

# Usage of Information and Communication Technology in the Delivery of Agricultural Extension Services: A Case Study of Gedaref State, Sudan

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## Abstract

The emergence of new agricultural development paradigms has led to challenging the conventional methods of delivering important services to farmers and the transformation of traditional societies into modern societies. Across the developing countries, agriculture is a major contributor to GDP and employment. The objective of this paper was to assess the use of ICTs in delivery of agricultural extension services in Gedaref State, Sudan. The primary data were collected from 94 extension officers representing total sample size in the Gedaref State in growing season 2018/2019. Well-constructed questionnaire was used for data collection. The data were coded, fed to computer and statistically analyzed by using (SPSS) software, emphasized on descriptive statistics analysis and Chi-square Test. The results indicated that the majority of the respondents (72.3%) used ICTs and 47.8% of the extension officers used ICTs for audiences as multiple purposes services. Also 93.6% of the respondents faced more than one constraint when using ICTs. Results of chi-square test showed significant association between some ICTs (mobile phone, computer, digital camera, audiovisual aids, TV) and their purpose ( $P=0.001$ ). Significant association between ICTs and constraints of using ICTs in delivery of agricultural extension services ( $P=0.001$ ). This paper concluded that the use of ICTs in the delivery of agricultural extension services to extension clientele in Gedaref State is still in the beginning stages according to the high percentage of using traditional ICTs such as TV in comparison to modern ICTs such as smart phone and internet websites. The paper recommends that more efforts should be exerted to train extension officers and beneficiaries on the active use of modern ICTs.

## Keywords

Agricultural extension services, ICTs, Gedaref State, Sudan

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## 1. Introduction

The agricultural sector of Sudan is the dominant sector of the Sudan's economy. The research has shown that the social and economic growth of Sudan depends to a great extent on the performance of the agricultural sector. In addition to generating directly about two-fifths of GDP, agriculture also drives activities in the industry and service sectors such as

transportation, agro-industries, and commerce, which account for a large part of the rest of the economy. Even more importantly, 80 percent of the labor force is employed in agricultural and related activities. Also the performance of agricultural sector is the main determinant of year-to-year changes in poverty levels and the food security of the population of any country.

Before oil extraction in 1999, agriculture was the source of virtually all of the Sudan's exports, and therefore, it is a key determinant of balance of payments developments. The agricultural resource base covers several agro-economic zones that include afforestation, farmlands, arable croplands and grazing lands for livestock as well as fisheries in the Nile basin and in the Red Sea. The current cropped area is about 41 million Acres (17 million hectares) which account to about 20 percent of the potential arable lands [1].

Global attention came back to agriculture due to the price hike in recent years, resulting partly from long-standing negligence on diffusion of appropriate technology that stagnated production in the face of a rising population. Increasing production is a major challenge facing present agriculture. Smallholder farmers which dominate the landscape of developing world need to improve their farming business through acquiring adequate knowledge and information. Agricultural extension services provide critical access to the knowledge, information and technology that farmers require to improve the productivity and thus improve the quality of their levels of livelihoods. It is hence crucial to provide farmers with the knowledge and information in a quality and timely way. Although some ground-breaking tools like the tele-centres can serve as major catalysts for information, knowledge and development opportunities, the access of farmers in remote villages to information is restricted due to the lack of infrastructure [2]. The use of information and communication technology (ICT) in agricultural extension and rural development has significantly increased in many countries where it has provided a medium to adequate access to agricultural information [3].

Information and communication technology (ICT) can play a key role in increasing agricultural production, poverty alleviation, education and health of rural people. In Africa, ICTs can be seen as an important component of agricultural development they can be used as modern tools in the provision of needed information, knowledge and skills for improving agricultural productivity and rural incomes of African countries. Agricultural extension and advisory services organizations can help rural people to use these ICTs effectively that in turn will lead to increase their production efficiency, enhance food security and better standard of living [4]. The effective agricultural extension work rely on extension messages (information) reaching many farmers and farmer's problems reaching extension agents quickly and regularly [5]. Information and communication technologies (ICTs) have promising future to transform agricultural sectors and economic growth of developing countries. There for technologies that can be used in producing, organizing and distributing information [6]. In the vast of African countries agricultural extension services are weak, unsatisfactory or not exist.

In Sudan as in the most developing countries ministry-based agricultural extension services are adopted and established after the Second World War as part of American Aid for developing countries in 1959. Therefore, agricultural extension services are still depend largely on the use of traditional communication methods in the delivery of these services to extension clientele [4]. When using traditional communication methods, extension officers cannot reach all the targeted clientele because of long distances, bad roads, poor communication infrastructure in most rural areas in the country, low financial support in addition to high farmers extension officer ratio. In the majority of developing countries, there are few extension officers to serve many farmers, for example in Kenya the ratio of farmers to extension officer is 753:1 [7].

## 2. Materials and Methods

### 2.1 Area of the study

The Gedaref State is located in Eastern Sudan (longitude 13° 51' E and latitude 34° 55' N) bordered by Kassala State at the north, Khartoum State at the northwest, Sinner State at the south, Gezira State at the west and Eritrea at the east. The state covers a total area of 75,263 Km<sup>2</sup> [2]. It is 600 meters above the sea level. About 1,348,378 people live in Gedaref area according to 2008 Population census (Population Census Council, 2009). The average population density of Gedaref area was estimated at approximately 18 persons per square kilometer.

The area is generally divided into three agro-ecological zones on the basis of the amount of rainfall and main agricultural characteristics. The northern zone with rate of rainfall less than 500 mm; where animals especially sheep production is primarily practiced beside crop production, the central zone with rainfall range between 500 to 600 mm and the southern zone with rainfall range between 600 to 900 [2].

### 2.2 Population and sample size

The target population is the total number of agricultural extension officers working for Agricultural Extension and Technology Transfer Administration of Gedaref State is estimated to be 94 agricultural extension officers. This number represents the sample size of the study.

## 2.3 Data collection and analysis

Field survey was used to collect data from 94 extension officers. A Close ended questionnaire consisting of twenty one questions was constructed and addressed socioeconomic characteristics of extension officers, kind of ICT used, purpose of use and constraints facing the use of ICT in the delivery of agricultural extension services to extension clientele in Gedaref State. The personal interview technique was used to administer the questionnaire. A pre-test for the questionnaire was made with 15 extension officers.

The collected data were coded, fed to computer and statistically analyzed by using Statistical Packages for Social Sciences (SPSS), discussed and interpreted using percentage, frequency distribution and chi-square test at  $P \leq 0.05$  = significance. Chi square is given by:

$$\chi^2 = \sum_{r=1}^R \sum_{c=1}^C (O_{rc} - E_{rc})^2 / E_{rc}$$

With degrees of freedom ( $\nu$ ) given by  $(R-1)(C-1)$ , where:

R: Rows of the contingency table, C: Columns of the contingency table, O: Observed value, E: Expected value [8].

## 3. Results and Discussion

### 3.1 Results of Descriptive analysis

**Table 1. Distribution of the extension officers according to their demographic characteristics**

Demographic characteristics		Frequency	Percent %
Sex	Male	47	50.0
	Female	47	50.0
Social status	Married	58	61.7
	Single	33	35.1
	Divorced	2	2.1
Educational level	Widowed	1	1.1
	Secondary school	2	2.1
	Diploma	3	3.2
	B.Sc.	86	91.5
	M.Sc.	3	3.2
Age group	15-25	5	5.3
	26-35	59	62.8
	36-45	23	24.5
Work experiences	46 and more	7	7.4
	less than 5 years	40	42.6
	5 to 10 years	30	31.9
	11 years and more	24	25.5
Total		94	100.0

Table 1 showed that 50% of the extension officers were males, while 50% of them were females this shows that the equal opportunities for appointment in the study area. The adopted agricultural extension approach should have gender sensitivity to keep suitable sex ratio among extension officers in order to cover the women farmers at farm level. Regarding values, norms, religion and traditions of rural people in Sudan extension organizations should recognize and respect the gender issue in their fields.

The majority of the extension officers (61.7%) were married while 35.1%, 2.1%, and 1.1% of them were single, divorced and widowed respectively. In this paper, married people are more creative and have more stability in their work.

Results extend to indicate that the majority of extension officers (91.5%) bachelor holders, compared to 3.2%, and 3.2% of them are M.Ss and Diploma holders respectively. Only 2.1% of them are secondary school certificate holders. Educational level of extension officers contributes directly to job performance and impact of extension work with rural

people. Education level of extension officers is one of the most serious problems of extension in many countries.

In regard to age 62.8% of the extension officers between 26-35 years old, 24.5% of them between 36-45 years old, 5.3% of them between 15-25 years old and 7.4% of them have 46 years old and more. Research showed that employing of young people can be cost effective and provide required skills and workforce in the future and a source of future management power.

Also, the results revealed that 42.6% of the extension officers reported that their work experiences less than 5 years. 31.9% of them reported that their work experiences 5-10 years and 25.5% of them reported that their work experiences 11 years and above. The work experience or period of appointment is essential for extension personnel. It will increase their ability, knowledge, skills, and behavioral dimensions which are important for the field level extension personnel, years of work experience help in the good management of the field and individuals and work in a spirit of one team and this reflected positive possibility in production and productively.

**Table 2. Distribution of the extension officers according to their use of ICT in the delivery of Agricultural Extension services**

Use of ICT	Frequency	Percent%
Use ICT	68	72.3
Did not use ICT	26	27.7
<b>Total</b>	<b>94</b>	<b>100.0</b>

Table 2 revealed that the majority of the extension officers (72.3%) reported that they used ICT in the delivery of agricultural extension services to their audiences. While 27.7% of them reported that they did not use ICT in the delivery of agricultural extension services to their audiences. Farmer's demand for information has increased in recent years due to greater market instability, more complex production technologies among others. Lack of timely information can prevent good quality decision and thus lower the efficiency of production decision among farmers. Therefore, ICT can be used to strengthen the capabilities of rural development workers, farmers, farmer organizations and rural communities as a whole.

**Table 3. Distribution of the extension officers according to the kind of ICT used in the delivery of agricultural extension services**

Kind of ICT used	Computer		Digital camera		Audiovisual aids		Television		mobile phone	
	Fre.	%	Fre.	%	Fre.	%	Fre.	%	Fre.	%
<b>Not used</b>	32	34	50	53	33	35.1	31	33	26	27.7
<b>Often</b>	32	34	10	10.6	48	51	54	57.5	60	63.8
<b>Some times</b>	21	22.3	7	7.4	9	9.6	7	7.4	6	6.4
<b>Rarely</b>	9	9.7	27	29	4	4.3	2	2.1	2	2.1
<b>Total</b>	<b>94</b>	<b>100</b>	<b>94</b>	<b>100</b>	<b>94</b>	<b>100</b>	<b>94</b>	<b>100</b>	<b>94</b>	<b>100</b>

Table 3 showed that: 34%, 53%, 35.1%, 33% and 27.7% of the extension officers reported that they did not use computer, video, audio-visual aids, television and mobile respectively in the delivery of agricultural extension services to their audiences.

34%, 10.6%, 51%, 57.5% and 63.8% of the extension officers reported that they often used computer, Digital camera, audio-visual aids, television and mobile phone respectively in the delivery of agricultural extension services to their audiences.

22.3%, 7.4%, 9.6%, 7.4% and 6.4% of the extension officers reported that they used computer, video, audio-visual aids, television and mobile respectively some times in the delivery of agricultural extension services to their audiences.

9.7%, 29%, 4.3%, 2.1% and 2.1% of the extension officers reported that they used computer, video, audio-visual aids, television and mobile respectively rarely in the delivery of agricultural extension services to their audiences.

The role of ICT in improving agricultural extension communication with beneficiaries to share information, skills, experiences and other purposes of communication was found to be the backbone of successful agricultural extension services that in turn will lead to the targeted agricultural development.

**Table 4. Distribution of the extension officers according to purposes for which ICTs were used**

Purpose of use of ICTs	Computer		Digital camera		Audiovisual aids		Television		mobile	
	Fre.	%	Fre.	%	Fre.	%	Fre.	%	Fre.	%
Not used	32	34	50	53.2	35	37.2	33	35.1	26	27.7
extension methods	25	26.6	15	16	30	31.9	35	37.2	12	12.8
source of agricultural information	6	6.4	5	5.3	2	2.1	1	1.1	6	6.4
source of problem solving practices	7	7.5	6	6.4	3	3.2	00	00	5	5.3
Multiple purposes	24	25.5	18	19.1	24	25.5	25	26.6	45	47.8
Total	94	100	94	100	94	100	94	100	94	100

Table 4 indicates the followings: 34%, 53%, 35.1%, 33% and 27.7% of the extension officers reported that they did not use computer, Digital camera, audio-visual aids, television and mobile respectively in the delivery of agricultural extension services to their audiences. 26.6%, 16%, 31.9%, 37.2% and 12.8% of the extension officers reported that they used computer, Digital camera, audio-visual aids, television and mobile respectively in the delivery of agricultural extension services to their audiences as extension methods. 6.4%, 5.3%, 2.1%, 1.1% and 6.4% of the extension officers reported that they used computer, Digital camera, audio-visual aids, television and mobile respectively in the delivery of agricultural extension services to their audiences as source of agricultural information. 7.5%, 6.4%, 3.2%, 0.0% and 5.3% of the extension officers reported that they used computer, Digital camera, audio-visual aids, television and mobile respectively in the delivery of agricultural extension services to their audiences as source of problem solving practices. 25.5%, 19.1%, 25.5%, 26.6% and 47.8% of the extension officers reported that they used computer, digital camera, audio-visual aids, television and mobile respectively in the delivery of agricultural extension services to their audiences for multiple purposes.

The use of ICTs in the delivery of agricultural extension services to extension audiences can have economic impact to their users because they can save time and money especially for those who do not prefer leaving their work sites and travel to near towns and cities to make their own purchases of agricultural inputs and other farm needs.

**Table 5. Distribution of the extension officers according to constraints facing their use of ICT in the delivery of agricultural extension services**

Constraints facing the use of ICTs	Frequency	Percent %
Lack of ICT	3	3.2
Lack of technical know-how	2	2.1
High cost of using ICT	1	1.1
all constraints	88	93.6
Total	94	100.

Table 5 revealed that 3.2% of the extension officers reported that they have no computer, video, audio-visual aids, television and mobile. 2.1% of the extension officers mentioned that they lack technical know-how which can help them to get more benefits from ICTs if they are trained in the proper use of them. 1.1% of the extension officers agreed that ICT have high cost including their prices and usage. And the majority of the extension officers (93.6%) reported that they faced many other constraints in their use of ICT in the delivery of agricultural extension services such the lack of internet centers in some rural areas in the state and the lack of technical know-how among farmers in using some ICTs.

### 3.2 Test of significance by using chi-square test:

**Table 6. Chi-square test for association between mobile phone and the purposes of using it**

Purpose of using mobile	Use of mobile		Total	Sig
	Yes	no		
Not used at all	2	21	23	.0001
As extension method only	12	0	12	
As source of extension information only	5	1	6	
As source of problem solving practices only	5	0	5	
More than one purpose	44	4	48	
Total	68	26	94	

Significance level at 0.05 or less

Table 6 revealed that there was a significant association between mobile phone and the purposes of using it. This result I line with [9], he reported that majority of stakeholder used modern mobile phone for multi-purposes to improve their production.

**Table 7. Chi-square test for association between computer and the purpose of using it**

Purpose of using computer	Use computer		Total	Sig
	Yes	No		
Not used at all	8	24	32	.0001
As extension method only	24	1	25	
As source of extension information only	6	0	6	
As source of problem solving practices only	7	0	7	
More than one purpose	23	1	24	
<b>Total</b>	68	26	94	

Significance level at 0.05 or less

The ICTs are a heterogeneous set of goods and services used to produce, process, distribute and transform information. The empirical literature acknowledges the benefits of ICTs on economic growth and positively correlates with Gross Domestic Product [10], the results in Table 7 showed that there was a significant association between computer and the purposes of using it.

**Table 8. Chi-square test for association between digital camera and the purposes of using it**

Purpose of using camera	Use of digital camera		Total	Sig.
	Yes	no		
Not used at all	23	26	49	.0001
As extension method only	16	0	16	
As source of extension information only	5	0	5	
As source of problem solving practices only	6	0	6	
More than one purpose	18	0	18	
<b>Total</b>	68	26	94	

Significance level at 0.05 or less

Table 8 indicates that there was a significant association between digital camera and the purposes of using it. The contributions of digital camera in increasing production is not separate from other ICTs also integral to economic development [11].

**Table 9. Chi-square test for association between audiovisual aids and the purposes of using it**

Purpose of using audiovisual	Use of audiovisual aids		Total	Sig.
	Yes	No		
Not used at all	10	25	35	.0001
As extension method only	29	1	30	
As source of extension information only	2	0	2	
As source of problem solving practices only	3	0	3	
More than one purpose	24	0	24	
<b>Total</b>	68	26	94	

Significance level at 0.05 or less

Table 9 revealed that there was a significant association between audiovisual aids and the purposes of using it [12], assessed the impacts of audiovisual aids use on agricultural in Africa. Her study centered on how the development audiovisual aids in Niger affected the welfare of stakeholder.

**Table 10. Chi-square test for association between TV and purposes of using it**

Purpose of using T.V	Use of TV		Total	Sig.
	Yes	no		
Not used at all	8	25	33	
As extension method only	34	1	35	
As source of extension information only	1	0	1	.0001
As source of problem solving practices only	25	0	25	
More than one purpose	0	0	0	
<b>Total</b>	68	26	94	

Significance level at 0.05 or less

The results in Table 10 agreed with [13] who stated that the access to agricultural information in Sudan continues to be challenging to farmers due to use of inadequate sources and traditional extension approaches such as TV and Radio. However, the rapid growth of modern ICTs usage in developing countries resulted in several advantages compared to other alternatives in term of costs, geographic coverage and ease of use.

### Conclusion and Recommendations

The use of ICTs in the delivery of agricultural extension services to extension clientele in Gedaref State is still in the beginning stages according the high percentage of using traditional ICTs such as TV in comparison to modern ICTs such as smart phone and internet websites. It found that lack of technical know-how, poor infrastructure, and the high cost of acquiring modern ICT devices were dominant in Gadaref State. The paper recommends that special programs should be designed for effective use of ICT in the delivery of agricultural extension services in the State, more integration efforts at various levels should be exerted to train extension officers and beneficiaries on the use of modern ICTs, the constraints facing the use of ICTs in the agricultural extension services in the State should be solved by all concerned partners.

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