Contextualizing the New normal: Crop Farmers' Utilization of E-Extension Resources in Osun State, Nigeria

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Abstract

Agricultural extension services is critically inadequate to cover the multitudes of clienteles and the traditional face-to-face exchange with clients has further worsen the situation. Thus, it has become highly imperative to adopt more innovative ways of reaching out to farmers to transform the long reliance on the largely inadequate face to face exchanges with farmers. This study assessed the utilization of e-extension resources among crop farmers in Osun State, Nigeria. Multi-stage sampling procedure was used for sampling 120 arable crop farmers. Well-structured interview schedule was employed to elicit relevant information on farmers' awareness of e-extension resources; their utilization of e-extension resources and constraints to use of e-extension resources. Descriptive statistics and inferential statistics were employed for statistical analyses at p≤0.05. Most of the respondents were married males with mean age of 44.3±11.4 years. Their farming experience and annual farm income averaged 28.6±16.7years and 1,112.73±693.68USD. They were mainly aware of Agricultural Development Programmes (ADP) helplines ($\bar{x}$2.78) and radio stations' agric programmes ($\bar{x}$2.53). Most of the respondents had never used AGRIVI 360 ($\bar{x}$=0.26) while few rarely used the National e-agric web portal ($\bar{x}$=0.67). Low access to ICTs in rural areas ($\bar{x}$2.66), poor relevance of e-extension materials (2.58) and lack of support infrastructures (2.50) constituted major constraints to e-resources utilization. Sex, primary occupation, years of education, secondary income and cooperative membership underlined farmers' utilization of e-extension resources. Sex, primary occupation, years of education, secondary income and cooperative membership influenced farmers' utilization of e-extension resources. The study concludes that the predominant small-scale farmers are characteristically limited in benefitting from the potentials of the e-resources thereby necessitating enhanced access to advanced ICTs and their support infrastructures to spur grassroots farmers to fully harness the prospects of e-extension information systems for sustainable agricultural development. Hence, policy makers and development practitioners should dwell on these farmers' realities to create an enabling environment towards achieving this goal.

Keywords: e-extension resources, ICTs, online information systems; agricultural helplines, support infrastructure

Introduction

Agricultural extension has rendered programmes and services in essential knowledge and agricultural technology to both farm and non-farm households in developing and developed countries ever since the colonial masters' days (Danso-Abbeam, Ehiakpor, and Aidoo 2018). The mechanism offered for the linkage of research outputs and development for grassroot farming transformation and potentials actualization has underscored their perpetual relevance. Despite the wide recognition of the stake of extension services in agricultural development, it is yet to deliver its full mandate for achieving global agricultural development and this is even more critical in the developing countries including like Nigeria. This stems from array of bottlenecks to the provision of quality and effective agricultural extension services in Nigeria. Commonly identified are unfavourable

staff-to-farmer extension ratio, poor link between research, extension and farmers, limited budget for extension services, lack of motivation of extension personnel, insufficient aids needed to disseminate information, poor transportation networks and logistics, large area of coverage and lack of implementation of agricultural extension policy (Apantaku *et al.,* 2016). Hence, extension services have failed to effectively reach its intended clientele, over the years.

Reliance on traditional face-to-face extension interaction strategies and agricultural information exchange with clients has further worsen the situation. This is because of the negligible ratio of field extension workers to the millions of farmers across the country. Even the training and visit strategy of utilising contact farmers has panacea to step down agricultural information is defeated based on inadequacy of personnel to cover minimum scheduled visits. Thus, it becomes highly imperative to adopt more innovative ways of reaching out to clientele in effective, efficient and cost-effective ways. Kumar *et al.,* (2020), asserted that the agricultural sector has become riskier as a result of climate change and emergent outbreaks of diseases. To this end, research updates and technologies for capacitating climate smart and resilient farming can be espoused with the advancements in ICT and digital tools for farming decisions guidance and precision. In this wise, extension agents are expected to assist the farming communities in using the provisions of the digital technologies for agricultural risk and emergency management. Failure to adopt ICTs in agricultural extension may lead to gross under-performance of digital technology for improved extension service delivery most especially in the management of agricultural risk and emergencies. The inabilities and impossibilities around conventional in-person communication networks in an emergency setting is necessitating investment in low-cost digital tools. This is poised to provide farmers with market connections and the needed support to gather real-time information on the challenges faced and adapting these tools to tackle other potential challenges timely.

Digital agricultural extension is now helping millions of farmers around the world to gain access to the best of agricultural knowledge and advice just from the palm of their hands. Khan *et al.* (2020) emphasized the need to graft the traditional extension methods, such as person, group, and mass communication methods; into ICTs to make knowledge accessible to all players in an effective, fast and efficient manner in order to strengthen the conventional extension system. Kurdyś-Kujawska *et al.* (2021) affirmed that digital agricultural extension is a scalable, cost-effective solution that allows farmers to access actionable knowledge. However, a significant obstacle to the adoption of ICT by agricultural workers and farmers is the fact that they are simply unaware of the existence of such digital solutions (Anyan & Frempong 2018).

Digital technologies have enabled farmers to escape the menace of farm gate pricing and also promote the use of digital financial services, such as loan acquisition, to expand their farms (Aker *et al.,* 2016). Several of these initiatives are made possible in various areas of agricultural extension service by mobile phones using computer systems, and web-based technologies (Onubedo *et al.,* 2018). Aker *et al.* (2016) in their review of the promises and setbacks found in the use of ICT in agricultural work recorded more than 140 digital agricultural initiatives across the globe. In this age of digital technology, extension staff and farmers alike are naturally attract and developing interest in the use of ICT in the agricultural sector, more importantly because ICTs are now being used in different ways for social interaction. Different ICTs are attracting the attention of various development actors even in agriculture in Nigeria based on their convenience, speed and resourcefulness.

Conversely, the digital-based agricultural sector is less focused owing to a lack of understanding and information about its potential position in managing agricultural risks and emergencies. According to Maertens *et al.* (2020), before the advent of COVID-19 pandemic, extension services mostly employed the "on the field" approaches, such as demonstration plots, group training and farm visits which are all implied as in-person interaction. However, COVID-19-related

physical distancing measures made such approach impossible, thereby necessitating the extension personnel to switch to digital tools for service delivery to farmers (Fatty, 2019). Hence, the new normal had gradually paved way for the potential adoption of digital technology in extension system. Saiz-Rubio and Rovira-Más (2020) affirmed that digital innovations make agriculture more attractive to young people and also bring about increment in agricultural productivity. Advances in digital technology offer an incentive for developing countries to exploit and utilize information and expertise to boost agriculture (Anyoha *et al.,* 2018).

Yousaf *et al.* (2021) submitted that the rapid spread of digital technologies in developing countries gives a unique opportunity for the transfer of knowledge through private and public information systems. Technological developments are creating increasingly powerful computing devices dynamic and virtual network which enable people around the world to interact and exchange knowledge with each other as a global village (Ajaegbu *et al.,* 2019). The deployment of digital technology during an emergency also plays a role in contributing to desperately needed changes to enable smallholder farmers to respond to the challenges of food security, market growth, climate change, and outbreak of diseases (Grote *et al.,* 2021). This can be incorporated through radio, SMS, television, film and internet services throughout the developing world (Olanrewaju and Farinde, 2017).

In developing countries, the growth of technology provides new opportunities to users to connect and access vital information, especially for people in remote communities (Cascio & Montealegre, 2016). Social media as part of digital technology can provide farmers with incredible resources, including helping them find updates on farm operations and clarifying their questions about the symptoms of plant or livestock diseases (Naruka *et al.*, 2017). Several success stories reflecting the potentials for the adoption of digital technology in the delivery of services to farmers are abound across the globe.

The emergencies, induced restrictions which hindered in-person interaction calls for strengthening of ICT support infrastructures to avail farmers, the opportunity to explore relevant e-extension resources at all times, to bridge the gap created by the safety precautions instituted across the globe in response to COVID-19 pandemic. It is against this background that this study was poised to examine utilization of e-extension information system among arable crop farmers in Osun State, Nigeria. This was done by describing the socioeconomic characteristics of selected farmers, examining the farmers' awareness of selected e-extension sources and their level of usage of the selected sources and identifying the constraints to the use of e-extension information system among respondents in a bid to demystify the effects of farmers' factors and the other constraints hindering utilization and map out strategies towards achieving improved use.

Theoretical review

This study is underpinned by the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh *et al.* (2003). The theory has four central determinants of intentions to use information technology. This includes performance expectancy, effort expectancy, social influence and facilitating conditions, all of which are influential and have been theorized in formulating the UTAUT with the core aim of determining user acceptance and usage behaviour on technology, the main import of this study.

1. *Performance expectancy* entails the degree to which the user expects that acceptance and usage of the system will help him attain higher yields in agricultural produce which is the ultimate aim of agricultural extension and advisory services.
2. *Effort expectancy* implies the degree of ease connected with the acceptance and usage of the system.
3. *Social influence* refers to the extent to which an individual perceives that other important members of the social system believe that he or she should use the new system (system effect).
4. *Facilitating conditions* bothers on how the age and experience of an individual influence the usage of a system. Gunawardena (2014)

opined that the moderators of this model are basically voluntariness and experience. The UTAUT also provides a refined view of how the determinants of intention and behavior change over time, however, most of the relationships in the model are moderated (Venkatesh *et al.,* 2007; Marikyan, & Papagiannidis, 2023)

Materials and Methods

This study was carried out in Osun State, Nigeria. For administrative convinience, the Osun State Agricultural Development Programme (OSADEP) divides the whole state into three Agricultural Zone namely Osogbo, Iwo and Ife/Ijesha Zones with its headquarters at Iwo. The study utilized a multistage sampling procedure to select the sampled arable crop farmers. At the first stage, Osogbo zone was purposively selected because it houses the state capital and has comparative advantage in terms of infrastructural support over other zones. Osogbo zone comprises a total of thirteen Local Government Areas (LGAs) including Osogbo, Olorunda, Irepodun, Orolu, Egbedore, Ejigbo, Ede North. Ede South, Ifedayo, Ifelodun, Odo Otin, Boripe and Bolorunduro LGAs. At the second stage, 25% (approximately 3) of the 13 LGAs in the zone were purposively selected based on the relative availability of support infrastructures for utilising E-Extension services. The selected LGAs were Olorunda, Irepodun and Ifelodun LGAs. Third stage involved proportionate random selection of 30% of the total number of predominant farming communities from the selected LGAs resulting to 3, 4 and 5 farming communities in Olorunda, Irepodun and Ifelodun, respectively. Lastly at the third stage, 10% of registered arable crop farmers from each farming community were randomly sampled and this generated a total of one hundred and twenty (120) respondents as the study sample.

Primary data were collected from the selected arable crop farmers using structured interview schedule. Relevant information were collected on socioeconomic characteristics, awareness of e-extension resources, the level of use and constraints to the use of e-extension resources among respondents in the study area. Awareness of e-extension resources was assesed with 3-point scale including not aware, heard of it and seen people access information through the source. These were scored 1, 2 and 3 respectively. Utilization was measured on 4-point scale never, rarely, sometimes and always used, scored 0, 1, 2 and 3. Constraints to use was measured using severity levels ranging from 0 to 3. Descriptive and inferential statistics were utilized to analyze the data collected. These include frequencies, percentages, mean and standard deviation, Chi-square and Pearson Product Moment Correlation (PPMC) was used to establish the relationship between selected socioeconomic variables and the usage of e-extension information sources, while regression analysis was used to isolate the socioeconomic determinants of arable crop farmers' utilization of e-extension resourses, at $p \leq 0.05$.

Results and Discussion

Socio-economic characteristics of arable crop farmers

Majority (63%) were aged 41-60 years, with a mean age of 44.3±11.4 years indicating the predominance of middle age people among the farmers as variedly reported in related studies in the area. Most of the farmers were of male gender (86.7%) and were married (81.7%). This also buttress male dominance of agricultural enterprises where in the women mostly contribute family labour. Close to half (46.9% and 44.4%) spent more than 12 years and between 7 to 12 years, respectively, in formal education. The mean year of formal education was 13.2 ±2.9 years which reflects that majority of the farmers completed secondary school education. This backs up the findings of Akintunde *et al.* (2022) which reported that as much as two-thirds of farmers in Osun State had some form of formal education.

Awareness of e-extension information systems

Results in Table 2 show that many farmers (64.2% and 58.3%) were absolutely unaware of AGRIVI 360 Farm Advisory portal and the national e-agriculture web portal, respectively while lower proportions (35.8% and 29.2%) indicated that they have only heard of them.

Table 1: Socioeconomic characteristics of arable crop farmers in the study area

Socio-economic characteristics	Frequency	Percentage (%)	Mean
Age (years)			44.3±11.4
≤ 40	34	28.6	
41-60	75	63	
≥ 61	10	8.4	
Gender			
Male	104	86.7	
Female	16	13.3	
Years of formal education			13.2±2.9
≤ 6	10	8.7	
7-12	51	44.4	
Above 12	54	46.9	
Primary occupation			
Farming	64	53.3	
Civil service	23	19.2	
Trading	19	15.8	
Artisanal works	14	11.7	
Secondary occupation			
Farming	57	47.5	
Trading	33	27.5	
Artisanal works	21	17.5	
Access to farm credits	51	42.5	
Quality of extension services accessed	108	90	
None		24.1	
Poor		44.2	
Fair		19.2	
Good		12.5	
Ever participated in any ICT training	64	53.3	
Mean of farming experience			28.6±16.7years
Mean of primary income			₦864,844.9±₦547,850.0
Mean of secondary income			₦334,548.60±₦202,350.8
Mean of total annual income			₦1,199,393.48±₦750,200.8
Total	**120**	**100.0**	

Source: Field survey; 2022

These show that the two web Portals (AGRIVI 360 and that of the federal ministry) were largely unpopular among the farmers in the study area. As for the e-channels of the National Agricultural Extension and research Liaison Services (NAERLS), close to half (44.2%) and only 19.1% have heard and know about the use of the agency's e-extension portal, respectively, while closer proportions (43.3% and 37.5%) heard and know others using the farmers helplines, respectively for obtaining extension information.

More so, more than half of the respondents were unaware of NAERLS online radio and about a quarter of them indicated that they heard about it, while the remaining 19.2%

Table 2: Distribution of respondents based on respondents' awareness of the E-extension information resources

E-extension resources	Am not Aware of it (%)	Av heard of it (%)	I have seen people source info. from it (%)	WMS	Sd	Rank
ADP's helplines and field officers phone contacts	0.0	7.5	92.5	2.78	0.6	1st
Radio stations agricultural programmes	5.8	0.0	94.2	2.53	0.7	2nd
Research institutes Agricultural video shows	0.0	29.2	70.8	2.34	0.9	3rd
Television stations Agric shows	5.8	25.8	68.4	2.1	0.9	4th
NAERLS online radio	52.5	28.3	19.2	1.67	0.8	5th
NAERLS National farmers helplines	17.5	43.3	39.2	1.23	0.7	6th
NAERLS e-extension portal	24.2	44.2	31.6	1.2	0.9	7th
Social media extension consultation platforms	21.7	62.5	15.8	0.96	0.6	8th
National e-agriculture web portal (Fed. Min of Agric.)	58.3	29.2	12.5	0.67	0.9	9th
AGRIVI 360 Farm Advisory portal	64.2	35.8	0.00	0.36	0.5	10th
Machine learning for extension information	70.8	29.2	0.00	0.29	0.5	11th
Artificial Intelligence for extension consultation	75.8	23.3	0.8	0.26	0.5	12th

Source: Field survey; 2022

affirmed that they were aware of its existence and used by others. These results show that a substantial proportion of the farmers were aware of the existence of the different NAERLS e-service outlets. Although, these indicate a fairer level of awareness of these NAERLS e-extension outlets than the AGRIVI 360 and national portals, they are also considerably unexperienced by most of the farmers. Among the other ICT-enabled platform for accessing extension resources, ADPs' phone contacts and helplines were prominently indicated to be utilized by the majority (85%), radio stations agricultural programmes (65%), research institutes' agricultural shows (63.3%) and television stations agricultural shows (50.8%). On the other hand, digital technologies platforms for e-extension services especially through machine learning and artificial intelligence were absolutely unknown to majority (70.8% and 75.8%), respectively. These findings reveal that traditional ICT tools especially radio and television as well as phones are the main ICT tools which farmers were mostly aware of for accessing agricultural extension contents. Prior to this study, Olanrewaju and Farinde (2017) had affirmed that these common ICTs especially radio and phones are appropriate channels for alternative communication of agricultural information for farmers' use.

Utilization of e-extension information system among respondents

Results presented in Table 3 show that most of the respondents had never used any of AGRIVI 360 ($\bar{x}$=0.26) while few were indicated to rarely use the National e-agric web portal ($\bar{x}$ =0.67). The use of NAERLS online radio ($\bar{x}$= 0.96) was rarely utilized by majority of farmers while the e-extension ($\bar{x}$=1.2), the farmers helplines ($\bar{x}$=1.23) and portal social media extension consultation platforms ($\bar{x}$=1.67) were sometimes used by majority of the farmers. These show that while the web portals were

largely not accessed by the farmers, the helplines and online radio were used infrequently just as the social media handles were substantially used as source of agricultural extension resources. This could be borne out of the increased popularity of social media platforms and the contributions to information sharing and interaction. Also, higher simplicity of getting through helplines via phone calls of listed contact and greater familiarity with radio presentations could have aider farmers relative higher use of the NAERLS helplines and online radio than the grossly unused web portals of AGRIVI 360 and NAERLS. As such, web-based portals for accessing extension contents remain alien to the grassroots farmers in the study area.

Constraints to use of e-extension resources

Results in Table 4 show that the most severe constraints identified by majority of the farmers

Table 3: Distribution of respondents based on utilization of e-extension information resources

E-extension resources	WMS	Rank
ADP's helplines and field officers phone contacts	2.78	1st
Radio stations agricultural programmes	2.53	2nd
Research institutes Agricultural video shows	2.34	3rd
Television stations Agric shows	2.10	4th
Social media extension consultation platforms	1.67	5th
NAERLS National farmers helplines	1.23	6th
NAERLS e-extension portal	1.20	7th
NAERLS online radio	0.96	8th
National e-agriculture web portal (fed. Min of Agric)	0.67	9th
Machine learning for extension information/advice	0.26	10th
Artificial Intelligence for extension consultation	0.29	11th
AGRIVI 360 Farm Advisory portal	0.26	12th

Source: Field survey; 2022

On the other hand, the frequent use of ADP's contacts/helplines ($\bar{x}$=2.78) and radio stations extension programmes ($\bar{x}$=2.53) by majority of the farmers was affirmed. Also, research institutes' agricultural video shows ($\bar{x}$ =2.34) and television programmes were used somewhat frequently by many of the farmers. The earlier results showing higher awareness of these traditional ICTs media (phone calls/SMS, radio, television and videos) has espoused their use by farmers for obtaining extension services and contents. This finding underscores the widely acclaimed impetus of ICTs for capacity building and bridging knowledge gap (Adesoji *et al.* 2021 and Ndimbo *et al.*, 2023). However, the current advancement of these ICTs especially phones through artificial intelligence and machine learning for precise guidance of farmers decisions, were grossly unutilized by the farmers. This corroborates the position of Olanrewaju *et al.* (2023) who opined that the increased availability of digital technologies is yet to infiltrate local agricultural systems in Nigeria. Similarly, Muhammad *et al.* (2018) found television and fellow farmers as the main sources of information on agricultural risk management among farmers in Malaysia.

are low deployment of ICTs in rural areas ($\bar{x}$ =2.66±0.5), poor relevance of e-extension materials ($\bar{x}$=2.58±0.5), lack of supporting infrastructures ($\bar{x}$=2.5±0.5), poor response from feedback interface on the web portals ($\bar{x}$ =2.42±0.7) and lack of relevant training and skill development for utilizing e-resources ($\bar{x}$ =2.28±0.8). The least severe constraints are preference for physical contact with extension personnel ($\bar{x}$=1.33±0.5) and no room for accessing personalized information on farm specific issues ($\bar{x}$=1.17±0.4). These results showcase the persistence of poor infrastructural development of rural areas and technical

Table 4: Constraints to farmers' use of e-extension resources

Constraints	WMS ($\bar{X}$)	Rank
Low deployment/access of ICTs in rural areas	2.66	1st
Poor relevance of e-extension materials	2.58	2nd
Lack of supporting infrastructures	2.50	3rd
Poor response to the feedback interface on the web	2.42	4th
Lack of relevant training and skill development	2.28	5th
Poor response of the web pages when surfing	1.99	6th
Low level of education	1.95	7th
High traffic on the helplines	1.89	8th
Incomprehensive content of extension resources on the portal	1.85	9th
Poor knowledge of ICT	1.74	10th
Lack of adequate information for web navigation of the portals	1.73	11th
No specific information on the helplines' contacts	1.59	12th
Restricted timing of the helplines working period	1.53	13th
Poor internet access	1.48	14th
Poverty/lack of resources	1.42	15th
Preference for physical contact with extension personnel	1.33	16th
No room for accessing personalized information for solving farm specific problems	1.17	17th

Source: Field survey; 2022

personnel for limiting the potentials of technological deployment as well as the poor capacity of extension systems for tailoring e-contents to farmers' real needs. This exposes the persistence of systemic issues constraining technological inclusion and the attendant technological lag of Nigerian agriculture which was highlighted by the findings of Olanrewaju *et al.* (2023)

Relationship between selected socio-economic characteristics and farmers' use of e-extension resources

The results in Table 5 show the summarized output of the association of categorical socio-economic variables of the farmers with their level of utilization of e-extension resources. The results show that the type of primary occupation ($\chi 2=32.7$), membership of cooperative society ($\chi 2=26.03$) and credits accessibility status ($\chi 2=13.1$) of farmers were significantly associated with farmers utilization of the e-extension platforms or resources. This illustrates that the primary engagements of the farmers could interact with their affinity to explore electronic platforms for extension services. Social capacities often opportune by participation in cooperative groups could portend a lead way to their use of e-resources for their production processes. Similarly, credit accessibility could enable farmers' solvency to procure and utilize facilities for accessing e-resources such as android phones and needed subscription for internet access.

Table 5 further reveals that farmers' age (r=0.446), years of formal education (r=0.51), income from secondary sources (r=0.62), farm size (r=0.45) and total annual income (r=0.37) had positive and significant relationship with their utilization of e-extension resources. This stipulates that cultivation of large farm sizes and associated higher income are related to appreciable level of utilization of e-extension resources. Accordingly, there is higher tendency of large-scale farmers to utilize e-extension resources than the small-scale farmers. As such, large scale farmers may find e-extension resources easier to use than the resource poor small-scale farmers. This highlights that production scale of farmers could underpin their effort expectancy in using the e-extension resources. Thus, a longer

year spent by farmers in formal education is reflected to be related higher utilization of the e-extension resources. As education empowers farmers to be more cosmopolite and positively disposed to innovations, it is thus indicated as positively interacting with farmers' utilization of e-resources for obtaining needed agricultural extension services. As such education could avail social influence or panacea for facilitating conditions as posited by the UTAUT theory. Given these, the domination of small scale and poorly educated rural farmers in the national agricultural workforce portend minimal potentials of the deployment of e-extension resources for supplementing the current shortage of extension personnel in Nigeria. This mirrors a similar situation in Nigeria poultry sector evidenced by the study of Olanrewaju *et al.* (2023) which revealed that farmers affinity towards technological upgrade of the farms was related to the degree of cosmopoliteness and production scale features. These underscore the impetus for a social orientation change and sensitization of grassroots farmers towards the potency of technological tools especially the e-extension resources utilization for agricultural development in Nigeria.

Socio-economic determinants of arable crop farmers' utilization of e-extension resources

Overall, evidence in Table 6 shows the results of the regression model of the effects of socio-economic factors on farmers' utilization of e-extension resources. It shows that female gender (β=-2.91) with reference to male significantly utilized the e-resources at lower levels. In the same way, primary engagement in other occupations aside farming namely civil service (β=2.75), trading (β=3.05) and artisanal works (β=2.9) underpins significant utilization of e-resources for accessing extension content than those who were farmers primarily. This means that those engaged in farming as a form of secondary occupation would seek to explore e-extension resources as opposed to those who had farming as their primary occupation. Explaining this could be the expectation of non-farmers' tendency to seek farming guides through the use of e-extension resources to enhance capacity for their secondary farming occupation, while the major farmers might choose to leverage on their farming experience and established relationships.

Participation in cooperative society as well as credit accessibility also significantly underpinned greater utilization of e-extension

Table 5: Result of Chi square and correlation analyses of the association of socio-economic characteristics with farmers' utilization of e-extension resources

Socio-economic variables	χ2	Degree of freedom	
Primary occupation	32.74	6	0.000
Marital status	15.03	8	0.059
Membership of cooperative	26.03	2	0.000
Credits accessibility	13.11	2	0.001
Extension service access	12.47	4	0.014
Correlations of socio-economic characteristics and utilization of e-extension resources			
	R	**r2**	**P-value**
Age	0.446*	0.199	0.000
Household size	-0.093	0.008	0.316
Years of education	0.519*	0.269	0.000
Primary income	0.099	0.009	0.283
Secondary Income	0.628*	0.394	0.000
Farm size	0.456*	0.208	0.000
Total annual income	0.377*	0.142	0.000

Source: Field survey; 2022

resources. As such, room for external orientation offered by cooperative society participation may enhance farmers exploration of e-extension resources utilization. In the same way, as credits accessibility capacitates financial resources for farming, e-extension resources would be necessitated as complementary resource in order to ascertain required productivity and turn over for credit repayment. Furthermore, higher level of formal education was reflected with significantly higher utilization just as higher income earnings underpinned higher e-resources utilization. These show that the degree of farmers' exposure to formal education and financial status had a role to play in their level of e-resources utilization for accessing extension contents. Thus, farmers' social orientation which is informed by cooperative membership and educational exposure, complements other factors namely financial capacity and gender in influencing the utilization of e-extension resources as inputs for farming activities. As these variables comes to play in distinguishing farmers production scale in the Nigerian agricultural context, it was implied that the predominant small-scale farmers are characteristically limited in benefitting from the potentials of the e-resources for bridging extension services accessibility gap. These support the reported effect of socio-economic characteristics of farmers on their utilization of ICTs in Nigeria (Olanrewaju and Farinde, 2017; Muhammad *et al.,* 2019). As such, enhanced access to ICTs and their support infrastructures coupled with improved level of formal education may spur grassroots farmers to fully harness the prospects of e-extension information systems for sustainable agricultural development. Policy makers and development practitioners should dwell on these farmers' realities in order to create an enabling environment to achieve this goal.

Table 6: Effects of farmers' selected socio-economic characteristics on use of e-extension resources

Socio-economic variables	b	T	P-value
Sex (female)	-2.91	-4.15	0.000*
Pry occupation:			
Civil service	2.75	3.05	2.92
Trading	3.23	4.25	3.78
Artisan	0.002*	0.000*	0.000*
Years of education	0.065	2.2	0.030*
Secondary income	1.34E6	2.28	0.025*
Farm size	0.021	0.35	0.725
Age	0.029	0.73	0.468
Membership of cooperative	2.26	3.56	0.001*
Credits accessibility	-1.45	-2.72	0.008
Annual income	4.25E8	0.09	0.92
Constant	9.19	8.88	0.000

F= 21.3 R2 =0.693.

Conclusion and recommendations

Web-based portals for accessing agricultural extension contents remain alien to the grassroots farmers and only the traditional ICTs, research institutes' agricultural video shows and ADP's contact or helplines are periodically accessed for relevant information. The farmers attributed their poor utilization of the e-extension sources to infrastructural and technical ability issues, poor relevance of e-extension contents, and irresponsive feedback interface of online sources among others. Accordingly, the farmers utilization of the e-extension sources as inputs for farming activities is underpinned by their gender,

social orientation and financial capacities all of which delineate the characteristic production scale of the farmers. Thus, the predominantly small scale production might not tap from the potentials of the e-extension sources for bridging extension services inaccessibility. Drastic measures for sensitizing farmers on the services of the e-extension portals and helplines need to be embarked upon to intimate the grassroots farmers of the web portals operation, registration requirements and other relevant information needed for access. The online portals should be subjected to usability tests especially with smallholder farmers to determine the appropriateness.

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