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The Potentials of E-Extension for Sustainable Agricultural Development in Nigeria

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Abstract

The Agricultural sector has not been left out of the revolution technology is bringing to the world. The need for precision farming towards sustainable agriculture has made agricultural information and knowledge more crucial. Agricultural extension agencies have continuously adopted various emerging technologies and their advantages cannot be underestimated. E- Extension is a means of delivering and transferring information to farmers through electronic devices and ICTs. E-extension can reach a wide range of audiences rapidly within a short period. This study examines the e-extension systems that have been adopted in Nigeria, the ICT tools and e-resources used for e-extension were examined. The delivery of advisory services through Farmers' help line, audio-visual messages, short messages and others was explored. This review considered the adoption of e-extension by developed nations. The review was done extensively reviewing publications and literature. The paper also discussed the constraints to e-extension, which were poor electric power supply, low literacy, cost of electronic technology, poor funding of public extension services, low ICT literacy, poor internet connectivity among others. Conclusively, e-extension can

transform the lives of farmers via easy access to advisory services if adopted. It is therefore recommended that extension work be encouraged by the relevant sectors.

Introduction

The role of agricultural extension cannot be underestimated in the agricultural sector, as it assists men and women farmers to get knowledge and skills to improve their agricultural production (Abuta *et al.*, 2021). It also shares technical advice and information with men and women farmers that will help to improve their farm management skills. It aids in improving the livelihood of farmers through the transfer of knowledge and helps in the development of rural communities (Alabi, 2021). However, in the face of emerging global challenges, there's a need to for an unusual agricultural extension approach. These challenges include soil degradation, climate change, and rapid population growth. This is important, especially in a time of uncertainties in climatic conditions and the need for updated information on various agricultural issues such as agronomic practices, post-harvest operations, livestock husbandry, forestry and veterinary services (Ogedengbe *et al.*, 2022). Extension and outreach are key pillars for global agricultural development and food systems (Jeffrey & Karim, 2021). It ensures a connection between researchers working on various elements of agriculture with farmers who implement study findings to enhance agricultural output and processing.

Despite the huge advantage of agricultural extension in the agricultural sector in Nigeria, the scarcity of agricultural extension professionals has been a significant obstacle to distributing agricultural knowledge to farmers. As a result of a rapidly growing population and also an increasing population of farmers in Nigeria, the traditional face-to-face agricultural extension system is becoming less effective and no cost effective, hence, the need for e-extension which has the capacity to reach a high population of farmers.

The rise of digital technology such as cellphones, internet access, and sensor-based systems has heralded a new era in agricultural extension services. These technologies have enabled real-time communication, data-driven decision-making, and access to a vast repository of agricultural information (Singh *et al.*, 2023).

E- Extension in Agriculture

E-extension is the use of Internet technology or information communication technology (ICT) as a platform for exchanging information and providing services to actors in the agricultural value chain (Ifejika *et al.*, 2019). E-extension may alternatively be defined as a system of institutions that offers an improved option to agriculture's traditional extension system (Ifeanyi-obi & Corbon, 2023). It is a jointly constructed internet-based environment designed to improve face-to-face and paper-based interactions, as well as an electronic tool for delivering sound and up-to-date agricultural information (Renwick, 2019). E-extension is more effective when it complements traditional techniques. Before the COVID-19 crisis, Olagunju *et al.* (2021) observed that agricultural extension services primarily relied on "on-the-field" methods, including activities like demonstration plots, group training, and farm visits. These approaches involved direct face-to-face interactions, as highlighted by Maertens *et al.* (2020). Olagunju *et al.* (2021) and Farinde *et al.* (2022) reported that distance-related COVID-19 measures hindered the traditional extension method, compelling the extension workers to adopt digital tools for the delivery of services to farmers. 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 (Ogochukwu *et al.*, 2021). Kamruzzaman *et al.* (2021) explained that, e-agricultural extension technology is the only measure to reach a maximum number of farmers who are using Android or basic phones. E-extension provides opportunities for distance learning and training through the use of the internet, thereby overcoming the challenges of location and creating a work-life balance for extension workers. The face-to-face extension system is strengthened by the e-extension system. When extension workers complement the traditional extension system with an e-extension system, it enhances the success rate of the expected outcome. However, most farmers are from rural areas and their literacy level is usually low, therefore, e-extension services must be well-planned to ensure effectiveness.

E-Extension Programmes in Nigeria

E-extension is an emerging trend in Nigeria. For some years back there has been growth in the adoption of the e-extension system in Nigeria, though it has not gotten to the peak, however, there has been an obvious growth in the adoption of e-extension in Nigeria.

The Nigerian government has played a pivotal role in promoting e-extension through initiatives such as the National e-Agriculture Extension Strategy (NAES). Launched in collaboration with the Food and Agriculture Organization (FAO), NAES aims to harness digital technologies to deliver extension services to farmers across the country (Federal Ministry of Agriculture and Rural Development, 2020). Furthermore, the National Agricultural Extension and Research Liaison Services (NAERLS) has developed an e-extension platform, which provides farmers with access to agricultural information via mobile phones and the Internet (NAERLS, 2021). One of such platform was the National Farmer Help Line (NFHL).

The NFHL is an e-extension approach established in 2014 by the National Agricultural Extension Research and Liaison Services (NAERLS) Nigeria (NAERLS, Extension Bulletin, 2020). It was established to increase productivity for sustainable agricultural development in the country across the six geo-political zones. This was done so as to cover a wider area and reach target beneficiaries in every aspect of agriculture (NAERLS, Extension Bulletin, 2020). The NFHL enables farmers to get reliable and successful agricultural extension services by electronically disseminating appropriate agronomic practices. This is done using the latest ICT as a medium for the dissemination of information. It also aids the delivery of improved technologies, market linkages and other agricultural information as seen in Figure 1 (Bashir, *et al.*, 2020).

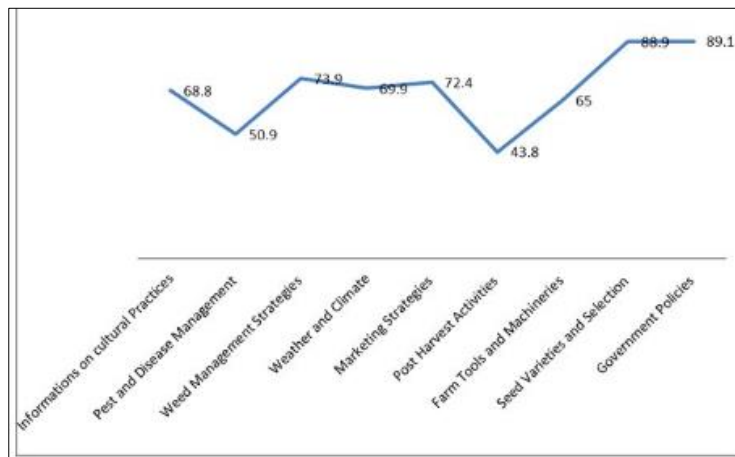


Figure 1: Types of information accessed by farmers from the national farmers helpline (Source: NAERLS Extension bulletin, 2020)

Another e-extension programme led by the Nigerian government was the Growth Enhancement Support Scheme (GESS) and the E-WALLET System. In July 2012, the Federal Government of Nigeria created the Growth Enhancement Support Scheme (GESS) (Agbareyo and Ukagha, 2018). The GESS is intended to notify farmers directly about government-subsidized agriculture supplies using GSM phones. The GESS is driven by an E-wallet, that offers a reliable and transparent mechanism for distributing and purchasing agricultural inputs via a voucher system. The plan provides enrolled farmers with E-wallet ability to purchase fertilizer, seeds, and other agricultural supplies at half the price from agro merchants. The federal and state governments are responsible for the remaining half. With worldwide access, e-wallets are excellent tools to facilitate online payments (Olagunju, 2021). Within 120 days of the e-wallet system's introduction, over 1.2 million farmers used it to purchase subsidized fertilizer. A total of 138,802.7 metric tons of fertilizer and 10,974.78 metric tons of seeds were distributed in 517 active redemption centers out of all the 804 centers spread across the Federation (Olagunju, 2021).

In addition to government-led initiatives, the private sector has also been actively involved in driving the adoption of e-extension in Nigeria. Companies such as Cellulant Nigeria and Farmcrowdy have developed mobile applications and online platforms to connect farmers with extension services, market information, and financial resources (Aliyu, 2020). These initiatives have contributed to improving the livelihoods of smallholder farmers and enhancing agricultural productivity in the country. Non-governmental organizations (NGOs) have also been instrumental in implementing e-extension programs in Nigeria. Organizations like the Sasakawa Africa Association (SAA) and the International Institute of Tropical Agriculture (IITA) have partnered with local communities to establish digital platforms for disseminating agricultural knowledge and providing technical support to farmers (Nwankwo & Ojo, 2021). These initiatives have helped to address the information gap and empower farmers with the necessary skills to improve their agricultural practices.

Radio and Television Programmes on Agriculture

Radio use is highly common among rural dwellers, because of the availability of brands of radio that are portable, movable and rechargeable. The role of radio

broadcasts as a powerful tool for information dissemination and education for rural dwellers in Nigeria is enormous (Nwankwo & Ojo, 2021). Radio and television have the capacity to modify the behaviours of farmers, as it has the capacity to influence the listeners when generated in a community-based and participatory fashion. Basically, out of so many channels, the conventional media, radio and television have become powerful. They are accessible and relevant tools for agricultural innovation and transformation to Nigeria's policymakers (Aliyu, 2020).

According to Danjuma *et al.* (2021), farmers can assess radio as a medium for education and the benefits of agricultural knowledge acquired are always evident in results obtained on farmlands. Examples of such radio programmes include the "Tom Sule" (in Tiv) agricultural radio programmes in Radio Benue and "farming world". The programme "Farming world" is aired twice weekly (Tuesday and Friday) for 15 minutes while Tom Sule (in Tiv) is aired for 30 minutes on Monday and Tuesday to create awareness on improved agricultural practices, to enlighten farmers on application of herbicides, and pesticides. According to the research, the majority (77.9%) of farmers believe that radio agricultural programmes are extremely significant in their agricultural operations, while just 22.1% believe that agricultural programs are unimportant.

E-Resources used by Extension Workers in Nigeria

According to Nwabwugwu, *et al.*, (2019), e-resources used by extension agents in Anambra (an Eastern state in Nigeria), are e-radio, e-magazine, e-journal, e-library, e-mail, online-databases, facebook, you-tube, twitter, e-agriculture, e-commerce, e-marketing, e-video conferencing, myspace, 2go and Whatsapp. Farmers and extension workers utilize these e-resources to communicate information about pest and disease outbreaks, climate, farm input, prices at the market, and processing processes.

Mobile/Smart Phones: Mobile phones are now one of the world's fastest growing information and communication technologies. Smartphones enable extension personnel and farmers to use social media. Both government and privately sponsored extension services are increasingly given via mobile phones, which are becoming more multipurpose wireless devices capable of giving timely and tailored information at scale, resulting in yield gains of up to 4% in some locations (Fabregas *et al.* 2019).

Mobile phone applications allow extension workers to reach an enormous amount of small-scale farmers concurrently in their native language. Agricultural information may be quickly delivered from extension to farmers via phones and Short Message Service (SMS). A number of mobile phone apps have been developed for agriculture in Nigeria. Notable mobile phone apps used in agriculture are Agrikore, Farm Crowdy, Verdant, AgroData, Hello Tractor, and Probit farms apps (Sennuga and Fadji, 2020).

Social Media: Apart from social media having the potential for usage as a tool for communication and networking in the farming community, it is an important marketing resource for farmers to use to connect to their customers and create a community which brings their farm to the public eye and ultimately leads to a more successful business (Olorunniyi, *et. al*, 2022). In a study by Nwali *et al.* (2022), it was observed that social media connectivity between farmers and agricultural extension agents improves farmers' information literacy, knowledge, and awareness of current farming trends, resulting in increased farming and food supply. The Agrikore app connects

farmers, agro-dealers, commodities traders, and insurers together on a single platform. FarmCrowdy facilitates the introduction of possible farm investors and farmers. The Verdant app provides market information and general agricultural advice, while the AgroData app connects farmers to agricultural information from research organizations. The Hello Tractor app allows farmers to rent tractors and other farming equipment. Probitfarms is utilized for farm management as well as connecting farmers to the market, while Compare-the-market compares daily market prices to purchase food crops and livestock in Nigeria. Equally, agricultural actors have utilized social media platforms such as WhatsApp, Facebook, Telegram, and Instagram to organize group chats for information exchange and agro-produce marketing. These mobile phone applications provide extension organizations with the possibility to use these platforms when carrying out extension initiatives (Nwali et al., 2022).

Short Message Service (SMS): Galeon et al., (2019) proposed that a daily e-extension Short Message Services (SMS) alert may be utilized to communicate agricultural information. SMS is used to give market information to small holders, giving them a link to daily prices for agricultural goods, extension agents, and methods for selling or bidding on text messages. Market information is given daily to database users via e-mail message (Galeon et al., 2019).

E-Extension in Developed Nations

E-extension services in agriculture have been adopted in various developed countries, some developed countries have developed unique approaches and strategies designed to suit their agricultural landscape and technological infrastructure.

The United States stands as a pioneer in the adoption of e-extension, with widespread usage of digital platforms such as the United States Department of Agriculture's (USDA) AgriLife Extension Service and the National Agricultural Library's Ag Data Commons. These platforms provide comprehensive information on topics ranging from crop management to livestock care, serving as valuable resources for farmers across the country (Kamruzzaman et al., 2021).

European countries like the Netherlands and Denmark, e-extension services have been integrated into national agricultural policies to enhance knowledge dissemination and support sustainable farming practices. For instance, the Dutch Ministry of Agriculture, Nature, and Food Quality operates the Knowledge Portal for Sustainable Agriculture, offering farmers access to online courses, expert advice, and practical tools for improving farm management (Ministry of Agriculture, Nature, and Food Quality, 2023). Also, Denmark's AgriFish Agency provides digital advisory services through its LandbrugsInfo platform, covering topics such as organic farming, crop rotation, and climate mitigation strategies (Nwali et al., 2022).

Challenges of E-Extension in Nigeria

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. The challenges are:

The challenges of e-extension in Nigeria are;

1. Poor electricity supply: ICTs requires electricity to function, gadgets that do not use electricity on the go, usually need charging of batteries when depleted. Poor electricity limits rural farmers from benefitting from e-extension. Likewise, extension agents located in areas with epileptic power supply would be hindered
2. Complexity in the use of e-resources: most times, the use of e-resources involves a complex process which tends to be ambiguous for the comprehension of a rural farmer. It's therefore imperative for e-resources developers to ensure there processes are simplified for a lay man to understand.
3. Low ICT literacy: Most agricultural activities in Nigeria take place in rural locations where most farmers lack the IT skills necessary to operate electronic agricultural extension services (Etuk et al, 2023). Extension workers knowledge on e-extension and the use of ICT should be updated from time to time.
4. High Cost of Maintenance: maintaining e-extension devices are expensive (Bashir *et al.*, 2020). The time, facility updates and funding of e-extension is costly for farmers and extension workers, hence, the government should step in to support financially.
5. Poor internet connectivity: Internet connections vary with location in Nigeria. While some parts have good internet connection, some have poor internet connectivity
6. Lack of ICT infrastructures and devices; this applies to both extension workers and farmers. The high cost of acquiring ICT infrastructures and devices is the main reason for its lack. The unavailability of devices such as mast, computer, smart phones, e.t.c to access agricultural information makes agricultural e-extension impossible.
7. Lack of Knowledge of the potential of e-extension; some educated farmers who possess ICT abilities, and also living in locations with good networks are unaware of the necessity of e-agricultural education and extension in the twenty-first century (Onah *et al.*, 2021). Lack of knowledge regarding how electronic technology might be used to manage agricultural dangers and emergencies in Nigeria has resulted in a less focused usage of electronic technology in agriculture (Khan, *et al.*, 2020).

Conclusion and Recommendations

The potential of e-extension to revolutionize the agriculture sector in Nigeria is enormous. It has the capacity to transform the lives of farmers through easy and fast access to information and advisory services, it also enables extension agents to be more effective by delivering extension services swiftly, while reaching a large audience in a cost effective way. However, the e-extension is yet to operate in its fullest capacity in Nigeria as a result of certain constraints that must be overcome.

Governments and private sector/donor agencies can encourage farm households to use ICTs by providing financial and material support.

Governments should increase awareness and training for farmers and extension workers to utilize ICT more effectively and efficiently.

The government should provide subsidies for farmers to access and afford smartphones and broadband.

Government should make policies that will promote e-extension.

Network providers should be mandated to provide excellent internet services in rural areas

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