart agricultural technologies.

Table 2: Knowledge of smart agricultural practices

Statement	VF (%)	FM (%)	LF (%)	NF (%)	Mean	STD
Use of mobile apps for agriculture	59.4	31.7	8.9	0.0	3.50	0.66
ICT tools for agricultural extension	46.5	48.5	4.0	1.00	3.41	0.62
Remote sensing and GIS in agriculture	39.6	47.5	13	0.00	3.29	0.68
Use of climate smart technologies	31.7	59.4	6.9	2.1	3.21	0.65
Precision agricultural techniques	32.7	54.5	12	1.0	3.19	0.67
Automated irrigation systems	34.7	38.6	2.0	6.9	3.01	0.91

Cut-off point = 3.0; N = 101
Source: Field survey (2025).

Training Needs of Extension Personnel on Smart Agricultural Practice

Table 3 shows that extension personnel expressed a high demand for training across all identified smart agricultural competencies, with mean scores ranging from 3.35 to 3.46 on a four-point scale. All values are above the cut-off point of ($\bar{x}$ = 3.0), indicating a generally high level of training needs. As shown in the Table 3, data collection and analysis for smart farming recorded the highest mean score ($\bar{x}$ = 3.46), with 52.5% of the respondents strongly agreeing. This reflects the growing importance of data-driven decision-making in modern agriculture and suggests a gap in the capacity of extension personnel to effectively manage and interpret agricultural data. Closely following this are the digital tools for market access and agricultural e-commerce, recording a high mean score ($\bar{x}$ = 3.43), supported by 53.5% of respondents who strongly agreed, indicating a strong demand for digital market integration skills. Similarly, the use of drones for precision farming and ICT applications for extension services both recorded mean scores of ($\bar{x}$ = 3.40), with a majority 96.1 and 96.1 of extension personnel agreed to the need of training on digital market integration skills and ICT application respectively highlighting the increasing relevance of digital technologies in extension service delivery. In addition, remote sensing and GIS applications ($\bar{x}$ = 3.39) and mobile-based extension advisory services ($\bar{x}$ = 3.36) were also highly rated, with a substantial proportion of extension personnel indicating strong agreement. This suggests that extension personnel recognise the importance of spatial technologies and mobile platforms in providing real-time advisory services and improving farm

management practice. Although application of climate-smart technologies recorded the lowest mean score ($\bar{x}$ = 3.35), with 46.5% strongly agreeing, it still reflects a high level of training need. The comparatively lower ranking may be attributed to the technical complexity or limited exposure to such innovations. Nonetheless, its importance remains critical in addressing climate variability and enhancing agricultural resilience. Overall, the table indicates a broad and urgent demand for advanced digital, analytical, and technology-driven training among extension personnel in Ogun State. This finding aligns with the increasing emphasis on digital agriculture and innovation systems, where competencies in data analytics, ICT tools, and precision technologies are essential for effective extension service delivery (Umunakwe et al., 2025). The high demand across all areas suggests that the current training exposure may not be sufficient to meet the evolving demands of modern agricultural systems

Table 3: Training needs of extension personnel on smart agricultural practice

Specific skills	SA (%)	AG (%)	DA (%)	SD (%)	Mean	STD
Data collection and analysis for smart farming	52.5	38.6	5.9	3.0	3.46	0.74
Digital tools for market access and agricultural e-commerce	53.5	37.6	6.9	2.0	3.43	0.71
Use of drones for precision farming	45.5	50.5	2.0	2.0	3.40	0.63
ICT applications for extension services	44.6	51.5	3.0	2.0	3.40	0.60
Remote sensing GIS and applications in agriculture	49.5	42.6	5.0	3.0	3,39	0,72
Mobile-based extension advisory services	43.6	50.5	4.0	2.0	3.36	0.66
Application of climate-smart technologies	46.5	44,6	6.9	2.0	3.35	0.70

Cut-off point n = 101
Source: Field survey (2025).

Relationship between Knowledge of Smart Agriculture and Training Need

Table 1 illustrates the relationship between extension personnel's knowledge of smart agricultural practices and the need for specific smart agricultural skill train. The Table shows a significant positive relationship (r = 0.276) between the two variables at a p-value less than 0.05. The implication of this is that there is a moderate positive relationship between the two variables. Based on this, the null hypothesis is rejected, implying that there was a significant relationship between knowledge of smart agricultural practices and training received among extension personnel. This result suggests that extension personnel who have participated in training programmes tend to exhibit higher levels of knowledge of smart agricultural technologies. In other words,

training is associated with improved knowledge and understanding of digital and innovative agricultural practices. This finding is consistent with Tafida et al. (2021), who reported that training programmes enhance the technical competence of extension workers and improve their ability to adopt innovative practices. Similarly, Cayabyab et al. (2024) in their study found that training programmes benefit the extension personnel by enhancing their knowledge and skills, thereby improving their decision-making in farm production. It could be inferred from the result that structured ICT and smart agriculture training significantly improve participants' knowledge and skills in modern agricultural systems.

Table 5: Relationship between knowledge and training need on specific smart agricultural technologies

Variables	r-value
Knowledge of smart agricultural practices and training need on specific skill of smart agricultural practices	0.276*

*Significant at P ≤ 0.05;
df = degree of freedom;
n =101Source:
Field survey (2025).

Conclusion and Recommendations

The study concludes that agricultural extension personnel in Ogun State ADP possess a relatively high level of awareness of smart agricultural technologies, particularly in ICT tools and mobile-based advisory systems. However, this knowledge is not evenly distributed across all areas, as competencies in advanced technologies such as automated irrigation systems remain comparatively low. Despite moderate exposure to structured training programmes, there is insufficient emphasis on experiential and field-based learning, which is critical for effective technology transfer. The high demand for training in data analytics, digital market tools, drone applications, and GIS indicates a clear gap between existing competencies and the skills required in modern agricultural systems. Furthermore, the significant relationship that existed between training received and knowledge underscores the importance of continuous professional development in strengthening extension service delivery.

Based on the findings, the following recommendations are proposed to enhance the capacity of extension personnel in Ogun State:

1. Training programmes should be conducted by the Institute of Agricultural Research and Training (IAR&T) on prioritise data analytics and smart farming decision-support systems, as these represent the most critical skill gaps identified.

2. OGDEP and Institute of Agricultural Research should conduct training on practical, field-based (on-the-job) training to complement existing formal training structures and enhance real-life application of knowledge.

3. Extension institutions should invest in capacity building on advanced technologies such as drones, GIS, and automated irrigation systems, where knowledge gaps are still evident.

4. IAR&T should strengthen digital agricultural extension platforms, particularly mobile advisory services and e-commerce tools, to improve farmer outreach and market integration.

5. Policymakers and stakeholders in the Federal and State Ministries of Agriculture should support continuous and structured training frameworks, given the proven relationship between training and knowledge acquisition.

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