International Journal of Research inSocial Science
Vol. 12 Issue 01, January 2022,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

Impact of Information and Communication Technology (ICT) on Agricultural Output in Rural Areas in Kogi State

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Abstract

The importance of agriculture in the rural areas in Kogi State cannot be overemphasized. This study therefore, investigated the impact of access to, ownership and utilization of ICT on agricultural output in Kogi State. Primary data were collected through household survey using structured questionnaire. The structured questionnaire was validated in a departmental seminar where the proposal and draft of the instrument were presented. Multi-stage sampling method was adopted to select 10 households each from 120 rural communities that were earlier randomly selected from the 21 Local Government Areas (LGAs) of the State. This makes a total sample of 1,200 households used in the survey. The data collected were analyzed through the use of descriptive and inferential statistics. Three (3) models of regression were estimated in the study using ordinary least square (OLS) technique. It was found out that households' access to, ownership and utilization of ICT have had positive and statistically significant impact on agricultural output in rural areas of Kogi State at 5% significance level.The study therefore, recommended that Kogi State government, Non-Governmental Organizations and individual philanthropists should establish more ICT training centres and Community Internet Service Centres (CISC) in rural areas. Also, ICT training workshops should be specifically organized for framers in rural areas in Kogi State.

Key Words: Information, Communication, Technology, Agricultural Output, Rural Areas
JEL Classification:O13, O30, R20

1.0 Introduction

Agriculture is the predominant economic activity in rural areas in Kogi State. Despite the enormous resources (in terms of arable land and manpower) in the agricultural sector, the sector is characterised by low productive capacity due to ageing smallholder-farmers and poor extension services from the Ministry of Agriculture. The state has great potentials in agriculture which has remained inert. It is evident that the agricultural potentials of Kogi State is being underutilised as a result of rural-urban migration with the attendant loss of manpower and lack of access to timely information and agricultural inputs (Kogi State Government, 2012).

ICTs are changing the world at an unprecedented rate. The information age has opened up the entire world and has turned it into a global village. The lives of people, how they live, the type of jobs they do, the way they communicate, and the way they travel are being affected almost day-to-day by the introduction of new technological and scientific inventions. The rapid evolution and accessibility to electronic devices like mobile phones, laptops, tablets and the rapid expansion of the telecommunications industry in Nigeria have greatly influenced and facilitated easy access to ICT and awareness of its potential benefits (Kogi State Government, 2012).

The main objective of this study is to investigate the impact of access to, ownership and utilization of ICT on agricultural output in rural areas in Kogi State. The study covers 120 rural communities selected across all the Local Government Areas in Kogi State. Following the introduction; section two is the conceptual review on ICT, rural area, theory of growth and theoretical nexus between ICT and agricultural output, empirical discourse between ICT and agricultural output; section three is the methodology; discussion of results is presented in section four while section five contains the conclusion and recommendations.

2.0 Conceptual Clarifications

2.1 Rural Area

The American Bureau of Census (2000) classifies a group of people living in a community having a population of not more than 2,500 as rural. Whereas in Nigeria, the National Bureau of Statistics defined a community with less than 20,000 people rural (Ocheni & Nwankwo, 2012). Ashley & Maxwell (2001) defined rural area as constituting a space where human settlement and infrastructure occupy only small patches of the landscape, most of which is dominated by fields, pastures, woods, water, mountains and deserts.

Farooq (2012) defined rural area as an area which is underdeveloped and not civilised based on geographical conditions. Furthermore, he outlined the characteristics of rural areas to include:

i. sparsely populated because many people often migrate to urban areas because of one reason or another;
ii. homogeneity in profession. The major occupation of people in rural areas is agriculture;
iii. having strong cultural bond. There is homogeneity in their mode of dressing, language and customs;
iv. having inadequate means of communication; and
v. having slow rate of development due to inadequate education and modern technology.

2.2 Information and Communication Technology (ICT)

ICTs are those technologies that can be used to interlink information technology devices such as personal computers with communication technologies such as telephones

and their telecommunication networks. Michiels and Van Crowder (2001) defined ICTs as a range of electronic technologies which when converged in new configurations are flexible, adaptable, enabling and capable of transforming organizations and redefining social relations. The range of technologies is increasing all the time and there is a convergence between the new technologies and conventional media. According to Rodriguez and Wilson (2000), ICT is a set of activities which facilitate and enhance the processing, transmission and dissemination of information by electronic means.

ESCAP (2000) defined ICT as techniques people use in order to share, distribute, and gather information for communicating through computers and computer networks. Marcelle (2000) stated that ICT refers to a complex entity as well as application and services used for the production, distribution, processing, and transformation of information with the aid of ICT tools.

Ogunsola and Aboyade (2005) posited that ICT came into being as a result of related technologies clearly stated by their functional usage in information access and communication which is centralized through the Internet. This rapid and ongoing convergence means that devices such as digital cameras, digital video cameras and players, personal digital assistants, slide projectors and mobile telephones are also compatible with more traditional media such as radio (digital, satellite) and television (cable, digital, satellite).

According to Adigwe (2012), ICT is perceived to be a force to be reckoned with in the 21st century because it has caused and continues to cause major changes in the way we live. In the electronic media, ICT has ignited and provoked radical and drastic changes that have affected and revolutionized the broadcast industry, most especially in immediacy and timeliness of news. According to him, ICTs play a pivotal role in the world economy and the ICT sector is increasing its trend share of economic activity. ICTs are an important

input for economic performance. Information is critical to the social and economic activities that comprise the development process. Telecommunications, as a means of sharing information, is not simply a connection between people, but a link in the chain of the development process itself (Hudson, 1995).

2.3 Theoretical Nexus between ICT and Agricultural Output

According to Stienen et. al (2007), agriculture is an important sector with the majority of the rural population in developing countries depending on it. The sector faces major challenges of enhancing production in a situation of dwindling natural resources necessary for production. The growing demand for agricultural products, however, also offers opportunities for producers to sustain and improve their livelihoods. Information and communication technologies (ICTs) play an important role in addressing these challenges and uplifting the livelihoods of the rural poor. Information has a central role in our modern way of living and agriculture is no exception. Success in farming requires gaining, processing, using and evaluating a huge amount of information (policy, markets, new methods etc.). Farmers are working in an information-intensive environment and numerous studies have shown that ICT can play a vital role in realizing benefits with more effective information management at the farm level (Mihaly, 2012).

Niederhauser, et. al (2008) observed that ICTs are transforming all human activities, including agriculture which is the mainstay of most rural areas. They asserted that one of the main reasons for the inequitable distribution of economic gains between the haves and have-nots is the gap in access to information. ICT plays an important role in bridging this gap and eventually will help in poverty alleviation. Farmers can get access to knowledge to improve their production and even get better price for their produce through variety of ICT systems. The advancements in ICT can be utilized for providing accurate,

timely, relevant information and services to the farmers, thereby facilitating an environment for more remunerative agriculture. ICT is a powerful and productive system which can accelerate economic and social development in rural areas.

According to Roger (2002) information and communication have always mattered in agriculture. Ever since people have grown crops, raised livestock, and caught fish, they have sought information from one another. What is the most effective planting strategy on steep slopes? Where can I buy the improved seed or feed this year? How can I acquire a land title? Who is paying the highest price at the market? How can I participate in the government's credit programme? Producers rarely find it easy to obtain answers to such questions, even if similar ones arise season-after-season. Farmers in a village may have planted the 'same' crop for centuries, but over time, weather patterns and soil conditions change and epidemics of pests and diseases come and go. Updated information allows the farmers to cope with and even benefit from these changes. Providing such knowledge can be challenging, however, because the highly localized nature of agriculture means that information must be tailored specifically to distinct conditions.

Nwankwo (2012) observed that ICT helps in increasing the efficient productivity and sustainability of small scale farmers through greater interaction in communication, evaluation, production and sharing of useful information which include the use of computer, Internet services, geographical information system, mobile phones, radio and television. He further asserted that ICTs have made tremendous contributions in extension delivery for sustainable development of agriculture.

Ugboh and Tibi (2008) opined that in most developing countries like Nigeria, opportunities offered by ICT can be exploited for enhancing the income of farmers and other rural dwellers through improved knowledge about new ways of farming, fishing,

animal production and home management. Marketing information is also made easy for producers to be linked directly with consumers. This will enhance better pricing.

Pramanik, Sarkar, and Kandar (2017), opined that ICT can transform the common agriculture process to a smart one. With the help of ICT based service a farmer can directly seek advice in his own language from some agricultural experts. He can apply online for soil test and get suggestions from experts regarding the type of crop which is best suited for a particular soil.

2.4 Empirical Discourse between ICT and Agricultural Output

The International Institute for Communication and Development (IICD) (2015) believes that people need access to information and communication to improve their lives, particularly in developing countries. "Farmers, workers and entrepreneurs can use ICT to access market information, improve quality and productivity and strengthen business skills and employment opportunities". The explosion of ICT, especially mobile phones, has transformed the development landscape of rural sub-Saharan Africa. By integrating once-isolated people into economies and polities, mobile phones and other technologies are improving life for rural populations, sometimes dramatically.

In a descriptive study of the impact of Internet on the lives of grass-root people in Solomon Island; Chand, Leeming, Stork, Agassi and Biliki (2005) concluded thataccess to the Internet has assisted in reducing the digital divide, facilitated communications for rural villagers, helped farmers receive agriculture information, enhanced business activities, enabled NGOs to find out shipping schedules, liaise with banks for financial transactions, liaise with government offices in the capital city Honiara, assisted in education and finally assisted in health-related issues.

Adesola (2012), Isife et al (2013) observed that ICTs are critical components of poverty alleviation strategies, because they offer the promise of easy access to huge amounts of information useful for the poor. Sanusi, et al (2010), Kayode-Adedeji and Agwu (2015) observed that ICTs have a high possibility of effecting positive change in the life and activities of the farmers when additional input and effort are provided to the extension method of communication in order to create a multi-dimensional approach that will adequately suit farmers' local situation and conditions. Yekini, et al (2012) found out that ICT can promote increasing productivity, improve market access and create employment opportunities.

3.0 Methodology

This study utilized the survey design, which was conducted through the administration of structured questionnaire to the people in selected rural areas in Kogi State. The survey design was adopted because it made it easy for people to participate and remain anonymous. The study also used quantitative and qualitative data which were obtained through the use of a structured questionnaire.

3.1 Instrument for Data Collection

Copies of a structured questionnaire were used for data collection in this study. The questionnaire sought information about households' characteristics, agricultural output and households' access to, ownership and utilization of ICT.

3.2 Method of Analysis

Three (3) econometrics models were estimated in the study in order to investigate the impact access to ICT, Ownership of ICT and Utilization of ICT have had on agricultural output in rural areas in Kogi State. The models were estimated with the use of Ordinary Least Square (OLS) technique using computer software (E-views version 10).

The estimated models were subsequently analyzed on the basis of the sign and significance of the coefficients of the variables of interest.

3.3 Model Specification

Agricultural Output Model:

This model seeks to examine the impact of ICT on agricultural output in the rural areas in Kogi State. The model is an extension of Antel (1983) as cited in Chavula (2014) production function model based on Solow-Swan economic growth model (1956). The production function model is stated below:

$$\text{Log } Q = \text{Log } A + \alpha \text{Log } K + \beta \text{Log } H + \delta \text{Log } P + \varepsilon \quad \ldots\ldots\ldots\ldots (3.7)$$

Where Q is agricultural output, K is machinery and fertilizer, H is human capital represented by work force, P is physical capital (land holding) and ε is random error term.

For the purpose of this study the model was modified thus:

$$\text{Log } Q = \text{Log } A + \alpha \text{Log } K + \beta \text{Log } H + \delta \text{Log } P + \theta_i X_i + g_i T_i + \varepsilon_i \ldots (3.8)$$

Where Q = agricultural output (proxied by monetary value of total agricultural output)

A = constant term

K = machinery and fertilizer (proxied by monetary value of farm tools and expenditure on fertilizer)

H = work force (proxied by number of people engaged on the farm)

P = land cultivated (proxied by number of acres of land cultivated)

X_i = vector of household characteristics such as household size (HS), head of household's level of education (HE), age of household head (AH), marital status of household head (MS), gender of household head (GH), housing of household (HH) and electricity available in household (EH).

T_i = vector of ICT variables such as household access to radio (HAR), household ownership of radio (HOR), household utilization of radio (HUR), household access to television (HAT), household ownership of television (HOT), household utilization of television (HUT), household access to GSM phone (HAG), household ownership of GSM phone (HOG), household utilization of GSM phone (HUG), household access to personal computer (HAP), household ownership of personal computer (HOP), household utilization of personal computer (HUP), household access to Internet (HAI), household ownership of Internet MODEM (HOI), household utilization of Internet (HUI). α, β, δ= Co-efficients of independent variables

θ_i = co-efficient vector of household characteristics

g_i = co-efficient vector of ICT variables

ε_i = random error term

The a-priori expectations were that: α, β, δ, θ_i, $g_i > 0$.

4.0 Empirical Results

4.1 Impact of Access, Ownership and Utilization of ICT on Agricultural Output in Rural Areas of Kogi State

Table 4.10: Impact of Access, Ownership and UtilizationICT on Agricultural Output in Rural Areas of Kogi State

ICT OLS Model Estimation						
Dependent Variable: LOG (Agricultural Output)					No. of Obseravtions: 314	
	Access		Ownership		Utilisation	
Independent Variables	Coefficient	Probability	Coefficient	Probability	Coefficient	Probability
Constant	3.186**	0.0300	3.3690	0.2200	2.9134***	0.0067
LOG (Machinery and fertilizer)	0.651**	0.0188	0.3350	0.3610	0.4844*	0.0555
LOG (Land cultivated)	0.1210	0.7810	0.0540	0.8950	0.3260	0.3036
LOG (Labour force)	0.1360	0.6250	0.2020	0.4790	0.3244	0.1416
Household Size	0.0120	0.8540	0.0050	0.9340	0.0035	0.9327
Household's Head Level of Education	0.0010	0.9630	0.0070	0.7610	-0.0204	0.3374
Age of Household Head	-0.0060	0.7230	0.0010	0.9820	-0.0051	0.6612
Marital Status of Household Head	0.0890	0.8300	-0.0190	0.9550	-0.0218	0.9281
Gender of Household Head	-0.1260	0.6300	-0.0640	0.7800	-0.1064	0.5626
Housing of Household	0.2920	0.3080	0.1930	0.4490	0.3072	0.1343
Electricity Available in the Household	0.0290	0.8900	0.0120	0.9560	-0.0367	0.8026
Household ICT Knowledge	0.3420	0.4040	0.1530	0.5990	0.3234	0.2820
Household Access to Radio	0.1270	0.6420	-	-	-	-
Household Access to Television	0.0040	0.9880	-	-	-	-
Household Access to GSM Phone	0.4600*	0.0916	-	-	-	-
Household Access to Personal Computer	0.1750	0.7030	-	-	-	-
Household Access to the Internet	0.7800**	0.0131	-	-	-	-
Household Ownership of Radio	-	-	0.0060	0.9780	-	-
Household Ownership of Television	-	-	0.6210**	0.0339	-	-
Household Ownership of GSM Phone	-	-	0.5990**	0.0322	-	-
Household Ownership of Personal Computer	-	-	0.4100*	0.0606	-	-
Household Ownership of Internet MODEM	-	-	0.0630	0.8720	-	-
Household ICT Knowledge	-	-	-	-	-	-
Household Utilisation of Radio	-	-	-	-	0.0127	0.9382
Household Utilisation of Television	-	-	-	-	0.6453*	0.0799
Household Utilisation of GSM Phone	-	-	-	-	0.1722	0.3522
Household Utilisation of Personal Computer	-	-	-	-	0.5629*	0.0653
Household Utilisation of the Internet	-	-	-	-	0.6340**	0.0143
R-Squared	0.6842		0.6265		0.7076	
(***) Significant at 1%, (**) Significant at 5% and (*) Significant at 10%.						

Table 4.10 shows the estimated OLS models of the impact of ICT on Agricultural Output in rural areas of Kogi State. The Access to ICT model has an R-square of 0.6842; this indicates that about 68 percent variation in the dependent variable (agricultural output) is explained by the explanatory variables (vector of household characteristics and vector of ICT variables (see section 3.3), while the error term takes care of the remaining 32 percent that are variables that were not included in the model because of certain qualitative features.

Holding the vector of household characteristics constant, the coefficients and the associated probabilities of the vector of ICT variables used in the study indicate that all the ICT variables have the expected signs. These imply that households' access to radio, television, GSM phone, personal computer, the Internet and their ICT knowledge all have positive impact on agricultural output in rural areas of Kogi State.

Statistically, the positive impact of households' access to the Internet is significant at 5 percent; while that of GSM phone is significant at 10 percent. The other ICT variables such as households' access to radio, television, personal computer and ICT knowledge are not statistically significant. The plausible reasons for this include; epileptic power supply, inadequate or non-availability of public cyber café and lack of ICT knowledge among farmers in rural areas of Kogi State. Also, some of the information media may not be transmitting information that is relevant to farmers in rural areas of Kogi State.

On the basis of the magnitude of the coefficients of the ICT variables, households' access to the Internet appears to have had more positive impact on agricultural output in the rural areas of Kogi State since it has the highest coefficient (0.7800).

These results mean that households' access to radio, television, GSM phone, personal computer, the Internet and their ICT knowledge increases their agricultural output; especially when these information media make relevant and timely information available to farmers in the rural areas of Kogi State. It should however be noted that only the positive impact of access to the Internet and GSM phone is apparent. These assertions are similar to those of other researchers such as Roger (2002), Stienen et. al. (2007), Niedrhauser et. al (2008); to mention just a few.

Also shown on Table 4.10 is the Ownership model. A look at the model shows that it has an R-square of 0.6265. This indicates that about 63 percent variation in the dependent variable (agricultural output) is explained by the explanatory variables (vector

of household characteristics and vector of ICT variables (see section 3.3)), while the error term takes care of the remaining 37 percent that are variables in the study that cannot be included in the model because of certain qualitative features.

Holding the vector of household characteristics constant, the coefficients and the associated probabilities of the vector of ICT variables used in the study indicate that all the ICT variables have the expected signs. These imply that household ownership of radio, television, GSM phone, personal computer, Internet and their ICT knowledge all have positive impact on agricultural output in rural areas of Kogi State.

Statistically, the positive impact of household ownership of television and GSM phone are significant at 5 percent; while households' ownership of personal computer is significant at 10 percent. The other ICT variables such as household ownership of radio, Internet MODEM and ICT knowledge are not statistically significant. The plausible reasons for this may be that farmers in rural areas in Kogi State are not fully utilizing their radio, Internet MODEM and ICT knowledge in ways that will enable them increase their agricultural output.

On the basis of the magnitude of the coefficients of the ICT variables, households' ownership of television appears to have had more positive impact on agricultural output in the rural areas of Kogi State since it has the highest coefficient (0.6210).

These results imply that households' ownership of radio, television, GSM phone, personal computer, the Internet and their ICT knowledge increases their agricultural output; especially when these information media make relevant and timely information available to farmers in the rural areas of Kogi State.

Table 4.10 also shows the Utilization of ICT Model. The model shows the impact of ICT utilization on agricultural output in rural areas in Kogi State. A cursory look at the

model shows that it has an R-square of 0.7076. This indicates that about 71 percent variation in the dependent variable (agricultural output) is explained by the explanatory variables (vector of household characteristics and vector of ICT variables (see section 3.3)), while the error term takes care of the remaining 29 percent that are variables in the study that cannot be included in the model because of certain qualitative features.

Holding the vector of household characteristics constant, the coefficients and the associated probabilities of the vector of ICT variables used in the study indicate that all the ICT variables have the expected signs. These imply that households use of radio, television, GSM phone, personal computer, Internet and their ICT knowledge all have positive impact on agricultural output in rural areas of Kogi State.

Statistically, the positive impact of households' use of the Internet is significant at 5 percent; while those of television and personal computer are significant at 10 percent. The other ICT variables such as household use of radio, GSM phone and ICT knowledge are not statistically significant. The plausible reasons for this include; epileptic power supply and the inability of farmers in rural areas in Kogi State to use these ICT gadgets to obtain relevant information that will enable them increase their agricultural output. Also, some of the information media in rural areas may not be transmitting information that is relevant to farmers.

On the basis of the magnitude of the coefficients of the ICT variables, households' utilization of the Internet appears to have had more positive impact on agricultural output in the rural areas of Kogi State with the highest coefficient (0.6340).

These results imply that households' active usage of radio, television, GSM phone, personal computer, the Internet and their ICT knowledge will increase their agricultural output; especially when these information media make relevant and timely information available to farmers in the rural areas of Kogi State. It should however be noted that only

the positive impact of the utilization of television, personal computer and the Internet are significant.

5.0 Conclusion and Recommendations

Households' access, ownership and utilization of ICT have had positive and statistically significant impact on agricultural output in rural areas of Kogi State at 5% significance level. It is noteworthy that the potentials and opportunities offered by ICT have not been fully exploited in rural areas in Kogi State due to ICT illiteracy, epileptic and lack of electricity, lack of access, ownership and utilization of ICT gadgets. It is therefore recommended that Kogi State government and non-governmental organizations should establishment ICT training centres across rural areas in Kogi State. ICT training workshops should be organized for farmers in the rural areas to enable them take advantage of the opportunities that ICT offers.

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