

Review paper

Role of Information and Communication Technology in Promoting Household Food Security in Nigeria

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ABSTRACT: This Information and communication technology (ICT) has become a recurrent decimal in all aspects of human endeavour. The litany of ICT tools and resources in most households are used to disseminate, information in all aspects of household life, including agricultural production and food security. Even though over 70% of the Nigerian population is engaged in farming and the huge investment in the farm sector, the impressive figures of food production turned out annually by the national bureau of statistics is in contrast to the number of people without access to adequate food and nutrition continue to rise annually. The paper reviewed the role of ICT in promoting household food security in Nigeria. It discussed the importance of food security, the role of ICT in promoting food security, challenges faced by households in the utilization of ICT, and the approaches for enhancing the use of ICT by families for promoting food security. From the review, it was found out that ICT has enormous roles to play in boasting food production and fostering equitable distribution and marketing of food products. Key challenges to the effective utilization of ICT in promoting food security include lack of access to ICT tools, low literacy level, and inadequate capital, among others. It recommended that massive sensitization and literacy programmes on ICT, and providing ICT tools at affordable rates to households among others could promote food security.

Keywords: Information and Communication Technologies, Household

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INTRODUCTION

Information and communication technology (ICT) has become a recurrent decimal in virtually all aspects of human endeavour. Its utilization and application have become so popular that there is hardly a household without evidence of ICT use either in the form of mobile phones, calculators, laptop, and radio, among others. Principally, the litany of ICT tools and resources in most households are used to link people, disseminate, store and manage information. ICT find application in various spheres of life and are used to perform several functions. According to Lashgarara et al. (2010), ICTs is used to

enhance rural decision power, extend rural markets, preserve the environment, increase life quality and empower the rural poor. They can be crucial in domains such as social development, research, education, extension, the management and control of organization, gender equality, hygiene, the environment, agriculture and nutrition. This could be achieved through proper dissemination and monitoring of critical signals necessary for efficient service delivery, including food production, hence food security. The essential condition for obtaining food security is communication because it is an essential

factor in the food system (Lashgarara et al., 2010). According to Clapp (2016) and De Schutter (2014), food insecurity results mainly from the inequitable distribution of resources and information in the agriculture and food production system.

Despite the enormous investment and annual budgetary allocation in the agricultural sector, and the impressive figures turned out by the national bureau of statistics, the number of people without access to adequate food and nutrition continue to rise annually, mostly in sub-Saharan African countries. According to the United Nations (2017), about 795 million people, or every ninth person in the world is undernourished, with the majority living in developing countries and rural areas. According to FAO in Mbow et al. (2019), over 1.02 billion people globally suffer from hunger with about 830 million in developing countries. The Federal Ministry of Agriculture and Rural Development (FMARD) (2015) reported that about 53 million Nigerians accounting for 30 percent of the population were hungry in 2010, while Oxfam (2017) reported that Nigeria ranked 110th in the global food index. While most of the product may never reach the consumers due to post-harvest wastage occasioned by low storage and handling facilities, most people lack knowledge of where to access the farm produce. This situation is mainly a result of inadequate information exchange within the agricultural food system. With mobile penetration at about 68 per cent and internet penetration at 28 per cent (Manyinka et al. (2013) in Oluwatayo and Ojo (2019)), ICTs can play a critical role in improving food security in Nigeria.

This paper, therefore reviewed the role of information and communication technologies in promoting household food security in Nigeria. The article reviewed the role of ICT in promoting food security, challenges faced by households in the utilization of ICT, and the approaches for enhancing the use of ICT by families for promoting food security. Conclusions and recommendations were drawn from the review.

Conceptual clarification

Information and communication technology

Information and Communications Technology (ICT), according to Yekini (2014), is a specific term that stresses the role of unified communications and the integration of telecommunications, computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information. According to Norad (2002), ICT represents the collection of hardware and software used to produce, prepare, transfer and store data via devices such as computers, radios,

televisions, among others. For Oluwatayo (2014), Information and Communication Technology (ICT) refer to technologies used for a wide range of activities especially for generating, collecting, sharing, and transmitting information.

Amy (2012) defines ICT as tools that “capture, store, process, share, display, protect, and manage information. According to Asenso-Okyere and Mekonnen (2012); Cynthia *et al.* (2016) cited in Oluwatayo and Ojo (2019), ICT includes hardware, software, media for collection, storage, processing, transmission and presentation of information through the computer, internet, CD-ROMS, e-mail, telephone, radio, television, video and digital cameras, among others. Kudayeva et al., n.d. in Hafeez et al. (2008), defined ICT as information and communication technologies present in a set of methods, engineering processes, hardware and software combined for collecting, processing, storing, distributing, displaying and using data for its users.

Obayelu and Oyunlade (2006) classified ICTs into New ICTs, old ICTs, and very old ICTs. The new ICTs according to the authors include computers, satellites, one-on-one connections, mobile phones, the internet, e-mail, the web, internet services, video conferences, CD-ROMs, personal computers (PC), distance control systems, informational-geographical systems, global positioning systems (GPS), electronic cameras, databases, among others. The old ICTs are the group that includes radios, televisions, telephones, and telegraphs, audio and video cassettes, films and slides. In contrast, the very old ICTs comprise of newspapers, books, photo albums, posters, theatre, human interactions, markets and plays. These can be used to create awareness and disseminate message in the food production and distribution value chain with a positive impact on food security.

Food security

Food security is a concept that has been variously defined by different authors. Still, a fact that tends to remain sacrosanct among all the authors is that the idea of food security connotes food availability, food accessibility and food utilization (Bakhtiari and Haghi, 2003). According to Clapp (2016), food security is an inevitable element for all aspects of human endeavour. The importance of food security made the United Nations include it as a component of the sustainable development goals which officially came into force on January 1st 2016 as the successor to the Millennium Development Goals. Sustainable Development Goal 2 aims to end hunger and ensure access to sufficient, safe and nutritious food by all people all year round (FAO, 2015; United Nations, 2017). According to CTA (2005), FAO (2001) and FAO (2016b),

food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. A household is said to be food secure when all members of the family have access to good quality food in the right quantity and time. Time here is the essence because prolonged absence of food may result in irredeemable damages. According to Mbow et al. (2019), 'all people at all times' implies the need for equitable and stable food distribution, including the need for inter-generational equity, and therefore sustainability in food production. 'Safe and nutritious food for a healthy life' implies that food insecurity can occur if the diet is not nutritious, including when there is the consumption of an excess of calories, or if food is not safe, meaning free from harmful substances. For Temu and Msuya (2004), food security is the guarantee of the physical availability of and economical accessibility to sufficient food in terms of quantity and quality while cultural admittance for all people at all times means having healthy and active lives to preserve human places and degrees. In the context of this review, food security is the ability of a household to access the right quantity and quality of food required for all members at the right time and form. It calls for the promotion of all pillars of food security which include availability, access, utilization, and stability (FAO, 2016a).

Household

The term household describes people living together under the same shelter. The United Nations (2017) defined a household as a group of persons who make the same provision for food, shelter and other essentials for living. It is a fundamental socio-economic unit in human societies and occupies a strategic position in the national economic development of a nation. Glewwe and Grosh (2000) described a household as a group of people who live together, pool their money, and eat at least one meal together each day. Whenever a government contemplates vital decisions relating to demographic, social and economic processes, the household becomes a reference point. Critical decisions about childbearing, education, health care, consumption, labour force participation, migration and savings are based on families.

A household, is therefore, a group of people who usually live and eat their meals together in the family. Members must acknowledge the authority of one person as head of household, and that person must live with the rest of the family members. The persons may be related or not, living under the same roof, under the responsibility of a head whose authority is acknowledged by all the members. The ordinary household is composed of a head of the family, his spouse(s), his unmarried children,

and possibly his relatives or other persons to whom he is unrelated. The household can be limited to only one person or a person with his children. Considering the critical position of the household in the society, food security at the household level automatically translates to food security at the regional, national and international levels.

Role of ICT in promoting food security

Information and communication technology finds relevance in all aspects of the food system and the agriculture production value chain. According to Zyl et al. (2012), cited in Oluwatayo and Ojo (2019), ICT finds application in three significant aspects in the food production value chain. These are the pre-cultivation, crop cultivation and post-harvest stages. According to the authors, ICT is deployed at the pre-cultivation stage in crop selection; land selection based on soil analysis, topography among others; calendar definition in the planning of farm operations based on weather, activity and season; access to credit and access to input markets, among others. At the second stage, ICT can be used for land preparation and sowing, input management, water management and fertilization and pest management. The third stage involves marketing, transportation, packaging, food processing, among others. Research by CTA (2017) shows that the benefits of using ICT in promoting households' food security are huge as ICT supports collaboration and cooperation among different stakeholders which promotes agriculture sustainability.

Specifically, ICT plays the following roles in enhancing household food security:

1. Promote information dissemination: According to Mensink and Vranken, (2017), ICT plays a crucial role in enhancing market access to the rural population who live in isolation, with limited access to communication technologies. According to Lashgarara et al. (2010), ICT has the potential for improving food security by enabling access to information and information dissemination on food production, market, input use, food processing and storage, food supply and consumption. Even illiterate farmers can access agricultural message in books through visual means. Olaniyi and Ismaila (2016) posit that Information and Communications Technologies (ICTs) enable easy and rapid access to reliable information to households and farmers, especially on food security dimensions. This is so because ICT facilitates information dissemination to rural farmers at low cost, which promotes agricultural productivity. Arjan (2009) note that improving access to information reduces transport and trade costs which is crucial in promoting

trade and food security.

2. Promote significant linkage in the food system: The activity of all stakeholders in the food system depends mainly on effective information dissemination within the food production value chain. The food system according to Mbow et al. (2019), encompasses all the activities and actors in the production, transport, manufacturing, retailing, consumption, and waste of food, and their impacts on nutrition, health and well-being. The activities of the actors in the food system lead to outcomes such as food security and affect the environment. When there are adequate information exchange and coordination within the food production system, productivity is enhanced, while wastage is reduced, thus enhancing food security.

3. Promotes technological advancement in agriculture: ICT is primary driver of technological advancement in agriculture, as evidenced in such fields as bioinformatics, farm automation and precision farming. Bioinformatics is the field of science that combines information technology and computer science with biology. Precision farming, or precision agriculture, is a technique that uses technology to collect and analyze data for the assessment of variations in soil or climate conditions, to guide the application of the good agricultural practices, in the right place, in the right way, at the right time. Farm automation involves the use of control systems, such as computers, to derive higher yields with more predictable results through farming processes that are more efficient, less labour intensive and less time-consuming.

4. Helps in stabilizing prices of food produce: Empirical evidence suggests that, in the area of agricultural production, costs of inputs such as seeds, fertilizers and pesticides are the most frequently telecommunicated information. The telephone (mobile or fixed-line) is the communications technology most commonly used by farmers. Knowledge of variations in input prices will enable food producers to acquire inputs at the best possible prices and reduced cost of production.

5. Helps in educating the populace and enhancing efficient networking: The critical ICT applications for addressing malnutrition relate to educating personnel and enabling efficient networking. Food insecurity and vulnerability information and mapping systems are increasingly used to assemble, analyze and disseminate profiles of food insecure and malnourished groups: who they are, where they are, and why they are at risk (Olaniyi and Ismaila, 2016). This will promote equitable distribution of food and reduce localized cases of food shortage.

6. Creates a link between the food system and the

markets: ICT helps to link the food production sector to the market at local, national, regional and international trade systems. According to Bello (2014) and Mensink and Vranken (2017), ICT provides a platform for market networks that link sellers to buyers. ICT enhances the potential to search for information and increase the quantity and quality of knowledge available, ultimately reducing uncertainty and enhancing market participation. A study by Olaniyi and Ismaila (2016) on ICT and households' food security in Nigeria confirmed that ICT improves household's food security by connecting rural agricultural families to markets and other agriculture stakeholders in the supply chain. Mago (2012) shows that rural farmers travel long distances in search of market. Access to ICT services, therefore, enables household members to obtain better prices and access to better market opportunities (FAO, 2011).

7. Enhances equity in the distribution of food products: where agricultural products are unequally distributed, shortages occur; and where transportation systems are inadequate to bring sufficient food into the deficit region, or where people are unable to access food or afford the costs of the food provided or imported for their needs, critical food shortages and even famines occur. The availability of adequate information is an effective means of averting such situations. According to Olaniyi and Ismaila (2016), knowledge of the variability of food production is needed to plan accumulations of food stocks. Further, the difficulties of moving food into isolated regions will abate if the limited transportation facilities are more efficiently utilized. The costs of food imports will be lower if there is sufficient time to purchase food in regional or world markets and to arrange for inexpensive shipment to areas of food shortage.

8. Facilitates effective policymaking and intergovernmental collaboration: Poor policy decisions are one major factor contributing to food insecurity. Food insecurity sometimes happens because the food is not where it is needed, not because of the shortage in global supply of food (Oluwatayo and Ojo, 2019). Food security depends on the availability of food, physical and economic access to it, and the physiological utilization of nutrients. Ensuring food security is a complex task involving agricultural, nutritional, gender and technological issues. Thus it requires the intervention of various ministries within a country and a streamlined and well-coordinated flow of communication between them.

9. Monitoring and forecasting of climate, weather and crops: the Climate Change Adaptation and ICT (2016), observed that, the use of ICT makes it possible to create a climate information system for farmers to gain access to communications on risk prevention and mitigation, and

daily weather forecasts. Through ICT, farmers can monitor and forecast climate, weather and crops; integrate forecasts with strategic preparation and response among others.

10. Promotes an integrated agricultural monitoring system: ICT makes it possible for farmers to make crucial decisions in the production system. According to Mensink and Vranken (2017), farmers can be able to make predictions on crop yields and the effect of climate change by combining satellite data and social - economic data. They can easily plan for a cropping season, monitoring and responding to a cropping season in progress, and managing the harvest (Economic and Social Commission for Asia and the Pacific, 2008). ICT is fundamental in providing farmers with useful messages on weather reports and crop prices, as well as in educating them about new farming techniques.

11. Promotes nutritional status of households and contain malnutrition: ICT help create awareness on nutrition - related issues which guide families on the choice of food items to consume. According to the technical centre for agriculture and rural cooperation (CTA) (2017), ICT provides avenues for reducing malnutrition and improve health by encouraging consumption of highly nutritious foods.

12. Promotes timely delivery of grants and aids to farmers: ICT has the potentials to enhance convenient and cost -effective transactions along the supply chain with limited travels. It is to reduce time spent on off - farm activities and create more productive work hours on the farm. According to Mensink and Vranken (2017), financial institutions are able to access timely feedback from farmers on loans, and other services on a timely and cost - effective manner. Lashgarara et al. (2010), summarized the roles of ICT in enhancing food security to include: increasing production of agricultural products; providing information about food; improving rural and farmers' power of management; helping to ensure agricultural inputs; providing feedback about the planting and harvesting of farm products; improving agricultural product marketing; improving decision – making; representing educational – sanitary services; and decreasing costs. Others include job creation; informing farmers about market policies; transferring technologies and new methods; improving interactions and communications; facilitating the acquisition knowledge and consideration to clientele needs.

In conclusion, Olaniyi and Ismaila (2016) explained that ICT could meet the information needs of the locals by disseminating the acquired knowledge and skills, which could abate the challenges, faced at achieving food

security and promote increased agricultural production, awareness and sharing of communication that will eventually improve the chances of food security for all. Chowdhury (2001) identified the relevance of ICTs as regards to food security and poverty reduction to include making information available on food security dimensions, marketing of produce and help farmers to make rational decisions. The capacity of ICT on food security is related to improving communication between research systems, farmers and extension, improving ease of access to information concerning inputs, introduce technologies, provide more rapid right to use high quality information, ensure information about the suitable times and places for optimized sales of agricultural products, increase farm yields and decrease farm product losses (Temu and Msuya, 2004).

Challenges to the utilization of information and communication technology for promoting food security

In spite of the enormous benefits and prospects of ICT in promoting food security, this has not been fully realized in sub -Saharan Africa in general and Nigeria in particular, due to several challenges. There is generally low level of ICT literacy among the Nigerian populace. According to Bello and Aderbigbe (2014); Olaniyi and Ismaila (2016), the rural population has fewer skills and knowledge in utilizing ICT compared to urban population. Since most of the food production activities take place in rural areas, low ICT literacy will affect information dissemination and agricultural productivity with an adverse effect on food security.

Danaan (2006) noted that high level of illiteracy and lack of technical know-how among farming population account for sub - optimal utilization of ICT in fostering food security. According to the Technical Center for Agriculture (CTA, 2004), illiteracy hampers versatility in the use of ICTs, making the number of farmers who use these technologies few and far below expectation. According to Mboho (2007), this limits the ability of farming households in using the modern technologies effectively to promote food security dimensions.

According to Mensink and Vranken (2017), the role of ICT in promoting households' food security is hampered by high cost, low connectivity, limited capacity and content, especially in rural areas. Showole and Hashim (2014) identified poor connectivity, lack of relevant content, lack of ICT infrastructure and skills, high cost, inefficient and poor quality service, as the significant impediments for effective utilization of ICT in the food production value chain. Manu (2002) identified a low level of ICT readiness of not only the research and extension organization but indeed of the developing countries

themselves as challenges. Other challenges include high-level rural poverty and high-level illiteracy of farmers and computer researchers and extension. Al-Alwani (2005); Albirini (2006); Ghavifekr et al. (2016) identified little access and network connection, limited technical support on ICT, and lack of adequate training, among others as challenges.

Approaches for enhancing ICT utilization in promoting food security

It is undoubtedly true that convincing information exchange among stakeholders - the Government, private sector, the academic community, farmer organizations, research institutions, non – governmental organizations and civil society will go a long way to ensure stability in food production and distribution. Stability in food production can only be achieved integrating ICT into the food system and agriculture production value chain, and the capacity of stakeholders, mainly rural household, to access and utilize various ICT tools. According to the Economic and Social Commission for Asia and the Pacific (2008), governments at all levels should ensure that: a sound, market-oriented ICT regulatory framework is provided for the ICT sector: provide regulations and conditions that motivate operators to serve regions where it is economically unfeasible but socially desirable for them to do so; create incentives and conducive environment to encourage investor and donor involvement in ICT infrastructure development; introduce common standards and ICT-based monitoring and forecasts; and support research institutions and other nonprofit organizations that use ICT tools to assess and transmit commodity prices, thereby allowing markets to emerge.

The provision of support for ICT use to increase the efficiency of knowledge systems in the context of agricultural production, and support for intermediate organizations in terms of transferring knowledge from global or regional levels to local levels is necessary to ensure stability in food supply. In most countries, it starts with the integration of agricultural extension services into knowledge systems; and create initiatives that combine existing media channels, such as rural radio stations, with ICT to match potential local demand with global content, and to distribute the information widely in the relevant languages. Al-Alwani (2005) and Albirini (2006) supported the development of infrastructure, especially in rural areas where agricultural activities take place. Mensink and Vranken (2017), called for ICT literacy programmes and building the economic potentials of families and producers to access and utilize ICT in seeking information relating to the production, distribution and marketing of food products. Bello and Aderbigbe (2014); Olaniyi and Ismaila (2016), noted that the rural

dweller need update on the knowledge and skills relating to ICT since they have lower skills compared to their urban counterparts.

Highlights

- 1 Information and communication technology plays a significant role in promoting household and national food security.
- 2 The role of ICT in promoting household and national food security in Nigeria is constrained by a number of factors: including high cost of ICT infrastructure, low connectivity in terms of coverage and internet bandwidth, limited capacity and infrastructure, low skills in internet utilization among others.
- 3 The development of ICT infrastructure, enhanced internet coverage and bandwidth, information exchange among stakeholders can contribute enhanced food security at the household and national level.
- 4 The recommendations of this review will help inform policy and decision making to overcome food security problems in the country.

Conclusion

The effective use of ICT to connect food production system actors has shown great promise in improving food security through timely dissemination of news, distribution of food and reduction of food waste. All pillars of nutrition – availability, accessibility, utilization and stability are strengthened when people become aware of the when, where and how questions of food security. These questions can only be answered through appropriate knowledge sharing, enabled by the effective use of ICTs.

Recommendations

Based on the review and the conclusion, the following recommendations were made:

1. ICT infrastructure such as electricity, internet facilities and computers should be developed in both rural and urban areas to facilitate effective information dissemination.
2. Training programmes should be organized by relevant government ministries and agencies, non - governmental organizations etc. to enhance the capacity of stakeholders in the utilization of ICT
3. The capabilities of agricultural extension agents and nutrition - based extension agencies should be improved to facilitate collection, collation, and dissemination of messages to stakeholders in the food production system.

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