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Information and communication technologies: saving tool for agricultural production and extension services

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Information plays a significant role in empowering farmers to enhance their livelihoods, efficient dissemination of information is the key to filling the gap that exist between analogue and digital world. Technological information that affects production and disseminated of information depends on effective communication. The communication of technology and economic information in the face of global food crisis is absolutely a tool for agriculture and rural development. The current advancements in Information and Communication Technologies (ICTs) has broken world barriers and turned the world into a village, making information accessible to everyone, everywhere and at any particular point in time. There is scarcely a field of act today that has not felt the impact of the dramatic changes in Information and Communication Technologies that have evolved within the last 10-15 years but the use of ICT requires positive attitude from the users. The Nigerian Agricultural sector serves as the leading significant sector as it serves as the main employer of labour and source of income to many, almost every household is engaged in Agriculture. Although, the traditional approaches of agriculture that is adapted have several problems in terms of profit, production and marketing. Some of these problems of the traditional agriculture can be effectively addressed by using Information and Communication Technologies which play a crucial role in elevating the livelihoods of the agricultural small landholder farmers. It is therefore important that constraints to the use of ICT tools by extension officer be eradicated and the use of ICT tools by extension officer be enhanced. Also, the educational level of extension officers should be improved through the acquisition of more related qualification. Lastly, readiness of extension officer be enhanced by effective policy and adequate provision of ICT tools.

Key words: Agricultural Production, ICTs, Farmers, Information and Extension

INTRODUCTION

The relationship that exists between agriculture and development is of great importance in the world. In the year 2000, the Millennium development Goals (MDGs) was implemented in Africa to serve as a guide and work plan for the attainment of development with over two-third of the target group being rural communities (Tolulope and Chinonso, 2013). The importance of the agriculture sector cannot be overemphasized; it plays a major role in improving the livelihood of rural dwellers, reduction of poverty, improving nutrition and general well-being of the population. Data from the World Development Indicator (WDI) showed that there was a significant correlation between food production and first school enrolment ratio and gender equality, while there is a substantial link between food production and child mortality rates, this affirms the importance of agriculture in economic development (Adekunle *et al.,* 2018).

In the past decades, the agricultural sector has experienced a setback and steady decline in its productivity. However, in recent time, indices have revealed that the world already began witnessing a gradual but sluggish growth (Salau and Saingbe, 2008).

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This growth was necessitated by population growth, changing climate and technology needs (Henri-Ukoha *et al.,* 2012) ranging from mechanized farming equipment, post-harvest technologies, innovations like ICT facilities, improved and high yielding varieties, efficiency in land use and integrated pest control. On a general note, Agriculture is an information-intensive industry. It relies upon continuous information from local, regional and world market (Akinbile, and Alabi, 2010).

Information and Communication Technologies (ICTs) are all technologies devised in the widespread, transfer and distribution of knowledge. ICTs are rapidly integrating global communication networks as well as international trade with implications on developing nations. ICTs are also employed in enabling, strengthening or replacing existing information systems and networks. Since information is crucial in the facilitating of agricultural and rural development as well as bringing about social and economic changes, ICTs is employed in the promotion and distribution of new and existing farming information and knowledge which is communicated within the agricultural sector (Swanson and Rajalahti, 2010). For the development of all sectors in Africa, Agriculture inclusive, Information and communication technologies (ICTs) remains one of the novel innovations that cannot be overlooked due to the fact that ICT is a driving force capable of bringing about development and transformation in this digital age (Olaniyi *et al,* 2013). As noted by Emenari, (2004) the immense transformation within the lives of people, especially those in the developing nations relies on annexing advancements in ICTs. As a matter of fact, ICTs are what rural dwellers must climb to the heights developed countries had reached.

Contribution of Agriculture to Nigeria Economy

Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. Agriculture, value added (% of GDP) in Nigeria was 21.21 as of 2016. Its highest value over the past 37 years was 48.57 in 2002, while its lowest value was 20.24 in 2014. Gross domestic product (GDP) represents the sum of value added by all its producers. Value added is the value of the gross output of producers less the value of intermediate goods and services consumed in production, before accounting for consumption of fixed capital in production (Adekunle *et al*., 2018). The United Nations System of National Accounts calls for value added to be valued at either basic prices (excluding net taxes on products) or producer prices (including net taxes on products paid by producers but excluding sales or value added taxes). Both valuations exclude transport charges that are invoiced separately by producers. Total GDP is measured at purchaser prices. Value added by industry is normally measured at basic prices (Adekunle et al, 2018).

Barrier breaking and wider connection through the adoption of ICTs

The current advancements in ICT has broken world barriers and turned the world into a village, making information accessible to everyone, everywhere and at any particular point in time (Onasanya, *et al.,* 2011). ICTs includes a range of apparatus and services, some of which are been used for agricultural extension purposes in Nigeria. The ICT have been employed for extension purpose in various forms using radio, television, short message services (SMS), mobile phones, programme, camera, video, rural radio, CD-Rom, world wide web (www), e-mail, computer, contact data base and systems DVD, and web publishing.

ICT also play a significant role in achieving transformation, it consists of three main technologies which are: Engineering, Communication Technology and Knowledge Management Technology. These technologies are used for the processing, exchanging and management of data, information and knowledge. Recent developments in information and engineering (ICT) offer an honest opportunity to facilitate the flow of knowledge and technology services delivery especially to the farmers. It's comprehensible that on one hand agriculture is becoming highly science driven and knowledge intensive, but on the other hand the current public extension system has subsided effective, longer consuming and fails to satisfy the expectations of those involved in agricultural product production (Akinbile, and Alabi, 2010). The extensive use of up to date information technology must be promoted for communication between researchers, extension workers and farmers to transfer technologies and knowledge in an exceedingly cost effective manner. ICT has many potential applications in agricultural extension (Zijp, 1994), it provides new information services to farmers in the rural areas who are to be the users, and also enables them to have a better understanding and control over the information channels. Also, the utilization of ICT proven to be an important pillar of agricultural extension and within the present scenario of a rapidly changing world, it has been recognized as a significant mechanism for delivering knowledge (information) and advice as an input for contemporary farming (Jones, 1997).

Dynamism of ICTs in human endeavour

There is scarcely a field of act today that has not felt the impact of the dramatic changes in Information and Communication Technologies that have evolved within

the last 10-15 years. Information Communication Technologies have exceptional features that provide opportunities to harness them in ways within which are different from how the conventional media have been used for development. As reported by Michiels and Van Crowder (2001), comparing ICTs with traditional media, ICTs gives opportunities for two-way and horizontal communication and for creation of new communication channels for rural communities and consequently the intermediaries and development organizations that provide supports for them. Once mastered, they potentially permit every user to be a sender, receiver, 'narrowcaster' and broadcaster; support bottom-up articulation of development needs and perceptions, and facilitate the integration of world and native knowledge and information, support, create and strengthen interactive and collaborative networks that allow the circulation of information to and from rural communities; encourage coordination of national and native development efforts, facilitate discussion between communities, intermediaries and development organizations; and overcome physical barriers to knowledge and information dissemination. ICTs may serve as improvement for the capacity of grassroots organizations to make their voices heard. ICTs enhance the pliability to seem for information and increase the quantity of accessible information, eventually reducing uncertainty and enhancing market participation. In agriculture ICT has in some ways provided justification to problems such as "how do buyers and sellers locate each other and what prices are usually achieved?" "is it better to store the produce or sell it immediately?" (Bertolini, 2004). ICTs also provide for people and communities new opportunities to make them not only consumers but also producers of data.

ICTs as a tool for bridge building

According to CTA (2000) efficient dissemination of information is the key to filling the gap that exist between analogue and digital world. However this may be the problem faced by the development stakeholders and actors in developing countries like Nigeria. Information and thus the technologies that facilitate its use, exchange, and reliability has been for many years the important aspects of agriculture and agriculture-related resource management. Some factors such as decisions on production (what to plant, when to plant it, the things to cultivate) harvest, storage and Marketing (where, how and what price to sell) have depended on knowledge, communication, and data exchange.

In Nigeria, younger people of farming profession are getting involved in the adoption of ICT services for agricultural information, because they were functionally literate. Providing ICT services to rural areas will therefore be an advantage. The research result of Lokeswari (2016) says farmers use the ICT services frequently as and when they needed information. He further observed that exposure of farmers to mass media was found conducive to utilization of ICT by farmers in India. Current information allows farmers to survive and even benefit from these changes. The role of Information and Communication Technologies (ICT) to support agriculture production system has been investigated by many government agencies has proved to play a vital role in the transfer of technology and to share the modern agriculture practices with the farmers. However, many of these farmers are not completely utilizing the full potential of the ICT. There are number of factors hindered the utilization of the service including the failures to visit farmers, lack of promotion of the service and training of farmers. Language and traditional constraints to ensure adequate ICT infrastructure in the agricultural communities

ICT and the Nigeria Agricultural extension system

Farmers and members of rural communities have needs for information and suitable methods of learning that seem not to be met (Greenridge, 2003; Lightfoot, 2003; Agwu *et al.,* 2008), in developing nations like Nigeria. Within the midst of this alteration, extensionists are trying to provide justification on how best to harness information and communication technologies (ICTs) to improve rural livelihoods. Old ways of delivering important services to citizens are being challenged due to the emerging new paradigm of agricultural development. In addition, traditional societies are also being transformed into knowledge societies globally (Meera et al 2004).

The agricultural communications industry has changed because of the dramatic changes in the agricultural industry. Possibly, there is more information but less knowledge than before in agriculture and that is a huge opportunity for extension officers. At the same time, the emergence of the internet as a communications medium, as well as the convergence of many other traditional communications vehicles like print, radio, television and database marketing, has a direct impact on extension officers approach their jobs.

Today agriculture holds a unique position in society. As more and more of the world's population moves from rural to urban areas, agriculture as a way of life is changing. Although its role in food production has not changed (Boone, et al., 2000)

The problem of agricultural development in Nigeria and some African countries have been linked to the low level of agricultural information exchange (Agwu *et al.,* 2008). Arokoyo (2003) stated that, the national extension in Nigeria relies on the T&V delivery system, traditionally supported by television, radio, mobile cinema, video, and telephone being the only actual ICT used by majority of extension workers. However, telephone use in extension delivery is extremely limited despite the launch and

explosion of the worldwide system of mobile communication (GSM) because most ADPS even at the headquarters do not have functional lines (Agwu and Chah, 2007).

Attitude of Nigeria farmers to the Adoption and utilisation of ICTS for agricultural development

Today, Agriculture is the mainstay of most African countries. It plays major role in the development of the continent. The situation is not different to Nigeria economy due to its central role in building a strong economy, reducing inequalities by increasing incomes and employment opportunities for the poor, while nurturing natural resources.

Effective agricultural development requires access to information on all aspects of agricultural production, processing and marketing and This as a matter of need to increase because ICT is already showing the potential to play an important role in the delivery of this information to this sector in both developed and developing countries. Nevertheless, attitude is a major factor to be considered.

The use of ICT requires positive attitude from the users as emphasized and proved by previous studies (Simpson, 2005; Kenneth and Liquat, 2006 and Loh et al., 2009). As noted by Horne (1985) attitude represents a mental and neural state of readiness, organized through experience. It brings into play a directive or dynamic influence upon the responses of people to any or all objects and situations. As reported by Breckler *et al.,* (1992), attitude may determine an individual's degree of like or dislike towards something. For ICT usage, positive attitude is a vital requirement as it has been noted that the agricultural communities have positive attitude towards ICT and that they welcome any ICT project to be developed in their areas (Shiro 2008). However, their less usage of ICT is as a result of their lack of ICT knowledge. Dixon (2009) detected that frequent usage and exposure to ICT must be considered if someone wants to create a positive attitude towards ICT. Frequent use and acquiring more exposure to ICT, will give them a better knowledge of the usefulness and benefits of ICT and thereby create a positive attitude towards the usage of ICT.

Information and farmer's livelihood

Information plays a significant role in empowering farmers to enhance their livelihoods. Important information like sowing, improving soils, seeking the simplest price for his or her produce and ways to combat pests and diseases all empower the farmer and their deciding capabilities. Seasonal variability in weather patterns, deterioration in soil conditions and sporadic climatic events like drought, floods, pest and disease outbreaks complicate the choice making process of the farmers and influences their information requirements. Providing such knowledge will be challenging because the information must be tailored specifically to distinct conditions to the interest of farmers. Given these challenges the arrival of data and Communication Technology (ICT) is well timed and its potential to contribute to improving agricultural productivity has been extensively reported (Armstrong et al., 2010, Armstrong *et al.,* 2011, Armstrong *et al.,* 2012a, b). With the growing mobile, wireless, and Internet industries, ICT has found a foothold even in poor smallholder farms and in their activities. Acquiring knowledge from information and making decisions supported that knowledge is that the simplest tool for the farmers (Armstrong *et al.,* 2011). ICT has been reported to possess an increasing impact on agricultural sector and on the processes related to food production (Blurton, 2010). This impact has coincided with great efforts by government and industry in developing countries like India to boost the sustainability of agricultural systems so as to produce food for an increasing world population and to enhance rural livelihoods. So up-to-date information through ICT allows farmers to survive and even take pleasure in these changes and challenges.

Constraints to the use of ICTs in agriculture

Information and Communication have always players a key role in agriculture as farmers are always in search of methods to enhance their crop production. Farmers have difficulty in searching the answers to such issues whether or not they're very experienced within the specific cropping regime. Constrain to the use of ICTs ranges from place to position but there are general constrain and a few of them are: lack of communication infrastructure on which ICTs depend, lack of communication network, high cost of ICTs software hardware, lack of sufficient trained computer personnel, erratic power supply, poor finance and lack of internet access within the rural areas. It is presumed that ICTs access unevenly benefits urban and wealthy reside. According to Arokoyo (2003), utilization of ICTs in agricultural sector is also faced with obstacles such by inadequate infrastructure, limited human resource and capacity, absence of national policies and low ICTs literacy.

Beyond the farmers constrains, extension workers also face variety of challenges which they consider as serious constraints to the utilization of ICTs. These specific constraints perceived by extension workers include; lack of competence in handling ICT facilities, unavailability of hardware required by modern ICTs, erratic power supply and lack of communication infrastructure on which ICTs depend. It's important to acknowledge that availability and affordability of telecommunications infrastructure and support for rural communities, researches and extension organizations is usually lacking in Nigeria. Specifically, the supply of kit including phones (fixed and mobile), computers, radio, TV, video camera, a sturdy telecom

equipment, preferably with reliable broad band with easy internet access and warranted operation funds also are not affordable by majority of stakeholders found within the agricultural sector, even when available. Other constraints include lack of sufficient trained computer personnel, poor finance, lack of adequate awareness about ICTs, lack of internet access to the agricultural areas, poor communication network and nature of knowledge provided.

Some other constrains on the side of farmers in using ICTs includes lack of confidence in operating ICT facilities like computers, lack of competence in handling ICT facilities, lack of adequate time for training on ICT facilities and unavailability of hardware required for contemporary ICTs. Bertolini (2004) observed that several drawbacks to the usage of ICTs in developing countries occurs especially in areas where access to telephone and electricity networks is a problem. Electricity and power supplies are absolute prerequisites to using contemporary ICT systems (Agwu *et al.,* 2007). Academy for Educational Development and Win rock International (2003) also reported that more than 1.5 billion people in developing countries lack quite affordable gratings or 'mains' of electric service, and over a billion people has been predicted to lack mains electricity in the future. For these people, other energy options like small renewable energy-based power systems (solar photovoltaic (PV), small wind-electric turbines), are essential if they're to learn from rural ICTs use.

Implications of early adoption and Primordial System of agricultural practice in Nigeria

Ghana perhaps appears to be one the foremost countries of the globe and first in West African sub region to adopt ICTs in its National Agricultural Research System (NARS). Researchers within the Ghanaian NARS are using computer and internet based ICT to communicate with one another and to hold out some important aspects of their research activities (Sraku – lartey and San, 2003). Global Watch (2002) predicted that ICT are going to be employed in extension activities through the establishment of data centres and telecentres which will facilitate collaborative research through the utilization of local area networks, wide area networks and research networks because of more inter disciplinary research.

However, in Nigeria, weak and inadequate legal framework on the utilization of ICTs in educational activity has affected the agricultural development process. It thus becomes important to know the precise actors who play or should play a role in establishing basic ICT services in rural areas. This identification will help orient projects and programmes that may lead them to effectively and collectively engage in dialogue around telecommunications policy reform. These actors according to Richardson (2003) include:

Telecommunications service providers (also referred to as operators), regulators and policy-makers, telecommunications policy reform advocates (most often found in, and focused on, urban service issues, and sometimes nascent in rural areas), rural clients (current and potential), 'Last mile' entrepreneurs (phone shop operators and cyber café or telecenter operators), extension managers and other professionals who deliver rural services.

Extension has a very important role to play in facilitating and brokering the participation of rural and agricultural organizations in policy dialogue on telecommunications reform so as to shape national telecommunications policies and programmes to satisfy the requirements of rural areas (Richardson, 2003), this is a new role for extension agents. During this role, they have to be ready to examine the appropriateness of various ICTs, the accessibility of ICTs in rural and remote areas, how best to reconcile costs and benefits, and the way to insure that ICTs access include a diversity of cultures, languages, social strata, and age groups, and is gender sensitive (Richardson, 2003; *Agwu et al.,* 2007).

Strategy for way forward

There is no doubt that Information and Communication Technology (ICT) can revolutionize Nigeria farming sector and will bring about benefits to all farmers including small landholders. The Nigerian Agricultural sector serves as the leading significant sector as it serves as the main employer of labour and source of income to many, almost every household is engaged in Agriculture. Although, the traditional approaches of agriculture that is adapted, has several problems in terms of profit, production, marketing etc. The problem of the traditional agriculture can be effectively addressed by using Information and Communication Technologies (ICT), which play a crucial role in elevating the livelihoods of the agricultural small landholder farmers. ICT provides opportunity for growing demand for brand fresh approaches. Furthermore, it helps in empowering the Agriculturist through the provision of better access to natural resources, effective production strategies, banking and financial services, improved agricultural technologies, markets, etc.

The vision of the final public agricultural extension system in Nigeria is that there should be a media sub-unit within agricultural sub programmes equipped with the contemporary communication facilities for communicating effectively both within the organization and to link research institutes, related agencies and farmers. Olajubu, *et al.,* 2006; and Arokoyo, 2011 opined that ICTs have great impact on effective communication, product differentiation, productivity and employment opportunity in productive sectors of the economy. It's therefore crucial that developing nations maximize the potentials of ICTs

for vast development purposes in agriculture sector. Interestingly, information has become one altogether the primary important factor of production and there is little doubt that this trend will continue. In this present age only knowledge accumulation and application can aid development and make extraordinary opportunities available to reduce the rate of poverty. It has been estimated that effective integration of ICTs in several sectors of the economy will expand process rate by 2-3 percent. Having timely and relevant information, particularly information related to marketing on transport availability, new marketing opportunities and the market prices of farm input and output is essential to an agricultural economy that is efficiently and productively inclined (Olaniyi, and Adewale, 2014).

As noted by Zhang and Aikman (2007), attitude is a mediator on the role of attitude toward object on behavioral intention. Therefore, related Government agencies or private companies should understand that a positive attitude toward ICT would lead potential users especially the agricultural communities to come to a decision to accept and use of it. Besides, efforts should be put into identifying factors that may contribute for positive attitude toward ICT usage. So, to make sure the effectiveness of ICT, the agricultural community especially their leaders must have a positive attitude towards ICT usage.

The provision of excellent tool for agriculture development AMIS (Agricultural Market Information Services) will provide better farm management and solutions to improve marketing capabilities. This system can help Nigeria farmers and traders to efficiently develop business relations. Field agents can also use the system to update their records and monitor quality standards, which improve planning and protect small landholders from market disruptions

CONCLUSION

In conclusion, if modern ICT facilities are not adequately built into the mainstream of Nigerian agricultural extension system, there will be no improvement in the dissemination, utilization and application of scientific agricultural information for development of Nigeria agricultural system. At the moment, Nigeria agricultural extensions professionals are not in attendance of national policy dialogues that create policy change towards universal ICTs access. Information Communication Technologies access implies not only the physical availability of communication tools and methods but also the existence of the right conditions for their use in receiving information. These conditions include the ease of use of the technologies, regular electric power supply and availability of spare parts.

In this regard, government should take steps to build three basic infrastructures in the rural areas: electricity, telephone and internet connectivity.

Extension officers had high perception of the effect of ICT on agricultural information access. The effect of ICT on agricultural information access were mentioned to include: increase information availability, increase knowledge on farming activities, improve quality of information and record keeping respectively, improves awareness of agricultural events, news and information flow respectively, enhances accuracy of information, enhances capacity building agricultural markets, enhances timeliness of information and improve the relevance of research. It is therefore important that constraints to the use of ICT tools by extension officer be eradicated and the use of ICT tools by extension officer be enhanced. Also, the educational level of extension officers should be improved through the acquisition of more related qualification. Finally, readiness (a composite of access, availability, accessibility, competence and use of ICT tools) of extension officer be enhanced by effective policy and adequate provision of ICT tools.

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