The Effect of ICT on Households' Food Security in Uganda. Evidence from Acholi Sub Region in Northern Uganda

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Abstract

According to the Global Food Security Report (2017), about 108 million people are food insecure all over the world, and the situation is likely to worsen. It is estimated that by 2050, 9.1 billion people worldwide will be food insecure (FAO-UN, 2010). ICT is known for promoting food security in rural areas through access to information (Olaniyi, 2016). An investigation of ICT usage on households' food security is therefore paramount.

The study aimed at investigating the effect of ICT utilization on households' food security in Uganda, with evidence from Acholi Sub region. The study employed a cross- sectional and descriptive research design through quantitative and qualitative research approach. Data was obtained with the help of 380 questionnaires, Focused discussion guide, documentary review and observation checklist. Results shows that on average 18.2% of the households in Acholi sub-region use ICT tools to access food security information while 31.9% do not use ICT tools for food security information. It was also found that the majority of the households' access information through the available Local FM radios followed by mobile phones. Findings also indicate that utilization of ICT tools in accessing food security information improves households' food security status by 38%. The study recommends more development of ICT infrastructure in the region to increase access to information for households' food security.

Key words: *Food Security, Food Supply, ICT, Acholi Sub-Region, Uganda*

Introduction

Food security is essential for all aspects of life (FAO-UN, 2010; Clapp, 2016). Due to its significant impact on human wellbeing it has continue to gain more attention in the recent years. In 2014, food security was incorporated into the Sustainable Development Goals for the post 2015 development agenda (FAO, 2015). In 2016, the common of science and technology for development selected "the role of science, technology and innovation in ensuring food security" by 2030 among its top two priority areas (UN, 2017).

The current state of global food security crisis raises serious concerns as the number of people who are food insecure had surpassed 108 million people worldwide by 2016 and emerging trends are further threatening global food supply (FSIN, 2017). In Uganda 80% of households has no access to market information for improve their food security situation.

One way to improve households' food security is to promote ICT to increase information flow in rural areas for market access. ITU (2009) shows that ICT plays a key role in promoting information flow for market access to the rural population who lives in isolation, with limited access to information and advanced technologies (Mensink &Vranken, 2017).

ICTs offer platforms for social economic transformation and enable farmers to be innovative, participate at all levels of the value chain, and empower themselves by getting access to information on production, market, and consumption (CTA, 2017). According to Olaniyi (2016), low access and adoption of ICT keeps marginalized groups uninformed with low levels of household food security. Although the effect of ICT on food security has been demonstrated by several researchers worldwide, little attention has been put to understand the effect of ICT on households' food security in Uganda, specifically Acholi Sub region.

Background

About 108 million people over the world are suffering from food security crisis, 50% eat nutritionally inadequate diet, and one out of nine people suffer hunger and malnutrition (World Economic Forum, 2017; CTA, 2017). According to FSIN (2017), the number is likely to grow to 9.1 billion by 2050. In Africa, the number is more alarming. For example, in West Africa, 6.3 million people are experiencing food insecurity. According to the Uganda National Food security Assessment report (2017), 11 million people are experiencing acute food insecurity, and Acholi Sub region is listed among the most affected regions in the country. The situation is predicted to worsen if ICT infrastructures are not improved.

Researchers have shown that food insecurity results mainly from unequal distribution of resources and information (Clapp, 2012; Sen, 1981; Schutter, 2014). According to the international covenant on civil and political rights article 19, all people should have a right to access information. In 2016, UNESCO marked 28th September a day for world Universal access to information (CIPESA, 2017). Access to market information is significant in improving food security especially when information on production, risk and uncertainty prevention in agriculture is provided along the supply chain. ICT provide a platform to improve food security by enabling access to information and information dissemination on food production, market, input use, food processing and storage, food supply and consumption (Lashgararara, 2010). ICT tool like mobile phones reduce the time and cost of accessing information, and enable easy and fast transfer of money from one person to another. In South Asia, Sub Saharan Africa, and North America farmers have been encouraged to use extension models and personal models of assembling and dissemination of information through mobile phones and internet for cost effective innovations in agriculture. Illiterate farmers access agricultural information in books through visual means (Borish, 2016). In India, farmers' access agriculture extension services using an electronic device called e-sagu using their mobile phones (Cheripelly and Chand, 2015).

Nevertheless, ICT is not fully embraced in many low developed countries including Uganda mainly because of the differences in social classes. Majority of the small scale farmers in rural areas face a challenge of inadequate information flow. Rural population has less skills and knowledge in utilizing ICT compared to urban population (Bello, 2014; Olaniyi, 2016). Further, while the UN suggest internet as an important tool for accessing information(CIPESA,2017), tapping opportunities of ICT in enhancing households' food security is constrained by low connectivity, high cost, limited capacity and content especially in rural

areas, affecting the adoption and scaling up of ICT especially in rural areas (Mensink & Vranken, 2017). Local FM radios and mobile phones are key tools used in accessing information in Africa. Internet subscription is still very low at 21% in Uganda, 32% in Tanzania, 33% in Rwanda, and 30% in Kenya (World Bank, 2017). In Acholi sub region, only 12.3% of the people in Acholi Sub region have access to computers (Achora, 2015).

Although there have been several studies on factors affecting households' food security in Uganda little has been done to explore the effect of ICT on households' food security, particularly in Acholi sub region. This study was thus aimed at investigating the effect of ICT utilization on households' food security in Acholi sub region.

The Problem

Food security is vital for the survival of individuals, families, nations and ultimately for a healthy life (FAO, 2015). Yet in Acholi sub-region, food decline is on the increase with 50% of the population largely food insecure, accessing only one and half meal in a day (IPC report, 2017). The report stressed that 85% of households in the region who depend on their own agriculture food production and other non-agricultural livelihoods rely solely on traditional knowledge to make decisions in accessing food, planting seeds, harvesting, managing livestock, predicting weather patterns and droughts situation, hence causing food insecurity. According to Olaniyi (2016) Information and Communications Technologies (ICTs) enable easy and rapid access to reliable information to households and farmers especially on food security dimensions. It was unclear whether the population in Acholi sub region utilizes ICT tools or services to strengthen food security at the household level.

The study was therefore, to investigate the impact of ICTs on households' food security in Acholi sub region with particular emphasis on availability and utilization of ICT tools for food security information. The study was conducted in 2017 and findings are presented in the proceeding sections.

Objectives of the study

The purpose of this study was to investigate the effect of ICT utilization on households' food security. Specifically, the study aimed at;

- Examining availability of ICT tools in Acholi Sub region
- Investigating utilization of ICT tools in accessing food security information in Acholi sub region.

Conceptual and theoretical overview

Food security

Food security is as "a situation when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" Food security is conceptualized on four dimensions; Food availability, Food access, Food stability, and Food utilization (FAO, 2002).

ICT and Food security

ICT refers to technologies that allow handling and communication of information. These include hardware technologies and software technologies. According to NPCC (2017), ICTs are processes, applications, and equipments used to organize, store, analyze, present, and disseminate information. Amy (2012) define ICT as tools that "capture, store, process, share, display, protect, and manage information".
Traditionally, personal networks, extension services, radios, televisions, and print media were important tools of communication for rural community transformation. Information flow was mainly one sided from the sender to the receiver (RIU, 2011). These were however limited in coverage, timely deliverance of information, cost effectiveness, and interaction.

Inadequacies in old communication channels encouraged more innovations in ICT, resulting into a new group of ICT technologies mainly using electronic Medias such as mobile phones and computers. New ICTs encouraged a participatory approach where communication and information flow was two sided (RUI, 2011). Nevertheless, the new approach does not provide for class differences. Interactions of old and new communication channels can however create a big impact in promoting households' food security (Olayini, 2016; Bello, 2014; Lasagarara, 2010).

With the gradual innovations in new technologies, ICT is predominantly gaining ground in reducing food insecurity worldwide. UN and several multilateral agencies like the World Bank and African Development Bank have embraced the idea of fighting food insecurity through satellite data and Geospatial information management system using mobile phones and the internet. These have provided a platform for improving agriculture productivity and reduce the impact of climate change on agriculture production. Farmers are also able to make predictions on crop yields and the effect of climate change by combining satellite data and social economic data (Mensink&Vranken, 2017).

Though Geographical information systems and global positioning systems, farmers are able to map and monitor the quality of soil nutrients, and food production. Combined with satellite images and drones, farmers are able to predict crop yields and the level of pest and crop diseases in the soil (Mensink&Vranken, 2017). Through use of ICT, climate information systems have been created to allow farmers access information on risk prevention and mitigation and weather forecasts on a daily basis using SMS via cell phones, internet, and radio channels in case of illiterate farmers (Climate Change Adaptation and ICT, 2016). This encourages sustainability and profitability in the agriculture sector (UTI, 2009).

Through mobile phones, farmers are able to access extension services via community knowledge workers through SMS. Community knowledge workers access agriculture extension information through cloud computing. SMS text messaging have also become popular in dissemination and exchanging information on agriculture production, market, weather forecasts, and markets amongst farmers and agriculture stakeholders(Kreep,2011). In Uganda, the Technical Centre for Agriculture and Rural Cooperation (CTA) provide farmers with information on sowing, planting, irrigation, application of fertilizers, pests and diseases, and weather forecasts using mobile phones and internet (Mensink&Vranken, 2017).

Agriculture and food security research has been made easy using ICT. Through several data systems like the geographical Information system, drones, and satellite data systems, a number of agriculture data sets can be created. Such information is used by different organizations such USDA, FAO, to analyze, exchange and make forecasts on crop yields, pests and diseases, soil types, land location, input use and nutrition. Data collection on a number of agriculture variables is easy, timely and cost effective. Farmers are encouraged to send specific information to the researchers using SMS text messages via their phones (Mensink &Vranken, 2017).

Short term productivity information systems combining both metrological and data on value addition have been made available to address challenges of risk and uncertainty in agriculture resulting from pests and diseases, floods, and climate change on several radio channels around the world. FAO rural radio in Africa is significant in providing information on environment and farming conditions to farmers (UTI, 2009; Mensink &Vranken, 2017).

ICT provides huge benefits in creating access to markets. Through Radios, mobile phones, Televisions, and website portals, households get information on market prices, which reduce uncertainty and exploitation of smallholder farmers especially by the middle men. ICT further provides a platform for market networks that links sellers to buyers (Bello, 2014; Deniva, 2014; Mensink &Vranken, 2017).

Different national and international organizations such as World food organizations, FAO stat, and CFSVA are able to monitor, predict and communicate information on food production, shortages, and emerging situations. UTI (2009) shows that mapping and monitoring agriculture production and shortages is a step to achieving food security.

ICT provide avenues for reducing malnutrition and improve health by encouraging consumption of highly nutritious foods. Through mobile phones and internet, households can access nutrition information on all food types. It is now possible to locate or search for any information on food calories, and intake (CTA, 2017). According to Yagos et al., (2017) ICT has made it easy to access e consultations, and referrals for better health.

Mobile Money Transfer using ICT have been invented and used in worldwide to make timely and cost effective transactions along the supply chain with limited travels. Kirui et al., 2012 shows that mobile money transfer can increase agricultural commercialization by 37%. Financial institutions are able to access timely information from farmers on loans, and other services on a timely and cost effective manner (Mensink & Vranken, 2017).

Literature review

Availability of ICT tools for Households' food security information

Rebekka (2015) in India found that mobile phones followed by televisions and radios are widely available ICT tools in faming households. Similarly, Olaniyi(2016) and Agwu(2014) made the same observations in Nigeria, These studies were however based on samples on only farmers, and seems to suggest that availability of ICT by farmers have a big impact on agricultural production and food security. The view is similar to Kuchrik(2011) who suggested that ICT promotes agriculture productivity in farming households.

Conversely studies such as Mtega (2012) in Tanzania, Ninsiima(2012) and Farm radio (2011) in Uganda suggest that radios are widely available ICT tools for accessing information by the households. According to Mtega majority of the studied respondents owned a portable radio for accessing information. Other sources of information included news papers, television, and cell phones are key sources of information in Tanzania. Findings by farm radio also suggested that 76% of the households in Africa, and 70% in Uganda own a radio.

The above studies seem to suggest that use of computers and internet in accessing information on agriculture and food security is inadequate. A finding by Ninsiima (2012) confirms this statement. Such finding suggests that low use of computers by households to acquire agriculture and food security information. Nevertheless, Fan Yang (2016) in his study on the influence of ICT on Agricultural development in China suggest a positive trend in use of internet and computers for agricultural information.

Utilization of ICT to access food security information

Studies carried out by Katalyst (2012) in Bangladesh, Fan yang (2016) in China, Aluvoric (2016) in the global south, Olaniyi(2016) in Nigeria, Anselme(2012) and Farm radio(2011) in Uganda shows that farmers use ICT to access agriculture information. The findings of these studies suggest a positive relationship between use of ICT and agricultural productivity for households' food security. Through radios, farmers are able to acquire knowledge on several agricultural practices, weather forecasts, prices, and available markets. Lashgarara (2010) shows that in Iran, rural households use mobile phones to interact with other agricultural stakeholders, access information on markets, prices, and be part of different agricultural programs on old technologies. Through mobile phones, farmers are able to coordinate

through the supply value chain. According to Anselme (2012) ICT connects smallholder farmers to markets and access farm inputs via their phones. Study by CTA (2017) shows that farmers are able to access information on nutrition and health through mobile phones via sms, emails, and phone calls. In Malawi, such practice has managed to reduce the level of malnutrition. The same study shows that ICT makes use of statellite data very easy. Farmers are getting extension services, information on prices, input use, and pests and diseases. In India, it is evidenced that use of satellite data has increased agricultural productivity by 40%.

While mobile phones are predominantly becoming major communication channels in rural areas, (Lasagara,2010; Yaghoobi,2011; and Bello, 2014) suggest an interactive approach of both the old and new communication channels for a more comprehensive impact. Fan yang (2016) found evidence to suggest that households interact new and old technologies to create a greater impact on agricultural productivity and food security. The study indicated 71.3% of the households' access internet using mobile phones.

Effects of ICT utilization on households' food security

A study by Olaniyi et al., (2016) on ICT and households' food security in Nigeria confirmed that ICT improves household's food security by connecting rural agricultural households to markets and other agriculture stakeholders in the supply chain. Research by CTA (2017) further shows that the benefits of using ICT in promoting households' food security are huge. ICT supports collaboration and cooperation among different stakeholders which promotes agriculture sustainability. ICT promotes farmer's participation and self-empowerment, access to extension services, finance and trade. It enables tracking of progress, identify gaps, and create awareness for workable solutions.

Kuchrik(2011) found that ICT facilitates information dissemination to rural farmers at low cost, which promotes agriculture productivity. He further revealed that integrating ICTs like phones with other information systems such as the Geographical Information System assist in distribution of food by locating food surplus and deficit areas which promote household's food security.

Mago (2012) shows that rural farmers travel long distances in search for markets. Arjan (2009) note that improving access to information reduces transport and trade costs which is crucial in promoting trade and food security. Access to ICT services enable households to obtain better prices and access to better market opportunities (FAO, 2011). A study by Anselme(2012) further revealed that access and use of mobile phones improve agriculture productivity by linking smallholder farmers to markets. Through mobile phones, household farmers are able to access market information enabling them to acquire farm inputs and sell their output.

Chorudhmy (2001) further shows that internet covers a broader area than mobile phones and thus combining mobile phones and internet can present more reliable results in addressing households food security.

Methodology

Study area

The study was carried out in Acholi sub region. Acholi sub region is found in Northern Uganda. The region comprises of eight districts, with a population of 1,580,300 people. Acholi sub region is bordered by Karamoja Sub region in the East, West Nile Sub region in the West, South Sudan in the North, and Lango Sub region in the South. The region is about 28,278 sq.km with a latitude of 4o 12" N, 1o 29" S, and longitude of 29o34" E, 35o0" W. Agriculture is the main activity and source of livelihood in the region with about 85% of the population engaged in farming (IPC, 2017).

Sampling technique
The study population comprised of households, market vendors, market representatives and local and district markets.

The study used probability sampling technique. Both simple and purposive random sampling techniques were employed. Simple random sampling was applied in the selection of households while purposive sampling was used in the selection of districts, Sub counties, parishes, and villages. In addition, systematic and stratified sampling was used to select sample fractions and select study samples from the selected study areas population.

Methods of data collection
Data was collected from primary sources using quantitative and qualitative tools of data collection.

Analytical techniques
Data analysis was majorly descriptive supplemented by inferential statistics from regressions using SPSS. Variable were measured using a five likert scale presented from rated 1 up to 5, for Strongly Agree, Agree, Strongly Disagree, Disagree, and not sure. To categorize households into food security and food insecurity, scores were aggregated into a binary score of 1=food security, and 0= food insecurity. Minimum and maximum scores were used as a yardstick to distinguish between food secure households and non food secure households. Categorization of households was however based on average of binary aggregates.

Regression Model
The effect of ICT on food security was analyzed using Ordinary Least Square (OLS) regression.
$\text{Log Fs} = \beta_o + \beta x_i + e_i$
Where Fs is households' food security, and βx_i is ICT utilization.
The effect of geographical variation on use of ICT and households' food security was examined by regressing information on urban and rural areas individually.

Results and discussions

The purpose of this study was to analyze the effect of ICT utilization on households' food security in Acholi Sub region. Specifically, the study examined the level of households' food security in Acholi sub region; utilization of ICT in Acholi sub region, and how this affects households' food security.
The results of the study are presented according to personal profile of respondents; utilization of ICT tools; and the effect of ICT on households' food security.

Personal profile of respondents
Data was collected on six households' personal characteristics (Gender, Age, Education, Occupation, Household income, and household size).
Overall, 58.9% of the respondents reside in rural areas, while 41.1% live in the urban areas.
Findings on personal characteristics show that 53% of the respondents were female and 47% were male. Majority of the respondents surveyed (62.4%) were youth between the ages of 18-35. This is consistent with UBOS (2016) findings indicating that over 50% of the population in Uganda is youth. The biggest number of survey respondents (42%) was secondary school drop outs. Farming (50%) followed by business (16%) were main occupations of survey respondents. According to IPC (2017), more than 80% of the population in Acholi sub region is engaged in agriculture as the private sector is still very weak. Average household size was 1-2 members (60.5%), while many of the respondents (26%) earned below Sh.50, 000.

Availability of ICT tools in Acholi sub region

The study investigated availability of ICT tools and the results are presented below;

Table 1: Availability of ICT tools

ICT tool	Frequency	Valid Percent	Cumulative Percentange
Valid Phone	212	57.3	57.3
Radio	56	15.1	72.4
Computer	3	.8	73.2
None of the above	99	26.8	100.0
Total	370	100.0	

Source: survey data

Results on table 1 above shows that cell phones (57.3%) are the most available ICT tools used to access information in Acholi sub region followed by Radios (15.1%), and computer (0.8%). Meanwhile, 99% of the respondents indicated no ownership of any of the mentioned ICT tools under study. The findings thus reveal that cell phones are major ICT tools used for communication and accessing information. The results conform to (Owen,2008; Olaniyi,2016) findings that mobile phones are common means of accessing information in low developed countries especially in rural areas and use of internet is still very low. A study by Achora (2015), revealed that majority of the people in Northern Uganda use phones (75% of 402 respondents surveyed), while very few 12.3% out of 397 surveyed use computers.

Across examination of availability of ICT tool by location showed that while phones are widely used in both urban and rural areas, the number is more in urban areas by 2% than in rural areas. Conversely, radios are widely used in rural areas by 25% than in urban areas. Bartholomew (2011) shows that majority of the Ugandans in rural areas use radios than mobile phones compared to urban households. Also, out of all households with no ICT tools, the number is more in rural areas by 56% than in urban areas. This could be explained by the high levels of poverty in rural areas. This may be explained by the high rate of poverty in rural areas.

Utilization of ICT for accessing food security information

Findings shows that on average, 18.2% of the households in Acholi sub region use ICT tools to access food security information while 31.9% use ICT for other purposes and not accessing information on food security. The results further suggest that radios are most used ICT tools to access information followed by mobile phones. The results therefore suggest that the use of ICT to access information on food security is still inadequate in Acholi sub region. Most of the information on agriculture and food security is disseminated and shared through radios. Further, use of modern ICT like computers, internet, and mobile phones to access and share agriculture and market information is also still very low. This is evidenced by the fact that on average only 0.4% of the studied respondents used computers to access market information and majority (44.6%) do not use computers to access market information.

Effect of ICT on households' food security

Correlation results show a weak positive relationship of 0.38 between ICT utilization and Food security at a probability level of of 0.000 established at 5% level of significance. R2 of 14% confirms this weak relationship implying that ICT utilization only accounts for 14% of the factors affecting households' food security in Acholi sub region. The results however confirm the hypothesis that ICT utilization influence households' food security and rejects the alternative of no effect. The t statistics and p value of <0.05, Cl.95 (.251, .417) further indicates that ICT significantly influence households' food security and is a good predictor of household's food security in Acholi sub region. The findings are similar to the

findings of Olaniyi and Kayode(2016) showing that ICT usage affects households' food security in all the dimensions.

Further, coefficient results of the form $\beta_1 = \delta \ln(FS)/\delta(x_i$ shows that a one unit increase in ICT utilization increase the probability of households' food security by 33.4%. Food security is predicted to be 1.707 when ICT is zero.

Table 2: ICT utilization and households' food security

Coefficients[a]										
Model	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part
1 (Constant)	1.707			13.760	.000	1.463	1.951			
ICT	.334	.042	.380	7.875	.000	.251	.417	.380	.380	.380

a. Dependent Variable:FS

Conclusion

Study findings show that Acholi sub region is experiencing household food insecurity especially in rural areas as majority of the households are farmers earning less than Sh.50, 000 per month.
Mobile phones and radios are major ICT tools for available for accessing food security information in Acholi sub region and availability of computers is significantly very low. Results however suggest a difference by geographical location. In urban areas, mobile phones are major ICT tools available for accessing information while radios are common in rural areas. Findings further indicate that households use available ICT to access agriculture and market information. Nevertheless, utilization of ICT in rural areas is still inadequate.

The study also concludes that there exists a weak positive relationship between ICT utilization and households' food security. This implies that besides ICT, there could be other factors affecting households' food security in Acholi sub region. The study therefore recommends further research on factors affecting households' food security to holistically tackle the problem of food security in the region.

Policy Recommendations

The study shows that use of computers is still very poor at 0.8%. Mawazo (2012) revealed that utilization of ICT in Uganda, particularly in rural areas is restricted by limited power connection and low internet connectivity. The study recommends an increase in investment in ICT infrastructure by both private and government sector.

Bello (2014), also shows that utilization of ICT in developing countries is still very low. This is confirmed by the study results showing that 27% of the respondents did not own any ICT tool for communication or accessing information. A likely explanation for this could be the high poverty levels and low community transformation especially in rural areas. Policy strategies should therefore be directed towards poverty reduction to facilitate the purchase and use of different ICT tools.
The study further recommends that the government reduce taxes on prominent ICT tools used to access food security information in a bid to reduce food insecurity especially in rural.
The government should create awareness on the importance of ICT in enhancing households' food security.

Government should invest in capacity building to ensure that the public appreciates the need for ICT facilities.
Ministry of ICT should decentralize its ICT investment fund to boost utilization of ICT at regional and sub regional level. Agriculture and food security information should be channeled through commonly available ICT tools like radios and mobile phones.

The researcher recommends that the Government, district authorities and development partners need to urgently promote and deploy appropriate ICT tools and services at each stage of the agricultural value chain including pre-cultivation, crop cultivation and post-harvest and harvesting to allow households access reliable agricultural information and increase food security in Acholi sub-region. If this is not subsequently done, many women and children are likely to die with hunger and uncontrolled diseases such as nodding syndrome will continue.

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