

The adoption and use of ICT by small scale farmers in Gezira State, Sudan

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Abstract

In Sudan common sources of agricultural information that have been used are the radio, television, extension, magazines, newspapers and face-to-face communication. This paper sought to identify the key factors that influence the use of ICT and the challenges of ICT adoption for disseminating agricultural information among farmers in Sudan's Gezira State. Socio-economic, cultural influences, technical shortcomings of information providers, and the age of farmers were related to the adoption and use of ICT. The most popular means of access to agricultural information were print media, friends, neighbours, agrochemical companies, research stations and extension officers with more than 50% respondents followed by radio (21.9%), TV (14.6%), internet (3.3%) and mobile phone above 10%. Thus, radio was the most popular ICT facility. The most common challenges to the adoption of ICT by farmers were low education levels, low income, cultural inertia, inadequate ICT skills among researchers and shortage of electricity. The scarcity of relevant content in local languages was also cited as a hurdle to adoption and use of ICT.

Key words: Challenges, disseminating, ICT adoption, ICT use

Résumé

IAu Soudan, les sources communes d'information agricole qui ont été utilisés sont la radio, la télévision, la vulgarisation, les magazines, les journaux et la communication face-à-face. Cet article a cherché à identifier les facteurs clés qui influent sur l'utilisation des TIC et les défis de l'adoption des TIC pour diffuser l'information agricole auprès des agriculteurs dans l'Etat de Gezira au Soudan. Les influences socio-économiques et culturelles, les insuffisances techniques des fournisseurs d'information, et de l'âge des agriculteurs étaient liés à l'adoption et l'utilisation des TIC. Les moyens les plus populaires de l'accès à l'information agricole sont les médias imprimés, les amis, les voisins, les entreprises de produits agrochimiques, les stations de recherche et les agents de vulgarisation, avec plus de 50% des répondants, suivie par la radio (21,9%), la télévision (14,6%), l'internet (3,3%) et le téléphone mobile au-dessus de 10%. Ainsi, la radio est le centre le plus populaire des TIC. Les défis les plus communs à l'adoption des TIC par les agriculteurs étaient leurs faibles niveaux d'éducation, le faible revenu, l'inertie culturelle, des compétences inadéquates en TIC entre les chercheurs et la pénurie d'électricité. La rareté des contenus pertinents dans les langues locales a également été citée comme un obstacle à l'adoption et l'utilisation des TIC.

Mots clés: défis, la diffusion, l'adoption des TIC, l'utilisation des TIC

Introduction

Globally, the pressure from population growth and competition for land for bio-fuels has placed greater demand on farmers to improve farm productivity while the need for food security continues to be a priority in many developing countries. Additionally, ability to adapt to climate change was listed as a key challenge to agriculture in the 21st century by the world summit on food security in 2009 (FAO, 2011a).

In Sudan, a lot of research has been carried out especially by Agricultural Research Corporation (ARC), Ministry of Agriculture, Animal Wealth and Natural Resources and Universities such as Khartoum University and University of Gezira (Ahmed, 2003). However, it has been demonstrated that the linkages between researchers, extension agents and farmers is not effective and that there is a mismatch between research output and on-farm practices (Simumba and Koopman, 2011). This is particularly true in sub-Sahara Africa where the majority of the food-insecure nations are located (FAO, 2011b).

It is thought that Information and Communication Technology (ICT) that includes radio, TV, mobile phone and Internet can be applied to narrow the gap between researchers and farmers by providing channels to convey information between researchers, extension agents and farmers. Several trials of such use of ICT have been conducted worldwide (Nyirenda-Jere, 2010), however, in Sudan little is known about the interaction of ICT use and flow of agricultural information linking researchers, extension agents and farmers.

The study reported here set out to ascertain how cultural, socio-economic factors influence the adoption and use of ICT by farmers for accessing agricultural information. Additionally, the study was intended to help identify the challenges to ICT use and adoption among farmers.

Methodology

A descriptive cross-sectional survey was conducted in 2010 with a sample of 120 farmers in Gezira State of Sudan using proportionate stratified sampling with a sampling frame based on farmers' database from the Sudan Ministry of Agriculture. The key data collection instrument was a self-designed questionnaire which was pilot-tested in Sennar locality where the reliability coefficient using Cronbach alpha was found to be 0.8. The instrument was in English but required to be translated in the field because the farmers spoke Arabic. Additionally, 30 researchers from the Gezira Research Station and Ministry of Agriculture were interviewed about farmers' adoption and use of ICT. The researchers included plant scientists, entomologists, agricultural engineers and agricultural extension officers.

Results and discussion

It was found that the vast majority (93.3%) of the respondents were literate based on completion of the adult literacy classes, primary school, secondary school and post-secondary studies as shown in Table 1. UNICEF (2010) reports an adult literacy rate of 70% for Sudan. The high literacy in Gezira State recorded in the current study may be explained by the central location of the State and its proximity to the capital city Khartoum. This proximity would be expected to provide greater advantage to learners than more remote areas and areas of conflict. It would be expected that the higher the level of education among the respondents, the more responsive they would be to many agricultural extension programmes and policies. This is an advantage for dissemination of farm innovations as education has been shown to be a factor in the adoption of high yielding modern farm practices (Obinne, 1991).

Additionally, as shown in Table 2, this indicated that majority (61%) of the farmers were 50 years and below. Again, it is expected that the relatively youthful famers would more easily adopt technology for the purpose of acquiring agricultural education. The older generation is unfamiliar with new communication technologies and in many cases, their children are far more familiar with social networking and other recent advances in Internet use. There is a

Table 1. Educational Levels of Farmers in Gezira State, Sudan.

Items	Frequency	Percent
No formal education	8	6.7
Adult literacy education	6	5.0
Primary school	41	34.2
Secondary school	36	30.0
Post-secondary school	29	24.1
Total	120	100.0

Table 2. Farmers ages in Gezira State, Sudan.

Age of farmers	Frequency	Percent
20-35 years	32	26.7
36-50 years	41	34.2
51-65 years	38	31.7
66-80 years	9	7.4
Total	120	100.0

major need for a cultural change so that they can take advantage of these tools to enhance their networking, advocacy and other opportunities to have impact (Porcari, 2010).

The result in Table 3 reveals that farmer's experience in agriculture in Gezira state is more than 10 years. . Long experience in farming is an advantage for improving productivity,

since it encourages rapid adoption of farm innovations (Obinne, 1991).

Farmers in Gezira have relatively small farms with 55.8% having 10 acres or less and 77.5% having less than 20 acres of land. The majority 69%, own their land with the rest leasing or farming on communal land while 61.7% earn between US\$400 and 2,000 per year from their land [1 US\$= 9.00 SDG].

ICT used by farmers in Gezira State

Table 4 Shows the ICT that are used by farmers in Gezira state which are: Radio, TV, Mobile Phone, Internet and others. The highest number (21.9%) of farmers is using Radio to access the agricultural information while 14.6% percent of farmers are using TV. The national radio and TV broadcast at least one weekly programme of about one hour long on agriculture. Programmes are presented in a non-scientific language that can easily be understood by farmers. The use of non-scientific language has made radios the most effective and popular media in rural areas of Sudan (Bashir, 2008).

The respondents mentioned additional advantages of the radio, namely, wide coverage, portable, battery operation, relatively inexpensive to produce and to broadcast and effective in case of illiterate audience. The respondents also mentioned the advantages of the TV, The likely advantage of TV include the fact that most of the farmers owned TV sets and the visual nature of TV content. Mobile Phones were used by 10.2% of farmers. According to the results farmers noted that mobile phone is portable, having high speed in transmitting agricultural information and inexpensive.

Table 3. Farmer's experience in agriculture in Gezira State, Sudan.

Years of experience	Frequency	Percent
Less than 5 years	7	5.8
5- 10 years	26	21.7
More than 10 years	87	72.5
Total	120	100.0

Table 4. ICT Used by Farmers in Gezira State, Sudan.

Tools	Frequency	Percent
Radio	60	21.9
TV	40	14.6
Mobile Phone	28	10.2
Internet	9	3.3
Others*	137	50
Total	274	100.0

Others*: print media, friends, neighbours, agrochemical companies, research stations and extension officers.

Only 3.3% of farmers are using Internet. Computer databases are available in ARC, National Centre for Research (NCR), Sudanese Agriculturists Union (SAU) and Shambat Library Complex (SHAM). Databases include Sudanese collection of scientific journals and foreign collection that includes Access to Global Online Research in Agriculture (AGORA), The Essential Electronic Library (TEEAL) and International Centre for Agricultural Research in Dry Areas (ICARDA) library. The respective institutions provide free access to these information sources through computer based network in each institution. However, there is no specific computer database that provides a link between farmers and other stakeholders in the agricultural sector especially with research output (Bashir, 2008). This might be partly because of inaccessibility of Internet as well as inadequate technical skills to use the technology on the part of farmers. Almost 50 % percent of farmers are using other methods including print media, friends, neighbours, agrochemical companies, research stations and extension officers.

ICT adoption challenges

Identifying the key challenges to technology adoption was a key objective of this study. Four categories of challenges were investigated that included socio-economic factors, cultural factors, technical factors and infrastructural support.

Among the socio-economic challenges that were rated in this study, 47% of the researchers rated educational level as the top challenge followed by income level (37%), gender (13%) and farm size (5%). A chi-square cross-tabulation was carried out between the various ICT and the socio-economic factors as shown in Table 5. A significance of 0.013 was obtained which was less than the significance level α of 0.05 indicating that there was a statistically significant relationship between the adoption of ICT and these socio-economic factors. The results are in harmony with RBEC (2001) who found that in developing and transition

Table 5. Cross tabulation between ICT used and socio economic factors affecting their use.

Socio economic constraints	ICT										Total	
	Radio		TV		Internet		Mobile phone		Print media		Co	%
	Co	%	Co	%	Co	%	Co	%	Co	%		
Education level	6	20.0	2	6.7	0	0.0	1	3.3	1	3.3	10	33.3
Income	0	0.0	2	6.7	1	3.3	0	0.0	5	16.7	8	26.7
Farm size	1	3.3	3	10.0	0	0.0	2	6.7	0	0.0	6	20.0
Gender	3	10.0	1	3.3	0	0.0	1	3.3	1	3.3	6	20.0
Total	10	33.3	8	26.7	1	3.3	4	13.3	7	23.3	30	100.0

Chi-square test: Value = 20.711, df = 12, $\hat{\alpha}$ =0.05, Significance = 0.013. Co= count. % = Percentage of total.

countries, most people cannot afford to use new ICT. Because the new ICT services such as the Internet are expensive to establish some level of cost recovery is imperative, therefore, service providers charge fees which may be unaffordable for the lower income segments in the community.

A similar cross-tabulation between ICT and cultural factors that included cultural beliefs, legal frameworks and politics yielded a significance of 0.028 at 12 degrees of freedom against a significance level of 0.05 indicating that there is a statistically significant relationship between adoption of ICT and these cultural factors. These findings agree with the results of Baron (1999) who identified culture is one of the impediments to adoption and use of ICT. He hypothesized that people had difficulties in shifting from a worldview based on oral tradition and the physical proximity of objects, places and persons, to one in which the world is converted into digital objects such as files and windows that are closer to the idea of virtual reality.

LaMonica (2010) a brilliant inventor with more than 400 patents, argues that the speed of technology adoption should not be measured by how fast you can invent new products but by how long the “collective culture” of the target group takes to give up old ways even when the old ways are a source of frustration. In his view, the rate of “emotional, intellectual, cultural, and regulatory” inertia in the world is very high and getting higher (LaMonica, 2010). Z’arate *et al.* (2009) cited in Z’arate and Shaw (2010) define cultural inertia as “desire to avoid cultural change, or conversely, to continue change once change is already occurring”. Any interventions to promote new technologies need to take cultural inertia into account as a significant resistive force. With regard to politics, Rohozinski (1996) found that political factors can significantly affect the ways and means by which development actors can promote or pursue an ICT agenda.

Among the technical challenges that were rated in this study, 53% of the researchers rated the scarcity of skilled staff and technicians as the top hurdle. Twenty one percent rated weaknesses in methods of dissemination as the second most important barrier to adoption with 13% rating inappropriate information packaging and shortage of ICT centres tying in third place. Like socio-economic and cultural factors, there was a statistically significant relationship between these technical challenges and the adoption of ICT with significance at 0.003 at 12 degrees of freedom and an alpha value of 0.05.

These staff shortcomings were cited in relation to the research stations meaning that a substantial proportion of researchers and research technicians are perceived to have inadequate ICT skills to enable them use ICT for information dissemination. The findings confirmed the results of Hebert (2007) and Keengwe *et al.* (2009) who found that researchers lacked adequate skills and time not only to publish research on the Internet but also to undertake research that could lead to outputs worthy of dissemination. Heavy workloads, and the fact that Internet access for most of them was in cyber cafes, did not allow time or a suitable environment to engage in Internet searches or online dissemination of their work.

The infrastructural support challenges that were rated in this study included availability of roads, electricity and telecommunications infrastructure. Table 6 shows the situation with regard to the availability of electricity.

Table 6. Electricity availability to support dissemination of agricultural information.

Percent	Frequency	Items
3.3	4	Missing
47.5	57	no power
11.7	14	frequent power cut
37.5	45	reliable power supply
100.0	120	Total

It was found that 50.8% of farmers have little or no access to electricity (grid or solar) making it difficult to use ICT such as TV that cannot easily run on batteries. Similar figures were obtained for access to roads with 54.2% of the farmers indicating that there is little or no road infrastructure in the places they lived. With regard to telecommunications infrastructure, 30.8% reported little or no infrastructure indicating relatively good coverage of the target population. Reports such as Foster *et al.* (2010), illustrate the stark contrast not only between rural and urban Africa but also between developing countries in Africa and developing countries elsewhere with respect to the state of infrastructural development. The results from the current study show that, even in Sudan, a relatively oil-rich nation, infrastructural challenges are still dire. In such an environment, the uptake of ICT in rural areas is likely to be stunted especially by shortage of electricity and telecommunications infrastructure.

In addition to the three categories of challenges that were investigated, it was also noted that there were other factors that need more study including low awareness about ICT, reluctance to change traditional ways of farming and the relative lack of content in local languages specifically in Arabic.

Conclusions

There is global pressure on food production due to factors such as competition for farmland by bio-fuels, population rise and climate change yet, in developing countries and especially in Africa, there is little linkage between research output and farming leading to low adoption of such research. It is useful to ascertain the status of adoption of ICT by farmers for the purpose of acquiring agricultural information. Such ICT adoption would be expected to lead to improved productivity. In this survey of farmers in Gezira State, Sudan, was found that while the uptake of older ICT such as radio and TV was relatively established at 21.9% and 14.6% respectively newer ICT were less used with only 3.3% using the Internet.

Some of the reasons for lower adoption of the newer ICT were identified as high cost relative to farmer income, limited availability, little localised content as well as cultural inertia.

Although more than 90% of farmers were literate yet the researchers who were surveyed rated low education levels as the key barrier to adoption of ICT by farmers. The scarcity of skilled staff and technicians in the research institutions was additionally rated as a key hurdle as was shortage of electricity.

Recommendations

It is recommended that key interventions to improve ICT adoption and use include awareness campaigns to counteract cultural inertia, improve ICT skills of research staff and related technical staff, provide more localised content relevant to farmers, reduce the relative cost of the newer ICT especially the Internet, and improve rural infrastructure especially provision of electricity. This research was exploratory and further research is needed on issues such as the role of gender, culture and politics on ICT adoption. Similarly, the capability of research institutions to provide appropriate localised content is an issue that requires further research.

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