



Evaluation of Agricultural Research, Extension and Farmers Linkages: A case study from Gezira State Sudan

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Abstract

The present study seeks to evaluate the agricultural research, extension, and farmers linkages in Gezira State, Sudan. A field survey was used to collect data from 50 extension agents, 50 farmers and 50 researchers in Gezira State, Sudan. The collected data were coded, fed to the computer, statistically analyzed using (SPSS), discussed, and interpreted using descriptive statistics. The results revealed weak linkages between research and farmers, between extension and farmers, and between research and extension. The used method of communication between research, extension, and farmers are workshops, training periods for extension agents, field days, and demonstrations. The Main constraints facing the linkages between research, extension, and farmers are a lack of budgets for linkage activities, weak infrastructure, continuous change of extension agents' workplaces, and separate administrations of research and extension organizations. From this study, it can be concluded that the weak linkages between these three agricultural pillars will lead to low adoption of new agricultural technologies and consequently lead to low income from agricultural production in the country. The study recommends that constraints facing agricultural research, extension, and farmer's linkages should be solved.

1. Introduction

Agricultural research, extension, and farmers are the main and basic pillars of any agricultural system, and the effectiveness of these pillars depends on the strong link with each other and therefore the strong interaction and effective cooperation between all agricultural stakeholders, where we find that the need for this link is basic and important in order to achieve the common goal of increasing agricultural production and raising the standard of living in rural areas. If there is a weak link between research and extension, the researcher may not be aware of the difficulties facing farmers to develop appropriate solutions to them, in addition to not knowing how to implement research recommendations in farmers' fields. The existence of weak links between agricultural research and extension, farmers, and other extension partners is the main obstacle to preparing, testing, disseminating, and adopting new agricultural technology, as we find that this would impede the flow of information from research to extension or vice versa, which negatively affects production and productivity.

The concept of linkage refers to communication and working relationship found between two or more organizations seeking to fulfill shared objectives. Havelock (1986) contends that linkage is a term used to indicate that two systems are connected by messages so as to form a greater system. He argues that if the barriers between two systems are permeable enough for messages and responses to flow out of each to the other, then a link has been created between the two. The continuous flow of agricultural technologies will definitely play a vital role in identifying research problems and adapting the new recommendations to farm conditions. Therefore, the effective communication linkages between research, extension, and farmers are important in the modification of new recommendations and in initiating further research (Agbamu, 2000). Extension and agriculture research are examples of two systems that can be linked together by information flow and feedback (Munyua et al., 2002). The farmer falls in between research and extension and is expected to be the main target and beneficiary of their activities. The research-extension-farmer

relationship should be viewed as an interdependent and inter-related continuum. The farmer falls in between extension and research and is considered to be the main audience and beneficiary of their activities. The research-extension-farmer relationship should be viewed as an interdependent and inter-related continuum (Belay and Alemu, 2017).

In traditional research and extension linkage systems, agricultural technology development and transfer have tended to be largely based on a 'top-down' or one-way communication model with information flowing from researchers to end-users. This traditional extension model viewed farmers, extensionists, and researchers as three separate strata and the linkages between them are weak or non-existent which has led to a situation where farmers have limited options in decision making on agricultural technologies suitable to their farming needs and those within their local social, cultural, economic, and political environment (Faylon and Acoba, 2002). Since the 1980s, academic institutions, policymakers, and development practitioners have recognized the key role of farmers in agricultural technology development and the transfer complete process. As a result, they have proved that the whole process of technology identification, development, and transfer must shift from a 'top-down' approach or model towards one in which the research-extension system becomes more demand-driven, customized to local conditions and needs, and responsive to farmers' interest and problems. Consequently, it was emphasized that the whole process of agricultural technology development and dissemination must be based on equal partnership between farmers, researchers, and extension officers who learn from each other and contribute their knowledge and skills (Belay and Alemu, 2017).

In general, the role of linkages in the research-extension-farmers linkage system in most countries was weak. Various reasons were adduced but the most striking ones were the non-involvement of farmers in the process, top-down management approach, poor use of linkage mechanisms and strategies, poor monitoring and evaluation, inadequate funding, and political interference, especially in developing countries (Urhibo, 2021). In recent years, in several developing countries, the relationship between research and extension systems has become increasingly a two-way process and farmers who are key stakeholders in the development and dissemination of agricultural technologies have become the target and the hub around which researchers and extensionists focus their actions (Agbamu, 2000; Asiabaka, 2002; Belay and Alemu, 2004; Purcell and Anderson, 1997). To improve the linkage mechanism, countries must apply a number of approaches. One method includes surveys of farmers' problems conducted jointly by research and extension to make published annual reports. And annual workshops where research and extension activities are presented to a large audience is another useful mechanism (Park and Sang, 2016).

In Sudan, agricultural extension services were started since 1959 as ministry-based agricultural extension services (known as National Agricultural Extension Administration at the federal level) after the Second World War as a part of American technical aid for developing countries. From that time to nowadays many development and structural changes were made to this administration. In the year (2004) its name was changed to the Administration of Extension and Technology Transfer. This administration has a branch in each State Ministry of Agriculture of the country and dominated the majority of organizations that provided agricultural extension services in the country (Abdel Rahman et al., 2016).

There were five major methods of diffusion of agricultural information of Agricultural Research Corporation (ARC), the most popular of which are reports and publications but these reports could not be utilized by farmers as a result of the high percentage of illiteracy among them as reported by World Bank. The second one is agricultural extension, but according to the scarcity of staff-and fuel for extension vehicles, this method of information diffusion must be highly problematic. In addition to other methods such as meetings and seminars.

Therefore, the linkage between the ARC and extension should be improved as well as improve extension services and increase personal contact with farmers either through meetings or demonstration farms. The primary suggestion for improvement was to formalize the linkage of ARC and extension to disseminate research information, the Farming Systems Research approach appears to be one of the potential means for enhancing this communication (Lacy et al., 1983).

2. Materials and Methods

This study was conducted in the Gezira State, which is located in the centre of Sudan and is considered one of the most important States in terms of agricultural production, as it includes the Gezira and Rahad Schemes, private farms on the banks of the Blue Nile River, rain-fed agriculture sector, and natural pastures for animal production, especially in the Butana area.

Study population and Sample size:

The study population included three categories: the category of agricultural extension agents in the Gezira State, whose number is estimated at about 150, and 50 extension agents were selected using the simple random sampling technique. The category of farmers in the State in all sectors, whose number is estimated at about 2000 farmers, 5% were selected using the simple random sampling technique (100 farmers). The category of researchers at the

headquarter of the Agricultural Research Corporation (ARC), whose number is estimated to be about 50 researchers, was used as the sample size.

Data collection and analysis:

The population that was used to assess the linkages between agricultural research, extension, and farmers, determined of Gezira state, Sudan. A questionnaire consisting of eight questions was constructed and the personal interview technique was used to administer the questionnaire. The collected data were statistically analyzed and interpreted using percentage, and frequency distribution. Secondary data were collected from published related articles on the internet.

3. Results and Discussion

3.1 Selected socioeconomic profile of respondents:

Age categories:

The results of the age categories of respondents were presented in Table (1). The age of respondents ranged from 20 to 51 years and above. 60% of farmers, 70% of researchers, and 12% of extension agents fell within the age of 41-50 years respectively. 20% of farmers, 12% of researchers, and 60% of extension agents fell within the age of 31-40 years respectively. 10% of farmers, 4% of researchers, and 20% of extension agents fell within the age of 20-30 years respectively. 10% of farmers, 14% of researchers, and 8% of extension agents fell within the age of 51 years and above respectively. Generally, the assumption is that younger people tend to be more productive than their older counterparts.

Table1. Percentage distribution of respondents according to their age categories

Age categories	Farmers		Researchers		Extension agents	
	Frequency	%	Frequency	%	Frequency	%
20 -30	10	10	02	04	10	20
31 -40	20	20	06	12	30	60
41-50	60	60	35	70	06	12
51 and above	10	10	07	14	04	08
Total	100	100	50	100	50	100

Educational level:

The results of the educational level of respondents were shown in Table (2). In terms of education level, 13% of farmers had primary, 15% acquired intermediate education, 22% had secondary education, 40% of farmers possessed a diploma education and 10% had university education. All researchers 100 % and 20% of extension agents acquired university education respectively. 80% of extension agents possessed a diploma education.

Table2. Percentage distribution of respondents according to their educational level

Educational level	Farmers		Researchers		Extension agents	
	Frequency	%	Frequency	%	Frequency	%
Illiterate	00	00	00	00	00	00
Primary	13	13	00	00	00	00
Intermediate	15	15	00	00	00	00
Secondary	22	22	00	00	00	00
Diploma	40	40	00	00	40	80
University	10	10	50	100	10	20
Total	100	100	50	50	50	50

3.2 Linkage between research and farmers:

Table (3) showed that the majority of farmers 90%, researchers 80%, and 90% of extension agents respectively reported that the linkage between research and farmers is weak. 10%, 14%, and 10% of farmers, researchers, and extension agents respectively reported that the linkage between research and farmers is good, while 6% of researchers reported that the linkage between research and farmers is very good. A similar result was reported by Nyamupangedengu and Terblanche (2016) who found non-existent farmer-research linkages in the Nyanga district in Zimbabwe.

Table3. Percentage distribution of respondents according to linkage between research and farmers

Linkage level	Farmers		Researchers		Extension agents	
	Frequency	%	Frequency	%	Frequency	%
1- None	00	00	00	00	00	00
2-Weak	90	90	40	80	45	90
3-Good	10	10	07	14	05	10
4-Very good	00	00	03	06	00	00
Total	100	100	50	100	50	100

3.3 Linkage between extension and farmers:

Table (4) revealed that the majority of farmers 95%, researchers 80%, and 70% of extension agents respectively reported that the linkage between extension and farmers is weak. 10% and 30% of researchers and extension agents respectively reported that the linkage between extension and farmers is good.5% of farmers reported that there was no linkage between extension and farmers. This result of the present study is in line with the result reported by Nyamupangedengu and Terblanche (2016) who found very weak farmers-extension linkages in the Nyanga district in Zimbabwe.

Table 4. Percentage distribution of respondents according to linkage between extension and farmers

Linkage level	Farmers		Researchers		Extension agents	
	Frequency	%	Frequency	%	Frequency	%
None	05	05	05	10	00	00
Weak	95	95	40	80	35	70
Good	00	00	05	10	15	30
Very good	00	00	00	00	00	00
Total	100	100	50	100	50	100

3.4 Linkage between research and extension:

Table (5) indicates that the majority of farmers 65%, and researchers 70%, and 80% of extension agents respectively reported that the linkage between research and extension is weak.10%, 10%, 20% of farmers, researchers, and extension agents respectively reported that the linkage between research and extension is good, while10% of researchers reported that the linkage between research and extension is very good.25% of farmers reported that there was no linkage between research and extension. This result is in line with the results reported by Nyamupangedengu and Terblanche (2016) who mentioned non-existent research-extension linkages in the Nyanga district in Zimbabwe. Similar results were reported by Belay and Alemu (2017) who found that the results of the historical review of agricultural research and extension linkages in Ethiopia reveal that research-extension linkage was generally weak. The results of this study were also in accord with those reported by Shantanu et al (2001) who cited that in India the linkages between research –extension, and research- farmers are absent to weak and in some cases moderate.

The results of this study disagree with the results reported by Adesoji and Aratunde (2012). Who mentioned that there were strong communication linkages between extension agents and researchers and between researchers and farmers. Also, there was a strong communication linkage between researchers and extension agents, researchers and farmers as well as between extension agents and farmers. Similar results were reported by Babu and Ram (2019) who cited that Nepal's agriculture growth has been very slow, primarily due to inadequate research and extension linkage and coordination among public and private partners.

Table 5. Percentage distribution of respondents according to linkage between research and extension

Linkage level	Farmers		Researchers		Extension agents	
	Frequency	%	Frequency	%	Frequency	%
None	25	25	00	00	00	00
Weak	65	65	35	70	40	80
Good	10	10	10	20	10	20
Very good	00	00	05	10	00	00
Total	100	100	50	100	50	100

3.5 Used methods of communication between farmer, research and extension

Table (6) showed that 10% of researchers reported that the used methods of communication between farmers, research, and extension are joint committees. All farmers 100%, researchers 90%, and extension agents 100% respectively reported that there were no joint committees between farmers research and extension. All farmers 100%, researchers 100%, and extension agents 100% respectively reported that there were no regular meetings between farmers, research, and extension. 20% of farmers, 20%, researchers 20%, and extension agents respectively reported that the used method of communication between farmers, research, and extension are workshops. All farmers 100%, researchers 100%, and extension agents 100% respectively reported that there were no joint field visits and on-farm research between farmers, research, and extension. 30% of farmers, 30%, researchers 40%, and extension agents respectively reported that the used method of communication between farmers, research, and extension are training periods for extension agents. 50% of farmers, 40%, researchers 40%, and extension agents respectively reported that the used methods of communication between farmers, research, and extension are field days and demonstrations. Similar results were found by Ojacor (2000) who cited that the use of seasonal workshops was adopted as a communication method between research, extension, and farmers. The results of the present study are not in line with the results reported by Ojacor (2000) who reported that in Uganda the linkages which were adopted are operationalized through joint field visits and on-farm research.

3.6 Main constraints facing the linkages between research, extension and farmers:

Table (7) indicates that 25% of farmers and 10% of researchers respectively reported that the main constraint facing the linkages between research, extension, and farmers is the lack of budgets for linkage activities. 20% of farmers, and 70%, of researchers, respectively reported that the main constraint facing the linkages between research, extension, and farmers are weak infrastructure. 55% of farmers, and 20%, of extension agents, respectively reported that the main constraint facing the linkages between research, extension, and farmers are the continuous change of extension agents' workplaces. 20% of farmers, and 80%, of extension agents, respectively reported that the main constraints facing the linkages between research, extension, and farmers are separate administration of research and extension organizations. Similar results were found by Yenesew Sewnet et al., (2015) who reported that separated administration of research and extension institutions, high turnover of development agents, poor infrastructural developments, and lack of budgets for linkage activities were the main causes of weak research, extension and farmers linkages in Ethiopia. A similar result was also reported by Jonathan (2010) who mentioned that in the case of negative factors influencing research-extension-farmers linkages in Tanzania, the majority of researchers and extension staff mentioned the non-availability of adequate funds for these linkages.

Table 6. Percentage distribution of respondents according to used methods of linkage between farmer`s unions, research and extension

Methods of linkage	Farmers		Researchers		Extension agents	
	Frequency	%	Frequency	%	Frequency	%
1-Joint committees	00	00	05	10	00	00
2-Regular meetings	00	00	00	00	00	00
3-Workshops	20	20	10	20	10	20
4- Joint field visits and on-farm research	00	00	00	00	00	00
5-Training periods for extension agents	30	30	15	30	20	40
6- Field days and demonstrations	50	50	20	40	20	40
Total	100	100	50	100	50	100

Table7. Percentage distribution of respondents according to main constraints facing the linkages between research, extension and farmers

Constraints	Farmers		Researchers		Extension agents	
	Frequency	%	Frequency	%	Frequency	%
1- Lack of budgets for linkage activities	25	25	05	10	00	00
2-Weak infrastructure	20	20	35	70	00	00
3- Continuous change of extension agents' workplaces	55	55	00	00	10	20
4-Separated administrations	00	00	10	20	40	80
Total	100	100	50	100	50	100

4. Conclusion and Recommendation

Majority of farmers 90%, researchers 80%, and 90% of extension agents respectively reported that the linkage between research and farmers is weak. Majority of farmers 95%, researchers 80%, and 70% of extension agents respectively reported that the linkage between extension and farmers is weak. Majority of farmers 65%, and researchers 70%, and 80% of extension agents respectively reported that the linkage between research and extension is weak.

From this study, it can be concluded that the weak linkages between these three agricultural pillars will lead to low adoption of new agricultural technologies and consequently lead to low income from agricultural production in the country. The study recommends that constraints facing agricultural research, extension, and farmers linkages should be solved.

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