Implications of Digital Divide in Digitalization of Farming Activities in the NAERLS Adopted Villages

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Abstract

Agricultural practice in Nigeria is predominantly in the rural area where the traditional cultivation system is the dominant practice with fewer new media tools (NMTs) drives. This creates strategic setbacks to integrating agricultural stakeholders, particularly the adopted village farmers of the NAERLS into the new media hub for the Participatory Agricultural Extension System (PAES). A mixed method was premised on for counterfactuals to facilitate novelties. As a result, the full participation of some agricultural stakeholders is not guaranteed due to the digital divide. Three-quarters (about 159 million) of the Nigerian population is under the age of 35 years implying that Nigeria has a youthful population, making the future of the country's agriculture dependent on her youths who are new media savvy without access to secure land. This implies that the agriculturalist has limited access to requisite information on Climate-Smart Agriculture (CSA) in the tech-driven global space. Hence, the need to use NMTs to mitigate the digital divide in advancing the NAERLS adopted village farmers, agricultural activities, and systems in Nigeria. Thus, the study reflected on the NMTs' technological revolutionary in the agricultural sector, the concept of the adopted village, CSA, and agricultural extension systems in Nigeria. More so, looked at the digital divide in agricultural extension, the role of NMTs4AE in creating a participatory agricultural extension system, and the creation of synergy among agricultural stakeholders based on knowledge, and practices for increasing productivity via climate-smart agriculture as purported to improve the economic status and livelihood of selected adopted villages in Nigeria.

Keywords: *Mitigation, Digital Divide, Climate-Smart Agriculture, Adopted Villages*

Introduction

Agricultural practice in Nigeria is predominantly in the rural area with an arable land potential of about 34 million (m) hectares (ha); 6.5mha for permanent crops, 30.3mha for pastures, and more than 80% of Nigeria's farmers are still smallholder farmers, where the traditional cultivation system is the dominant practice with fewer new media tools (NMTs) drives, these numbers account for 90% of Nigeria's agricultural produce (National Agricultural Extension and Research Liaison Services/ Federal Department of Agricultural Extension NAERLS/ FDAE, 2014). The agriculture sector contributes 22.35 percent of Nigeria's Gross Domestic Production (GDP) and employed about 75% of the Nigerian population of over 200 million people in 2020 (National Bureau of Statistics NBS, 2021). However, three-quarters (about 159 million) of the population is under the age of 35 years (NBS, 2021), implying that Nigeria has a youthful population, making the future of the country's agriculture dependent on her youths who are new media savvy without access to secure land. The NAERLS/ FDAE (2014); Onagwa (2016) reported that agricultural practices in Nigeria are predominantly peasantry; with less information and technological drives, as the traditional system of cultivation is the dominant practice. As a result, the

full participation of some agricultural stakeholders is not guaranteed due to the digital divide. This creates strategic setbacks to integrating agricultural stakeholders, particularly the NAERLS-adopted village farmers into the new media hub of the Participatory Agricultural Extension System (PAES).

In Nigeria as in many countries in the world, there is a strong desire for the digitization and conscious use of the New Media Tools (NMTs) for the agricultural sector (NMTs4A) particularly for agricultural extension services (NMTs4AE), to facilitate agricultural information dissemination to agricultural stakeholders, feedback from the farmer, and create awareness on the need for its utilization for adequate food production, the development of the rural areas and increase productivity in Nigeria. The NAERLS has advocated for and deployed the NMTs for more than 10 years, to help its farmers access agricultural information, access quality inputs, create business links, and model farming practices in its adopted villages. In addition, the farmers were provided with the NMTs (Apps) and ICT facilities such as Mobile phones, Tablets, and training received based on how to use these applications and their significance on different occasions in all the NAERLS adopted villages across the six Egro-ecological Zones in Nigeria (NAERLS, 2020). Categorically, one of the innovations needed to utilize the potential of the NMTs/ Apps is via the National Farmers HelpLine (NFHL); Farm Radio Network by the Nigerian government in collaboration with the Food and Agricultural Organization of the UN (Idu and Obinne, 2009; NAERLS, 2006).

Essentially, the NMTs are meant to provide innovative and technological support on agricultural information to farmers for farming practices to be done at ease and invariably improve their farming efficiency and boost food production. Furthermore, increase the farmers' links to agribusiness, quality inputs, and wealth creation opportunities irrespective of the geographical locations of farms or the social class of the farmers belong to. Meanwhile, in developed countries such as Isreal, Britain, Germany, China, Japan, and America, contemporary agriculture practices are information/ new media technology-driven. However, it has been proven that most farmers in Nigeria jettisoned agricultural innovations and technologies introduced to them, and the agricultural extension performed below expectations largely due to the inability to effectively disseminate adoptable/adaptable agricultural innovations to farmers (Atala, 2009). Studies by Meitei and Devi (2009); Halakatti, Gowda, and Natikar (2010); Chukwu, (2015) identified breaches such as ineffective linkage system, lack of access to quality inputs, inaccessible interface for participatory extension, and contact among the agricultural stakeholders have retard the essential functions of agriculture in the adopted villages. Moreover, there is no empirical evidence to show farmers' assessment of the NMT's utilization in farming activities in the NAERLS-adopted villages.

The Adopted Villages Concept

According to Atala and Hassan (2012), the adopted village concept is an extension model whereby villages with potential impact (that is, villages, where new ideas have been introduced in the past and households within the villages, are found to be receptive and willing to adopt the new technology) are selected to be developed in an integrated manner. This includes economic development, infrastructure development, and other aspects of human development such as education, health, and drinking water supply. In other words, it is a multidisciplinary approach involving any willing Government/Non-Govern- mental Agencies such as Research Institutes, Universities, Farmers' Clubs, Individual Rural Volunteers, Cooperatives, and Bank Branches. The NAERLS began its adopted village project in 2005 with the general aim and objective as defined by the Agricultural Research Council of Nigeria (ARCN) of improving the economic status and livelihood of selected villages in the six agro-ecological zones in Nigeria namely, North-East, North-West, North-Central, South-East, South-West, and South-South zones, where the NMTs were deployed to and used by the farmers for improving agricultural practices (NAERLS, 2011).

The Adopted Village Model Aims and Objectives

In Nigeria, the concept of the adopted village was initiated to facilitate the trial of new research findings by scientists under the farmers' environmental conditions. The scheme has the added advantage of involving the farmers in either the trial as observers, in the case of researchers managed, or executors in the case of farmers-managed/ controlled trials. The involvement of farmers will in turn speed up the rate of adoption of such technologies by neighbouring farmers, as the trial also serves as a demonstration plot (ARCN, 2011; Akinola, Ene, and Baiyegunhi, 2013). The adopted village, well thought out, was a strategic attempt by the government to encourage large-scale adoption of improved technologies, empower resource-poor farmers economically, create job and wealth opportunities, and ensure food security in Nigeria. Specifically, Atala and Hassan (2012) opined that the adopted villages' project is to:

- create awareness in the villages and build people's organizations/groups for various developmental activities through workshops and meetings;
- facilitate convergence/integration of various programs of State, Local Governments, and other agencies in the villages;
- ensure socio-economic and livelihood advancement with enhanced credit support and financial inclusion of all families in the villages;
- identify capacity building needs of the villagers;
- assist in infrastructure development in the villages through the participation of people/ local institutions;
- protect forests and preserve the village eco-system and conserve soil health and other natural resources; and
- monitor the progress of the implementation of the project.

Materials and Methods

Review of the digitization and digitalization of farming activities in the selected NAERLS-adopted. The data used consists of secondary data which were collected from the research observation through an elicitation diary data collection method. The review reflected on the new media technological revolutionary in the agricultural sector, the concept of the adopted village, aims and objectives, the concept of CSA, and agricultural extension systems in Nigeria. More so, looked at the digital divide in agricultural extension, the implications of the digital divide in the digitalization of farming activities in the NAERLS-adopted villages as well as, discussed the role of NMTs4AE in creating a participatory agricultural extension system and mitigate the digital divide for climate-smart agriculture in the NAERLS-adopted villages.

Digitization and Digitalization

The digitization of agriculture in Nigeria is believed to have revolutionized the processes of one-to-one, one-to-many, many-to-one, and many-to-many communication among agriculture stakeholders (Afolabi, 2019). According to Gateway (2010), this has enabled the synchronicity of messages thus, enhancing the range efficiency and effectiveness of information delivery via electronic signals. The mean aim is to support and accelerate projects based on new technologies such as the New Media Tools (NMTs) used for agriculture (NMTs for Agriculture [NMT4A]) as with the case of digitization agriculture mission 2021-2025 in India (www.ibef.org- accessed 14th July 2022). Digitalization in agriculture is the use of digital technologies platform that encompasses new media tools for agriculture the 'new media kit' to change agricultural practices and an agribusiness model and provides new revenue and value-addition-producing opportunities on digital platforms deployed by the NAERLS to boost technology adoption

among farmers and her adopted villages. These NMTs/ICTs-based applications used for agriculture are numerous. They vary as follows:

- Web portals and Social networks/ media- Facebook, Google+, LinkedIn, and WhatsApp.
- Geographic Information Systems [GISs] - Thematic maps, Satellite imagery, Coordinate, and Geospatial data.
- Hybrid projects: ICTs with traditional extension elements- Tablet, iPad, Agric-Drone, Mobile phone, Smart Radio, Smart Television, and Internet facilities.
- Telecentres and mobile communication- Voice or Text messaging, Video, and Photos.
- Photo sharing sites- Blogs, Web blogs, Web 2.0, and Open Data Kit [ODK].

These h-techs have revolutionized the agricultural activities of smallholder and large-scale farmers worldwide (Okafor and Malizu, 2013; World Summit on the Information Society [WSIS], 2013). Essentially, the NMTs are meant to provide innovative and technological support on agricultural information, and training provided to the farmers through the Growth Enhancement Support Scheme [GESS], Nigeria Central Bank of Nigeria's Anchor Borrower's, Ashwani (2020), and Alliance for Green Revolution in Africa [AGRA] (AGRA/NAERLS CBA Project) to farmers for farming practices to be done at ease and invariably improve their farming efficiency and boost food production in the NAERLS Adopted Villages.

Concept of Climate-Smart Agriculture

Climate-Smart Agriculture (CSA) is to promote the development of technical digital tools with investment conditions to achieve sustainable agricultural practices, and eco-friendly realistic under policy development for food security in a changing climate. The effects of climate change on the ecosystem as it hit farmers, herders, and fishers, and the hardest caused by human activities on the planet earth, provoked the climate-smart agriculture approach. Ashwani (2020), opines that future growth in the agricultural sector must come from new technologies which are not only user-friendly, cost-effective, and youth-based but, are also in conformity with the climatic system of the World. This increases sustainably agricultural productivity and incomes, helping adapt and build resilience to climate change impacts, and wherever possible, reducing and/or removing greenhouse gas effects on the ecosystem. Additionally, make doing agriculture easier with evidence knowledge-based technologies for agricultural practices to increase productivity, and nutritional security and improve farm family livelihoods in Nigeria.

Nigeria has an estimated population of 212 million as of the end of the first quarter of 2021(National Population Commission [NPC], 2021). Three-quarters (159 million) of this population are under the age of 35 years implying that Nigeria has a youthful population, making the future of the country's agriculture dependent on its youths who are new media savvy (United Nations Development Programme [UNDP], 2020). This implies that agriculture in Nigeria should be a youth-dominated profession that can be propelled by encouraging these hi-tech-savvy youths to utilize the NMTs and partake in the available opportunities in the agricultural sector to be employed as well as become self-reliant.

Agricultural Extension Systems in Nigeria

According to Arokoyo, Tologbonse, Auta, Ikani, Oyedokun, and Chinaka (2011), the agricultural extension system in Nigeria collapsed in the 1980s shortly after the Structural Adjustment Programs (SAP). The Agricultural Development Projects (ADPs), which formed the backbone of the extension system, worked well before the structural adjustment period. Within this framework is the NAERLS which has been serving as the first known institution that disseminated extension service information to farmers through pamphlets,

radio, and other media. The major factor in Nigeria's collapse of the Training and Visit (T&V) extension system was the withdrawal of the World Bank's financial support to the ADP. The ADPs ran into difficulties due to a lack of access to financial resources to support their operations. Invariably, the performance, and hence the effectiveness of Nigeria's agricultural extension service became seriously impaired by poorly trained staff and a lack of synergies with other donor-supported projects. All of these were the outcome of the predominantly top-down approaches to the communication process which did not pay more attention to indigenous knowledge and felt needs in development projects design and implementation (Arokoyo *et al.*, 2011).

Haugh (2007) reported that agricultural extension services are supposed to fulfill many aims, from reducing rural poverty and improving livelihoods for rural households to increasing the overall production and contribution to foreign exchange earnings from export. Farmers in Nigeria face increasingly complex challenges in today's rapidly changing food, fibre, and agricultural markets. The high demand by consumers and stringent environmental regulations, demand for upgrades, and standards enable farmers to be better informed and supported. Thus, the extension system needed is not just to produce more food. Farmers need to be supported to use the right kinds of seeds, and fertilizers, meet maximum residue levels in food commodities, and improve food handling, storage, packaging, and marketing of products through digital means to meet the global markets (Agriculture in Nigeria 2013). According to Wongsodikromo (2012), the less developed countries, extension work is a challenge due to the weak link between research and extension. Moreover, the research focuses on technical aspects to generate useful technologies, while the extension focuses on users' acceptance and adoption of those technologies. What is needed today is a highly knowledgeable extension service backed up by ICTs infrastructures to support farmers from the farm to the mill, and the market in a chain of added values at each stage of the process. The extension workers must be equipped on how to use the digital tools to help link farmers more effectively and responsively to domestic and international markets, to enhance crop planting diversification, sustainable technology transfer (through updating platforms on best practices, input and output markets, rainfall pattern, trans-boundary crop, and livestock diseases.

Although the Agricultural Extension Transformation Agenda was launched to propel the sector. This vital farmer support system is imperative to ATA's success to achieve food and nutrition security, wealth, and job creation and indeed to making Nigeria a major player in global food markets. Among the goal is to put in place a knowledge-based, demand-responsive, pluralistic, market-oriented, and ICT-driven participatory agricultural extension service for Nigeria (Adesina, 2012).

The GESS is in line with global agriculture best practices to digitalize extension work in Nigeria for the effective delivery of e-extension through the generation and maintenance of an accurate farmers' database. In the year 2013, the first Federal Department of Extension was established to provide the much-needed impetus for leadership, coordination, monitoring, and quality assurance to drive the transformation of extension delivery at all levels through agricultural extension advisory service providers among which is the NAERLS. This single step has led to the award of the contract by the Federal Ministry of Agriculture and Rural Development for the building of Farmers' Help Centers in all the agroecological zones of the country. These centers when completed are expected to provide a one-stop information platform to farmers at no cost and their request through mobile phones or other communication devices. However, the absence of the requisite digital devices in rural communities has created a digital divide and made it difficult over time to coordinate and streamline agricultural extension operations across the country, leading to a multiplicity of disjointed efforts and unrestricted corruption in the distribution of farm inputs by the government. In the study by Gadzama and Akinola (2013) entitled "Adoption and Diffusion of ICTs in Extension Services: Implication for the Agricultural Transformation Programme in Nigeria", the authors averred that the rapid development of ICT is the biggest factor for change in extension services delivery, one which facilitates and re-enforces other

changes. This position is logically supporting the submission of Ismail, Issa, Adebowale, Tenuche, and Bashir (2013) on the fact that other infrastructure must be developed along the ICT for optimal results. Therefore, the integration of the adopted villages into the database is crucial to sustaining CSA practices as well as mitigating the digital divide.

The Federal Department of Extension worked on an information framework that is digitalization where farmers' cell phone numbers were mapped to their agricultural information needs. They get information such as good agronomic practices, market linkages, and weather news on their phones. To ensure that farmers get information in their local languages the African Language Translation Institute of the National Open University of Nigeria developed a language application for selected crop value chains deployed on the digital platform. More so, initiated the 'Farmers Helpline', which is a web and mobile phone-based extension service delivery system with an audio and video call-in facility. With 24-hour service and an extension toll-free line, farmers can call experts (in the three major local languages) and seek extension information and advice (Score Card, 2013). To this end, the Department of Extension is engaging relevant organized private service providers in the areas such as seeds, fertilizers, agrochemicals, and machinery to strengthen the digitization of Nigeria's extension service delivery. All of this help the Nigerian government diversifies and expand the delivery of extension services by encouraging the participation of the private sector, Civil Society Organisations (CSOs), Farmer-Based Organizations (FBOs), Universities, and Research Institutes. The involvement of these FBOs was to strengthen the country's national extension system and ensure smallholder farmers in the adopted villages have access to critical services such as training on new agricultural technologies and advice in areas such as farm input supply, credit, marketing, and farm management (Agriculture in Nigeria, 2013).

Digital Divides in Agricultural Extension

The digital divide in agricultural extension in this context is described as the intellectual and physical breach existing between the agricultural stakeholders; who have access to affordable gadgets necessary to take advantage of the new media, skills to use the new media tools, reliable and secure internet service to access agricultural information and those who are unable to do so. Although it has been proven that most farmers in Nigeria jettisoned agricultural innovations and technologies introduced to them because the agricultural extension performed below expectations largely due to the inability to effectively disseminate adoptable/adaptable agricultural innovations to farmers (Atala, 2009). Given this, Sulaiman and Davis (2014), Kuria (2014); Kipkurgat, Onyiego, and Chemwaina (2016); Suchiradipta, and Saravanan (2016); Davis and Terblanché (2016); Abu, Mohammed, Debashish, and Md. Abdul (2017), expressed that, h-tech utilization is faced with new and complex challenges such that to properly integrate and make good use of the NMTs for agricultural practices needs a new approach and capacities to effectively deal with.

The Role of NMTs4AE in Participatory Agricultural Extension System

The New Media Tools for Agriculture Extension (NMT4AE) are digital Apps used on the ICTs platform that encompasses different NMTs known as 'new media kit' and 'hub' used for agricultural extension, that provide opportunities for individuals: male or female adults particularly the youth to do agriculture at ease in the global space and not just gadgets. Agricultural extension is seen as one of the policy instruments which governments use to stimulate agricultural development. Its activities are a form of social innovation in agricultural change, which was developed over nearly four thousand years by being created, recreated, adapted, and developed (Jones (1986) in Oladele (2011); Ahmed, (1982) in Bne Saad (1990) as cited by Malgie, Ori, Wolfgang, and Vanwing, 2018). According to Freire (2018), the concept of the Participatory Approach [PA] emerged as a means of mobilizing stakeholders to be involved in the development process of the agricultural sector. Thus, the major role of NMT4AE in the

Participatory Agricultural Extension System (PAES) is to mitigate the divide for increased productivity. According to Muto and Yamano (2009); Aker and Mbit (2010); Kamani and Kathiriya (2014), and Ben-David (2017) are in accord that, the utilization of the NMTs4AE is fundamental to any agricultural extension services in various ways such as spread and received new messages among the agricultural stakeholders via the networking interface as a result of the feedback mechanism. It is an indication of a PAES based on its symbolic and purposive information-sharing process though; it requires sophisticated facilities applications and skills to operate at that level but, the feedback is readily noted among individuals and direct in group contact. According to the Food and Agriculture Organization (FAO, 2017) as cited in Malgie *et al* (2018), there are different types of extension methods to provide information. They are classified by the way of contact: (a) Individual Extension Method (IEM): one-to-one discussions, farm visits, office visits, telephone calls, and written correspondence; (b) Group Extension Method (GEM): speeches, meetings, talks and seminars, demonstrations and group discussions; (c) Mass Extension Method (MEM): newspaper, magazines, publications, exhibitions, internet, radio, and television.

Implications of digital divide in the digitalization of farming activities in the NAERLS adopted villages

The implications of the digital divide in the digitalization of farming activities in the NAERLS adopted villages as well as the NMTs4AE roles for agricultural extension services to mitigate the digital divide for climate-smart agriculture cannot be overstressed. Scholars Muto and Yamano (2009), Aker and Mbit (2010), Kamani and Kathiriya (2014), and Ben-David (2017) in their different submissions agreed that the utilization of the NMTs4AE plays significant roles in agricultural development as well as fundamental to any agricultural development process in the world in various ways.

i. It helps to check climate change phenomena, weather forecasting, and emergency response activities as the case demand.
ii. To carry out other processes or applications as required on the farm and to inform the public of weather updates on climate change (WSIS, 2003).

In the contemporary, these milestones are perceived as the major driver or information facilitators of the world's Gross Domestic Product (GDP) through globalization. Though, it is powered and enhanced by the use of ICTs on which virtually every sector now relies. Moreover, the global South which is largely agrarian has continued to strive to find relevance at the international frontiers. More so, the general purpose of NMTs for agriculture herein is to enable the agricultural stakeholders to familiarize themselves with and imbibe the use of computers, smart television, smart radio, smartphone/ mobile phone, and related information that is productivity driven by the use of the NMTs.

Although it is still difficult to see the sustainability of the NMT's approach neither in their farming activities nor in their yields, despite the support given to the farmers in the adopted villages such as improved seeds, seedlings, agrochemical, and training provided to the farmers through the Growth Enhancement Support Scheme [GESS], Nigeria Central Bank of Nigeria's Anchor Borrower's, Ashwani (2020) and Alliance for Green Revolution in Africa [AGRA]/ National Agricultural Extension and Research Liaison Services-Community Based Agent Project (AGRA/NAERLS CBA Project). Despite all the efforts made to expand the sources of agricultural information by utilizing the NMTs' potential to enable the farmers to have access to genuine agro-dealers for quality inputs, and credit facilities to enhance farming activities and boost food production. More so, using the value chain approach in the ATA programme that established knowledge and skills-based demand responsive extension and advisory services. However, the milestones for the food growth rate did not improve to meet the desired results as speculated. Thereby, making the Nigerian agricultural sector's growth rate fluctuate downward

from 4.3% in 2014 to 3.7% in 2015, and improve by 4.1% in 2016, but dwindled consistently for three years with the estimated growth rate at 3.5% in 2017, 3.4% in 2018 and 3.17% in 2019, again improved by 3.42% in 2020 (NBS, 2021).

Thus, the creation of synergy among agricultural stakeholders based on knowledge, and practices for increasing productivity by the adoption of climate-smart agriculture practices through capacity building for the farmers and extension agents is important to reap the gains of CSA for agricultural transformation. This position was also taken by Issa (2013) when he recommended in a study that extension workers and farmers plus other stakeholders be properly trained as enshrined in the ATA document for the success of the initiative. In a related study by Krunal and Dhaval (2013), in "Cultivating ICT & Networking: The Role of Social Media in Agriculture", they believe that agriculture is a key sector in most developing countries, as the general opinion is that a happy nation can feed their citizens. This implies that the agriculturalist needs access to requisite information on Climate-Smart Agriculture (CSA) in the tech-driven global space. Hence, the need to mitigate the digital divide in the digitalization in advancing CSA in the NAERLS adopted villages' agricultural activities to improve the economic status and livelihood of farmers in the selected adopted villages as well as the rural communities in Nigeria.

Conclusion

Nigeria has played a dynamic role in the global space regarding the digitalization of agriculture, and the provision of high-definition-network Internet service and NM gadgets to farmers. Nigeria has also been active in the back-to-land policy with the provision of input support to her farmers and acknowledging climate-smart agriculture. However, visibly, NAERLS does not take seriously acquiring or making available more of the NMTs for the rural communities, the practicable analysis of the problem of the digital divide of the peasants about the utilization of the NMTs4AE, and then fails to clearly outline a strategy for implementation of CSA among the small-holder in the adopted villages. Many ICTs-NMTs policies in Nigeria are non-inclusive, this is because NMTs are often deemed personal applications mostly acquired by large-scale farmers, and do not take into consideration NMTs4A as an important issue in the agricultural sector. We believe an NMTs analysis is essential in ensuring the creation of synergy among agricultural stakeholders based on knowledge and practices on climate-smart agriculture and implementation strategies to guarantee the inclusion of all agricultural stakeholders, addressing the digital divide, and the need to increase productivity, nutritional security, and improve farm family livelihoods.

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