

The Impact of ICT in Sustainable Agricultural farming in Adamawa State Nigeria

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Abstract:

An agricultural activity has been a major source of livelihood in Nigeria, as many of its citizens depends on it for survival. In Adamawa State, about 70% its population depends on agriculture for their livelihood. ICT plays a significant role in in promoting agricultural activities, however there are some challenges faced by farmers when trying to make use of ICT. This study examines the issues of using Information and Communication Technology (ICT) in agricultural production in Adamawa State. The study sampled five selected local government areas in Adamawa State. A total of 370 respondents were selected at random across the selected LGAs. A five-point Likert scale questionnaire of 15 questions drawn from the research question was used as an instrument for data collection and it comprises sections A and B. Data collected were analyzed using descriptive statistical methods. The results of the study revealed that ICT contributes significantly in improving farmers' agricultural techniques, market information, yields a good quantity of crops and increases knowledge of herbicides and farming activities. The results of the study also revealed some of the challenges faced by farmers using ICT which include inadequate ICT facilities, high cost of ICT farming tools, poor eye sight due to age and lack of access to credit loan. Hence the study recommended that to fully harness and optimize the inherent positive externality of ICT investment in the Adamawa State serious effort needs to be invested in the area of education and training of farmers to adopt and apply ICT products across the value chains of agriculture, loan and grant should be made available to farmers to purchase ICT tools and equipment for crop farming, network service providers should also improve the quality if their services.

Keywords: Agriculture, Crop farmers, ICT, Impacts, Adamawa State, food security

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I. Introduction

It is important to note that Agricultural sector in Nigeria has been a major source of livelihood to many Nigerians, Most especially in Adamawa State. Even though with the present insecurity in northern Nigeria, farmers are finding it hard to farm owing to banditry and insurgency, Agricultural activities remain a source of income, food and a means of survival to the people of Adamawa State. Agricultural sector has played a dominant role in Nigerian economies. In recent times, the vital importance of the sector for broad-based growth, food security, and nutrition and poverty reduction has been recognized. The agriculture sector continues to ensure sustainability, rural development and poverty reduction in the twenty-first century as many people especially in developing countries depend on it for deriving their livelihoods, especially in Nigeria (Chiwawa, 2019).

Crop farming is one of the dominant agricultural activities being practiced in Adamawa State because of its socio-economic benefits to poor communities in such as household food security, poverty alleviation, generating income, cementing social relationships and providing about 50% of the labor force in the state (Molotsi et al., 2019). while crop farming is mainly focused on the economic well-being of the farmers, in most developing countries people go into crop production for other off-farm expenses such as payment of medical bills, school fees, insurance against emergencies, and purchase of food etc (Cholo et al. 2017).

Information and Communication Technologies (ICTs) are the technologies used for the extensive dissemination and sharing of information among people at a fast rate (Nwafor et al. 2020) As a result, this specifies what smallholder farmers' need for relevant and timely market information can be met using ICT-based information sources. The use of ICTs forms part of the 4th Industrial Revolution, where things are done over digital usage. Oladele (2015) mentioned that there is a rapid growth of ICTs usage throughout the world as ICTs consolidate the global communication networks. Thus, ICTs use the latest technology to process and transmit information for livestock farmers (Serbulova et al., 2019). ICTs is playing a fundamental role in stimulating and disseminating agricultural information that is essential for enhancing farming (Kante et al.,

2016). These ICTs involve hardware, software, networks, and information tools for collecting, storing, processing, transmitting, and presenting the information. They further include radio, television, phones, computers, Internet technologies, and databases that disseminate information quickly and fast.

Information and Communication Technology (ICT) plays a significant role in the growth and development of the agriculture sector through the effective deployment of Information Communication Technology (ICT) tools and equipment. ICT has been a significant contributor to the growth and socio-economic development in countries, where ICT is deployed effectively (Bilali & Allahyari., 2018). The effective integration of ICT in the agriculture sector in developed countries has led to tremendous improvement in agriculture value chain efficiency and productivity, while ICT uptake in agriculture in Africa especially Nigeria took a sluggish start and a major transformation of the sector has yet to take place. Bilali and Allahyari (2018) assert that ICT-based innovations can improve rural livelihoods and empower smallholder farmers in developing counties by enhancing their connectivity and increasing access to accurate and timely agriculture information.

This paper is aimed at investigating the impacts of ICT in Agricultural sector in Adamawa State, Nigeria. The results of the study will be significantly important to the good people of Adamawa state, Nigerian Government and to researchers.

II. Related Work

Ayim et al. (2020) offer a systematic review of literature on ICT adoption in agriculture. The review reveals that mobile-based services have improved the access to information on best practices in agricultural activities; however, the service is constrained by poor technological infrastructure and farmers' low capacity. Nevertheless, from previous studies, empirical review discovered that most of the studies from the region on the interaction between information and communication technologies (ICTs) and the agricultural sector are still being conducted conceptually and at the micro-level with few studies being conducted at the macro-level. Studies from Stat FAO (2017) have revealed that the application of ICTs to the agricultural sector, which is mostly considered the largest economic sector in Africa, has resulted in an increase in productivity, an increase in the usage of new high-yield variety seeds, chemical fertilizers and other inputs. More so, ICT has presented the need for technological adoption in terms of information on new seed varieties, inputs, new market and market prices at a low cost, thereby facilitating an increase in agricultural growth.

A study by Schmid (2015) showed that the adoption of technology performs an important function within the agricultural sector in Africa as the number of mobile subscribers in sub-Saharan Africa steadily increases in the last decade, thereby causing a transformation in the methods farmers used in cultivating their fields and sell their products. Several studies across the SSA region have identified ICTs to have a relationship with an increase in efficiency, productivity and communication that exists between buyers and sellers with the end result of reducing waste and price dispersion. Panda et al. (2018) showed that an enormous prospect for agricultural and allied sectors growth is the adoption of ICTs, as it has the potential of converting farming into profitable and enjoyable deeds, recalling farmers back into farming and enticing the rural youths into agriculture. More so, categories of farmers in recent times based on the advancement of ICTs have access to well-timed, precise, and relevant information services. In Senegal, a study revealed that through the creation of websites, communities that are at risk have been able to get information on climate change adaptation (World Bank, 2012)

Scherr et al. (2012) describe various large-scale programs that were supported by international organizations, such as the Great Green Wall Initiative, which used comprehensive regional land use management information systems. The authors described the use of ICT solutions such as remote sensing technology and diverse databases (such as land use and other social, economic, and ecological information) to support multi-stakeholder planning, governance, spatial targeting of investments, and monitoring. Zewge and Dittrich (2017) performed a systematic mapping study of journal and conference papers published between 2006 and 2014 and observed that the rapid proliferation of ICT in the developing world has been considered an opportunity for supporting rural communities. Besides, the authors also observed that only a few scientific publications are related to ICT for agriculture though some African countries (such as Kenya and Uganda) have achieved a good level of adoption of ICT innovation among their farming communities. This fact contrasts significantly with the fact that more than 80% of the labor force is engaged in agriculture. In a similar study, Lwoga and Sangeda (2019) reviewed existing SLR studies published on ICT and development between January 1990 and July 2017. Their reviews indicates that there is limited evidence on the long-term contribution of ICT use on livelihoods, inclusiveness, wellbeing, and freedom in developing countries, suggesting the need for further study on the appropriate and sustainable use of ICT for development.

Mujeyi et al. (2021) have studied the impact of the adoption of personal ICT gadgets, such as radios, phones, and televisions in relation to the adoption of climate-smart agriculture. Their findings indicate that the adoption of climate-smart agriculture and access to information through radio, TV, and mobile phones, have a

positive impact on the welfare of farmers and recommend that access to timely information and forecasts is an essential aspect of ensuring the welfare of households. The adoption of ICT innovations is also found to be crucial in maximizing farm-level uptake and diffusion of other innovations such as biological control innovations. Bahn et al.(2021) reviewed the role of digital solutions in improving sustainability in the Middle East and North Africa. They found out that at the time of their research the adoption of digital agriculture is led by high-value agricultural products targeting the domestic and export markets to nearby countries. The general rate of adoption of digital agriculture was found to be at an early stage. Clearly, the main drivers for the adoption of digital technologies turned out to be economic sustainability. The authors proposed that policymakers need to foster the adoption of those technologies that support social and environmental sustainability.

Klerkx et al.(2019) reviewed several social science articles to study the effect of the latest ICT technologies, such as big data, the internet of things, augmented reality, robotics, AI, and blockchain on social, economic, and institutional dynamics in the agriculture sector. They identified and grouped the literature on the adoption of digital technologies in agriculture around the following thematic clusters: use and adaptation, farmer identity and skills, power and ethics, knowledge, and economics and management. They identified four thematic areas that they consider as poorly which include the conceptualization of digital agriculture from broader social, cyber-physical and ecological systems, and policy processes of the digitalization of agriculture.

The results of these studies indicate that more detailed research is needed that targets the various aspects of the adoption of ICT innovations in the agricultural sectors of Africa, especially in crop farming.

III. Methods and Material

3.1. Study Area

The study was conducted in Adamawa state. The state is located in the northeast sub-region of Nigeria, Adamawa with its capital in Yola is on latitude 9.330N and longitude 12.50E. The state was created in 1991 from the defunct Gongola State. Adamawa State is one of the largest states in terms of land mass, occupying about 36,917km². Adamawa lies within the Sub-Sudan Savannah and the Guinea Savannah belts. Topographically, it is a mountainous land crossed by the larger river valleys of Benue, Gongola and Yedsarem. The valleys of Cameroun, Mandara and Adamawa Mountains form part of this undulating landscape. Adamawa is an agrarian state, therefore the major occupation of the people is farming and few others are engaged in business and formal sector employment with the public and private sectors. Cash crops grown in the state are cotton and groundnuts while food crops include maize, yam, cassava, guinea corn, millet and rice. The village communities living on the banks of the rivers engage in fishing while the Fulanis rear cattle. Adamawa State is the eighth largest in area but the thirteenth least population with an estimated population of about 4.25 million people. A study like this, therefore, is timely to address the problems faced by the vast majority of its inhabitants who rely on farming as a source of livelihood.

3.2 Sampling procedure and sampling size

The study made use of a multi-stage sampling procedure. The first stage was to select five Local Governments in Adamawa State. The selected Local Government Areas were Guyuk, Hong, Ganye, Numan, and Yola North due to their active participation in crop farming and contributing extensively to farmers' livelihoods (food security and farm revenues). The second stage was to select two districts and wards within the selected LGAs that practice crop farming. The third stage was selecting crop farmers using random sampling. A total of 74 farmers were sampled from each of the five selected Local Government Area, 37 farmers from each of the selected districts in the selected Local Government. A total of 370 farmers were randomly selected. The study used a sample of 370 due to financial constraints as the study was self-funded and could not reach the whole Local Government.

3.3. Data collection

The research paper made use of both qualitative and quantitative approaches to discover the determinants of using information and communication technologies (ICT) by crop farmers.

Primary data was the tool used to collect data. A structured questionnaire was used to collect and gather information. The questionnaire comprised three sections that included the respondents' demographic information, the types and use of ICT adopted, the barriers faced by crop farmers in adopting ICT, and lastly, factors influencing farmers' decisions. The questionnaire embraced close-ended questions. A five likert scale questionnaire comprises of two sections was designed for the study as an instrument for data collection. Data was collected through a single-visit farmer survey. This was done in the form of face-to-face and self-administered questionnaires.

3.4. Data Analysis

Data were analyzed with the simple percentage and the simple mean score. Tables and simple percentages were used to analyze section A while simple percentages and the simple mean score with tables were used to analyze section B.

Using the mean score of

$$\frac{\sum FX}{N}$$

ΣFX = frequency multiplied (X) score

N = Total Number of the population

The cut-off point was fixed at 3.0. A mean score above 3.0 was accepted while a mean score below 3.0 was rejected

N=370

IV. Results and Discussion

4.1 Results

Demographic distribution of respondents

Table: 1 Sex distribution

Sex	Number	Percentage
Male	253	68.4
Female	117	31.6
Total	370	100

Table 2: Age distribution

Age	Number	Percentage
25-35	20	5.4
36-45	101	27.3
46-55	211	57.1
56 and above	38	10.2
Total	370	100

Table: 3 Marital Statuses

Marital Status	Number	Percentage
Married	252	68.2
Separated	88	23.7
Single	30	8.1
Total	370	100

Table:4 Education Qualifications

Education Qualification	Number	Percentage
SSCE	22	5.9
NCE/ND	123	33.2
HND, B. Sc and above	225	60.9
Total	379	100

Table: 5 Years of farming experience

Years	Number	Percentage
Less than 6 years	32	8.6
7- 25 Years	267	72.2
Above 26 years	71	19.2
Total	370	100

Table 1 results indicated that most of the crop farmers in the study area are headed by male farmers (in a proportion of 68.4% males to 31.6% females). This affirmed that male is mostly into farming than female. These results were in line with the study conducted by Chikaire et al. (2017) that male farmers were dominating farming and agriculture because males are landowners and head of the family who makes family decisions. The results in table 2 show that the average age of farmers' heads was between 46-55 (57.1%) years. This means farming is practiced by elderly people in the study area due to the retirements, poor income, and it serves as extra source of

income for people. The study affirmed that 68.2% of the respondents are married as shown in table 3. This means that married farmers play a significant role in providing for the family and assisting with family labor. These results agree with Nwafor et al. (2020) that married farmers were very important with the provision of family labor which assists in decreasing hiring. Table 4 shows that Crop farmers in Adamawa State are literate and majority of the farmers have post-secondary education with 60.9% of them having HND, B. Sc and above. These findings agree with Luqman et al. (2019), that small-holder farmers were literate which made it easy for them to understand agricultural information and adopt innovative technologies aimed at improving farm output. This means farmers can interpret information and use advanced technologies in their farms. Table 5 indicated that majority of the farmers have 7-25 (72.2%) years of farming experience, which is valuable in operating the farm and they know exactly what is best for their farming.

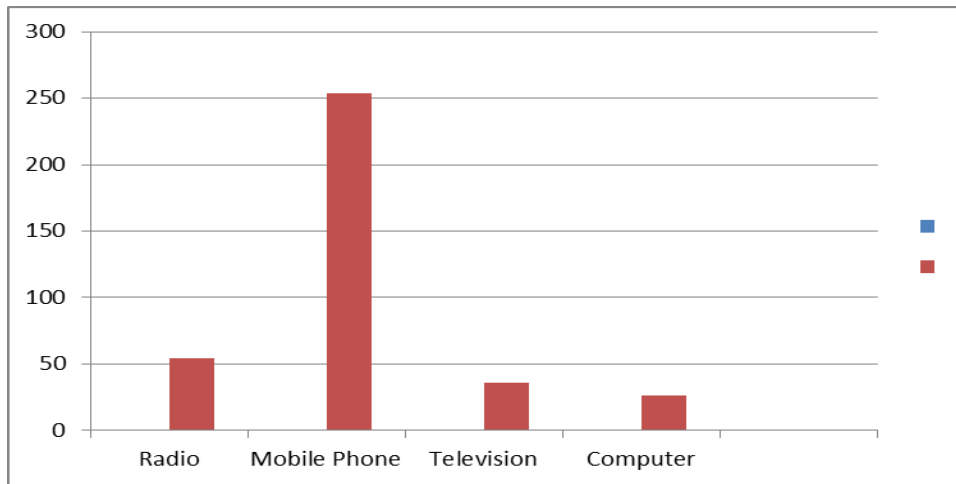


Figure 1: ICT Tools used by crop farmers

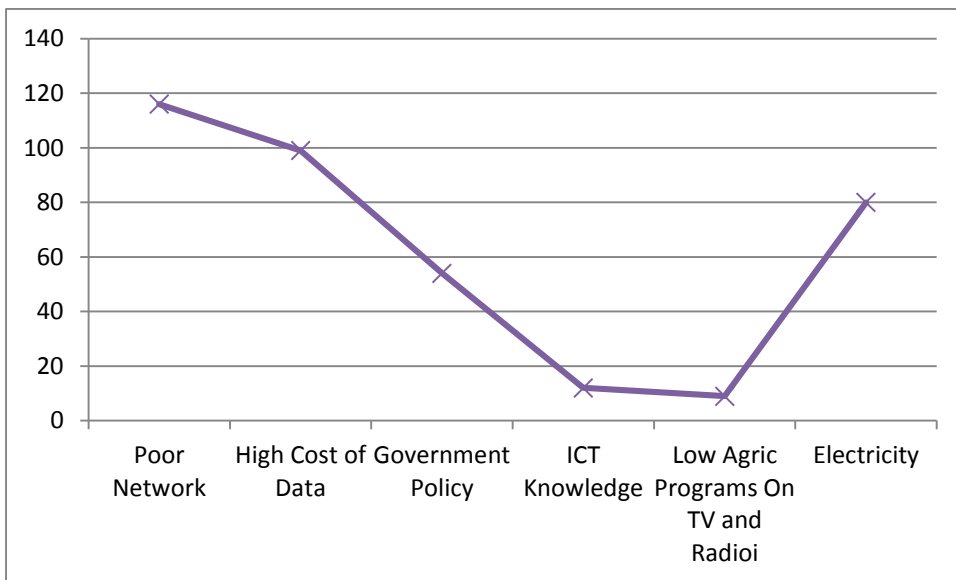


Figure 2: Constraints faced by crop farmers in using ICT

Table 6: Effects of using ICTs in Crop Farming

S/N	Variable	SA	A	SD	D	UD	Mean score	Remark
1	ICT increases agricultural information availability to crop farmers.	152	177	29	12	0	4.3	Accept
2	ICT increases knowledge on-farm activities and breeding techniques.	203	126	25	11	05	4.4	Accept
3		172	134	09	55	0	4.1	Accept
4	ICT improves the quality of marketing information, monitoring of farm produce and access to the market.	169	130	12	59	0	4.0	Accept
5	ICT improve access to agricultural input, herbicides and disease control	29	48	176	117	0	2.3	Reject
6		10	26	204	30	0	2.2	Reject
7	There are availability and accessibility of agricultural tools and Technology used in developed countries	24	38	179	129	0	1.00	Reject
8		201	227	24	12	05	4.4	Accept

The majority of age crop farmers do not have poor eyesight to access their Mobile phones
 Easy Access to credit and loan to improve crop farming
 High cost of data and ICT facilities

Source: Field Survey 2023

4.2 Discussions

The results of the study revealed that crop farmers have different access and ownership of ICTs as shown in Figure 1. The majority of the farmers were Mobile phone owners (68.6%) while other farmers confirmed owning radio (14.4%), television (9.8%) and Computer (7.1%). The study indicates that crop farmers were mostly using Mobile phones to seek market information and sell crops via call/SMS to traders, Farm organizations, people living near towns, and extensions and were also using them to access market information and send/receive some e-mails from brokers, production, markets, and any updating them about new agricultural inputs.

Table 5 shows the results of the effect of ICT on crop farming. Item1 on the table indicates that the majority of the respondents agreed that ICT increases agricultural information availability to crop farmers. The results also show that ICT increases knowledge of farming activities and breeding techniques, respondents accepted that ICT improve the quality of marketing information, monitoring of farm produce and easy access to the market. The results further revealed that ICT plays a significant role in improving access to agricultural input, herbicides and disease control. On the other hand, the study rejected that there are availability and accessibility of agricultural tools and Technology used in developed countries, that aged farmers are not affected with sight problems due to ageing and also rejected that there is easy Access to credit and loans to improve crop farming.

Figure 2 shows the challenges faced by farmers in using ICT. The majority of farmers have indicated that network problem (31.4%) is the main challenge faced by farmers which makes it difficult for them to use the ICT as they have found a good network to access it while others decide not to use it at all. The second problem is the high cost of data (26.8%) as this denies them access to the internet whenever they run out of that and could not afford to buy on time. Financial support is the third challenge (21.6%) as most of the farmers depend on farming and social grants for income, making it hard to purchase the ICTs tools for farming use. Others include electricity (14.6%) and knowledge of ICT tools (3.2%). Agricultural programs on TV and radio (2.45).

V. Conclusion and Recommendations

The study revealed that some of the common ICT tools used by farmers include Radio, mobile phone, Television and computer, this agreed to the study conducted by Olaniyi et al. (2013) the study identified radio, television, video recorder, audio cassette, mobile phone (GSM), computer and camera as ICT tools relevant to

cassava production activities in Nigeria. This study also examines the prospects and problems of using ICT in crop farming in Adamawa State. This was in line with the study conducted by Kante et al. (2016) on the factors affecting the use of ICT in agriculture which poor electricity, high cost of data among others. ICT has brought a significant change in the world and the farming sector. With the use of ICT tools in agriculture farmer's crop farmers will increase their knowledge of farming activities, improve marketing information and will be able to connect to global markets. With ICT farmers will improve access to agriculture input, disease control, and record keeping. This is in line with study of Abebaw and Yared (2019) and Bosch et al. (2012) stipulate that the use of technology in agriculture (such as e-marketing) has impacted the exclusion of mediators, decreases expenses and benefits in finding customers as well as being user friendly.

The study revealed some challenges faced by farmers when using ICT. Most of the challenges faced by farmers were poor network coverage by network providers, the continual increase in data bundle, electricity, lack of financial support to farmers to burst their purchasing power and lack of proper attention by the government. This result is in agreement with the study conducted by Von Loeper et al. (2016) that agricultural farmer's faces challenges when using ICT tools.

Based on the findings of the study, the study recommends that:

- 1) To fully harness and optimize the inherent positive externality of ICT investment in the Adamawa State serious effort needs to be invested in the area of education and training of farmers to adopt and apply ICT products across the value chains of agriculture
- 2) The Federal government should monitor Network service providers and ensure that they improve the quality of their services
- 3) The federal government should ensure that the power holding company of Nigeria should improve the regular power supply
- 4) Loans and Grant should be made available to farmers to purchase ICT tools and equipment to improve crop production
- 5) Government should endeavor to make ICT products affordable for the poor who constitutes the larger part of rural farmers to guarantee access and adoption for agricultural activities.

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