Enhancing Agricultural Extension Services in Nigeria Leveraging Digital Technology

Ochuko Piserchia and David Edimu

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A Case Study of the USAID Feed the Future Funded Agricultural Extension and Advisory Services Activity

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1.0 Abstract

Nigeria is the most populous country in Africa, with an estimated population of over 200 million people and arable land for agricultural. Agriculture contributes to the nation's economy, contributing about 25% to its GDP. The agricultural sector is a source of livelihood for many youths, including women, and provides jobs for about 70% of its workforce. Despite the potential to grow the nation's economy through agriculture and the diversification of its economy from oil, the agriculture sector has suffered setbacks. Most farmers in Nigeria are smallholder farmers (SHFs) with limited resources such as access to finance, improved seeds, poor extension services, and digital technology to scale their farming businesses. To respond to some of the challenges faced by the average smallholder farmer, the United States Agency for International Development (USAID) Feed the Future-funded program launched the Agricultural Extension and Advisory Services Activity in Nigeria and identified digital technology as a platform to leverage and unlock the bottlenecks experienced by smallholder farmers in extension services in Nigeria.

Extension services in agriculture are a vital part of the value chain because they help farmers improve their farming practices by incorporating innovations and best farming practices. While digital extension services offer significant benefits, they also come with potential challenges, such as the need for reliable internet connectivity and the digital literacy of farmers. Digital extension is revolutionizing the agricultural landscape, transforming age-old farming practices with cutting-edge innovations that deliver knowledge right to the farmer's doorstep while bridging the once vast divide between extension agents and the communities they serve. These services connect farmers with agricultural innovations at scale by enhancing knowledge, techniques, and skills to farmers. The use of digital technology such as video-enabled extension and digital apps in agricultural extension helps to enhance the overall experience of the average smallholder farmer by promoting precision agriculture, facilitating outreach, and providing extension and advisory services to the vast number of farmers, enhancing productivity and income more cost-effectively.

1.1 The Use of Innovative Digital Solutions in Agricultural Extension

Agricultural extension services are a significant conduit in addressing rural poverty and food insecurity. It serves as a tool for technology transfers, supports rural adult education, disseminates best agricultural practices, and assists farmers in problem-solving. Extension Services, as defined by Food and Agricultural Organization (FAO), are systems that facilitate access to knowledge, information, and technologies from farmers, their organizations, and other market actors. They also facilitate their interaction with partners in research, education, agribusiness, and other relevant institutions, creating a collaborative community. Extension services are fundamental in making agricultural activities more effective and efficient to meet the growing needs and demands of the underserved farmers. Hence, they are regarded as a policy tool for promoting the safety and quality of agricultural products. Agricultural extension is aimed at improving farmers' knowledge of rural development; hence, it has been recognized as a critical component for technology transfer. Thus, agricultural extension is a major component to facilitate development since it plays a starring role in agricultural and rural development effort.

Digital innovation is transforming the agricultural sector. The successful adoption of digital extension has revealed a new era in agriculture due to its ability to harness technology's power to project farming into a future where knowledge and growth are intertwined. In Nigeria, Ghana and other developing countries in Africa, innovative solutions such as the use of digital apps and video-enabled extensions are being used to replace age-old farming practices with cutting-edge innovations. These equip farmers with the right skills and knowledge to transform and scale their farming practices, bridging the vast divide between extension agents and the communities they serve. These digital solutions such as the use of video-enabled extensions, the use of digital app, and communication to farming cohorts using radio, have been used to successfully enhance the dissemination of most impactful farming practices and technologies such as the use of improved seedlings, stocking ponds with juveniles instead of fingerlings, healthy nutrition messaging, mechanized farming such as the use of threshers, tractors and irrigation for farming rather than depending on age practices like using a handheld hoe. The success of these digital solutions reassures us of their potential to revolutionize agriculture.

1.2 The USAID Nigeria Agricultural Extension and Advisory Services Activity as a Driver in Extension Delivery

The Extension Activity has a mandate to reach and enhance the productivity, income, and nutritional status of at least two million smallholder farmers (SHFs) in Nigeria. One million of these farmers are expected to be reached through ICT. As a strategy to meet this target, the Extension Activity conducted a mapping to market (M2M) and ICT landscape assessment by undertaking a

scoping analysis to map and characterize ICT service providers in agriculture and identify digital platforms that offer timely, quality, last mile services to many value chain actors, including farmers. Building on the landscape assessment, the Extension Activity has worked with micro, small, and medium enterprises (MSMEs) to identify ready-to-use and scale, low-cost ICT-enabled extension and knowledge-sharing platforms that currently provide accurate and timely extension information to agricultural value chain actors across its focal states, especially in remote areas. From the landscape assessment and ICT mapping exercise, the Extension Activity identified radio, mobile phone with short message service (SMS), Interactive Voice Response (IVR), WhatsApp/social media, and video recording as ICT channels for disseminating extension messaging to SHFs. To achieve its mandate, the Extension Activity engaged four ICT micro, small, and medium enterprises (MSMEs) to reach smallholder farmers using the identified channels. The Extension Activity, in collaboration with the National Agricultural Extension Research and Liason Services (NAERLS) and the AfricaRice Center, is committed to inclusivity. By adopting the Farmer Helpline and piloting the RiceApp, the Extension Activity reached to the Smallholder Farmers in Kaduna, Niger, Benue, and Kebbi states in Nigeria, ensuring that they integrated in the journey towards adoption of impactful farming practices for enhanced productivity, income and better livelihoods.

2.0 How Digital Technology is Transforming Agricultural Extension Services

Digital technology is helping bridge Nigeria's farmer-to-extension ratio gap. Based on statistics from the FAO, Nigeria's extension agent-to-farmer ratio stands at 1:10,000. To contribute to bridging this gap, the Extension Activity, conducted a Mapping to Markets and ICT landscape assessment. This assessment identified various digital platforms with the potential to promote inclusiveness and increase extension outreach to smallholder farmers across seven states (Delta, Kebbi, Niger, Cross River, Benue, and Kaduna) in Nigeria. These digital platforms provide a cost-effective mechanism for service providers to offer timely, quality, last-mile services to value chain actors, including farmers. Service providers and micro, small, and medium enterprises (MSMEs) are key drivers in scaling affordable ICT-enabled extension services to farmers especially in remote areas while also improving the efficiency of last-mile service delivery networks.

Three major ICT solutions are currently used to enhance extension services in Nigeria- i.e. use of video enabled extension, the use of digital app and radio to reach smallholders farmers in remote communities. Other solutions include the use of mobile phone with SMS, IVR, and WhatsApp/social media features. Through this effort, smallholder farmers received extension messaging from ICT service providers. For instance, In Delta state and Cross River State, major hatchery operators are now using the WhatsApp platform and the videos produced by the Extension Activity on the use of stocking of ponds with juvenile to advertise their fish hatchery products and services. To facilitate collaboration and peer learning and knowledge sharing among MSME cohorts' members, WhatsApp groups were created by the members critical to enhance their business operations.

2.1 Scaling digital extension solutions for Business Expansion and Service Delivery

Rural farmers in Nigeria are currently being exposed to various ICT platforms and tools such as WhatsApp group chats, Bulk SMS, USSD, and RiceAdvice App, and videos to enhance extension messaging with value-added services. These platforms foster a sense of community and collaboration, enabling effective extension delivery. Commercial linkages and platforms identified to promote extension messaging to SHFs include WhatsApp group chat, Facebook Marketplace, bulk SMS, and video extension. Using WhatsApp, Facebook, and bulk SMS, MSME service providers used the platforms to actively promote their businesses and commercialize the use of the most impactful practices to SHFs within their network. Farmers who adopted these digital platforms are using them to promote their farming businesses, connect to market opportunities (business linkage), and communicate within their communities. In Nigeria, fish farmers and hatchery operators in Cross River and Delta are promoting their fish business using the WhatsApp and videos made on stocking ponds with juvenile fish. This approach has significantly altered the dynamics of extension delivery, demonstrating the potential of ICT tools in serving farmers in Nigeria.

2.1.1 The Use of Video-Enabled Extension: Video-enabled extension has proven a potent tool for disseminating knowledge on best farming practices to farmers. The adoption of these practices significantly increases SHFs' productivity and income. In Nigeria, video-enabled extension is being used to disseminate knowledge on the most impactful farming practices to an estimated 2 million farmers. Farmers and extension agents are receiving trainings on the digital video-enabled extension approach. This approach cultivates a fertile ground for education, enhanced learning and practical application by uploading best practices into videos which is shared across farming communities. Videos of the most impactful practices (MIPs), such as the benefits of using improved seeds, messages on healthy nutrition, and benefits of adopting mechanized farming practices and alternative feeding methods, were produced, and disseminated to SHFs across seven states through the engagement of extension agents in Agricultural Development Programs (ADPs). The evidence of the impact of video messaging as a marketing tool is also evident outside of Cross River and Ebonyi states, with MSMEs beginning to produce videos to stimulate demand for their services. To facilitate the adoption of mechanized threshing as an alternative to manual threshing, the Extension Activity developed a participatory video highlighting the benefits of mechanized threshing. MSMEs service providers who have adopted the mechanized threshing services are providing services to the farmers within their clusters. This, in turn, stimulates demand for threshing services.

2.1.2 The Use of Digital Apps – The Innovative Rice App (RiceAdvice), Field Area Measure, Plantix, and the AI Farmer Chat: RiceAdvice, Field Area Measure, Plantix, and Farmer Chat, represents a significant innovation in the growing pool of agricultural advisory services. These apps provide farmers with critical information and tools to optimize their farming practices. For instance, the RiceAdvice app from the AfricaRice Center is currently used in Nigeria to disseminate best practices in rice farming several rice producing states. The tool is interactive, and the guidelines provided by the tool are generated based on farmers' responses to multiple-choice questions related to farm conditions, crop management practices and the market. Expected users include fellow

government and research institutions, farmers, extension workers, private rice companies, and development agencies in Africa interested in advice on rice production. The deployment of the RiceAdvice app by the Extension Activity in 2022 exposed over 35,000 SHFs to the use of improved seed and optimum fertilizer application for enhanced productivity. Field Area Measure assists in accurately determining the size of agricultural fields, enabling the farmer to estimate yield. Plantix serves as a digital plant clinic, diagnosing crop diseases and providing treatment advice. Farmer Chat, developed on OpenAI's technology, is a custom AI chatbot that integrates a vast library of agricultural information to ensure accuracy and reliability. With the help of these app suites, extension agents can now more effectively and efficiently interact with a greater number of farmers, encouraging the adoption of gender- and climate-smart farming practices that will boost farming communities' productivity, incomes, and resilience to climate change. To scale this solution to farmers, the Extension Activity engaged and trained 92 partner MSMEs alongside 320 extension agents.

3.0 Key Results from Implementation

System Change Effected by Digital Innovations:

- Digital extension solution has proved to be uniquely beneficial for women SHFs because it provides them quick access to information that may not have been previously available to them due to social restrictions especially in the northern part of Nigeria.
- The adoption of the digital extension solutions has enabled farmers to plan and budget for their farming activities and this attitudinal change is spreading rapidly in the farming communities especially in Niger, Kaduna and Kebbi States.
- Through the services of the MSMEs, farmers are beginning to know their exact farm size, determine the amount and cost of inputs needed to cultivate the farmland The farmer now farm to realize the yields projected by the RiceAdvice App. This practice has helped the SHFs to save cost, especially in fertilizer optimization, planting materials and labour cost. It has also ignited a business mind-set in their agricultural practices.
- Through the adoption of digital solutions, MSMEs have changed the mindset of the SHFs in their communities from petty trading into entrepreneurial farmers. The MSMEs and extension agents have realized the business value of digital extension services and are now commercializing these digital solutions to farmers at a cost.

3.2   Conclusions

ICTs and Agtech provide new opportunities for agricultural development in Nigeria. The gradual penetration of ICTs into agricultural extension practices has provided extension workers and

farmers a platform to communicate across borders. It enhances the dissemination of information on best practices, prices, input availability, and new technologies. Farmers can improve their production, incomes, and living standards with greater access to such information. In Nigeria, the Federal Government is focused on revitalizing agricultural extension services by empowering and equipping extension workers within its ADPs with IT skills to support farmers in digital farm mapping, soil type identification, meteorology, and agricultural records. The establishment of farmer helplines by NAERLS to support planning, production, storage and distribution of crops, livestock, and fisheries products is also changing extension practices in the country regarding service delivery.

ICT4Ag also provides timely and on-demand information and data. Many ICT4Ag solutions build on prevalent technologies (such as SMS accessed via regular mobile phones). Though low digital literacy remains a problem, using prevailing technologies could enhance the use of these solutions. The use of ICTs in agriculture can also drive transaction costs down, making them affordable to farmers and good business solutions. This assessment conducted by the Extension Activity presents a review of ICT for agriculture landscape in Nigeria and incorporates information gathered from stakeholder meetings with a varieties of private extension service providers in Nigeria. To improve the adoption of digital solutions for agriculture based on the analysis of ICT and agtech ecosystem in Nigeria, some of the most pressing needs are for sustainability and scalability of digital solutions, so that many producers and value chain actors can be reached by a well-coordinated pluralistic set of providers in a manner that is financially profitable. In this regard, engaging the private sector is not just important, it's imperative. The incorporation of ICTs into an effective extension system that also has appropriate governance structures, policies, and capacities is a key step in this direction (Huber, 2017).

The growth of the Agtech sector, coupled with the growth of the private sector and government interest, makes this an appropriate time to incorporate ICTs into extension. An electronic extension, or e-extension, system that builds on the use cases and solutions described earlier could ensure that smallholder farmers are reached, and that farm incomes and yields increase. Issues of poverty and food insecurity are addressed.

Studies conducted in Nigeria show that most extension personnel have access to computers, radio, telephones, television and video recording equipment, which they could use to provide all their activities with the necessary training, infrastructure and funding. And, whilst the use of ICTs has not been totally adopted by extension officers in all their activities, there is hope that the technologies will be absorbed into extension duties on a large scale in the next few years.

3. 1 Challenges & Recommendations

Despite the potential to grow the agriculture sector using digital technology, challenges still abound. For instance, farmers in rural, hard-to-reach communities experience poor Internet penetration and low digital literacy level. As such, some of them are still unable to access extension services. The cost of acquiring smartphones is also a constraint for rural farmers. Other challenges include erratic

power supplies; high costs of ICT infrastructure; low incomes of rural farmers; lack of policies to enhance ICT development in rural areas; and a lack of necessary skills to use the technologies. Despite such problems, opportunities abound in terms of adoption of novel agricultural practices promoted through ICTs, and more farmers in the ACP region have developed their ICT literacy via extension training, increasing the use of such technologies. Further, ICTs are transforming agricultural extension through enabling greater access to text, graphics, audio and video files in an integrated manner.

To this end, it is critical for government to implement policy that enables the business environment and attracts investments that are most likely to bring about improvements in the performance of the extension system over the longer term. Below are some key recommendations:

1. Government should support the private sector such as (ICT4Ag and agtech companies) to build digital solutions that support agriculture. For example, Huber (2017) suggests integrating the NAERLS' Farmer Helpline with electronic wallet system to facilitate a public-private partnership platform combining input provision and comprehensive advisory services and adapting the Anchor Borrowers Programe to include group loans for farmers.
2. Given low digital literacy levels, future digital extension and advisory services should use prevalent, existing technologies like radio, SMS and IVR to reach farmers widely. The information disseminated should be timely and relevant. It should be crop and geography specific and include commodity prices, weather, agronomic tips, and inputs availability, ideally building off or leveraging the existing e-wallet system (Huber, 2017).

3. Private sector companies, especially MSMEs, should pilot low-cost ICT-enabled extension directly. This could include integrating extension advice with other market services, like inputs, outputs, finance, transport and storage. The Feed the Future Nigeria Agriculture Extension and Advisory Service Activity could help draw down some of the initial risk via the Partnership and Investment Fund. The Extension Activity will work with the private sector, including agtech, to crowdsource digital solutions to support agricultural extension.

4. Radio and participatory video approaches could be used beyond extension to also reach farmers about existing digital solutions. Video can also be used to allow farmers to share information with peers.

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