

Effect Of Ict On Agricultural Sector In Nigeria

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Abstract: The past decade is characterized by major changes in the Information and Communication Technology (ICT) environment in agriculture worldwide. The study is aimed at determining the influence of information communication technologies in dissemination of information to urban farmers. Primary data for the study was obtained by random sampling of 60 respondents from agricultural companies in Imo state, Abia state and FCT, Abuja. Descriptive statistics such as mean and frequency table for data analysis were used and questionnaires also administered to the farmers. Secondary data were obtained from published documents and records. From the findings, the results obtained shows that a mean score of 0.33 and standard deviation of 2.56 agree that you use statistical packages in the computer for researches. Mean score of 0.3 agree strongly that there's a wider access to foreign journals as a result of the internet. A mean score of 0.2 agree that the problems associated with the use of ICT include poor internet connectivity, unstable power supply (0.25), high cost of using commercial cyber café (0.16) and lack of subscription to agricultural database (0.16). Based on the results, this study recommends that agricultural sectors should be well funded so that they can subscribe to outstanding databases, power supply that will meet the needs of agricultural researchers. Secondly, agricultural researchers should improve their ICT infrastructures and the larger part of its bandwidth should be given to the sector to reduce the cost of using commercial cyber cafes for the agricultural sector.

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1. Introduction

Agriculture also called farming or husbandry is the cultivation of animals, plants, fungi and other life forms for food, fiber, biofuel and other products used to sustain life. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that nurtured the development of civilization. The word agriculture is the English adaptation of Latin *Agricoltura* from *ager*, "a field", and *cultura*, "cultivation" in the strict sense of "tillage of the soil". Thus, the literal reading of the word yields "tillage of fields" (Bolens 1997).

Moving on how best to conceptualize Information and Communication Technology (ICT), the term itself pertains to a myriad of standalone media, including telephone and mobile telephony, radio, video, tele-text, fax as well as computer mediated networks that link a personal computer through a modem to the internet. ICT can be thought of as an integrated system that incorporates the technology and infrastructure required to store, manipulate, deliver and transmit data which allows information to

be shared, facilitate access to the ICT infrastructure, and through which innovation takes place (Dzidonu 2002).

The purpose of this project: The Impact of Information and Communication Technology (ICT) in

Agriculture is to understand how Information and Communication Technology in Agriculture can contribute to fostering conditions that support local, regional and national development goals and what such developments mean in terms of capabilities, empowerment and sustainable livelihood. Civilization began with agriculture. When our nomadic ancestors began to settle and grow their food, human society was forever changed. Not only did villages and cities begin to flourish, so also did knowledge, arts and technological sciences. Human communities, no matter how sophisticated, could not ignore the importance of agriculture. To be far from dependable sources of food was to risk malnutrition and starvation. According to (Olomola 2007), Agriculture in Nigeria is a major branch in Nigeria, providing employment for 70% of the population. The sector is being transformed by commercialization at the small, medium and large-scale enterprise levels. Major crops include beans, cashew nuts, palm oil, plantains, rice, rubber, soybeans and yams.

In 1990, 82 million hectares out of Nigeria's total land area of about 91 million hectares were found to be arable, although only 42 percent of the cultivable area was farmed. Much of this land was farmed under the bush fallow system, whereby land is left idle for a period of time to allow natural regeneration of soil fertility (Olomola 2007).

He also stated that 18 million hectares were classified as permanent pasture, but had the potential to support crops. Most of the 20 million hectares covered by forests and woodlands are believed to have agricultural potential. Agricultural holdings are small and scattered, and farming is carried out with simple tools. Cocoa is the leading non-oil foreign exchange earner but the dominance of smallholders and lack of farm labor due to urbanization hold back production (Olomola 2007). He also cited in his piece that in 1999, Nigeria produced 145,000 tons of cocoa beans, but has the potential for over 300,000 per year.

However, a lot of problems have been encountered with agriculture which includes:

1. The use of crude tools and implements
2. Lack of finance or credit facilities
3. Poor transportation
4. Inadequate land due to land tenure system
5. Inadequate agricultural and extension services
6. Problems of pest and diseases
7. Lack of storage and processing facilities
8. Negative attitude of people towards farming due to its low reward.

With the above facilities not being in place, agriculture will make no sense to the common man. However, when ICT comes into play in agriculture, there'll be a remarkable improvement in the Nigerian sector as a whole.

2. Background

The application of ICT to agricultural research has attracted comments and several publications across the globe, many of which concentrated on review of programmes or established systems. According to (Salau 2008), Information technology is a key to agricultural development. Consequently agricultural researchers, trainers, extension workers, farmers and students must have easy and uninterrupted access to ICT facilities in their immediate environment. A sample of 60 Agricultural workers was randomly selected for the study using a set of questionnaire. Data analysis was through the use of descriptive statistics, and linear regression model. The finding shows that a mean score of 0.33 agree to the use of statistical packages in the computer for research work. On the respondent's benefits on ICT use, a mean score of 0.3 strongly agree that there's a wider access to foreign journals as a result of the internet. The key problems militating against the use of ICTs in the area were poor access to ICT facilities, lack of computer knowledge, low income and poor power supply. It was recommended that agricultural organizations should install all necessary ICT facilities in their establishments and provide training opportunities for their staff. Constant power supply to

both urban and rural communities should be considered a fundamental human right and treated as such.

Historically, agricultural service delivery in developing countries started with production-oriented limited extension services for export crops. The attention was diverted in the fifties to food production and improved farming techniques (Anandajayasekeram P. 2008). It is widely accepted that ICT is an important element within the array of market and non-market entities and agents that provide human capital enhancing inputs, as well as flow of information that can improve farmers' and other rural peoples' welfare.

ICT is widely expected to be a useful tool contributing to development around the world (UNDP 2005). It is also found that ICT allows efficient and transparent storage, processing and communication of information and that entrepreneurial innovation in this field may affect economic and social change (Kaushik 2004). Growth in ICT investment is also found to be positively associated with growth in both GDP and productivity in most Asia-Pacific countries for the period 1984-1990 (Kraemer 1994).

According to (Richardson 1997), ICT kiosks, ICT-equipped intermediary organizations and mobile phones are expected to play an important role in strengthening the more complex and time-urgent pathways of information and knowledge-sharing on which agricultural innovations depend. According to (Meera 2002), ICT would enable extension workers to gather, store, retrieve and disseminate a broad range of information needed by small producers such as information on best practices, new technology, better prices of input and outputs, better storage facilities, improved transportation links, collective negotiations with buyers, information on weather.

Moreover, (Heeks 2009) find in their ICT evaluation compendium that ICT is not fully utilized in agriculture. Scaling up of delivery still remains at experimental stage. Although, farmers have the real need to access to market information, land records and services, accounting and farm management information, management of pests and diseases, rural development programs and ICT could help accessing these services (Meera 2002). Poor marginalized and illiterate farmers and females are excluded, and marginal areas are excluded. Staff for agricultural extension projects have inadequate training and farmers have very little faith in ICT project personnel and their commitment to achieve the goals of the projects (Meera 2002).

The problems identified with Agriculture and the use of ICT includes:

1. The low level of ICT readiness of not only the research and extension organization but indeed of the developing countries themselves. Mostly

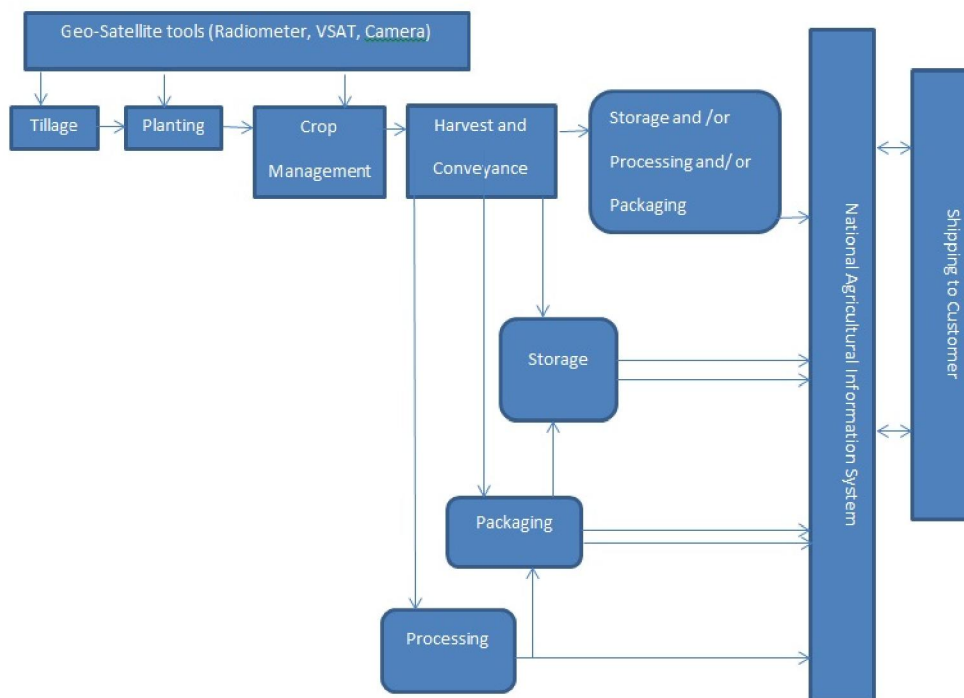
developing countries have one out of every good Africans outside South African has access to the internet compared to one in 38 in the rest of the World (Manu 2002).

2. High level rural poverty.
3. High level illiteracy of farmers and computer researchers and extension.

The basis of this study is to make known the impact of ICT in agriculture thereby support in strengthening and improving capacity through sharing research and other databases and information among the national, sub-regional and regional agricultural research networks.

Thus, the following research questions guided the study:

1. What are the types of ICT facilities used by agricultural researchers in agricultural sector?
2. What are the benefits of ICT use in research in the agricultural sector?
3. What are the constraints to ICT utilization for agricultural researchers in the agricultural sector?



Process Flow Diagram Of Ict In Agriculture

Process flow diagrams are illustrations of key business process and their interactions. In the figure above, tillage, planting, crop management is done with the aid of the Geo-satellite tool which includes machineries, radiometer, VSAT, cameras. The machineries do the work of the planting and tillage. For crop management, the VSAT, radio and cameras helps in its establishment with the aid of the extension

3. Research Approach And Methods

The impact of Information and Communication Technology, ICT developed by this study was guided by the most predominant hitches that arise within the agricultural research environment which include:

1. Low level of data storage upgrading
2. Sharing and retrieval of information on agricultural research by researchers
3. Developing/donor partners and policy makers
4. Inadequate modern and effective mechanism for analysing agricultural research activities among stakeholders
5. Low awareness/accessibility of information on agricultural research activities among stakeholders.
6. Low awareness/accessibility of information on agricultural research activities/findings by the farmers and other end users.

The study was conducted using random sampling.

farmers. Immediately after harvest, follows a period of storage, packaging (and possibly storage) and processing. These are done with the aid of the National agricultural Information System (NAIS) in the region before they are shipped to the customer.

This study examines an ICT-based intervention that has succeeded in integrating smallholder-resource and poor farmers into a higher agricultural chain. The

design assesses how it resolves the smallholder farmers' idiosyncratic market failures and examines member-farmers' marketing margins.

The research study was conducted in various parts of the states. A population of (60) Sixty urban farmers were randomly selected and interviewed. Ada-Palm Industries, Ohaji, Imo State. Descriptive statistics such as mean, percentages and frequency tables are used for random sampling while questionnaires are used for interviewing.

4. Case 1 –Using Radios And Videos To Reach Rural Farmers

New ICT has benefited radio by offering better and cheaper means of recording, mixing, editing and transmitting (for example, the digital audio recorder, audio editing on computers, and the electronic transmittal of sound programs as attachments). Development practitioners increasingly recognize the potential for combining radio with new internet-based ICTs, given that the new ICTs are still limited in some areas by the lack of telecommunications infrastructure and reach only a small number of people in developing countries.

Like radio, video has the advantage of attracting people's curiosity, and it appears to be an especially convincing medium when it captures familiar people or situations (as does local participation in radio broadcasts). Advances in ICT have made video much easier and less costly to produce and disseminate. Like radio, video does not demand literacy, and it suits the narrative culture that prevails in most developing countries. Images can make it easier for viewers with little education to understand complex topics (Lie 2009).

5. Case 2 – Integrating Mobile-Phone Based Learning

Some of the participating women were trained in developing audio content for mobile phone-based learning. Learning materials are prepared within the broad principles of open and distance learning to meet learners' time and geographical constraints. The learning materials convey information in short and concise messages. Three to five audio messages are sent to participating women every day. Each message runs for 60 seconds. Women preferred to receive the messages in the mornings while going to work or performing their household tasks—for example, while grazing the livestock. The women reported that they learned and practiced the messages and recorded them in their diaries. Illiterate women sought the help of literate family members to record the messages. Most of the respondents' families supported their learning objective, which benefited the entire family by expanding their knowledge base in relation to small

livestock production. Other multimedia learning materials were shown during meetings and telecast through local satellite channels run by NGOs. Once a week, members met and shared experiences. The horizontal and vertical transfer of knowledge has encouraged self-directed learning among the members (Balasubramanian 2010).

6. Case 3 - Documenting And Mobilizing Indigenous Knowledge

As experienced farmers migrate to urban areas, as the local farming population ages, Agricultural communities, much knowledge can be lost. This knowledge is worth preserving simply for its cultural value, but it is also instrumental in aiding researchers and extension workers to develop and adapt technology and practices. Farmer-led documentation is defined as an empowering process in which local communities take the lead role in the documentation process. The results are used by community members for learning within the community (internal learning) and exchange between communities, development agents, and policy makers. This process of engaging with farmers to document their knowledge and experiences showed that a "people-led development process does not only help increase yields or conserve the local biodiversity; it can also help farmers to get access to the resources they need By contributing to strengthening local organizations, networks, and alliances.

7. Data Collection And Extraction

Primary and secondary source of data was used for the study. The primary data was obtained through interview with respondent of 60 urban farmers using questionnaires verbal interview with extension agents, officials of agricultural department of Ada- Palm Industries, Ohaji, Imo State, EZ Holdings, Eziala, Imo state and Umudike holdings, Abia State. Thirty-one questionnaires were administered and the target respondents were the urban farmers. The process used here is random sampling where descriptive statistics such as mean, percentages and frequency tables were administered.

Secondary sources of data used for the study includes official documents from the library, seminar papers, internet and publications by the Borno State Agricultural Development Programmes (BOSADP) and National Agricultural Seed Council, Abuja (NASC).

Descriptive statistics such as mean, percentages and frequency tables were used while Standard Deviation was employed in determining the measure of the spread of scores within the sets of data for the study. Thus, the formula below:

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

Formula for Standard Deviation

Where: S= Standard deviation, x = Frequency,
 \bar{x} = mean, N= Total number of frequency,
 \sum = Sum total

The standard deviation formula has been used to adopt tables in section 8

8. Results

There are three (3) fundamental research questions as stated in section 2 of this study.

- What are the types of ICT facilities used by agricultural researchers in agricultural sector?

Table 8.1 Respondents view on ICT facilities used

Item	Items on ICT facilities used for agricultural research	Frequency	Mean	SD	Decision
1	You use computer to process your research work	10	0.17	1.28	Agree
2	You use statistical packages in the computer for research	20	0.33	2.56	Agree
3	You use database packages for research	13	0.22	1.66	Agree
4	You use computers for data analysis	11	0.18	1.40	Agree
5	You use e-mail for research purposes	6	0.10	0.76	Agree
	Total	60			

- What are the benefits of ICT use in research in the agricultural sector?

The result in Table 8.2 indicates that respondents have varied opinions about the benefits of ICT to agricultural research. In item 1 (mean, 0.13) they agreed that literature search is made easier with the Internet, in item 2 (mean, 0.16) they agreed that they have been able to open new areas of research

The result in table below indicates that the responses of respondents agreed with the items regarding ICT facilities used for agricultural research. They agreed with item 1, (mean, 0.12) that the computer is used for research, item 2(mean, 0.33) shows that the statistical package is used for research, item 3 (mean, 0.22) shows that database packages are used for research and item 4 (mean, 0.18) shows agreement with computer use for data analysis. The table also showed that item 5 (mean, 0.11) indicate that respondents agreed to using e-mail for research purposes. From the above result, a higher number agree with the use of statistical packages in the computer for research. Random sampling and standard deviation formula are used in the calculations as shown in section 7

due to Internet use, and in item 3 (mean, 0.3), they agreed with access to foreign journals. In item 4 (mean, 0.03) they disagreed that they send their questionnaire online and item 5 (mean, 0.03) they disagreed that they receive completed questionnaire online.

Table 8.2 Respondents Benefits on ICT use

Item	Items on benefits of ICT use for agricultural research	Frequency	Mean	SD	Decision
1	You use computer to process your research work	8	0.13	1.03	Agree
2	Literature search is made easier for you with the Internet	10	0.16	1.28	Agree
3	You now have a wider access to foreign journals as a result of internet	18	0.3	2.31	Strongly agree
4	You send your questionnaires on-line using e-mail	2	0.03	0.26	Disagree
5	You receive your completed questionnaire online by e-mail	2	0.03	0.26	Disagree
6	You share information with colleagues through e-mail	4	0.06	0.51	Agree
7	Analysis and interpretation of your data is made easier with the computer	16	0.26	2.05	Strongly agree
	Total	60			

The table also indicated that respondents also agreed with items on benefits derived from e-mail use in items 6 and in item 7 (mean, 0.26) respondents agreed that analysis and interpretation of data is made easier with the computer. The result above reveals

that a mean score of 0.3 strongly agree that you get wider access to foreign journal as a result of the internet. Random sampling and standard deviation formula is used in the calculations as shown in section 7.

- What are the constraints to ICT utilization for agricultural researchers in the agricultural sector?

There were two levels of opinions regarding the constraints to ICT utilization for agricultural research by respondents in table 4.3 above. The respondents disagreed with item 1 which is on lack of access as constraint to ICT utilization having a mean of 0.11 and item 2 with a mean of 0.10 which relates to not being ICT literate. Respondents however, agreed that the cost of using commercial cyber café is high with a mean of 0.20 as constraint to ICT use for agricultural research in item 3. The other constraints respondents

agreed to were item 4, poor Internet connectivity at mean 0.20 and item 5 with mean of 0.25 which is unstable power supply. Furthermore, respondents agreed to item 6 which is lack of subscription to agricultural databases at 0.16 mean. The above result shows that a mean score of 0.25 agree with the fact that the limitation of ICT use in agriculture lies in unstable power supply. Random sampling and standard deviation formula is used in the calculations as shown in section 7.

Table 8.3 Respondents Constraints on ICT use

Item	Items on constraints of ICT use for agricultural research	Frequency	Mean	SD	Decision
1	You lack access to ICT facilities	7	0.11	0.90	Disagree
2	You are not ICT literate	6	0.10	0.77	Disagree
3	The cost of using commercial cyber café is high	10	0.16	1.28	Agree
4	There is always poor internet connectivity	12	0.20	1.54	Agree
5	There is unstable power supply	15	0.25	1.92	Agree
6	You don't have subscription to agricultural databases	10	0.16	1.28	Agree
	Total	60			

9. Discussion, Conclusion And Further Research

Research Question 1 in section 2 focused on ICT facilities used by agricultural researchers in agricultural sector. From observations, it was revealed that many agricultural researchers owned a laptop and browse by wireless networks. Furthermore, cybercafés were located in many schools of agriculture and offices to create Internet access for researchers which is supplemented by private cybercafés located close to their offices and within reach. Findings through the research questionnaire showed that all ICT facilities named in this study were used for agricultural research. The computer and its accomplishing packages, the statistical package and database packages were used for research especially computer used for data analysis. E-mail was used for research purposes, while electronic journals were used to publish research findings. Online databases were used for research too.

These findings confirm the findings by (Omotayo 2007) that a high percentage of agricultural researchers have access to both the computer and the Internet; and findings of (Adomi 2003) that researcher are major users of the Internet.

Research Question 2 in section 2 also dealt with benefits of ICT use in research in the agricultural sector. The findings showed that researchers have access to foreign journals with the use of ICT thereby reaffirming the position of (Omekwu 2002) that on-line and CD-ROM database systems have expanded

users' access to the most current information. The Internet, according to (Owoeye 2004) has made it possible for librarians to network and provide access to remote electronic databases, making in-roads to a wide range of services and products available to information users. Further findings indicated that analysis and interpretation of data is made easier with the computer. The study also found that researchers in agricultural sector hardly sent and received questionnaires on-line using e-mail in the conduct of their research. They did not benefit from electronic reference services. The findings indicated that literature search was made easier for lecturers of agricultural sciences using ICT. They have also been able to open new areas of research due to Internet use as found by the study. This is in agreement with findings by (Oduwole 2004) that the use of the Internet for academic research by Agricultural Scientist has improved their research output. The findings also showed that researchers of the agricultural sectors, who sent papers to editors for publication by e-mail, were able to register for variety of research information in e-mail box, received variety of research information in e-mail box and shared information with colleagues. Further findings showed that the graphical presentations in research publications are of higher quality using computers. It was indicated that enough research information is obtained in electronic resources and journals are read on-line as indicated by findings of this study.

Questionnaire Adopted For the Study

	Specific factors limiting farmers' use of ICT	AGREE	DIASGREE
1	Lack of ICT skills and inability to use	41	56
2	no perceived economic benefit	41	4
3	too hard to use	41	9
4	no ICT access and/or infrastructure	40	47
5	Lack of (personal) ICT support services	41	2
6	Cost of ICT and/or funds	41	26
7	Integration, reliability, usefulness of information	41	17
8	Available ICT unsuitable for practice or zone	41	2
9	Fear and/or distrust of technology	41	4
10	time limitations	41	0
11	lack of training	41	17
12	Tradition and/or Traditional practices	41	2
13	impediments .e.g. age, knowledge, English, motivation	41	48
14	don't understand value, lack awareness	41	19
15	other	26	0
	Factors limiting the use of ICT by research working with farmers		
16	None	41	0
17	Cost and/or lack of funds or equipment	41	26
18	no ICT access and/or infrastructure	41	26
19	Training	41	14
20	Lack of ICT skills and experience	41	12
21	Different priorities	41	14
22	Excessive time to develop and teach how to use	41	2
23	Lack of reliable data and/or information	41	7
24	Lack of suitable or reliable programs	41	4
25	Lack of ICT collaboration methodology and practical recommendations	41	9
26	Lack of info flow to farmers, their awareness	41	36
27	lack of common language or programs with farmers	41	39
28	Out of sync with farmers and their traditions	41	46
	Consequences for farmers not using ICT.		
29	None	41	2
30	Stop production	41	0
31	Loss of competitiveness	41	39
32	Loss of production and management efficiency	41	31

Finally agricultural researchers now experience less error in research papers due to ICT use. The benefits derived from the findings can be articulated in line with the statement of (Anasi 2002), that Information and Communication Technologies provide libraries immense opportunity for accessing and retrieving information resources without the restriction of time, space, or format, through online database searching, CD-ROM searching, e-mail services, Internet services, document delivery services, networking, Digitalization, and virtual library. Breakthroughs and development in ICT have increasingly reshape the way libraries and librarians access, retrieve, store, manipulate and disseminate needed information to their actual and potential users.

Poor connectivity, lack of relevant content, lack of ICT infrastructure & skills, high cost, inefficient and poor quality service, are the major impediments for ICT adoption.

It is suggested that further studies be conducted on the impact of ICT in agriculture. Some suggestions are outlined below:

- There is a need for further research work on the use of the remote sensing and GIS technology with the research study work covering the whole land area for Nigeria. This will provide the opportunity in carrying out a comprehensive appraisal of the agricultural land use changes scenario in the whole country. With the northern region of the country undergoing a rapid change in vegetation cover and

land use with desert encroachment a major problem, land use planners and environmental managers in the country will be able to make an assessment of the change scenario with a decision on which region of the country will be recommended for specific land use type based on consideration for the environment and its long term sustainability.

- There is also a need for further research work on resource use assessment to identify changes to the environmental resources in the country, more especially the water resources which is a major production resource for agriculture and other types or production activities in the country. With the country an arid region with water a limiting factor and drought a major occurrence in the country. There is need to identify regions already undergoing resource use stress for long term sustainability planning

Based on the findings of the study, it could be concluded that researchers in the agricultural sector have embraced ICT and are using it for research. Some of the facilities used are computer, statistical packages, database packages, CD-ROM, the Internet, e-mail and online databases. Agricultural researchers derive benefits from the use of ICT for research which include opening new areas of research, better analysis and interpretation of data, current literature, online publication of articles and easy transfer of research findings to editors for publication in journals. Researchers face some constraints on the utilization of ICT for agricultural research in the agricultural sector. Some of the constraints are high cost of using commercial cyber café, lack of up to date CD-ROM for current search, lack of time to spend in the café, unstable power supply and poor internet connectivity.

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