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# CHALLENGES OF USING INFORMATION AND COMMUNICATION TECHNOLOGIES TO DISSEMINATE AGRICULTURAL INFORMATION TO FARMERS IN SUDAN

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Abstract

*Purpose:* In this study, the challenges to effective use of ICT to disseminate agricultural information were investigated. The study also sought to determine the extent to which ICT usage influences the dissemination of agricultural information. The research additionally sought to identify socio-economic factors as well as cultural and technical constraints affecting the use of ICT.



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*Design/methodology/approach:* Data were obtained from a random sample of 120 farmers attained through proportionate stratified random sampling. Simple random sampling was used to select 30 researchers from Gezira Research Station and the Ministry of Agriculture.

*Findings:* The study generated information that can be used by stakeholders to create appropriate policy decisions involving the use of ICT. Among the researchers, the most popular methods of dissemination are print media (30%) followed by radio (20%) and TV (15%). For farmers, the most popular methods are radio (21.9%) followed by print media (15.33%) and TV (14.6%). The results indicate that socio-economic, technical and cultural factors influence the use of ICT. The study identified significant relationships between socio-economic, cultural and technical challenges and the use of ICT in the dissemination of agricultural information.

*Originality/value:* In conclusion, radio was the most popular ICT among farmers. However, the dissemination processes faced cultural, technical and socio-economic challenges.

**Keywords:** ICT, Challenges, Dissemination, Agricultural information

## INTRODUCTION

Across the developing world, agriculture is a major contributor to GDP and to employment (Ahmed, 2003; World Bank, 2012). For this reason, significant effort has been expended in the past decade to increase the use of ICT in agriculture, especially with the aim of improving the economic status of small-scale farmers in developing nations (Singh, 2006). However, over and over again, the reports seem to point to similar challenges that hinder the use and adoption of ICT. In many African countries, relatively high costs of services and lack of supporting infrastructure are the prominent challenges (Lwonga, 2010; Mwakaje, 2010; Dutta and Bilboa-Osorio, 2012). In other discussions, it is suggested that the issues are indeed deeper and touch on (i) the nature of adoption models; (ii) matching solutions with the target culture and traditions (iii) and building capacity and appetite to drive change in the institutions responsible for leading the change (Aleke *et al.*, 2011; Jamwal and Padha, 2009). Others strongly propose a review of the approaches to the adoption of ICT in agriculture. Some even suggest that many of those involved in this enterprise lack clarity regarding the role of ICT in agricultural development, to the point of advocating utopian views (Jamwal and Padha, 2009; Singh, 2006). The transformation of many national visions, such as that sought by Kenya's Vision 2030, will take

a generation of sustained research, development and social change. In these circumstances, it is easy to make a case for continuing research in this area of ICT application to help provide answers to the many unanswered or partially answered questions.

Agricultural research in Sudan started in 1902 (Ahmed, 2003). Most agricultural research in Sudan is carried out by the Agricultural Research Corporation (ARC) of the Ministry of Agriculture, and the Animal Resources Research Corporation (ARRC) of the Ministry of Animal Resources. Some is carried out by Institutes of Higher Education such as Khartoum University, the University of Gezira and Sudan University for Science and Technology (Ahmed, 2003). It is important to disseminate agricultural information to ensure farmers have adequate knowledge and skills to address their needs and sustain production. Research institutions have a responsibility to ensure that the information they disseminate is packaged in a way that makes it easy for the end-users to understand. Researchers need to use appropriate dissemination channels that will make the information accessible to the end-users (Ghobrial and Musa, 2006).

Although a lot of research has been done to improve agricultural productivity in Sudan, performance of the agriculture sector continues to decline. The achievement of high agricultural productivity depends on the availability and access to appropriate agricultural information. It also depends on the tools of dissemination for the right target groups. The challenges facing the use of ICT in dissemination of agricultural information are thought to have contributed to the reduction of agricultural productivity, economic performance, food security and loss of biodiversity in Sudan. There is deficiency of information on the challenges of using ICT to disseminate agricultural information to farmers. There is also scanty information on why agricultural information channels have not been effective.

This study sought to help fill this gap in knowledge. Sudan's agricultural information system faces several challenges which affect other information and knowledge systems in the country. Overall, the existing organisations and their resources are inadequate for the country's ICT needs. This is further compounded by the fact that there is no coordination in the management and provision of information. This brings with it certain weaknesses in the system, and issues such as complete neglect of certain areas of agricultural knowledge, fragmentation

of information resources, inadequacy of the services provided, and costly duplication of information materials and services (El-Siddig and Musa, 2008). Most institutions seem to have an adequate number of computers. The high cost of maintenance services in addition to its non-availability in remote and rural areas greatly affect the effective utilisation of ICT, especially with regard to those institutions that depend on information supplied from remote field stations (Bashir, 2008).

There is a need for selective dissemination in order to steer farmers in a particular direction. According to Ahmed (2003), almost all farmers agree that the technologies provided are costly to adopt and even if the technologies were inexpensive, farmers have limited financial resources. This study reveals that farmers' returns from their produce as per the individual accounts system is very low and that farmers bear all the risks that might adversely affect their crops for reasons beyond human control, such as unfavourable weather conditions. Therefore, 34% of Sudanese farmers are performing other jobs in addition to farming to earn extra income (Ahmed, 2003).

Common sources of agricultural information that have been used are the radio, television, extension, magazines, newspapers and face-to-face communication. Lately, research institutions have embraced the modern sources of information such as the internet, especially online databases, journals and articles that have made information more readily accessible, accurate and timely. These modern sources have been used within research institutions and extension service units, but their effectiveness in availing information to farmers has been criticized. It is thought that the modern sources of information have social, educational, economic, cultural and technical constraints which limit their effectiveness in disseminating agricultural information to farmers (Bashir, 2008).

## **METHODOLOGY**

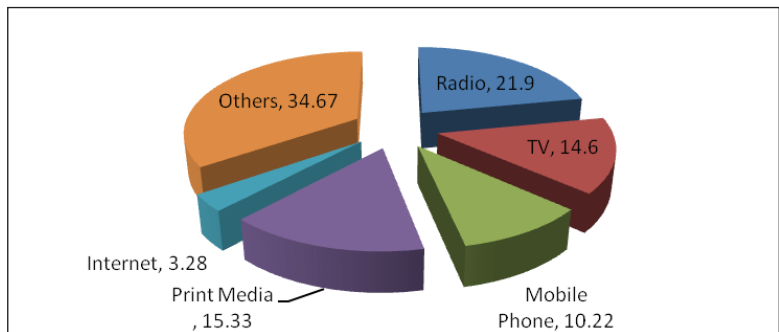
According to the Sudan's 5<sup>th</sup> population and housing census, the total estimated population of the Sudan was 39,000,000 people, of whom 3,575,280 were in Gezira State. The total number of farmers was 60,952 (Central Bureau of Statistics, 2008). The sample size of 120 farmers was obtained from the total population of the farmers in the state by proportionate stratified sampling. This sample of 120 farmers is above the recommended minimum sample of 100 for survey research (Kathuri and Pals, 1993). The extra 20 was to cater for attrition. The advantage

in stratified random sampling is to ensure inclusion. A self-designed questionnaire in English with a reliability coefficient of 0.80 (Cronbach's alpha) was used to obtain the data. Additionally, 30 researchers from Gezira Research Station and the Ministry of Agriculture were surveyed. This sample size was above the recommended minimum group sample for any statistical analysis (Edriss, 2003). The researchers included plant scientists, entomologists, agricultural engineers and agricultural extension officers. The questionnaires were coded and the data entered into the computer using Statistical Package for Social Sciences (SPSS) version 11.5 software. The software was used for data analysis. Data were analysed using both descriptive statistics (percentages and frequency) and inferential statistics (Chi-square test).

### RESULTS AND DISCUSSION

Figure 1 shows the ICT used for accessing agricultural information by farmers in Gezira State, which include radio, TV, internet, mobile phone, print media and others. While 21.9% of farmers are using radio, 15.33% of farmers are using print media, 14.6% of farmers are using TV, 10.22% are using mobile phone and 3.28% of farmers are using the internet. A high percentage (34.67%) of farmers obtain information from other sources such as friends, neighbours, extension staff, agro chemical companies and Agricultural Research Corporation stations.

Figure 2 Shows the ICT used to disseminate agricultural information by researchers in Gezira State, which include radio, TV, mobile phone, print media, internet and others. The highest number (29%) of researchers are using print media to disseminate agricultural information, while 27% of researchers are using radio, 19% are using TV, 14% are



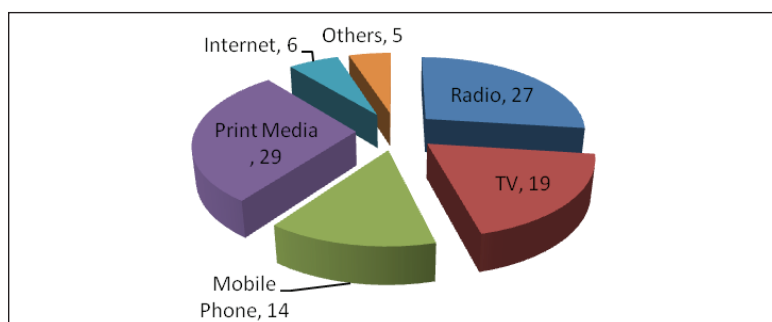
**Figure 1.** ICT use in accessing agricultural information in Gezira State, Sudan

using mobile phones and 6% are using the internet. A small percentage (5%) of researchers are using other methods including field days, farmers school, seminars, training, workshops, meetings, extension convoys and personal contact.

Table 1 shows socio-economic factors that are perceived to influence the use of ICT, which include gender, education level, income and farm size. The most prevalent socio-economic factor that is perceived to affect use of ICT by farmers is difficulty in reading and writing represented by their low educational level (47%) while 35% experience income-related challenges, 13 % gender and 5% farm size-related challenges.

The study further identified whether socio-economic factors significantly affect the use of ICT for disseminating agricultural information. A cross tabulation between socio-economic factors and ICT used in Gezira State to disseminate agricultural information was carried out. Table 2 below presents the results.

The Chi-square test value was 20.7 with a significance level of 0.013, indicating that socio-economic challenges such as education



**Figure 2.** ICT use in dissemination of agricultural information in Gezira State, Sudan

Items	Frequency	Per cent
Gender	8	13
Education level	28	47
Income	21	35
Farm size	3	5
Total	60	100

**Table 1.** Socio-economic factors that influence the use of ICT as perceived by researchers

**Table 2.** Cross tabulation between ICT used and socio-economic challenges affecting their use

Socio-economic factors	ICT											
	Radio		TV		Internet		Mobile phone		Print media		Total	
	count	%	count	%	count	%	count	%	count	%	count	%
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 = 20.7, df = 12, Significance = 0.013, % of total

and income level are related to the use of ICT in disseminating agricultural information. The results further indicate that most of the respondents cited education levels as an impediment to the use of ICT in communicating agricultural information.

Table 3 shows cultural factors that are related to the use of ICT, which include beliefs, political and institutional leadership, laws and others.

Forty-seven per cent of the researchers indicated that the farmer's beliefs related to traditional planting methods negatively influence their use of ICT. Thirty-seven per cent of the researchers noted that political and institutional leadership hindered the use of ICT in disseminating agricultural information. Sixteen per cent of the researchers reported that laws also hindered the use of ICT in disseminating agricultural information. The researchers perceived other challenges such as lack of opportunities for farmers to acquire appropriate knowledge as well as availability and accessibility to ICT devices. The researchers additionally perceived radio and TV programmes as challenges because in most cases these programmes tend to focus on political and other government-related messages and lack sufficient focus on technology transfer in agriculture.

The present study also investigated whether cultural challenges significantly affected the use of ICT for disseminating agricultural information. The findings are presented in Table 4.

As shown in Table 4, the Chi-square test value was 17.3 with a significance level of 0.028, indicating that a statistically significant relationship exists between cultural factors and use of ICT.

Table 5 shows technical factors that are perceived to affect the use of ICT among the researchers, which include packaging of information, limited skills among the staff and technicians, shortage

Items	Frequency	Per cent
Beliefs	14	47
Political & institutional leadership	11	37
Laws	5	16
Total	30	100

**Table 3.** Cultural factors that influence use of ICT as perceived by researchers



**Table 4.** Cross tabulation between ICT used and cultural challenges affecting their use

Cultural constraints	ICT											
	Radio	TV	Internet	Mobile phone	Print media	Total						
	count	%	count	%	count	%	count	%	count	%		
Beliefs	4	13.3	4	13.3	0	0.0	0	0.0	2	6.7	10	50.0
Political & institutional leadership	5	16.7	0	0.0	1	3.3	4	13.3	5	16.7	15	33.3
Laws	1	3.3	4	13.3	0	0.0	0	0.0	0	0.0	5	16.7
Total	10	33.3	8	26.7	1	3.3	4	13.3	7	23.3	30	100.0

Chi-square test: Value = 17.3, df = 12, Significance = 0.028, % of total

of ICT centres and methods of dissemination. Fifty-three per cent of the researchers mentioned that there is a lack of skilled staff and technicians while 21% indicated that methods of dissemination used also hindered the use of ICT. Lack of or inappropriate ICT centres were indicated by 13% of the respondents. The remaining 13% of the sampled researchers noted that dissemination of the information is constrained by the packaging of information.

In addition, the study sought to ascertain whether technical constraints were perceived to influence the use of ICT for disseminating agricultural information. The findings are presented in Table 6.

According to the results in Table 6, the Chi-square test value was 20.4 with a significance level of 0.003. These results indicate that technical constraints such as inadequate skills of staff, limited ICT centres, poor methods of communication and packaging of information affect the use of ICT in disseminating agricultural information. The majority of the respondents cited inadequate skilled staff and technicians as the major technical factor affecting the use of ICT in disseminating agricultural information. Lack of good infrastructure might contribute to this outcome.

Table 7 shows the appropriate ICT suggested by researchers, which include radio, TV, mobile phone, print media and others. Thirty eight per cent of the researchers prefer radio for dissemination while 30% prefer others (field days, Farmers School, seminars, training, workshops, meetings, extension convoys and personal contact), 23% suggest use of TV, 8% suggest print media and 3% prefer the mobile phone.

Items	Frequency	Per cent
Packaging of information	11	13
Skills of staff and technicians	46	53
ICT centres	11	13
Methods of dissemination	18	21
Total	86	100

**Table 5.** Technical factors that influence use of ICT as perceived by researchers

**Table 6.** Cross tabulation between ICT and the technical constraints affecting their use

Technical constraints	ICT											
	Radio		TV		Internet		Mobile phone		Print media		Total	
	Count	%	Count	%	Count	%	Count	%	Count	%	count	%
Skilled staff and technicians	3	10.0	5	16.7	0	0.0	1	3.3	2	6.7	11	36.7
ICT centres	4	13.3	0	0.0	0	0.0	3	10.0	1	3.3	8	26.7
Dissemination methods	3	10.0	2	6.7	0	0.0	0	0.0	1	3.3	6	20.0
Packaging of information	0	0.0	1	3.3	1	3.3	0	0.0	3	10.0	5	16.7
Total	10	33.3	8	26.7	1	3.3	4	13.3	7	23.3	30	100.0

Chi-square test: Value = 20.4, df = 12, Significance = 0.003, % of total

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## CONCLUSIONS

This study showed that while radio is quite popular as a source of agricultural information, the internet is still an emerging technology with only 3.3% of farmers reporting its use. On the other hand, researchers rely on print media as the main method of dissemination with only about 6% using the internet for dissemination. Some of the reported reasons for this situation include limited technical skills among agricultural research staff. One of the key reasons that text-based media are not popular among farmers is their limited reading and writing skills. There are also indications that cultural practices and beliefs are a barrier to the adoption of innovations in agriculture.

Consequently, in order to accelerate innovation and improve agricultural practices among farmers, policy needs to address both the technical and social-economic barriers to adoption as well as the cultural inertia. Issues such as reading levels require long term transformation strategies. Shorter term strategies are therefore required, such as deliberately ensuring that dissemination methods adopt accessible technologies, which in this instance include radio and TV. It will be essential for research organisations to match the dissemination methods with the farmers' preferences to attain more effective transfer of knowledge and skills from research to farmers. The study serves to inform stakeholders in agriculture in Sudan about the status of use of ICT in the dissemination of agricultural information.

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Items	Frequency	Per cent
Radio	15	38
TV	9	23
Mobile phone	1	3
Print media	3	8
Others	12	30
Total	40	100

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Others\*: field days, Farmers School, seminars, training, workshops, meetings, extension convoys and personal contact

**Table 7.** ICT suggested by researchers for use in dissemination of agricultural information

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## REFERENCES

- Ahmed, A. (2003), "Technology Management in the Sudan: Strategic and Policy Challenges", *Journal of Management Decision*, Vol. 41 No. 3, pp. 267-273.
- Aleke, B., Ojiako, U. and Wainwright, D.W. (2011), "ICT adoption in developing countries: perspectives from small-scale agribusinesses", *Journal of Enterprise Information Management*, Vol. 24 No.1, pp. 68-84.
- Bashir, Y.G.A. (2008), "Assessment of agricultural information needs in African, Caribbean & Pacific (acp) states", *Eastern Africa: Country Study Sudan*, Technical Center for Agricultural and Rural Cooperation (CTA).
- Central Bureau of Statistics, (2008), *The 5<sup>th</sup> Sudan population and housing census: Population and Housing Census*, Retrieved September 22, 2009, from [www.CBS.gov](http://www.CBS.gov).
- Dutta, S. and Bilboa-Osorio, B. (eds). (2012), "The Global Information Technology Report 2012, Living in a Hyperconnected World", *World Economic Forum and INSEAD*, 2012. Retrieved on 5<sup>th</sup> March 2013 from: [http://www3.weforum.org/docs/Global\\_IT\\_Report\\_2012.pdf](http://www3.weforum.org/docs/Global_IT_Report_2012.pdf)
- Edriss, A.K. (2003), "A passport to Research Methods", *Research Skills Building Approach*, Las Vegas: International Publishers Press.
- El-Siddig, K. and Musa, A.I. (2008), "Report on the National Agricultural Information System (NAIS) of the Sudan", *Proceedings of the Regional Workshop for Strengthening National Information Communication Management Focal Units in Near East Region*, Muscat, Oman, 8–10 January, 2008.
- Ghobrial, R.A. and Musa, A.I. (2006), "Towards an Agricultural Information Network in Sudan", *First IAALD Africa Chapter Conference*, Nairobi, Kenya 21-26 May 2006.

ILO. (2013), "Employment in agriculture of total employment by country", International Labour Organization–Key Indicators of the Labour Market database, 2013. Retrieved on 5<sup>th</sup> March 2013 from: [http://www.NationMaster.com/graph/lab\\_emp\\_in\\_agr\\_of\\_tot\\_emp-labor-employment-agriculture-total](http://www.NationMaster.com/graph/lab_emp_in_agr_of_tot_emp-labor-employment-agriculture-total)

Jamwal, S. and Padha, D. (2009), "A Study of Information and Communication Technology in the Area of Agriculture and Rural Development in J&K State", *Proceedings of the 3<sup>rd</sup> National Conference, INDIACom-2009, Computing For Nation Development, February 26–27, 2009, Bharati Vidyapeeth's Institute of Computer Applications and Management, New Delhi*, Retrieved on 5<sup>th</sup> March 2013 from: <http://www.bvicam.ac.in/news/INDIACom%202009%20Proceedings/pdfs/papers/56.pdf>

Kathuri, J.N. and Pals, D.A. (1993), *Introduction to Educational Research*, Egerton University, Njoro, Kenya. Educational Media Centre.

Lwonga, E.T. (2010), "The Case of Selected Telecentres and Rural Radio in Tanzania", *The Electronic Journal of Information Systems in Developing Countries*, Vol. 43 No.6, pp. 1-14. Retrieved on 5<sup>th</sup> March 2013, from: <http://www.ejisdc.org/ojs2../index.php/ejisdc/article/viewFile/729/334>

Mwakaje, A.G. (2010), "Information and Communication Technology for Rural Farmers Market Access in Tanzania", *Journal of Information Technology Impact*, Vol.10 No.2, pp.111-128. Retrieved on 5<sup>th</sup> March 2013 from: <http://www.jiti.com/v10/jiti.v10n2.111-128.pdf>

Singh, S. (2006), "Selected Success Stories on Agricultural Information Systems", *Asia-Pacific Association of Agricultural Research Institutions - FAO Regional Office for Asia and the Pacific*, 2006. Retrieved on 5<sup>th</sup> March 2013 from: [http://www.apaari.org/wp-content/uploads/2009/05/ss\\_2006\\_01.pdf](http://www.apaari.org/wp-content/uploads/2009/05/ss_2006_01.pdf)

World Bank. (2012), "World Development Indicators", 2012. Retrieved on 5<sup>th</sup> March 2013, from <http://data.worldbank.org/data-catalog/world-development-indicators>

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