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Knowledge level of extension agents on smart farming technologies in southwest Nigeria

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Abstract - This study assessed knowledge level of extension agents on smart farming technologies (SFT) in Southwest, Nigeria. Sampling of respondents was carried out in two stages to elicit data from 188 change agents in Southwestern Nigeria with the aid of a structured questionnaire. The statistical analytical tools employed in the study included both descriptive statistics (frequency counts, percentages and mean) and inferential statistics which was Logistic Regression Analysis. Findings showed that the extension agents were still in their active years with mean age of 44.2±7.6 years. The mean year spent in school was 17.2±3.4 years while the mean of years of working experience was 12.9±7.7 years. The available and mostly used SFT was precision farming technology. The respondents were most knowledgeable on smart greenhouse with a high knowledge score. The result of Logistic regression revealed age (p=0.035) and years of experience (p=0.057) as socio-economic factors that influence knowledge levels of extension agents on smart farming technologies. Conclusively, it was observed that precision farming technology was the available and most utilised smart farming technology, majority of the respondents were most knowledgeable on smart greenhouse while it was therefore recommended that Governments, private sectors, and non-governmental organizations should organise continuous training programs to focus on enhancing extension agents' knowledge and practical skills in underutilised technologies such as artificial intelligence (AI), robotics and drones, while also strengthening competencies in widely recognized technologies like precision farming and internet of things (IoTs).
Keywords: Socio-economic characteristics, smart farming technologies, extension agents, knowledge level.

INTRODUCTION

In developing countries, the agriculture industry continues to be one of the most significant drivers of national income and job development. As a result, enhancing the agricultural sector with new technologies is crucial for bolstering the national economies of those nations, Nigeria inclusive (Nyaga *et al.*, 2021). Agricultural production includes the production of food for humans and livestock, in addition to the raw materials needed for industrial processes. Food availability is a prerequisite to human beings' existence and quality of individual's life in particular (Sejabaledi, 2017).

Globally, agricultural extension services are vital components of agricultural development processes, encompassing the dissemination of information, technology transfer, and capacity-building to end users by enhancing their productivity and livelihoods (Rahman and Pal, 2021; Sahoo *et al.*, 2023). Agricultural extension is a fundamental medium of providing farmers with essential knowledge, skills, and information to improve their agricultural practices, increase productivity, and enhance their socio-economic well-being. This acts as a bridge/link between researchers, agricultural information experts and farmers, thus facilitating adoption of best agricultural practices and incorporation of cutting-edge technologies in the agricultural sector (Pallavi *et al*., 2023).

The integration of agricultural extension services with smart agriculture technologies creates a powerful synergy that enhances the dissemination and adoption of innovative farming practices. Smart agriculture addresses many issues related to crop production as it allows monitoring of the changes of climate factors, soil characteristics, soil moisture, etc. Robots, ground sensors, and drones can all be connected to the internet via the Internet of Things (IoT) technology, which enables objects to be linked together and controlled automatically (AlMetwally *et al*., 2020; Jui-Hsiung *et al.*, 2020). Precision agriculture focuses on optimizing spatial management techniques to boost crop yields while preventing the overuse of pesticides and fertilizers (Mohamed *et al.*,2021). In addition, the serious dearth of knowledge on smart technology information gathering among extension agents is quite massive and expensive. The antidote requires enormous investment in high data management skills, training and infrastructures. The direct linkage between adoption/advancement of any technologies and knowledge base among extension agents is widen by these notable deficiencies (Kwaghtyo and Eke, 2022; Kumar and Ilango, 2018).

Also, according to Njenga *et al.*, (2021) inadequate knowledge of smart technologies among the major players is rampant especially in developing economy and this negatively impact the adoption and implementation of new agricultural technologies. Therefore, there is need to investigate the knowledge level of extension agents about the opportunities and benefits of smart farming technologies, thus promoting the adoption rates and enhancing sustainability in food production within our immediate communities. Against these backdrops, the study is therefore described the socio-economic characteristics of the respondents in the study area, identified the smart farming agricultural technologies available and being used by the respondents and determined the knowledge level of Agricultural Extension Agents on smart farming technologies in the Southwest, Nigeria.

The study hypothesised that there is no significant relationship between socio-economic characteristics of the respondents and their knowledge of smart farming technologies.

METHODOLOGY

The study was carried out in Southwestern Nigeria, which comprises of six states namely, Lagos, Osun, Oyo, Ogun, Ondo and Ekiti States. The zone lies between Latitude 60 to the North and 40 to the South and longitude 40 to the West and 60 to the East. Southwestern Nigeria is bounded in the South by the Atlantic Ocean, in the East by Edo and Delta states, in the West by the Republic of Benin and in the North by Kwara and Kogi States. The area covers about 114,271km^2 which is approximately 12% of Nigerians total land area (National Agricultural Research Programme, 2016). Agricultural sector forms the basis of all the overall development thrust of the zone. It has a population of 33,045,477 constituting approximately 20 percent per annum.

Sampling of respondents was carried out in two stages. The first stage involved a random selection of 60% of the states in Southwest Nigeria. Therefore, four (4) states were selected, namely, Oyo, Osun, Ekiti and Ogun. The second stage involved a random selection of 80% extension agents in the selected states. This implies 45, 16, 53 and 74 extension agents were selected in Oyo, Osun, Ekiti and Ogun respectively. Therefore, a total of one-hundred and eighty-eight (188) extension agents were used as the sample size for this study with the aid of a structured questionnaire. A total of 32 items (cutting across eight categories) relating to smart farming technologies knowledge statements that extension agents were supposed to be knowledgeable about were presented to the respondents. They were asked to indicate whether these statements were correct (true) coded 2 or incorrect (false) coded 1 at nominal level. This was used to recategorize their scores into whether they have a high knowledge on SFT for those above the mean score or a low knowledge for those below the mean score.

RESULTS AND DISCUSSION

Socio economics characteristics

From Table 1, 65.4% of the respondents were male while 34.6% were female. This result go in line with that of Olaniyi *et al.*, (2020) where male was dominant among the extension agent. The distribution of respondents by their age revealed that 44.7% of the respondents were between the ages of 41-50 years of age, 32.9% were between 31-40 years of age, 21.3% were between 51-60 years of age while 1.1% of the respondents were within the age range of ≤30years of age with the mean age to be 44.2 years. This result implies that the extension agents are in their active age and would need training to ensure continued use of smart farming technology. This result is in line with the findings of Olorunfemi *et al.* (2020) which support the idea that age is expected to enhance their capacity to effectively communicate climate smart agricultural initiatives to farmers.

Table 1: Distribution of respondents based on socio-economic characteristics

Variables	Response options	Frequency	Percentage	Mean
Sex	Male	123	65.5	
	Female	65	34.6	
Age (years)	≤30	2	1.1	
	31-40	62	32.9	44.2
	41-50	84	44.7	
	51-60	40	21.3	
Years spent in school	5-10	9	4.8	
	11-16	58	30.9	17.5
	17-22	112	59.6	
	≥ 22	9	4.8	
Years of working experience	1-10	91	48.4	
	11-20	61	32.5	12.9
	21-30	33	17.6	
	31-40	3	1.5	
Training received	Yes	126	67.0	
	No	62	33.0	

Source: Field survey, 2024

More than half (59.6%) of the respondents spent between 17-22 years schooling, 30.9% spent 11-16 years, while 5-10 years and above 22 years in school were 4.8% respectively with the mean of 17 years schooling. This implies that majority of the extension agents were highly educated. The mean years of working experience was 12.9 years and it implies that the extension agents had spent a good considerable number of years in extension service thereby improving extension services and deriving enough benefits on various technologies including SFTs. This finding collaborates the finding of Uzoechi *et al.,* (2022) who reported average working experience of 5-15 years among extension agents in Southeast Nigeria. Source of training received, 41.0% of extension agents received training on SFT from ADP, 14.9% received from research institute and NGOs (11.2%) also provided training on SFT. Few (6.9%) received training from ministry of agriculture while 0.5% received training from world bank. This implies that many of the extension agents were still lacking comprehensive and high-quality training on SFTs. This finding collaborates with the finding of Ogunleye, (2014) who reported that training should be organized on the poorly used ICTs so that the respondents can benefit from them.

Smart farming technologies available and being used

The result in Table 2 shows that the majority (73.9%) of the respondents indicated precision farming technology available for use in their area, indicating a high level of knowledge of this SFT. A significant proportion of extension agents, 53.7%, reported having internet of things (IoTs) technology available, highlighting the potential for data-driven decision making in agriculture. The relatively low availability of artificial intelligence (AI) (13.8%) and robotics and drones (5.3%) suggest a need for increased investment in these areas to enhance agricultural productivity. The availability of smart irrigation systems 32.4% and smart greenhouses 33.5% indicates a growing trend towards precision agriculture and climate-smart agriculture in the region. However, the mere availability of these technologies does not automatically translate into widespread usage. These findings underscore the importance of providing extension agents with training and support on SFT to enhance their knowledge more on the available technologies.

Table 2: Distribution of respondents by types of SFT available

SFT available	Frequency*	Percentage (%)
Precision farming	139	73.9
Remote sensing	45	23.9
Internet of Things	121	53.7
Artificial Intelligence	26	13.8
Cloud computing	56	29.8
Robotics and Drones	10	5.3
Smart Irrigation system	61	32.4
Smart Greenhouse	63	33.5

Source: Field Survey, 2024
*Multiple responses

Level of use of smart farming technologies in work environment

Table 3 shows the level of use of smart farming technologies by the respondents in the study area. Based on the findings, any mean score greater or equal to 1.50 was categorized as high use and any mean score less than 1.50 was categorized as low use. Precision farming ($\bar{x}$ = 1.57) ranked 1st as the SFT used. This was followed by internet of things ($\bar{x}$= 1.39) which ranked 2nd, and irrigation system ($\bar{x}$=1.20) ranked 3rd. This suggests that precision farming had the highest level of use among the respondents surveyed. Also, artificial intelligence ($\bar{x}$= 0.98) ranked 4th subsequently followed by smart greenhouse ($\bar{x}$= 0.96) which ranked 5th, cloud computing ($\bar{x}$= 0.92) ranked 6th. Furthermore, remote sensing ($\bar{x}$= 0.91) ranked 7th while robotic and drones ($\bar{x}$= 0.61) ranked 8th among the extension agents in the study area.

Table 3: Distribution of respondents by the level of use of SFT

SN	Types of SFT	High	Moderate	Low	Not Use	WMS	Rank
1	Precision farming	23 (12.2)	90 (47.9)	46 (24.5)	29 (15.4)	1.57	1st
2	Remote sensing	7 (3.7)	30 (16.0)	91 (48.4)	60 (31.9)	0.91	7th
3	Internet of Things	9 (4.8)	88 (46.8)	58 (30.9)	33 (17.6)	1.39	2nd
4	Artificial Intelligence	4 (2.1)	47 (25.0)	79 (42.0)	58 (30.9)	0.98	4th
5	Cloud computing	3 (1.6)	46 (24.5)	72 (38.3)	67 (35.6)	0.92	6th
6	Robotics and Drones	0 (0.0)	6 (3.2)	102 (54.3)	80 (42.6)	0.61	8th
7	Smart Irrigation system	13 (6.9)	44 (23.4)	99 (52.7)	32 (17.0)	1.20	3rd
8	Smart Greenhouse	5 (2.7)	36 (19.1)	93 (49.5)	54 (28.7)	0.96	5th

Source: Field Survey, 2024

The result implies that precision farming is a more established technology compared to some of the other SFTs which have shown significant benefits for crop yields and resource management. This is in alignment with Abdulsalam, (2019), who opined that the benefit of precision farming helps to reduce both the cost of producing crops and the risk of environmental pollution.

Knowledge level of extension agents on Smart Farming Technologies.

Table 4 shows that the extension agents were knowledgeable on internet of things (IoTs) such as its role in tracking and monitoring of farm produce to reduce wastage (75.5%), its facilitation of farming automation (67.6%), internet connectivity for agricultural technologies (66.5%), and 53.2% saw IoTs investment as profitable in farming. However, low knowledge was identified that traditional farming practices is unnecessary with SF (41%) and 21.8% indicated that conventional methods could efficiently handle irrigation and climate forecasting. This implies that the extension agents in Southwest Nigeria need more training on the potential benefits of IoTs. The findings of this study agree with Olorunfemi *et al.* (2021) cited by Ojo *et al.,* (2023) who discovered low knowledge of the use of ICT for transferring information to farmers among the extension agents.

On precision farming, most of the extension agents were knowledgeable on minimization of fertilizer or pesticides waste (85.6%), right dosage delivery (77.7%), other inputs are incompatible with precision farming (58.5%), and 51.6% had low knowledge on optimization of spatial management is not possible in precision farming. The high level of knowledge exhibited by the extension agents on precision farming gives an indication of a good understanding of the benefits of precision agriculture in reducing the environmental impact of farming practices. They recognize the importance of minimizing wastage and preventing overuse of inputs, which agrees with the principles of precision agriculture (Kalischuk *et al.,* 2019).

The extension agents had a wide range of knowledge on robotics and drones, as presented in the table reveals that majority (67.6%), agreed with the fact that field monitoring/surveillance are easier with the aids of drones, efficient work rate (64.9%), reduction in labour cost (65.4%), and all farming operation cannot use robots and drones (55.9%). This implies that extension agents recognize the advantages of using drones for monitoring and surveillance, especially in challenging terrain. This agrees with Vinodhini, (2024) who opined that, a type of drone utilises laser beams to measure distances and creates detailed, three-dimensional maps of the terrain, assisting in topographic mapping and crop elevation analysis.

The results from Table 4 show that extension agents demonstrated high level of knowledge on remote monitoring helps farmers detect issues early and improve overall farm management (89.4%), using sensors to collect real-time weather data (81.9%), and sensors can be used to monitor or collect soil parameters (80.3%). On the other hand, a low knowledge response to forecasting is not reliable by sensors (60.1%). This indicates that extension agents have a good understanding of the benefits of smart farming technologies, particularly in terms of remote monitoring and sensor applications. However, the low knowledge exhibited on some of the identified responses needs urgent upgrade via training for them to be able to make the expected impact. This agrees with the findings of Ale *et al.* (2016) that extension agents in the Southwest zone of Nigeria needed to be more knowledgeable on diversification practices in crop enterprise for adequate dissemination to the farmers.

The result reveals that the respondents were mostly (73.4%) knowledgeable of the ability of AI in making decision efficiently while (51.1%) had low knowledge in precise and reliable with AI enabled farming. The result indicates that extension agents have a high level of knowledge and appreciation for the capabilities of AI in farming operations. This agrees with Zhang *et al.,* (2020) who opined that, it will enhance the accuracy and effectiveness of extension services, leading to optimized resource management and increased productivity.

Furthermore, majority (78.2%) of the respondents demonstrated a high level of knowledge on high cost of subscription and services, followed by effective data storage management systems (73.4%) while they had low knowledge in efficient management on physical data facilities (29.8%). This implies that extension agents were concerned with the high cost of cloud computing services. However, Maston *et al.,* (2011) argues that the benefits of cloud computing, including reduced capital expenditure and increased agility, may outweigh the costs for many organizations.

The result revealed that (88.8%) of the respondents had high knowledge on installation of pumps for easy water transportation, automated drip irrigation can be employed using soil moisture sensors to eliminate water wastage (79.3%), irrigation coupled with fertilizer application is possible with precise-to-point delivery system (75.5%). However, low knowledge was recorded for surface or sprinkler irrigation system is best practiced (25.0%) and water distribution is tailored towards precipitation (20.2%). This implies that extension agents recognize the critical role of pumps in ensuring water availability and efficient transport. This aligns with the study by Ramli and Jabbar (2022), which emphasized that the use of pumps in irrigation systems can greatly improve water distribution, even during dry periods.

Table 4: Distribution of respondents' knowledge levels on smart farming technologies.

Smart Farming Technologies	(%)
Internet of Things (IoT)	
Internet connectivity of robots, ground sensors, cameras and drones are possible and essential to agricultural productivity.	66.5
Internet of things enables easy coordination and automation of farming operations.	67.6
It enables efficient tracking and monitoring of farm produce, thereby minimizing wastage.	75.5
The progression and integration of smart technologies with traditional farming practices is unnecessary.	41
The investment in IoTs is massive and practically profitable in farming.	53.2
Operations such as irrigation, fertilization, harvesting, and climate forecasting are efficiently productive with conventional farming.	21.8
Precision agriculture	
Chemical and other inputs are incompatible with precision agriculture	58.5
Precision agriculture prevents the overuse of pesticides and fertilizers	77.7
Precision agriculture minimizes wastage of pesticides and fertilizers	85.6
Optimization of spatial management is not possible in precision farming	51.6
Robotics and Drones (Unmanned Aerial Vehicles)	
Robots and drones can work tirelessly and efficiently, reducing labour costs and improving overall productivity.	64.9
Image/ data capturing, object detection and field monitoring/ surveillance are easier with the aids of drones especially in difficult terrain.	67.6
Robots and drones cannot be deployed to all farming operations	65.4
Semi-automated or autonomous tractors are fabricated to couple with drones or robots in order to ease operation.	55.9
Farming operations are more predictable, reliable or less susceptible to damages with direct human involvement.	32.4
Remote sensing	
Sensors can be used to collect real-time weather data, such as temperature, humidity, wind speed, and precipitation	81.9
Sensors can be used to monitor or collect soil parameters and detect deficiencies or excesses	80.3
Remote monitoring also helps farmers detect issues early and take prompt action, in the process minimizing losses and improving overall farm management.	89.4
Sensor predictions are not reliable or dependable in forecasting	39.9
Artificial Intelligence	
AI enables machine decision in par with human intelligence in farming operations.	73.4
Precision and reliability are not correct with AI enabled farming.	51.1
Cloud computing	
Effective data storage management systems, algorithms and computation are virtually handled and supported	73.4
Physical data facilities are enough for efficient management	29.8
The cost of subscription and services are at the high end	78.2
Smart Irrigation system	
The surface or sprinkler irrigation system is best practiced and insufficient for production	25.0
Automated drip irrigation can be employed using soil moisture sensors to eliminate water wastage	79.3
Irrigation coupled with fertilizer or chemical pesticides application is possible with precise-to-point delivery system.	75.5
Water availability and transport system is enabled with installation of pumps.	88.8
Water availability and distribution is tailored towards precipitation.	20.2
Smart greenhouse	
The use of protected/ covered environment limits pest problem and other external factors.	86.7
Production is maximized through efficient use of space	86.7
Open field farming is still obtainable and should be generally practiced.	19.7

Source: Field Survey, 2024

The extension agents however had high knowledge on smart greenhouse on the use of protected/covered environment limits pest problem and other external factors, efficient use of space is maximised (86.7%) respectively while the extension agents had low knowledge on open field farming should be generally practiced (19.7%). This implies that the high percentages of responses indicate that extension agents recognize the advantages of using smart greenhouse to control pest problems and mitigate external environmental factors. This is supported by the study of Gruda *et al.,* (2021), which highlighted protected environments, such as greenhouses, can significantly reduce pest infestations and provide a stable microclimate for crops.

Knowledge scores of the extension agents on each of the SFTs

Table 5 shows that, majority (87.2%) of the extension agents had high knowledge score of percentages above the mean in smart greenhouse, this indicate that extension agents' strong understanding of smart greenhouses positions them as critical intermediaries in advancing controlled environment agriculture. This is supported by Kumar *et al., (*2023), which highlighted that extension agents' knowledge on smart greenhouse enables them to guide farmers in reducing resource wastage, and increasing yields through technologies such as automated climate control and real-time monitoring systems. Majority (81.4%) of the respondents also had high knowledge score on precision agriculture. This implies that, high knowledge score exhibited by the extension agents on precision farming gives an indication of a good understanding of the benefits of precision agriculture in reducing the environmental impact of farming practices. They recognize the importance of minimizing wastage and preventing overuse of inputs, which is in line with the principles of precision agriculture (Kalischuk *et al.,* 2019).

The results from Table 5 shows that (79.3%) of the respondents had high knowledge of smart irrigation. This implies that the extension agents have in-depth knowledge about efficient resources management such as water, fertilizer and pesticides application, a critical issue in agriculture. This aligns with Organisation for Economic Co-operation and Development (OECD), 2019 submission, to imply increased efficiency and waste reduction.

Table 5: Distribution of knowledge scores of the extension agents on SFTs

Knowledge Score	Percentage %	Mean (SD)
Internet of Things (IoT)		
6- 9 (Low)	66.5	9.23 (1.22)
10- 12 (High)	33.5	
Precision farming		
4- 6 (Low)	18.6	6.98 (1.03)
7- 8 (High)	81.4	
Robotics and Drones (UAV)		
5- 7.5 (Low)	43.6	7.48 (1.35)
7.6- 10 (High)	56.4	
Remote sensing		
4- 6 (Low)	42.0	6.53 (1.16)
7- 8 (High)	58.0	
Artificial intelligence		
2- 2.9 (Low)	74.5	3.21 (0.50)
3- 4 (High)	25.5	
Cloud computing		
3- 3.9 (Low)	47.3	4.65 (0.72)
4- 6 (High)	52.7	
Smart Irrigation system		
5- 7.5 (Low)	20.7	7.96 (0.83)
7.6- 10 (High)	79.3	
Smart greenhouse		
3- 3.9 (Low)	12.8	4.96 (0.56)
4- 6 (High)	87.2	
Overall knowledge score		
Low	**49.5**	**50.61(4.32)**
High	**50.5**	

Source: Field survey, 2024

However, the high knowledge score of 58.0% among extension workers in the application of remote sensing technologies in farming activities and operations suggest they had information of better and improved production methods in monitoring pest and diseases spread. This is partly supported by the result of Ibrahim *et al*., 2024 which highlighted the higher prediction rate in monitoring potato diseases aided with remote sensing-based climate data.

Furthermore, the 56.4% high knowledge score of extension agents regarding robotic and drones is a promising indicator for the future of agriculture, thus expertise lean towards significant advancements in productivity, sustainability, and data utilisation in farming. In general, the push towards agricultural productivity is greatly incentivized by engagement of relevant stakeholders such as extension services, investors and IT experts (Falana *et al.,* 2024). About 52.7% of extension agents indicated high knowledge level on the benefits and utilisation of cloud computing incorporated farming techniques, which encourages better service delivery in agriculture as supported by Paul *et al.,* (2020). Many extension workers reported low knowledge score of 33.5% in IoT-incorporated farming, the evident lack of robust infrastructures, connectivity and limited electricity access poses this major constraint in extending operations to include necessary IoTs- supported knowledge advancement and trainings (Agballa *et al.,* 2024).

Lastly, extension agents in general had low knowledge level with scores below the average benchmark in AI (25.5%), as contrary to the findings of Omole and Fasina (2024); which suggested high usage of AI-enabled technologies among agripreneurs in Ondo State, Nigeria. Meanwhile, the overall knowledge score (50.5%) of the respondents indicates that about half of the extension agents possess high level of SFTs, while (49.5%) of the respondents indicate a little below half had low level of knowledge in SFT implying that significant portion still lacks adequate knowledge of the use of SFTs.

Relationship between selected socio-economic characteristics of the respondents and the level of their knowledge on smart farming technologies.

The result of Logistic regression revealed a significant relationship between age (p=0.036) and years of experience (p=0.057) and socio-economic factors that influenced the knowledge level of the extension agents on smart farming technologies. Age (β= -0.072; p=0.036) had a negative significant relationship with their knowledge level of smart farming technologies at 5% level of significance. This indicates that as extension agents grow older, the knowledge level of the extension agents on SFTs decreases. This could be attributed to the fact that: older agents may have been used to traditional farming practices and may find it challenging to adapt to newer, smart farming technologies. Also, the rapid evolution of SFT practices, which includes the adoption of modern technologies and innovative farming strategies, might be more easily embraced by younger agents who are typically more open to new methods and lastly older agents may have fewer opportunities for continuous professional development, which might make them to miss out on the latest advancements in smart farming technologies. This finding corroborates Mubiru *et al.* (2018) that older farmers and extension agents often face challenges in adapting to smart farming technologies practices, as they tend to favour conventional methods. The fast-paced development of SFTs may pose a barrier for older individuals who may not have the necessary digital literacy or comfort with new practices.

Table 6: Logistic Regression Model showing relationship between selected socioeconomic characteristics of the extension Agents and knowledge level of smart farming technologies

Variables	Coefficient	Standard Error	z	P>|z|
Sex	0.0155944	0.3244366	0.05	0.962
Marital status	0.298822	0.3270356	-0.91	0.361
Age	-0.0721321	0.0343708	-2.10	0.036**
Years of education	0.0415218	0.0465151	0.89	0.372
Training received	0.4863754	0.3201153	1.52	0.129
Years of experience	0.0620787	0.0325789	1.91	0.057*
Constant	1.943194	1.365553	1.42	0.155

Source: Computed Data, 2024
* Significant at 10%, ** Significant at 5%
Number of obs. = 188
LR Chi-Squ. (6)= 9.16
Prob > Chi-Squ.= 0.1647
Log likelihood = -125.72049
Pseudo R^2 = 0.0352

Years of experience (β= 0.062; p=0.057) showed a positive and significant relationship with knowledge level of the extension agents on SFTs at 10% level**.** This implies that more experienced extension agents tend to have better knowledge of SFTs. Also, as extension agents with more years of experience, may have encountered a wider range and have a deeper understanding of farming systems, including technological impact on agriculture. This work's finding aligns with the opinion of Owen (2004) as cited in Uzoechi *et al*., (2022) who in their study suggested a long-term specialized development plan for extension agents towards their evaluation in their early years of service, to ensure development of their desired sub competencies to aid the usage of smart farming technologies.

CONCLUSION AND RECOMMENDATIONS

The study concludes that the extension agents were in their active years and would need training to ensure continued use of SFTs. Precision farming technology was the most available and utilised smart farming technology, majority of the respondents were most knowledgeable on smart greenhouse which limits pest problem and other external factors through the use of protected/covered environment in agriculture enables controlled growing conditions, optimizing factors such as temperature, humidity, and light to enhance crop yield and quality. Overall knowledge score indicated that about half of the extension agents possess high level of SFTs, while little below half had low level of knowledge in SFTs implying that significant portion still lacks adequate knowledge. Based on the findings, it is recommended that; there should be continuous and intensive training programs tailored to equip extension agents with the necessary technical know-how and hands-on experience in using smart farming technologies.

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