EMERGING ELECTRONIC AGRICULTURAL EXTENSION TECHNOLOGY: PROSPECTS, CHALLENGES AND STRATEGIES IN ABIA STATE, NIGERIA

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Abstract

The success of the Nigerian agricultural sector is partly dependent on the accessibility of vital agricultural information by farmers. However, the shortage of agricultural extension personnel has been a major challenge to disseminating agricultural information to farmers. Due to recent developments in ICT, more farmers can be easily reached and within a short time, hence the emergence of e-agricultural extension technology. This emerging technological innovation in agricultural extension thrives in developed parts of the world; however, it faces numerous challenges in Nigeria. Electronic agricultural extension technology has lots of prospects in advancing the course of agriculture in Nigeria, but it seems that its strategies are not fully known by farmers and extension agents. Unfortunately, there seems to be dearth of empirical studies or literature in Nigeria revealing the challenges, prospects and strategies for this innovative trend of agricultural extension. Thus, this study investigated the prospects, challenges and

strategies for promoting e-agricultural extension technology in the 21st century in Abia State. Three specific objectives guided the study. A descriptive survey research design was adopted for the study. The sample size for the study was 364 persons, which was determined using the Taro Yamane formula (1967). A multi-stage sampling technique was adopted to select participants for the study. A validated and pilot-tested structured questionnaire was used for data collection. The reliability of the instrument was .86 using Cronbach's Alpha Coefficient Test. Research ethics were ensured during data collection and analysis. Data collected were analyzed using mean and standard deviation. The study identified 14 prospects, 13challenges and 16strategies to promoting e-agricultural extension technology. Therefore, it was recommended, among others, that government should enact policies, ensure regular supply electricity, and train farmers, extension agents and researchers on ICT skills to facilitate e-agricultural extension technology.

Keywords: Agricultural extension, Agricultural Advisory Services, e-agriculture, agricultural extension technology, farmer education, agricultural information, ICT

Introduction

Agriculture remains the pivot of economic development in Nigeria. However, the development of this sector of the economy cannot be achieved without efficient and effective agricultural extension systems (Koyenikan, 2008). Agricultural extension, which is also known as Agricultural Advisory Services (AAS) or agricultural information system and communication networks (AISCN), plays a salient role in facilitating agricultural productivity, increasing food security, improving rural livelihoods and promoting agriculture as an engine of

pro-poor economic growth (FAO, 2017). In the words of Bello (2011), it can be conceptualized as the process of providing information to farmers to help them make a positive change. According to Food and Agriculture Organization (FAO, 2017), the relevance of agricultural and extension services to agriculture and farmers include; improving the well-being of individuals and communities, changing production systems so that they improve rural livelihoods and sustain the resource base, improving agriculture and the social, economic and political status of rural communities, improving the well-being of farm families, improving productivity and livelihoods for farmers, increasing and improving farmers' incomes and productivity on a sustainable basis, enhancing farmers' production, attaining higher levels of efficiency in the farm enterprise and food security and improving rural livelihoods. Francis (2014) opined that agricultural extension is valuable in making agricultural information get to farmers on time. Agricultural information includes all relevant information the farmer needs for improved and effective agricultural production. It may include information on improved seeds, farm machineries, implements, tools, market, farming methods, etc. Therefore, agricultural extension plays a vital role in disseminating agricultural information to famers for increased agricultural productivity.

More so, Bell, Payne and Bohn, in Vignare (2013), stated that the roles of agricultural extension are to link farmers to markets, raise general awareness of opportunities, provide technical information, demonstrate or train, diagnose problems and recommend solutions, respond to follow-up questions raised by clients, provide mass advisories, facilitate access to credit and inputs, assist with business planning, and conduct surveys, monitoring and evaluation, and enumerations. Agricultural extension brings about changes, through education and communication in farmers' attitude, knowledge and skills and its basic role is dissemination of information, building capacity of farmers through the use of a variety of communication

methods and help farmers make informed decisions (Bello, 2011; Koyenikan, 2008). Bello (2016) asserted that providing farmers with timely and relevant information, access to credit, and better market prices through effective agricultural extension services could go a long way in addressing global poverty and improving agricultural productivity. These functions inevitably require different Information and Communication Technology (ICT) strategies and options to accomplish.

In Francis (2014), most of the farmers in developing countries, Nigeria inclusive, live in rural areas and are in most cases divorced from technology and vital agricultural support services needed to carry out farming activities. Therefore, a thoroughly planned and effective integration of ICT in agricultural extension services will be relevant to smallholder farmers in these areas, who remain the bedrock of the agricultural and food supply chains in Nigeria. According to FAO (2017), *ICTs are very useful in agricultural extension, and in facilitating and reaching out to family farmers.* The aspect of timely and relevant agricultural information, especially with the role of Information Communication and Technology (ICT) to connect farmers with the agricultural information they need, has received much attention in the last decade. Therefore, there is a growing body of experience providing lessons on factors required for successful ICT applications in agricultural extension and on how ICT can lead to beneficial behaviour change amongst poor farmers, especially in rural areas (Bell, 2016).

Some authors have noted that there has been a major shift in modernizing or restructuring agricultural extension services, especially with the emergence of ICT (Bell, 2011; Vignare, 2013; & Bell, Payne & Andrea, 2011). This is because any attempt to strengthen and enhance the capability of existing extension functionaries from traditional methods to ICT-oriented methods which will accomplish the objectives of agricultural extension is a welcome

step for agricultural development (Sharma, Murthy & Attaluri, 2016). ICTs have been recognized as possessing the potentials of strengthening the linkage between extension agents, researchers and farmers. Therefore, prevailing weak linkage between the tripartite parties can be strengthened by technology (FAO, 2017). Remarkably, the application of Information and Communication Technology (ICT) in agricultural extension services in form of "e-agricultural extension technology" is becoming increasingly important in the 21st century. This is probably due to its wide and timely spread of useful agricultural information across farmers for increased agricultural productivity with less effort, as compared to traditional systems of information delivery in agricultural education and extension services.

In some countries of the world, traditional agricultural extension systems are being gradually replaced by electronic means. Electronic agricultural extension technology is an emerging trend in e-agricultural technology in Nigeria which focuses on the enhancement of agricultural and rural development through improved ICT processes (Singh & Kumar, 2015). More specifically, e-agricultural technology involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (IT) in the rural domain, with a primary focus on agriculture (Rajkumar**,** 2019). There are several types of activity related to e-agriculture applications that are widely recognized around the world today. The delivery of agricultural information and knowledge services (i.e. market prices, extension services, etc) using the Internet and related technologies falls under the definition of e-agriculture (Ghogare & Monga, 2015).Therefore, in the context of this study, e-agricultural education and extension technology is an aspect of e-agriculture which deals with the delivery of information to farmers through electronic devices or ICTs. The e-agricultural extension technology, based on Kamruzzaman, Daniell, Chowdhury and Crimp (2021), is a network of institutes that provide a more efficient alternative approach to the traditional extension system

for agriculture, fisheries and natural resources sectors. Kamruzzaman, Daniell, Chowdhury and Crimp (2021) further explained that recently, e-agricultural extension technology is the only measure to reach maximum number of farmers who are using android or basic phones. In agreement, Yahaya (2018) stated that electronic means of extending agricultural information to farmers is becoming a fastest way of reaching farmers in Nigeria. This is because young farmers have access to mobile phones and, therefore, it is easy for the agricultural education and extension workers to pass across innovative agricultural information on time. Most farmers who adopted technology mediated by agricultural extension service technology reported that the methodology and other details of innovations were useful (Bhattacharyya, Patil, Bhave, Sawant, Haldankar & Narkhede, 2018). The electronic agricultural extension technology reduces the time lag between need and application of farming technology, helps in cost reduction and waste reduction, assists farmers by opting as a part of decision-supporting system and improves traceability of farm products, which is a crucial parameter in the era of food certification. All these benefits together can contribute to doubling farmer's income (Bhave, Sawant, Parag & Narkhede, 2018). Also, Bhave, Sawant, Parag and Narkhede (2018) noted that electronic agricultural extension technology has the potential to transform traditional farming into precision farming. Precision farming requires the adoption of advanced technology; in most cases, agricultural technology is available, but its rate of adoption is slow. To enhance the adoption rate of agricultural technology by farmers, electronic agricultural education and extension would play a major role. The e-devices and software that can be used in disseminating agricultural information to farmers ensure data logs from censors and through feedback. Management and analysis of these logs lead to improved technology which further enhances access to technology, inputs and thus improves the rate of adoption. Therefore, to accomplish the roles of e-agricultural education and extension technology, certain ICT strategies are required.

Potential applications of ICTs in e-agricultural extension technology, according to Arokoyo (2005), include the capacity to reach a large audience. For example, the use of radio, TV and Internet, can be effectively used for training and demonstrations. T.V., video, VCD, and CD-ROM can be used to make the extension systems and structures more efficient through better management of information and scarce resources. The use of databases for MIS and networking software or the search and packaging of information on demand and for exploring of alternative production options and technologies, the use of search engines, the web and databases, and ICT may be used for normal weather forecasts and as a warning system for disease/pests outbreaks and other disasters before they occur, and also for the provision of timely and sensitive market information with the use of Radio, TV and SMS. ICTs are important for networking among and between the key stakeholders in the Research-Extension-Farmers-Inputs-Linkage System (REFILS). For example, telephone, video, SMS, and ICTs can also be effectively used for community mobilization, learning and action, as seen in Radio, TV, public address systems and the Web (Arokoyo, 2005).

Some strategies identified by Albert (2014) in disseminating agricultural information to farmers using electronic means include, use of database-driven websites to make information sharing and access easier, using streaming media to make non-text (video & audio) information more widely available to audience who may not be literate, using call centers telephone-based services (voice information services and text messaging content), using interactive applications over one way communication tool, giving attention to ICT training for staff responsible for agricultural and rural development, using private sector cyber café and private sector telephone systems visa prophentary sites for information access, creating agricultural website, introducing farmers to agricultural website, training farmers on ICT,

creating zonal internet centres in communities and increasing recognition of the internet as tool for supporting information learning. Abdulsalam, Olaifa and Frederick (2016) stated that there are numerous ICT channels through which agricultural information can reach the farmers in a bid to enhancing agricultural development. Some of these channels are text messaging, e-mail, radio, television, fax, etc. Parag (2010) stated that the dissemination of information to farmers has become increasingly integrated into ICTs. Pagra (2010) further explained that in some countries, rural tele-centres provide electronic information on education, agricultural and health issues and equip rural citizens with skills on how to use computers and provide basic literacy. Also, radio and TV programmers feature agricultural information. Ghogare & Monga (2015) posited that daily and seasonal SMS alert can be used to covey agricultural information. More advanced applications of e- agricultural extension in farming exist in the use of sophisticated ICTs, such as satellite systems, Global Positioning Systems (GPS), advanced computers and electronic systems to improve the quantity and quality of production (World Summit on the Information Society, 2003). Agricultural extension, which depends largely on information exchange between and among farmers and a broad range of other actors, is an area on which ICT can have significant impact. Research scientists can relate directly using electronic means with the farmers through ICTs. Frontline extension workers, who are the direct link between farmers and other actors in the agricultural knowledge and information system, are well-positioned to make use of ICT to access expert knowledge or other types of information that could be beneficial to the farmers (Salau & Saingbe, 2008).

The emerging electronic agricultural extension technology which has thrived in other countries of the world has met lots of challenges in different parts of Nigeria, despite its prospect in the 21st century. However, there seems to be little or no empirical studies in Nigeria, especially in Abia State, x-raying these challenges. In a study, Ken

(2013) identified that these challenges may include scarcity of electricity supply, poor ICT infrastructure, low ICT literacy, lack of relevant content, non-integration of services, issues of localization of ICTs, lack of advisory services, resource mobilization, general lack of interest by stakeholders and lack of understanding of the potentials of e-agriculture. In agreement, the researchers observed that majority of farmers, especially in rural areas of Abia State, seems to lack basic ICT skills and devices to access agricultural information from databases of private and public agricultural education and extension agencies. More so, some farmers are in places with poor network and ICT infrastructure. It was also observed that even some educated farmers who have ICT skills and are in places where there is adequate network do not realize the need for e-agricultural education and extension in the 21st century. A short interview with few agricultural extension workers reveals that an effective electronic means of disseminating agricultural information to farmers through information-based websites, daily or weekly SMS, radio, TV, satellites, etc., has not been adequately used; instead, the traditional methods are employed, despite the shortage of manpower for agricultural education and extension services in Abia State. Notably, policies promoting e-agriculture/agricultural extension seem to be lacking and there seems to be dearth of empirical literatures in the area of e-agricultural extension in Abia State. These issues are probably because the prospects of e-agricultural education and extension in the 21st century have not been fully realized by farmers, educators, government and private agricultural extension agencies. This, in turn, would greatly affect quick agricultural technology transfer to farmers through the extension workers in the 21st century; thus, there would be a decline in agricultural productivity. Lack of quick access to agricultural information is one of the problems affecting farmers, especially those in rural areas. Emerging e-agricultural education and extension in the current ICT-oriented society has the potentials of facilitating effective and quick dissemination of agricultural

information to farmers for increased agricultural productivity. During the COVID-19 incidence, attempts by agricultural extension agencies to reach farmers through electronic means yielded little success, probably as a result of incompetency of agents and infrastructural issues; more so, it served an eye-opener to the prospects of electronic agricultural education and extension technology in Nigeria. In developed countries of the world, electronic agricultural extension technologies are greatly adopted in reaching farmers; however, there seems to be many backdrops in Nigeria which are yet to be fully uncovered by literatures. Thus, the study seeks to investigate the prospects, challenges and strategies to e-agricultural extension technology in Abia State.

Purpose of the Study

The purpose of the study was to investigate the prospects, challenges and strategies to e-agricultural extension technology in the 21st century in Abia State. The following specific objectives guided the study. To determine;

1. prospects of e-agricultural extension technology;
2. challenges to e-agricultural extension technology; and
3. strategies for promoting e-agricultural extension technology.

Research Questions

1. What are the prospects of e-agricultural extension technology?
2. What are the challenges to e-agricultural extension technology?
3. What are the strategies for promoting e-agricultural extension technology?

Research Methodology

A descriptive survey research design was adopted for the study. The area of study was Abia State which is located in Southeast geopolitical zone of Nigeria between the latitudes 5°25'N and longitudes 7°30'E. It comprises three senatorial zones, which include: Abia South, Abia North and Abia Central, with an estimated landmass of about

6320km^2. There are three main agricultural zones in Abia State, namely, Aba zone in Abia South, Ohafia zone in Abia North and Umuahia zone in Abia Central. Abia State was suitable for this study because of its location in the Southeastern zone of Nigeria, where there are no religious restrictions in pig farming.

The target population of the study was 568 persons who comprised 142 registered crop farmers, 325 registered livestock farmers and 101 agricultural extension agents in Abia State (Agricultural Development Project, ADP, 2019). Sample of study was 364 persons, made up of 105 registered crop farmers, 179 registered livestock farmers and 80 extension agents. This sample size was determined using Taro Yamane formula (1967). 105 registered farmers, 179 registered and 80 agricultural extension workers were selected through a multistage sampling technique for a fair representation of opinions from the various agricultural zones.

A structured questionnaire, titled "Prospects, Challenges and Strategies to E-Agricultural Extension Technology Questionnaire" (PCSETQ) was used as instrument for data collection. This instrument was adapted by the researcher from review of related literatures. The PCSETQ was structured on four-point scale of Agreed, Strongly Agreed, Disagreed and Strongly Disagreed, with a corresponding value of 4, 3, 2, and 1 respectively. The questionnaire items were grouped into sections A and B. The first section (A) comprised the status of respondents (crop farmers, livestock farmers and extension agent). The second section contained 14 items on prospects of e-agricultural extension technology, 13 items on challenges to e-agricultural extension technology and 16 strategies for promoting e-agricultural extension technology. The questionnaire was validated by 3 experts in Agricultural Education and Extension in Abia State. Some items were properly re-adjusted to elicit desired information from respondents after face-validation. A pilot study was conducted using 8

crop farmers, 7 livestock farmers and 5 agricultural extension agents in Akwa Ibom State and the internal consistency of instrument (PCSETQ) was established at an acceptable reliability index of .86, using Cronbach's Alpha Coefficient.

Three hundred and sixty-four copies of the PCSETQ were administered by the researchers, with the aid of 2 research assistants, and an acceptable retrieval rate of 96.15% (350) was recorded. Data for the study were analyzed using descriptive statistics such as mean and standard deviation to answer research questions. Decisions on the questionnaire items were taken based on the 4-point scale average of 2.50; therefore, items that scored mean values less than 2.50 were regarded as "Disagree" and vice versa. Data collected for the study were cleansed, organized and analyzed by researchers using Excel and SPSS -version 22. Ethical permission to carry out the study was granted by the Agricultural Extension Unit of the Agricultural Development Project in Abia State. Respondents participated in this study voluntarily and their confidentiality in data analysis was ensured.

Results and Discussion

Table 1: *Descriptive statistics of respondents on prospects of e-agricultural extension technology in the 21st century in Abia State* (n=350)

S/N	Item Statement	$\bar{X}$	*S*	Remark
1	E-agricultural extension technology has the potential of reaching large population of farmers in a short time.	2.52	.856	A
2	It can provide 24 hours extension services for farmers.	2.54	.428	A

3	Farmers can easily access agricultural information anytime.	2.55	.676	A
4	It can quickly convey agricultural information to farmers with less effort.	2.58	.762	A
5	It is an attractive form of agricultural information delivery system capable of making up for shortage of manpower in extension.	2.62	.722	A
6	Farmers will get quick feedback to solutions of their problems in farming.	2.85	.733	A
7	It saves time and cost in disseminating agricultural information.	2.98	.949	A
8	Extension agents can on a regular basis effectively communicate to farmers through e-agricultural extension system.	3.12	.738	A
9	It has a potential of uniting farmers, extension agents and researchers for exchange of ideas with less effort	3.13	.847	A
10	Extension agents and researchers can with less effort exchange ideas through e-agricultural extension system.	3.16	.542	A

11	Electronic agricultural extension has the potential to transform traditional farming into precision farming.	3.24	.860	A
12	It can encourage effective farmer education	3.26	.865	A
13	E-agricultural extension has a wide coverage than the traditional system.	3.39	.664	A
14	Agricultural information is delivered at the convenience of farmers through electronic means.	3.09	.787	A

$\bar{X}$= *sample mean**, S**= standard deviation, A = Agreed,* ***n*** *= number of respondents.*

Data in Table 1 reveal that all the 13 items on prospects of e-agricultural extension technology had mean ratings, ranging from 2.52 to 3.39, which are above 2.50 on a 4-point scale. This means that respondents agreed to all items on the prospects of e-agricultural extension technology in the 21st century. The standard deviation ranged from .542 to .949 This showed that their responses were close to the mean and to one another in degrees of responses.

Table 2: *Descriptive statistics of respondents on challenges to e-agricultural extension technology in the 21st century in Abia State* (n=350)

S/N	Item Statement	$\bar{X}$	*S*	Remark
1	Extension agents lack ICT skills needed for e-agricultural extension.	2.52	.949	A

2	Farmers do not possess necessary ICT skills necessary for e-agricultural extension.	2.55	.652	A
3	Poor network services, especially in rural areas	2.64	.801	A
4	Lack of interests of the farmers	2.64	.801	A
5	Lack of capital	2.71	.698	A
6	Illiteracy	2.83	.661	A
7	Inadequate power supply	2.59	.661	A
8	Inadequate ICT infrastructures	2.86	.746	A
9	General lack of interest by government	2.86	.636	A
10	Non-integration of e-agricultural extension services in agricultural extension	2.88	.816	A
11	Lack of government policies on e-agricultural extension system	2.90	.815	A
12	There is little or no online agricultural extension database system or websites where farmers can get useful agricultural information.	2.98	.436	A
13	Lack of promotion of e-agricultural extension	3.09	.870	A

$\bar{X}$= *sample mean,* ***S****= standard deviation,* ***A*** *= Agreed,* ***n*** *= number of respondents.*

Data in Table 2 indicate that all the 13 items had mean ratings, ranging from 2.52 to 3.39 and above 2.50 on a 4-point scale. This shows that respondents agreed to all the 13 items on challenges to e-agricultural extension technology in the 21st century. The standard deviation of all items ranged from .542 to .949; this shows that their

responses were close to the mean and to one another in degrees of responses.

Table 3: *Descriptive statistics of respondents on strategies to promoting e-agricultural extension technology in the 21st century in Abia State* (n=350)

S/N	Item Statement	$\bar{X}$	*S*	Remark
1	Creating policy frameworks that can promote e-agriculture in the 21st century	3.16	.542	A
2	Making available adequate ICT infrastructures such as Radio, TV, satellite, smart phones, laptops etc to farmers and extension agents that will support e-agricultural extension in various agricultural zones	2.98	.949	A
3	Developing an online database system that connects farmers, extension agents and researchers for information exchange	2.54	.428	A
4	Creating local ICT offices within agricultural zones to support and carry out e-agricultural extension	3.24	.860	A
5	Designing state/national networks for e-agricultural extension systems	3.13	.847	A
6	Provision of adequate funds for e-agricultural extension systems	2.58	.762	A,
7	Boosting existing networks, especially in rural areas	2.52	.856	A

8	ICT training of stakeholders (farmers, extension workers and researchers) in agricultural extension for effective e-agricultural extension system	2.62	.722	A
9	Using database-driven websites to make information sharing and access easier	3.39	.664	A
10	Using of streaming media to make non-text (video & audio) information more widely available to audience who may not be literate	2.55	.676	A
11	Using call centers telephone and text messaging content	3.26	.865	A
12	Regular supply of electricity, especially in rural areas	3.12	.738	A
13	Using private sector cyber café and private sector telephone systems	2.85	.733	A
14	Creating agricultural extension websites	3.23	.423	A
15	Introducing farmers to agricultural websites	2.78	.876	A
16	Promoting recognition of the internet as tool for supporting information learning	3.12	.765	A

$\bar{X}$= *sample mean,* ***S****= standard deviation, A = Agreed,* ***n*** *= number of respondents.*

Data in Table 3 reveal that all the 16 items had mean scores, ranging from 2.52 to 3.39, which are above 2.50 on a 4-point scale. This means that respondents agreed to all the items on strategies to promoting e-agricultural extension technology in the 21st century. Also, the standard deviation for all items ranged from .542 to .949.

This shows that their responses were close to the mean and to one another in degrees of responses.

Discussion of Findings of the Study

The findings of the study on research question 1 showed that respondents agreed to 14 items on prospect of e-agricultural extension technology in the 21st century, which included its potentials of reaching a large population of farmers in a short time, providing 24-hour extension services for farmers, enabling farmers to access agricultural information at any time, conveying agricultural information to farmers with less effort, it is attractive and can make up for shortage of extension personnel, providing quick feedback to farmers, saving time and cost, ensuring effective communication between extension agents and farmers, uniting farmers, extension agents and researchers, encouraging effective farmer education, etc. Francis (2014), in agreement, partly opined that agricultural extension is valuable in making information get to farmers on time. Also, Arokoyo (2005) stated, in line with the findings of the study, that potential applications of ICTs in e-agricultural extension include: capacity to reach a large audience, networking among stakeholders of agricultural extension and it can be used to make the extension systems and structures more efficient through better management of information and scarce resources.

More so, the study also found that the following are some challenges to e-agricultural extension technology in the 21st century: lack of ICT skills by farmers and extension agents, poor network services, especially in rural areas, lack of interest by farmers, illiteracy, inadequate ICT infrastructure, lack of interest by government, lack of government policies promoting e-agricultural extension, etc. In line with the findings of the study, Ken (2013) pointed out that scarcity of electricity supply, poor ICT infrastructure, low ICT literacy, lack of relevant content, non-integration of services, issues of localization of ICTs, lack of advisory services, resource mobilization, general lack of

interest by stakeholders and lack of understanding of the potentials of e-agriculture are problems facing e-agricultural extension.

The study identified 16 strategies to promoting e-agricultural extension technology in the 21st century which included creating policy frameworks that can promote e-agriculture, making available adequate ICT infrastructures such as radio, TV, satellite, smart phones, laptops, etc., to farmers and extension agents that will support e-agricultural extension in various agricultural zones, ICT training of stakeholders (farmers, extension workers and researchers) in agricultural extension for effective e-agricultural extension system, developing an online database system that connects farmers, extension agents and researchers for information exchange, designing state/national networks for e-agricultural extension systems, boosting existing networks, especially in rural areas, ensuring regular supply of electricity, use of daily or weekly SMS, etc. These findings are in line with the strategies identified by Albert (2014) in disseminating agricultural information to farmers using electronic means. Albert suggested the use of database-driven websites, streaming media to make non-text (video & audio) information, call centers telephone, giving attention to ICT training for staff responsible for agricultural and rural development, using private sector cyber café and private sector telephone systems, creating agricultural websites, introducing farmers to agricultural websites, training farmers on ICT, creating zonal internet centres in communities and increasing recognition of the internet as tool for supporting information learning. In agreement with the findings of the study, Abdulsalam, Olaifa and Frederick (2016) stated that some of the channels through which information can be made available to farmers include: text messaging, e-mail, radio, television, fax, etc. Ghogare & Monga (2015) posited that daily and seasonal SMS alert can be used to covey agricultural information.

Conclusion

In an ICT-oriented society, there is need to fully integrate ICT into agricultural extension services for speedy dissemination of vital information to farmers. Due to developments in ICT, e-agricultural extension technology has thrived, especially in the developed parts of the world. In Nigeria, the emerging electronic agricultural extension technology has the potential of reaching a large number of farmers on time and within a short time for increased dissemination of information and agricultural productivity. Also, it would help to solve the problems of shortage of personnel or manpower in agricultural extension. Arguably, it should partly replace the traditional systems of disseminating agricultural information to farmers which have met a lot of challenges. The potentials of e-agricultural extension technology in Abia and other states in Nigeria cannot be underestimated in this information age; however, it has numerous challenges identified by this study, which must be thoroughly addressed. To overcome some of the challenges that may limit online agricultural extension technology in Abia State, there is need to create and adopt certain policy frameworks that can promote e-agricultural education and extension services. Other workable strategies include: making available adequate ICT infrastructures such as radio, TV, satellite, smart phones, laptops, etc., to farmers and extension agents that will support e-agricultural extension in various agricultural zones, ICT training of stakeholders (farmers, extension workers and researchers) in agricultural extension for effective e-agricultural extension system, developing an online database system that connects farmers, extension agents and researchers for information exchange, designing state/national networks for e-agricultural extension systems, boosting existing networks, especially in rural areas, ensuring regular supply of electricity, using daily or weekly SMS, among others.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Government should create policies that will promote the awareness and practice of e-agricultural extension technology.
2. Farmers and extension agents should be adequately trained on ICT skills to facilitate the implementation of e-agricultural extension technology.
3. Adequate ICT infrastructures should be made available to farmers and extension agents for successful running of e-agricultural extension technology.
4. Government should ensure regular supply of electricity to support the e-agricultural extension technology for effectiveness.
5. Local e-agricultural extension technology centres should be established by the government and private agencies to provide electronic information to farmers in all agricultural zones.

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