

Communication Factors Affecting the Adoption of Agricultural Innovations in East Nile Locality of Khartoum State, Sudan

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Abstract: This study was carried out to investigate the effect of communication factors on the adoption of agricultural innovations among the farmers in east Nile locality of Khartoum state, Sudan. The stratified random sample technique was used to select 174 farmers. The primary data were collected by the use of pre-tested interview schedule. Descriptive analysis was conducted to display frequencies and percentages of socio-economic characteristics and communication behavior of respondents. Multiple regression and One-way ANOVA techniques were also used for data analysis and discussion. The study findings of multiple regressions revealed that the level of follow-up of direct extension via radio and TV agricultural programs was significantly associated with age, level of education, income, the period of residency, and farm size. Analysis of variances (ANOVA) indicated that the speed of adoption of 8 agricultural technologies (seed varieties, fertilizer use, weeding, control of pests and diseases, harvest, post-harvest, marketing and problems solving by farmers was significantly increased with better access of farmers to sources of agricultural information. The study recommended some interventions to enhance extension communication and adoption of agricultural innovations.

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1. Introduction

Agricultural information and communication will help farmers to access agricultural information from credible sources through the right communication channel is vital that information relayed to farmers be simplified through effective communication channels. Agricultural information and communication channels will also increase production efficiency since in the times of drought, climate change, erosion and pests; the livelihood of farmers are unstable (Livondo et al 2015). To Mittal and Mehar (2016) farmers need a wide variety of information on various issues such as availability of new inputs, technology or seed variety; disease outbreak or weather forecasts, market information and price information of both input and output for crop production and management, availability of agricultural support services or government schemes related to agriculture. Livondo et al (2015) commented that farmers are most likely able to adopt agricultural technologies if they receive correct information through the right sources. Information materials should thus include simple explanations to farmers on how the control measures work. Farmers access agriculture information from different sources and also as per the needs and demand of farmer. Farmers' age and educational level as indicated by Yahaya and Badiru, (2002) were significantly related

to the media that farmers used to find information on improved technologies. According Hoi (2007) and FAWOLE (2008) the information exchange depends on the relation between senders and receivers: age, position, power, experience, level of education and Language. The quality of the extension service was higher if fewer farmers were visited and that the level of formal education of farmers, farm size, and age of farmers were significantly related to the farmers' adoption rate, and the high-adoption farmer groups showed positive attitude towards the extension services (Oladosu, 2006). According to Onasanya et al, (2006) the usefulness of a communication medium for a farmer will vary according to the adoption phase in which a potential adopter of an innovation passes. It is of great importance to know that the complexity of human behavior often leads to many problems in the communication process. In order to enhance awareness about the latest recommendations and lead farmers putting these recommendations into practice in a precise manner, the extension agencies are disseminating new technologies through different means including mass media (radio, TV and print media). Personal face-to-face extension methods, which come under individual and group categories have their own strengths and weaknesses, and once stimulated or made aware through mass media, farmers may seek additional information from

neighbors, friends, extension workers or progressive farmers in the area (IRFAN et al., 2006). The role of agricultural extension involves dissemination of information; building the capacity of farmers through the use of a variety of communication methods and help farmers make informed decisions (Sharafat et al., 2012). According to (Glendenning et al., 2010) and objective (convincing farmers for the adoption of a new technology is not so simple, different communication methods can be employed to achieve this. Strategic extension campaigns can raise awareness and even improve knowledge, do not guarantee sustained changes in more strongly held farming attitudes and practices (Rola and Jamias, 2002). Each method of agricultural extension has advantages and disadvantages, but all the methods can enhance each other, for example: Extension worker can use printed material along with other communication channels to reinforce the learning process of farmers (Farooq et al., 2007). Farmers learn about agricultural technologies through many formal and informal mechanisms, including trial and error, and from members of their social network, radio, newspaper...etc. (Gilbert et al., 2008), AKER, 2010 and Khan et al., 2010). Knowledge diffusion may involve government agencies, non-governmental organizations (NGOs), universities, and private companies. Training methods range from very intensive, face-to-face meetings to extensive mass media campaigns. An extension campaign that utilizes several different methodologies of information dissemination (e.g. radio messages, information

dissemination at markets, banners, posters, and bulletin boards) will be more effective than relying solely on one-to-one visits and the like should therefore increase farmers' interest, this is especially true when trying to reach farmers demographically different from the extension agents (Asiabaka et al., 2002).

Udomisori (2007) described several strategies and approaches used in development communication for agricultural development in Africa and the developing world. These include; media based approaches, interpersonal Trends in recent time have shown that agriculture is approaches, social marketing, instructional and very important to the overall development of any nation. Participatory approaches, capacity building, research and In Nigeria before the discovery of oil, agriculture was the community mobilization. The media have potentials of contributing immensely to reviving the agricultural sector, using her traditional role of information, education, entertainment, mobilization, socialization and agenda setting. Through this they inform and educate both the urban and rural farmers in new agricultural techniques (Aigwe, et al., (2017).

In Sudan, the mass media play a vital role in agricultural development for decades. The various States of the country were exposed to agricultural information through direct Radio and TV agricultural extension programs activities. Table 1 shows some of the agricultural programs of radio and TV broadcasted in some states of the Sudan including Khartoum.

Table 1: Summary of Agricultural Radio and TV programs in some States of the Sudan

State	Radio Agric. Program	TV Agric. Program
Khartoum	Higool Wa Girouf: Operating since 1990. Broadcast at 11 a.m. every Saturday. Period: 20-40 minute.	1.Zoraa Wa Zorra: (1990 -2002), 2.Sihool Al Khair 2003-2005, and 3.Al Magalla Alzirraeia:2006-now Broadcasting Tuesday at 12 noon for 30 minute
Northern	Misaha Khadra: Since2007 (5 years) broadcasting at 5.30p.m every Tuesday. Period: 45 minute.	Taganat Zirraeia: 2007-nown (5 years) *Broadcasting Every Tuesday between 8.20-8.50 am.
Sennar	1-Hiwar Ziraai: Operating since 2010 (3years), Broadcasting: Half Monthly (15 minute).-Kapsula Irshadia: Operating since 2005 (7years), broadcasted daily morning (3-4minute).	Almagalla Alzirraeia:1998 - Up-to-date (14 years). Broadcasting every Wednesday at 8 a.m. for 25 minutes
North Kordofan	Alard Alwaida: Operating since 2007(5 year) Broadcast on Wednesday at 7.10 pm (15 minute).	Ard Al Khair: One year daily on Sundays at 7.30 for 15 minutes.
West Dar fur	Higool Wa Sihool: (2003-2006) Every Monday at 4.30 pm, and stopped now, but there are community radio program at that time (30 minute).	
Kasala	1. Ard Al Khir: Since 1991, on Sunday afternoon for 15 minutes, 2. Ogash: Since 2009 year, on Tuesday afternoon for 15 minutes, and 3. Kapsulat Zirraeia: Daily between the regular programs (3-4minutes).	Ardna Al Tayiaba: Start in 2002 -2009, Broadcasting every Monday at 7:30 pm.

Source: Yahia, et al (2017)

Objectives of the Study:

The main objective of this study was to investigate the effect of communication factors on adoption of innovation in the study area. The specific objectives were to:

1. Identify farmers' level access to agricultural activities and programs.
2. Examine the relationships between farmers' personal and communication characteristics and their access to agricultural extension activities and programs.
3. Determine the difference between the degrees of access to different sources of agricultural information in accomplishing the adoption of agricultural innovation.

Methodology:

This study was conducted in July 2017 to assess the effect of communication factors on the adoption of agricultural innovations among the farmers in East Nile locality, Khartoum state.

The population of the study represents farmers in the main three agricultural sectors of the locality (plant, animal, and poultry). The stratified random sample method was adopted to select 174 farmers (58 from each sector). The Statistical Package for the Social Sciences (SPSS) was used to analyze the obtained data by implementing: (1) Descriptive analysis was carried out to display frequencies and percentages of socio-economic characteristics and communication behavior of respondents, and (2) analytical statistical procedures (multiple regression and one-way (ANOVA) were used data analysis and discussion.

Results and Discussion:**Farmers' level of access to agricultural activities and program**

Table2 shows that 48.9%, 35.6%, and 62.6% of respondents had access to the direct extension activities and agricultural programs via radio and TV respectively. Data in the table also indicate that 31.8%, 16.1%, and 51.4% of interviewed farmer had high level access to the direct extension activities and agricultural programs via radio and TV respectively. About 18.8%, 53.2%, and 33.9% of respondents had medium level access to the direct extension programs and agricultural programs via radio and TV respectively. However, 49.4%, 30.7%, and 14.7% of respondents had low level access to the direct extension programs and agricultural programs via radio and TV respectively. Respondents who have no or low access to the direct extension programs and agricultural programs via radio and TV commented that this situation resulted from (1) Weakness of announcements of these activities and programs, (2) The times of these activities is not suitable, and (3) No

further benefit derived from these activities to farmers, (4) Not having time to participate in the activities and listen or watch the program, (5) Weakness of desire to participate in the activities and listen or watch the program because the information provided is not related to their agricultural activities.

Determinants of participation in direct agricultural extension activities

Table3 indicates that the respondents' age, education level, period of residency, and farm size scales had significant positive regression weights, indicating respondents with higher scores on these scales are expected to have higher participation rates in direct agricultural extension activities, after controlling for the other variables in the model. The visiting cities scales had no significant positive regression weights. Income scale had a significant negative regression weight, indicating that interviewed farmers with higher income scores are expected to have lower participation rates in direct agricultural extension activities.

Results in the table indicate that older and educated farmers are more likely to look for new information to further develop their farm. This result is not consistent with Lawal and Oluyole (2008) who investigated factors influencing research result and adoption of agricultural technology in Nigeria. They concluded that young farmers are more receptive than older ones as the older are not always ready to part with the old techniques for new ones. This finding is also not consistent with Adhiguru et al., (2009) reported: Results of the regression analysis show negative coefficients and t-ratios on the relationship between age of the farmers and their adoption behaviors. The implication is that the farmers' ability to adopt new farm innovations decrease with age. The older the farmer, the less likely she/he will adopt innovations, this difference in the results may be due to differences in the personal characteristics of the farmers and the circumstances surrounding them from one country to another or from time to time.

Furthermore, farmers who have farms of larger size are more likely to look for agricultural information to improve their farm practices and achieve higher production levels, this result is entirely consistent with Adhiguru et al (2009) who reported that: Past research has found relationships between farm size and factors of production and also farm size and output. Larger farms are more likely to use advanced farming inputs such as fertilizer and improved seed varieties when compared to smaller farms, because they have the financial capacity to bring in and apply new agricultural technologies.

Determinants of the listening of agricultural programs via the radio

The results of the multiple regression analysis in Table 4 show that the age, education level, income and farm size scales carried significant positive weights. The period of residency and visiting cities scales displayed no significant positive regression weight. This result indicates that farmers who has long residency in the area are more interested to receive agricultural information through direct contact than any other source, because they are more familiar in contact with the agricultural extension agent. However, farmers who are the most visiting to the cities usually have more other access to information sources.

Determinants of watching TV agricultural programs

Results of the multiple regression analysis in Table 5, show that education level, income, the visiting cities, and farm size scales had significant positive regression weights, indicating that higher viewer ship rates of agricultural TV programs are expected among interviewed farmers with higher scores on these scales, after controlling for the other variables in the model. The period of residency scales had no significant positive regression weights. The age scale had a significant negative regression weight, indicating interviewed farmers with higher age scores are expected to watch agricultural programs on the TV less frequently.

Farmers with a high level of education and who often visit cities are expected to be more cultured and knowledgeable and farmers who have a high income are expected to have a higher ability to acquire TV sets and agricultural innovations. Maybe the three characteristics (culture, knowledge, and ability) had made those farmers more likely to look for new information about agricultural innovations through a high level of watching agricultural TV programs.

The results of the current research showed that young farmers are more willing to watch agricultural TV programs than older farmers. The reason which can explain this result, older farmers had a high rate of participation in direct extension activities and with a high level of listening to agricultural radio programs (see table 3), which might have reduced their level of watching agricultural TV programs. However, TV is relatively a new communication tool compared to

radio set particularly in rural area.

Degrees of access to different sources of agricultural information (one source, two sources, and three sources) in accomplishing adoption of agricultural innovation

Table 6 indicates that the variances of the three levels of access are significantly different among the eight types of agricultural innovation (seed varieties, fertilizer use, weeding, control of pests and diseases, harvest, post-harvest, marketing and problems solving), indicating that the proportion of immediate adoption of these agricultural innovation is expected to be high for interviewed farmers who rank high in level of access (three sources) compared to those who have medium or low levels of access (two or one sources). The variances of the three levels of access are not significantly different from the other three types of agricultural innovation (land preparation, sowing method, and irrigation method). According to the aforementioned results, farmers who have access to two extension activities programs are more likely to adopt the agricultural innovation earlier than farmers who have access to only one activity/program. Similarly, the farmers who have access to three extension activities/programs are more likely to adopt the agricultural innovation earlier than farmers who have access to two activities/programs, and so on. This is due to the fact that farmers, who have high access to information sources, may have the ability to acquire information they needed to pass the different stages of the innovation-decision process.

However, farmers exposed to many sources of information are expected to have a higher desire to adopt agricultural innovation than those who are exposed to limited sources, because their willingness and motivation had pushed them to seek out access to other sources of information and hence, those who have a higher level of access will adopt new innovations than others have medium or less access.

Knowledge, as commented by Rogers (2003) the knowledge is the first step in adoption process of innovation. Therefore, when knowledge sources increased the knowledge will increase, and accordingly contributes to accelerating the different stages of adoption process (Persuasion, decision, implementation and conformation) and vice versa.

Table 2: Summary of Frequency Distribution of Respondents According to their Level of Access to Agricultural Activities and programs

Method of Extension	Have Access						Level of Access to Agricultural Activities and programs					
	Yes		No		Total		Low		Medium		High	
	F	%	F	%	F.	%	F.	%	F	%	F	%
Direct activities	85	48.9	89	51.1	174	100	42	49.4	16	18.8	27	31.8
Radio Agri. program	62	35.6	112	64.4	174	100	19	30.7	33	53.2	10	16.1
TV Agri. program	109	62.6	65	37.4	174	100	16	14.7	37	33.9	56	51.4

Table 3: Multiple Regression Analysis of Participation in Direct Agricultural Extension Activities

Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-22,651	3,124		-2,175	,000
Respondents' age	,273	,015	,014	1,141	,019
Respondents' education level	5,222	0,144	,322	2,415	,000
Total income	,020	,033	-,032	-,572	-,021
Period of residency	,103	,101	,034	0,163	,024
Number of visiting the cities in year	,023	,002	,042	1,345	,314
Total farm size	,423	,046	,218	2,441	,000

Table 4: Multiple Regression Analysis of the Following of Agricultural Program via the Radio

Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-7,5443	3,147		-2,622	,001
Respondents' age	,232	,041	,182	2,227	,000
Respondents' education level	1,432	,315	,173	1,011	,000
Total income	,000	,000	,090	1,023	,022
Period of residency	,048	,051	,066	,946	,345
Number of visiting the cities in year	,000	,249	,140	,331	,537
Total farm size	,060	,112	,063	1,039	,019

Degrees of access to different sources of agricultural information (one source, two sources, and three sources) in accomplishing adoption of agricultural innovation

Table 6 indicates that the variances of the three levels of access are significantly different among the eight types of agricultural innovation (seed varieties, fertilizer use, weeding, control of pests and diseases, harvest, post-harvest, marketing and problems solving), indicating that the proportion of immediate adoption of these agricultural innovation is expected to be high for interviewed farmers who rank high in level of access (three sources) compared to those who have medium or low levels of access (two or one sources). The variances of the three levels of access are not significantly different from the other three types of agricultural innovation (land preparation, sowing method, and irrigation method). According to the aforementioned results, farmers who have access to two extension activities programs are more likely to adopt the agricultural innovation earlier than farmers who have access to only one activity/program. Similarly, the farmers who have access to three

extension activities/programs are more likely to adopt the agricultural innovation earlier than farmers who have access to two activities/programs, and so on. This is due to the fact that farmers, who have high access to information sources, may have the ability to acquire information which they needed to pass the different stages of the innovation-decision process. However, farmers exposed to many information sources are expected to have a higher desire to adopt agricultural innovation than farmers who are exposed to limited sources, because their willingness and motivation had pushed them to seek out access to other sources of information and hence, those who have a higher level of access will adopt new innovations than others have medium or less access. Knowledge as commented by Rogers (2003) the knowledge is the first step in adoption process of innovation. Therefore, when knowledge sources increased the knowledge will increase, and accordingly contributes to accelerating the different stages of adoption process (Persuasion, decision, implementation and conformation) and vice versa.

Table5: Multiple Regression Analysis of the Following of Agricultural Programs on the TV

Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	6,273	2,784		2,112	,041
Respondents' age	-,172	,079	-,120	-2,177	-,023
Respondents' education level	1,227	,511	,129	2,174	,017
Total income	,000	,000	,011	2,449	,009
Period of residency	,091	,078	,063	1,122	,546
Numbr of visiting the cities in year	,018	,002	,249	1,788	,001
Total farm size	,035	,003	,011	2,102	,000

Table 6: Difference between the Levels of Access to Agricultural Extension Activities and Programs in Accomplishing the Adoption of Agricultural Innovation

Innovation	Number of agricultural information Sources			F	Sig.	Result Indication
	one	two	three			
	Mean	Mean	Mean			
Land preparation	2.44	2.55	2.52	1.441	0.161	Not significantly different
Seed varieties	2.36	2.62	2.73	5.288	0.002	Significantly different
Sowing method	2.21	2.29	2.34	1.486	0.219	Not significantly different
Irrigation methods	1.66	1.71	1.76	2.032	0.127	Not significantly different
Fertilizer use	1.89	2.28	2.51	4.551	0.023	Significantly different
Weeding	1.77	1.93	2.14	5.776	0.037	significantly different
Control of pests and diseases	2.23	2.43	2.61	6.328	0.019	Significantly different
Harvest	2.08	2.47	2.72	5.219	0.012	significantly different
Post-harvest	2.37	2.89	2.97	4.556	0.027	Significantly different
Marketing	1.87	1.98	2.41	3.822	0.008	Significantly different
Problem solving	2.11	2.24	2.63	6.467	0.031	Significantly different

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Email: raoufbello@yahoo.com**Conclusion and Recommendations:**

Farmers of Khartoum and other States of the Sudan are exposed to agricultural information through direct extension activities, Radio and TV agricultural programs at different levels (high, medium, and low). The Radio program broadcasted in the State is Higool Wa Girouf (Operating since 1990. Broadcasted at 11 a.m. every Saturday for 20-40 minutes). The TV agricultural programs are 1. Zoraa Wa Zorra (1990 - 2002), 2. Sihool Al Khair (2003-2005) and 3. Al Magalla Alzirraeia (2006until now) Broadcasted on Tuesday at 12 noon for 30 minutes.

The study findings revealed that the respondent farmers who have low and /or medium access to the direct extension activities, and agricultural programs via Radio and TV, commented that factors limiting their access to these programs including *enter alia* time, no benefits derived from these programs sessions, and others. The study results also indicate that the level of follow-up of radio and TV agricultural programs was significantly associated with age, level of education, income, the period of residency, and farm size.

The study recommended that the direct extension activities and agricultural programs via radio and TV should be organized and broadcasted in suitable time for farmers, and introduce agricultural innovations accordingly to meet farmers' needs and taking into account their personal and communication characteristics in providing the agricultural extension

activities and program, to encourage them to adopt the agricultural innovations.

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