

Role and interactions of agro-pastoral organizations and finance institutions in agricultural innovation: the study of Rahad Agriculture Scheme- Sudan

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Abstract

The Establishment of the Rahad Scheme in Eastern Sudan in the 1970s established an agricultural innovation system where formal actors such as extension, research, finance institutions and informal actors such as agro pastoral organizations arenetworkingto provide better livelihoods within the irrigated scheme area. Thisinvestigation focuses onthe roles and interactions of agro pastoral organizations and financeinstitutions in relation to extension work in Rahad Scheme. Thechallenges that hinder interactions of agro pastoral organizations and finance institutions are also discussed, accordingly, suggestions to improve interactions of agro pastoral organizations and finance institutions are presented on this paper

System thinking was suggested as a methodology to analyze knowledge networking among and between finance institutions and agro pastoral organizations. Social network analysis was used to study connections and relations of agro pastoral organizations and finance institutions in Rahad Scheme. As a result new connections and relations has been suggested to improve the performance of the agro pastoral organizations and finance institutions in Rahad. Hoping that improvement of connections among the studied actors can lead to better appropriation of the innovation system within Rahad Scheme.

1. Introduction

The Rahad Agriculture Scheme was established in 1977 and situated within 14° 23 – 13° 30north and 34° 22-35° 55 east. It is located 260 km south east of Khartoum, the capital of Sudan, and El-Fau City is the headquarters of the scheme. It is irrigated from two sources, the Rahad River from autumn to summer and the Blue Nile River during winter. The total cultivated area in the scheme is 147,698hectares(Benedict *etal.*, 1982) (Rahad Agriculture Corporation, 2010).

One of the reasons for establishing of the Rahad Scheme was to shift the sustainably based economy of indigenous agro-pastorals surrounding the area of the scheme to a more intensified cultivation, so the government of Sudan anticipated that the standard of living – income, housing, nutrition, education, and values of those people – would be improved(Benedict *etal.*, 1982). In accordance with that planning, tenants were settled and allotted farming units of 9.2 hectares to plant cotton, ground nuts, and fodder crops. The Ministry of Agriculture in Sudan appointed the Rahad Agricultural Corporation to be the responsible institution for managing the Rahad scheme; the corporation was responsible for providing agriculture inputs and assessing costs against profits, while tenants were responsible for farming the land and would receive profits from their production(Benedict *et al.*, 1982).

Crop combination in the Rahad Scheme was modified according to farmers' needs and economical viability. Therefore, sorghum, sweet corn, wheat, and sunflower wereintroduced into the scheme(Benedict *etal.*, 1982) (Rahad Agriculture Corporation, 2010).

The scheme had undergone many changes since its foundation up until the time of the research study (2010/2011). Shifting the finance of inputs from government to banks and inadequately providing maintenance requirements for the scheme assets “canals and machinery” had led to increasing farmer debt and fluctuating productivity (primary data, 2010). Presently a private company has been invited by the government of Sudan to share farming the scheme with the farmers. By the end of the farming season, the cost of production will be calculated at the farm unit level, and net profit will be distributed 50% for farmers, 40% for the company, and 10% for the improvement of social services within the scheme area (Ministry of Agriculture and Forestry, 2009).

1.1 Problem statement

Agriculture innovations in Rahad Scheme is viewed as a networking of knowledge between formal and informal actors, by formal actors authors mean research, extension, finance and education institutions in the area of the project and informal actors are pastoral and farmers organizations, women and youth groups and elderly people. The research conducted in Rahad Scheme, from 2010 to 2011 aimed to study knowledge networking among and between the mentioned actors based on the notion of agriculture knowledge and information system. This paper is focusing on reflecting the role of agro pastoral organizations and finance institutions in Rahad Agriculture Scheme with emphasis to their relation to the Extension Department in the Scheme. Roles of and interactions between those actors are described and suggestions to better their interactions in Rahad Scheme are also discussed.

1.2 Objectives of the paper

1. To present roles and the interactions within agro pastoral organizations and finance institutions in Rahad Scheme in relation to extension work in the scheme
2. To explain how these relations are supporting or challenging the performance of agriculture innovations within Rahad Scheme.
3. To suggest how to improve the interactions within agro-pastoral and finance institutions in the Rahad Scheme

2. Literature review

2.1 Knowledge and information system perspectives to view agricultural innovations

The knowledge and information system is a perspective developed by Roling and others at Wageningen University (cf. RÖLING 1986, 1988,) cited by (ENGEL 1997).

The perspective views the performance of social organizations of innovations as relationships interplayed by different actors more than seeing innovations as a technological process that requires certain materialistic inputs and outputs. It is the relationships and integrations of actors that ease the performance of the innovations or constrain them (cf. RÖLING, 1986, and 1988) cited by ENGEL 1997).

Reasons for choosing the knowledge and information system perspective by social scientists to study innovations are many. First, the system has the potential to diagnose the innovation configuration at macro- and micro-levels in other word human actions or relations towards innovations are studied at different levels; perspectives can range from the relationship of two farmers to relationships between agro-business institutions (ENGEL 1997).

Second, it focuses on sharing knowledge among relevant stakeholders and not only on extension as the source of information; policy makers, education, and research institutes are also responsible for disseminating information and ideas so that innovations can bring better technological and social outcomes (ENGEL 1997).

Third, the knowledge and information system perspective has managed to raise radical questions about the classical definition of individuals within agricultural innovations as innovators, adopters,

laggards, or worse. Instead, a more comprehensive understanding of human agency through the system perspective is provided, *“What people know and do is intrinsically related.”*

Since certain farmers or groups of farmers reject applying certain technologies, there is a need for us to look to surrounding institutions, circumstances, and how the farmers are related to them. Moreover, in this regard, issuing of local knowledge and how farmers are deeply related is also vital, and the knowledge and information perspective can be realistically considered (ENGEL 1997).

Finally, according to the knowledge and information perspective, agricultural innovations are *“social efforts that require joint competence of interrelated actors rather than the sum of individual competences”* (ENGEL 1997). Since the system can provide a diagnostic framework for analysis and design management of interventions, we thought the perspective can be very useful for approaching our research question; it can first help us study the relationships of actors in the study area and how they communicate information with each other. Furthermore, it can help us suggest a basis for developing approaches to improve the performance of actors in the Rahad Scheme.

2.2 Innovations and Social Networks

ROGERS(1983) and BEAL and BOHLEN(1955) cited by VALENTE (1995) had earlier stressed that diffusion of innovations is a communication process, because innovation is communicated through certain channels over time among members of a social system. The time factor is essential in these types of innovation models; innovativeness (output of innovations) is correlated by the time of adoption with the level of education, level of income, cosmopolitan status, and contact with change agents (VALENTE 1995). The role of actors and their interactions in the settings of innovations had been neglected in those linear models (VALENTE 1995; SPIELMAN et al. 2010).

Rural sociological research has developed this classic model of innovation diffusion to other subsets of diffusion known as network models of innovations (VALENTE 1995). According to VALENTE(1995), the network is a pattern of relations that could connect members of social systems; friendship, advice, communication, or supports existing between members are examples.

Therefore, diffusion research employing a network perspective (LIU et al. 2005) stems from viewing the structure of the relations among members of the social system as a factor that shapes or constrains the spread of new ideas and practices in the social systems (BURT 1987, cited by LIU et al. 2005).

Thus network models explain innovation diffusion in accordance with the structure of the social system and the communication pattern (who talks to whom) in the social networks (VALENTE 1995). These models are also used to decide the flow of personal influence (who influences whom) (VALENTE 1995).

Therefore, the relations of a given actor or actors in the network (leadership model) (COLMAN et al. 1966) cited by (LIU et al. 2005) or relations and positions of all actors in the network structural models (BURT 1987) cited by (LIU et al. 2005) can influence the adoption of innovation.

Considering the social network structure as a factor influencing the diffusion of innovations, means that this diffusion can be searched as a relational context in addition to time influence. Researchers believe as FREEMAN(1984) cited by TRAPPMAN et al. (2011) and argue that social network analysis would study how the social structure within the innovation contexts emerged, how it evolved, and how the structure of relations exhibit consequences for behavior.

Using social networks as a dimension to study innovations is a way to explain complexities in the innovation processes, which leaner models failed to explain (i.e. heterogeneity of actors and their relations)(SPIELMAN, et al. 2010).

Researchers in this study examine the innovation process within the Rahad Scheme by looking at the information flow between different actors that form the social network of the Rahad Scheme (SPIELMAN, et al., 2010). This flow of information goes through links connecting actors in the scheme network (VALENTE, 1995; ENGEL, 1997). Actors' prominence in the network (LIU, et al, 2005) and the content of their contacts is assumed by the researchers as the factor that influences the innovativeness in the scheme context.

For the purpose of this paper, the researcher will present the role and flow of information within formal and informal actors in Rahad Scheme, namely among, extension, finance institutions and agro-pastoralists organizations .

3. Methodology

3.1 Knowledge and Information System Thinking

System thinking is an approach developed by scientists to study the world and how to intervene in it; more specifically, it is an approach to studying agricultural innovations as settings where knowledge and information interact and are exchanged by different stakeholders or actors (ENGEL, 1997). System thinking may not be the only valid way to do so, but it has been widely adopted by many disciplines (ENGEL, 1997; see also Röling, 1992). Although there is no agreed definition on what system thinking is in literature, it is referred to as '*an image or metaphor of the adaptive whole, which may be able to survive in a changing environment*' (SCHECKLAND and SCHOLLES, 1990 cited by: ENGEL, 1997).

Knowledge system thinking is a diagnostic approach that would either aim to implement better interventions, or an investigator would learn more about the function of the system (ENGEL, 1997).

There could be many methodologies for understanding the process of innovation in the Rahad Scheme; choosing knowledge system thinking will help one understand the nature of knowledge held by different actors. RAAKS or Rapid Agricultural Appraisal Knowledge System is an empirical methodology to question innovation systems (SCHECKLAND and SCHOLLES, 1990; cited by ENGEL, 1997). RAAKS is a tested, participatory action research methodology used to approach agricultural innovations with change, but it does not give direct answers to innovation problems (SALOMON and ENGEL, 1997). RAAKS is implemented in phases; each phase has its constructed images or windows to diagnose and better organize innovative performance of studied actors. (SALOMON and ENGEL, 1997; see also HULESBOCH (2001).

To reflect the focus of this paper results of RAAKS and SNAS will be used to show the suggestions to improve knowledge and information system within Rahad Scheme mainly among agro pastoral organizations; Farmers Union, Pastoral Union, Farmers Committees and Finance Institutions represented on Sudanese Agricultural Bank and Saving and Investment Bank; improvement of interactions of those actors in this paper is discussed in relation to extension work in the Rahad.

3.2 Social network analysis

Social network analysis is a methodological perspective that has been developed within the social sciences. Social network analysis stems from the importance of the relations connecting interacting entities (WASSERMANN and FAUST, 1994; SCOTT, 2000). It considers individual entities and the relations connecting them as the unit of the analysis (WASSERMANN and FAUST, 1994). Those individual entities could be individuals, groups of the same type, or different types. Entities in social network analysis are called actors, who are connected to others with relations (WASSERMANN and FAUST, 1994). Relations connecting actors are known as relational ties (there could be different kinds of relations connecting actors, i.e. biological relations, affiliations, behavioral interactions, etc.). Therefore, measurements of social network analysis are suitable for use in analyzing innovation systems based on a network perspective. The measurements used by the researchers for social network analysis are density, centrality of formal actors and informal actors, strength and weakness of relations of actors. For purpose of this paper, authors will present type of relation between some of formal actors and some of informal actors mainly extension, finance institutions and agro pastoral organizations in Rahad Scheme.

3.3 Use of RAAKS by the researcher in the Rahad agricultural scheme

To conduct RAAKS in Rahad Scheme (see figure1 in appendices), we thought that within the Rahad Scheme, information flows among and between different social actors within the innovation. This flow of information materializes in certain communications and relations among the actors. This networking characterizes actors' performance in the innovation over time. Knowing that the Rahad Scheme is an innovation that has been implemented by formal institutions for agro-pastoral communities to practice irrigated farming, the situation by necessity poses an interesting question of how communication and coordination have been taking place between those different actors in order to realize the Rahad Scheme. Conducting a RAAKS study by interviewing local and formal actors will help us understand how actors have been networking in order to facilitate the innovation, and then we can eventually formulate proper strategies for improving actors' networking.

Actors at the level of the Rahad Scheme are institutions whose members represent the Rahad scheme management, government, extension, research, education, investment; those institutions have to be concerned with agricultural innovation in Rahad. This imagined picture allowed us to include wide categories of actors within the scheme.

Actors at the level of villages are the individuals and associations that are identified as the agro-pastorals, who were the focus during implementation of the Rahad agricultural scheme. This imagined picture of local actors in Rahad allowed us to include wide categories of those actors within the scheme: agro pastorals and their associations, women groups, youth groups, and elderly people. In this paper some of actors are considered as private sectors mainly agro pastoral organizations

3.4 Phases of RAAKS in the Rahad Scheme

Phase A

To get a general understanding of knowledge networking among social actors in the Rahad scheme, or to clarify our problems on how the relationship and communication between formal actors and local actors in Rahad are taking place, we used most windows of phase A and selected windows of phase B (see appendix); that is to say we investigated who were actors in the Rahad scheme, what are their roles, objectives, and tasks (what they actually do), how they perceive the performance of the scheme within the given social, political, and ecological environment surrounding the scheme, what sources of information are available to them, and what cultural communication problems exist between them. The team managed to interview 15 relevant actors within the Rahad scheme in the first phase of RAAKS, and did one brainstorming session with eight actors who managed to show up.

Phase B

To get a more precise picture of Rahad actors networking, we conducted key informant interviews and group discussions with local actors in the Rahad scheme (see appendix). The team did 32 individual interviews, and 11 group discussions. The reason to have this number of interviews in qualitative research is due to the geographical and social combination of the Rahad scheme. The scheme is divided into three areas: north, middle, and south, and populated with different ethnic groups (see literature section).

Phase C

In order to improve the performance of the Rahad scheme, the researcher suggests that actors need to manage their knowledge on farming and livestock keeping within the scheme. Knowledge management is the “initiation, direction, and control of purposeful activities” (VAN HACK cited by ENGEL 1997). Knowledge management can be the future activity for actors of the Rahad Irrigated Scheme. It can be implemented in two stages. First they need to conduct training workshop where actors can decide the need to categorize their knowledge management tasks, find out which of the actors are policy makers, which are projects designer, etc. (ENGEL 1997) (. Actors need to define whom each actor needs to contact in order to do the task and why (ENGEL 1997). Then actors at the scheme level need to define which of the actors at the village level are their respective contacts or beneficiaries (ENGEL 1997) . The next step of phase C, extension in the Rahad scheme, is suggested to weave connections and create relations at different levels within the scheme (KREBS and HOLLEY 2002).

3.5 Sampling

Purposive sampling was conducted, as the researcher aimed to include actors concerned with innovations achieved by the Rahad Scheme (BRYMAN, 2001). After approaching the Rahad Scheme administration, researchers decided to conduct snowball sampling in order to interview actors within the scheme (BRYMAN, 2001). Snowball sampling allowed the researchers to move from one actor to the next during interviews by asking Who else do you think is involved with agricultural innovation in the Rahad Scheme. A structured questionnaire was used with 15 actors defined by the snowball sampling using individual interviewing in order to collect information on actors roles and objectives(phase A of RAAKS). To collect information at level of villages, in key informant interviewing and group discussions were conducted using purposive sampling technique to collect information on type of relations of actors at villages level (informal actors; phase B of RAAKS) However, for purpose of this paper,the researcher is presenting results of 6 main actors representing the roles and flow of knowledge and information within the scheme namely, Extension Department in Rahad Schemes Sudanese Agricultural Bank, Saving and Investment BankFarmers’ Union,Pastoral Unions and Farmers committees .

3.6 Data analysis

The researcher used Maxqda 10, which is a software method to analyze and interpret textual data (IVERB2007).

Maxqda helped the researcher process content analysis (CORBIN and STRAUSS 2008) for data collected using semi-structured interviews and group discussions (BRYMAN 2001).

Maxqda 10 was used to analyze data on the roles of the 6 relevant actors (RAAKS phase A). The researcher developed codes and sub-codes as the raw data from interviews was divided into different conceptual levels so that meanings could be inferred out of the textual content (CORBIN and STRAUSS 2008).Meanings of texts were merged and compared using the technique of retrieved codes in Maxqda 10 (IVERB 2007). Finally, concluding points or summaries of actors’ roles were drawn by the researcher’s consensus and thoughts.

Codes of the 6 actors’ roles were the sources of actors’ knowledge, and the type of knowledge. The sources of actors’ knowledge were divided into sub-codes of formal source of knowledge and informal source of knowledge.

The type of knowledge was divided into knowledge of cropping, knowledge of livestock keeping, and knowledge of organizational skills.

3.7 Analysis of social networks

Relation examined is the relation between actors at Rahad Scheme level and actors at villages (formal and informal actors). Ties between actors at two levels can be financial support, exchange of information on farming, and social services within Rahad Scheme. In other words the transaction networks and discrete networks that involve flows of information and services on farming and livestock keeping between actors at level of Rahad Scheme and actors at level of villages (CONWAY and STEWARD 1998; BORGATTI 2009). Connections between the two different levels of actors had been studied based on the weakness and strength of the connection. Two actors are strongly connected if they are connected together with more than one tie or a relationship; if they are connected through one tie they are considered weakly connected. If actors expressed less emotional intensity between them, they are considered weakly connected and vice versa (GRANOVETTER 1973; BAER; 2010). In Rahad Scheme network, valued graphs have been used by researchers to indicate strength and weaknesses of actors' relations using Netdraw software program techniques (BORGATTI and FREEMAN 2002). (Figure 1).

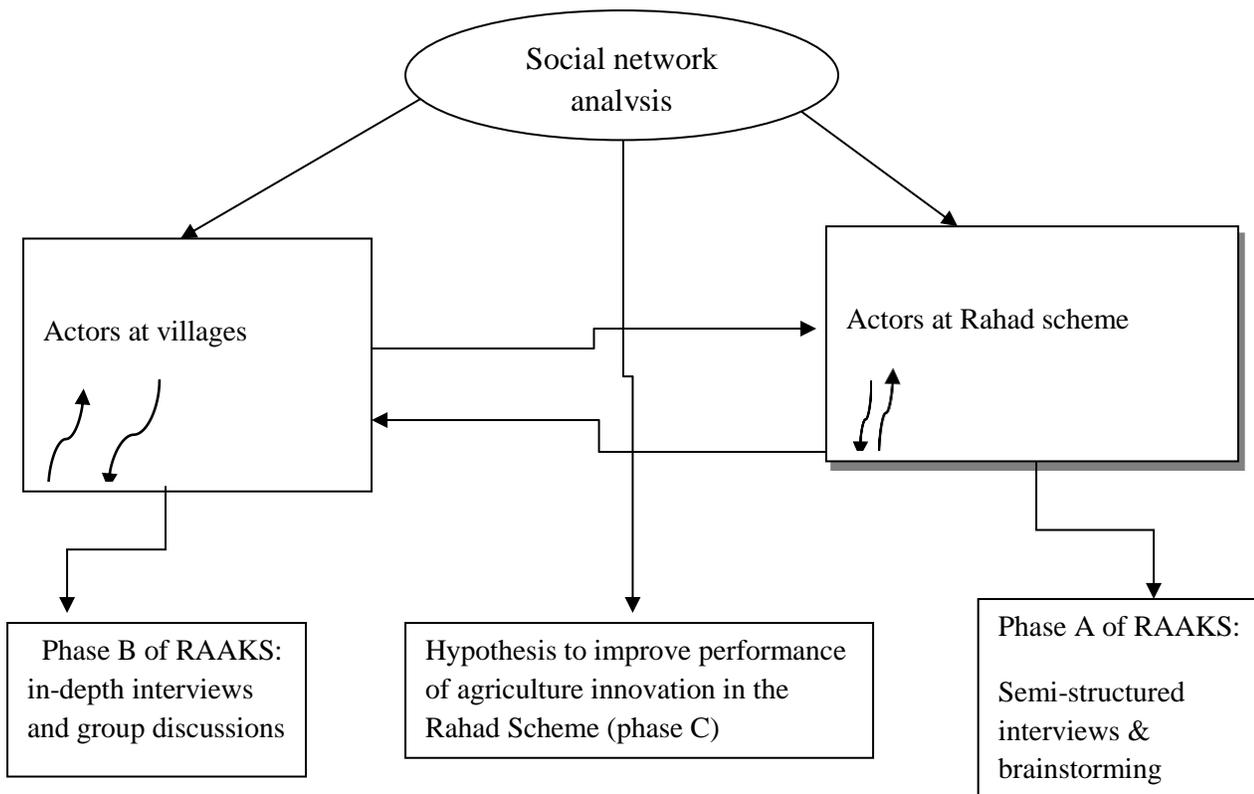


Figure 1: The research design indicating how researchers conducted RAAKS in the Rahad Scheme. Actors at Rahad scheme means the Rahad Scheme Administration, ministries, research institutes, education institutes, investment. Actors at villages scheme are individuals and associations of agro-pastorals (private sectors) settled to practice irrigated farming. Understanding the flow of information within and among both actors will improve the performance of agricultural innovation. Social network analysis is used to analyze part of the RAAKS research study.

4. Results and discussion

4.1 The Role of actors at Rahad Scheme administration level

The Extension and Technology Transfer Department in the Rahad Scheme

This Department is responsible for running extensional approaches to farmers; three extension approaches are conducted in the Rahad Scheme. Those approaches were the commodity approach, Training & Visit Approach (T&V) (World Bank), and Farmers' Field School (Food Agriculture Organization). The commodity approach or field inspector approach already existed in the Gezira Scheme; the approach was designed with inspectors (the term "extension" was not used) who were responsible for demonstrating to farmers the needed farm operations. Reviewed literature on the field inspector approach or commodity approach proved that instructing agricultural practices resulted in poor feedback from farmers, since the farmers had no way just to adopt agricultural packages. Extension linkages with the Research Station were not formally constructed; research results were not applied to farm operations.

The T & V approach in the Rahad scheme established formal linkages and feedback with the Rahad Research Station. However, the approach mainly depended on support from international agencies such as the World Bank. Therefore, withdrawal of that support resulted in ceasing activities of the T & V approach. The last extensional approach in the Rahad Scheme was the Farmers' Field School. The FFS held in the Rahad Scheme was characterized by poor attendance of farmers and a low number of training sessions. Shortages of irrigation water and lack of financing at the time could have discouraged farmers from attending. Therefore, implementation of FFS in the Rahad Scheme, in the researcher's opinion, was concurrent with technical and financial degradation in the Rahad Scheme. Extension in the Rahad Scheme thus went back to a conventional approach until the time of data collection. Interviewed extensionists believed that a new way of extension needed to be considered. They also mentioned issues such as the fact that renting or sharing farmland with laborers had helped increase farmers' absence from farms and lessened the contact of farmers with extensionists. The researcher argues that extension approaches implemented in the Rahad Scheme were designed based on individual models of diffusion of innovations, meaning that performance of farming in the Rahad Scheme depended on individual farmers adopting the required farming activities (LEE UWIS 2004; ENGEL 1997). In order to improve extension performance in the Rahad Scheme, it is important to view adoption of innovations as a complex process that involves communication and networking of different actors who can be sources of different information and knowledge on farming and not focused on individual farmers' performances. In order to make this situation happen, first networking of relations among actors is suggested by the researcher.

The Sudanese Agricultural Bank

Since the establishment of the Rahad Scheme, the Bank of Sudan has provided credits or loans to the Rahad Agricultural Corporation and other agricultural corporations to finance farming operations every season (EL AMIN and EL MAK 1997). The Rahad Corporation would recover land and water charges from farmers for cotton only, and other crops were freely charged (EL AMIN and EL MAK 1997). Farmers recognized this process as farming by subsidy from the government, but officially this economic policy was known as the Economic Recovery Program (EL AMIN and EL MAK 1997). The ERCP resulted in an accumulation of debt in agricultural corporations including the Rahad Agricultural Corporation (EL AMIN and EL MAK 1997). The government of Sudan enacted the National Economic Salvation Program; its policy measures in

the agricultural sector were to remove subsidies on fertilizers, pesticides, land, and water provided by the agricultural corporations (EL AMIN and EL MAK 1997). Financing production costs was shifted to commercial banks instead of the state-run Bank of Sudan (EL AMIN and EL MAK 1997). According to the Agricultural Bank actor, when the government stopped financing, farmers came to the bank (interview 4, paragraph 13).

The Sudanese Agricultural Bank is a developmental bank uses its human and technical resources to achieve agricultural and animal development (SUDANESE AGRICULTURAL BANK 2009). This aim is achieved through the presence of bank branches within producing sectors that offer financial, extensional, and banking services (SUDANESE AGRICULTURAL BANK 2009)

Since 1991, the Sudanese Agricultural Bank has financed farmers within irrigated scheme and farmers at rain-fed areas in all type of crops (EL AMIN and EL MAK 1997). For example, for cotton crops the bank would finance all farming operations by supporting inputs of seeds, fertilizer, and the cost of spraying the cotton with chemicals (interview 4, paragraphs 2, 3).

The bank will monitor this financing through control groups (farmers would be divided into groups; every group will be headed by a farmer, usually a member in the farmer's committee; the farmer would receive the inputs on behalf of his group and hand it to members). The bankers in the finance section would report the costs of finance for every group, and then the head of the group would be the contact person (interview 4, paragraph 2). The bank would decide the amount of money needed from the head of the group. Money would be collected from the groups of the farmers, while the bank calculates the cost. If farmers managed to pay their input costs and make a profit from their produce, the bank would return their profits. Farmers who produce amounts that fail to make profits must repay the cost of inputs (interview 4, paragraph 2). In some cases farmers produced amounts that did not allow them to pay the production costs. Usually, the Rahad Scheme Administration would be responsible for the farmers and would pay the finance costs if farmers failed to pay (interview 4, paragraph 2).

Financing farmers at the scheme level is considered a micro-finance that benefits many people with relatively little money (interview 4, paragraph 3). The other type of financing banks practice is macro-finance (interview 4, paragraph 3). This type of financing is approached with farmers in rain-fed areas within the El Fau locality. Farmers who apply for financing at this sector usually have a massive piece of land (farmer can own 410-1,255 hectare) (interview 4, paragraph 5). Reports on rain-fed farming stated that individuals own around 50 hectares on average (UNEP 2006; CFSAM 2011). Therefore, this type of finance is directed to large-scale farmers within rain-fed farming areas. In macro-financing the farmer would be asked to open a running account; his land would be checked; he would be given fuel, the cost of land preparation, the cost of seeds, and fertilizer (interview 4, paragraph 5). On the other hand, farmers should mortgage their land to cover 70% of the cost in case they failed to pay the bank input costs (interview 4, paragraph 5).

The Agricultural Bank is expanding its financing from the farming sector to include other social domains (interview 4, paragraph 3). For example, the bank is financing livestock for families. This activity was called the finance of producing families and first approached families working within the Rahad Scheme, teachers, or health officers in El Fau city (interview 4, paragraph 3).

The family will be asked to open account, then be given two cows, and be asked to pay back in two years with low monthly payments (interview 4, paragraph 3). Another project was to buy male goats to improve the breed; the family would borrow the goat and pay 20 cents per month for one year (interview 4, paragraph 3).

The bank introduced oil grinding in villages (small machines locally manufactured to grind oil seeds such as groundnuts); in every village there would be 3-4 local grinders (interview 4, paragraph 3). Financing small enterprises such as biscuit machines and sewing machines was also practiced by the bank (interview 4, paragraph 3). Trade was also financed, for example,

merchants to buy sugar and flour (interview 4, paragraph 3). They also financed construction materials for building houses (interview 4, paragraph 3).

Women are among those who are financed by the bank, but they are financed individually, meaning that the bank up until now has not financed women groups (interview 4, paragraph 9). According to the actor, in 90% of cases where women were financed, women would pay the cost of inputs back (interview 4, paragraph 9). The actor further mentioned that women are interested in getting financed for building houses and establishing kindergartens; therefore, the bank finances these categories for women (interview 4, paragraph 9).

The Savings and Social Development Bank

The aim of the Saving and Social Development Bank is to finance a limited slice of people or families with limited income whom are also called small producers by the bank (interview 4, paragraph 22) (Savings and Social Development Bank, 2012). According to the actor, the individual has a limited income, and he or she gets not more than five Euros per day (interview 4, paragraph 26).

The bank uses micro-finance policy to increase people's income, which will reflect on the economic growth of the community in the area (interview 4, paragraph 22) (Savings and Social Development Bank, 2012). The common activities for people within El Fau are farming and animal rising (interview 4, paragraph 31), so the bank mainly finances these two activities (interview 4, paragraph 31).

However, financing is also limited to active people who are well-experienced in farming and animal keeping (interview 4, paragraph 22). Before launching the project for an agent, the bank will collect information on the agent's income or financial status, what activity the agent is doing, and the relevance of the agent's activity with project intended to be financed (interview 4, paragraph 22). The bank finances projects either run by individuals or groups (interview 4, paragraph 42) (SAVING AND SOCIAL DEVELOPMENT BANK 2012).

Financing of groups takes place as follows: members of the association elect members of the executive office, usually three; the three will deal with the bank and sign papers (interview 4, paragraph 47) (SAVING AND SOCIAL DEVELOPMENT BANK 2012).

Most of the associations financed are pastoral associations and women's associations; there are around seven pastoral associations (interview 4, paragraph 44) and only one association for working women called Amna Eltyeb (interview 4, paragraph 53). In our second field work, we found out that there were around 10 new women's associations in addition to the women's union that were registered and financed with different projects by the bank (livestock, trading projects, and electric products) (interview 77, paragraph 31). The actor said the aim was to have 60% of finance projects go to women, (interview 4, and paragraph 53) (SAVING AND SOCIAL DEVELOPMENT BANK 2012). After financing a certain project, the bank would follow the payment through executives of the association (interview 4, paragraph 47). The actor considers itself as a pioneer and specializes in micro-financing in the area (interview 4, paragraph 23). About the actor's relation to the Rahad Scheme, the actor is not directly linked with the corporation, but the bank is directly connected with farmers and families that directly benefit from the scheme, farmers, and the staff of the scheme (interview 4, paragraph 33).

Rahad Scheme Farmers' Union

The Rahad Scheme Farmers' Union was first established in the south part of the scheme in the form of a starting committee. Then when the establishment of the scheme finished in 1982, a comprehensive union representing the geographical expansion of the scheme was formed (interview 11, paragraph 3).

The composition of the union is as follows: the base of the union is the general assembly, every village has a general assembly, and every village will select a production committee of 10 persons called the production council for the village. The 10 members of the production council of

the village are divided into a four-person central committee and a six-person production committee; the village council has president, secretary, treasurer, and members (interview 11, paragraph 3).

All farmers in the scheme (minimum should be around 500 persons) will meet to form a central committee. This committee is formed as follows: every village will select four people; the total will be 184 persons (4 x 46 villages). This number will select 24 people as the executive office; this office should be representative for all villages in the scheme (interview 11, paragraph 3).

Members of the executive committee in the union have authority to instruct services to the section committees (interview 11, paragraph 4). The section committee is a committee consisting of 10 persons selected at the level of the section and headed by the head of the section (interview 11, paragraph 4). The section committees instruct farmer committees at the village level.

These executives will hold a meeting with the central committee to select the president secretary and the general secretary of the whole union (interview 11, paragraph 3). There are also committees formed within the executive council of the union called the service committees such as the electricity committee, personnel committee, union building committee, and water committee. These committees are formed to respond to the needs of villagers in the scheme (interview 11, paragraph 3). Three members of the executive council are members on the administrative council of the scheme. Usually they are the general secretary, the treasurer, and the head of the union (interview 11, paragraph 4).

According to the Farmers' Union actor, the executives of the union attend meetings with the administrative council of the scheme (interview 11, paragraph 4). In these meetings, the union representative is able to supervise input supply to the farmers and money circulation within the scheme (interview 11, paragraph 4).

The Rahad Farmers' Union finances social services for scheme villages by deducting a certain share from farm production 2% (interview 11, paragraph 6). Coordination of these finances goes through a share with the Department of Social Services and development in the Rahad Scheme and a share with the El Fau locality (interview 11, paragraph 6). The Department of Social Services provides its technical views in implementing the services (interview 46, paragraph 4), and the El Fau locality provides the administrative side of implementing the services along with funds from the state (interview 11, paragraph 6). Involvement of the Rahad Farmers' Union in social services goes through the services committees in the administrative council and the section committees (who are the representatives of farmers' committees at the section level).

The section committee has the right to suggest programs according to the needs of the section and specifically hands the administrative council their proposals (interview 11, paragraph 4). The administrative council discusses with the Department of Social Development and develops the proposals in the Rahad scheme¹ (interview 11, paragraph 4).

Involvement of the Farmers' Union in providing such social services in the Rahad Scheme villages is actually a part of the objectives and roles attributed to the Sudanese National Farmers' Union (ABD ELRAHIM 2011). See Figure 1.0 to follow representation of Rahad Scheme Farmers' Union from village level to administration level.

The Farmers' Union in the Rahad Scheme has been among the decision makers for the privatization of the scheme; the secretary of the Farmers' Union is a member of the High Council of Agricultural Development, which is a political body containing politicians at the presidential level (interview 11, paragraph 15). This council suggested private companies as alternatives for managing national schemes, among of them the Rahad Scheme (interview 11, paragraph 15).

¹From interviews at the field level, we understood that within the Rahad scheme there is an administration for social development that conducts technical assistance with the section committee. They coordinate with the Farmers' Union to suggest proposals for rehabilitation or to establish social services in the villages of the scheme.

Involvement of the Farmers' Union in this decision indicates the polytypical role of the union in the Rahad Scheme (ABD ELRAHIM 2011). At the state level, the Rahad Scheme Farmers' Union and the rain-fed Farmers' Union represent the General Union of Sudanese Farmers (ABD ELRAHIM 2011)..

The Pastoral Union

The Pastoral Union in El Fau is a part of the National Pastoral Union, which was established in 1992 and is situated in Khartoum (interview 45, paragraph 4) (BARAKA 2012). The National Pastoral Union consists of unions in different states, at the state level there will be a Pastoral Union representing unions from different localities, and the Pastoral Union at the locality level consists of members of pastorals in villages (interview 5, paragraph 7) (BARAKA 2012). In El Fau, the pastoral union consists of 12 members: four of them will be representatives in Gedarifstate (400 Km eastern of Khartoum the capital of Sudan) and around 38 members at the state level will represent the state in the center (interview 5, paragraph 15). Moreover, the Pastoral Union in the El Fau locality deals with problems or issues within rain-fed farms and Rahad Scheme farms (according to geographical sections of the El Fau locality, there are representatives of the Pastoral Union who represent pastorals in rain-fed farms and scheme farms) (interview 2, paragraph 58). The head of the Pastoral Union in Khartoum mentioned that the union is an organization that aims to improve human beings (the pastorals), animals, and pastures. This main goal will be achieved by providing social services for pastorals (health and education), improving access to pathways, providing proper veterinary services and water points for pastorals (interview 45, paragraphs 5-8).

The actor from the Pastoral Union in El Fau reflected many problems as *status quo* that the actor is looking forward to change (interview 5, paragraph 8). Changing this problematic situation so far represents the current perceived role the union is responsible for.

In 2010, a law was launched to organize the production of farming and animal grazing in Sudan's Ministry of Justice (MINISTRY OF JUSTICE 2011). This law is known as the law of owners of agriculture and animal production (MINISTRY OF JUSTICE 2011). According to this law, farmers and pastorals are considered one sector of economic production (MINISTRY OF JUSTICE 2011). For example, the Pastoral Union and Rahad Farmers' Union is one unit of production. The regularities of this law are in its developing stages and there are no cultivated experiences on the ground yet.

4.2 The Role of actors at village level

Farmers' Committees

The Farmers' Union is connected to farmers through farmers' committees. The composition of the farmers' committee is as follows: the base of the Farmers' Union is the general assembly, every village has a general assembly, and every village will select a committee of ten persons who are called the village council. The ten-person village council is divided into four people as a central committee and six as the farmers' committee, sometimes called the production committee of the village. The village council has a president, secretary, treasurer, and members (interview 11, paragraph 3).

Farmers' committees are responsible for linking farmers with the extensionists. Some information is communicated from extensionists to the farmers' committee and then to the farmers (interview 23, paragraph 8).

Agricultural policies are formed at the level of the High Council of Agricultural Development, and the Federal Farmers' Union in Khartoum. These institutions decide which crops will be planted and discuss the types of financial resources to be used for farming. Then the decisions are handed to the section committees, then to farmers' committees, and then to the farmers (interview 23, paragraph 8) (CEM 2009; ABD ELRAHIM 2011).

Some interviewed farmers have recognized the role of farmers' committees in directing farmers with information inside farms, mosques, or clubs (interview 24, paragraph 39).

, the role of farmers' committees in solving the problem of animals intruding onto farms has been recognized by farmers. *"The farmers' committee is only useful in damage estimation, and we even share them or include them according to the auf (tradition and norms). If you are on the production committee, that means you are from good people in the village so we go and ask them to help you estimate the damage on the farm (if crops were attacked by an animal). In the past we used to ask farmers' committees for technical management such as watering crops"* (interview 18, paragraph 65).

However, other farmers think the farmers' committees are distant from farmers and mentioned that they farm with no directions from them because the farmers' committee itself is a way of decision making inside the Farmers' Union (interview 18, paragraph 64).

So it could be concluded that power issues dominate the relationship or the connection between the farmers' committees and the executive of the Farmers' Union.

4.3 Interactions of actors at the Rahad scheme level and actors at the village level

Connection of farmers' committees to the Rahad Scheme Administration (extension work)

Farmers committees are connected to the Rahad Scheme administration through their connection to extension agents (. The farmers' committee described its role as a link between extension in the scheme and the farmers or local bridges (Easley & Kleinberg, 2010) (interview 53, paragraph 5; interview 21, paragraph 6). One farmers' committee member mentioned, *"Our role is to link farmers with the administrators, or we are mediators between the farmer and the administration, and then we deliver the extension message from the administrators to the farmers"* (interview 23, paragraph 8). This quote reflects a classical view of extension as a message to deliver. Meanwhile extension can be looked at as advisory work in problem-solving situations as in HOFFMAN et al. (2009). The extension role has also been thought of as a facilitator for innovations in order to achieve innovation objectives (LEEUWIS 2004; CRISTOVAO et al. 2012). In this regard, extension can be a knowledge broker working in a platform that collects actors involved in the agricultural innovations in the Rahad Scheme.

They also expressed that they not only communicate information to farmers but also help farmers get financing from banks, as farmers' committees personally guarantee farmers (ref. group finance from the Agricultural Bank) (interview 23, paragraph 9).

Farmers' committees are also connected to the Rahad Scheme through their connection to the administration of social development. The administration is a sharer with the Farmers' Union and Rahad Corporation scheme. It is financed by the Farmers' Union and Rahad Corporation. The Rahad Corporation is responsible for the staff and running cost of offices, cars, and fuel while the Farmers' Union is supposed to cut from farm produce to finance social services around 5 pounds (80 cents) from every farmer. The administration coordinates with farmers' committees the assessment of social services needed by the villages (interview 46, paragraph 3).

In this connection, farmers' committees are the direct contacts of the Farmers' Union who deal with the section to decide what money each village would need. The section delivers the money to the head of the farmers' committee to use it (interview 46, paragraph 5).

Villages mostly decide to build schools and mosques, unless there are problems coming up. Most people decide to have schools and mosques; others prefer kindergartens and women's centers (interview 46, paragraph 5). Accordingly the connection of farmers' committees to the Rahad Scheme is a strong one. Reviewed literature has also proved that strongly connected actors are also important in sharing information within the networks. According to GRANOVETTER (1983),

the speed of information flow and credibility of information are greater through strong ties. Therefore, the researcher argues that since farmers' committees have connections with more actors in the network, more information can be accessed from them. For example, creating a relationship between the Pastoral Union and farmers' committees can lead to access to more information and better possibilities for animal keepers within the Rashad Scheme.

Connection of farmers' committees to the Farmers' Union

Interviewed farmers' committee members have expressed themselves as people who communicate information from the extensionists or Farmers' Union to the farmers (interview 20, paragraph 25; interview 21, paragraph 6) (Conway & Steward, 1998; Borgatti, 2009).

The following code was made by a farmers' committee member explaining their role, *"We are close to farmers in order to communicate information from the section or Farmers' Union to farmers. We follow the farming and watering, and if there are emergencies, we follow them. In the end we follow the harvest with farmers as well. We sometimes connect the farmer with farm administrators, i.e. if there are problems; we solve them with administrators or the Farmers' Union"* (interview 21, paragraph 6).

Accordingly the connection between the Farmers' Union and farmers' committees is considered a strong connection. However, from other interviews with farmers and farmers' committee members the RAAKS team understood that the farmers' committees are not always informed of decisions made by executives of the unions. One farmer mentioned, *"The Farmers' Union is distant from production committees. When they went to meet them for some issues or problems related to farming, they would not find them. The Farmers' Union is busy with its own issues"* (interview 18, paragraph 60). Analysis of the results on actors at the Rahad scheme level found that the Farmers' Union is a central actor in the network (in-closeness: 73.6, out-closeness: 73.6) (FREEMAN 1979) cited by (SCOTT 2000). The high centrality of the actors was an indicator of actors' power effects in the network (HANNENMAN and RIDDLE 2005). Therefore, the researcher assumes that power issues dominate the relationship or the connection between farmers' committees and the executive of the Farmers' Union.

Connection of farmers' committees to the Sudanese Agricultural Bank

Farmers' committees and the Sudanese Agricultural Bank have mentioned a connection to each other in the case of facilitating the financing of production costs to farmers in the Rahad Scheme since it is a one type of connection it can be said that the relation between farmers' committees and the Sudanese Agriculture Bank is weak. The following section explaining the relation, the Agricultural Bank finances irrigated scheme farmers and rain-fed farmers in all type of crops. For example, for cotton crops the bank finances all farming operations by supporting the input of seeds, fertilizer, and the cost of spraying cotton with pesticides (interview 4, paragraphs 2, 3).

The bank will monitor this financing through control groups. Farmers are divided into groups; every group will be headed by a farmer, usually a member of the farmers' committee. The farmer receives the inputs on behalf of his group and hands it to members. The bankers in the finance section report the costs of financing for every group, and then the head of the group will be the contact person (interview 4, paragraph 2). The bank decides the amount of money needed from the head of the group. Money will be collected from the groups of the farmers. The bank will calculate its cost. For farmers who managed to repay their input costs and make. However, Farmers Committees have suggested that the bank need to produce services of micro finance project to finance animal raising activities in the area of the scheme. In this regards Extension department in Rahad Scheme can facilitate this services by raising awareness and farmers' committees can organize farmers to make use of the services

Connection of farmers' committees to the Pastoral Union

One interviewed farmers' committee member was asked about his opinion of the Pastoral Union. He mentioned, *"Animals are grazing in farms of the scheme according to certain instructions developed by the scheme administration. The Pastoral Union does what it can to get involved in this or to re-organize the animals grazing"* (interview 21, paragraph 53). This statement indicates no

negative feelings from farmers' committees towards the role of the Pastoral Union in the scheme, in contrast to the views of the Farmers' Union representative on the Pastoral Union.

Another interviewed farmers' committee member knew about the Pastoral Union in the village but did not know exactly what they are doing (interview 53, paragraph 25). Another interviewed farmers' committee member in a group discussion said the relationship between people or farmers with larger amounts of animals and farmers with fewer animals in the Rahad Scheme is good because the owners of animals can buy crop residue (interview 23, paragraph 47). Pastoral Union members have admitted the complementary relationship of pastorals' and farmers' activities on farms, but they negatively comment on the Rahad Scheme administration on issues of animal grazing within the scheme farms (interview 23, paragraph 49; interview 5, paragraph 12; interview 44, paragraph 6). A member of the Pastoral Union at the village level who was a brother of a farmers' committee member mentioned, *"In order to better coordinate or organize the relationship between farming activities and grazing activities in scheme farms, the Pastoral Union should be involved or represented in farmers' committees."* According to him, pastorals were never represented in the administration of the scheme (interview 44, paragraph 18).

Therefore, it can be argued that at the farm level, the relationship between farmers' committees and the Pastoral Union is not expressed as a negative relationship, but there are no official connections between them. Moreover, farmers' committees are not fully aware of Pastoral Union issues or what the Pastoral Union exactly is doing. Therefore, the connection of farmers' committees and the Pastoral Union is weak. The Pastoral Union actor mentioned the necessity of getting his union to participate in work of farmers' committees at the village level. This could be a first stage to build connections between the Pastoral Union and farmers' committees in organizing grazing activities within the Rahad Scheme. This suggestion as discussed in other sections can be an idea of creating a connection between actors to get access to diverse information in the Rahad Scheme.

5. CONCLUSION

Extension approaches used in the Rahad Scheme were financed and supported by international agencies, and there have been no national extension approaches directed towards extension work within irrigated schemes including Rahad Scheme. Therefore, farmers, extension, and research connections worked well according to the objectives of these extension approaches, mainly T & V and FFS approaches. In order to improve the relationship between extension work and farmers, the extension department needs to create knowledge sharing between different farming practices, for example, exchanging information on extension approaches used in other parts of the country and considering rain-fed farming practices within irrigated farming practices. Considering rain-fed farming is important because farmers in the Rahad Scheme refer their knowledge on farming to their parents or formal experiences within rain-fed farming.

The Farmers' Union and Pastoral Union are related negatively to each other in regards to livestock keeping and farming activities. Each actor had its own ideas about the better function of farming and animal keeping in the area. Therefore, both actors poorly communicate on these issues. To facilitate communication between both actors, there is a need to create connections between the both actors. This connection can start from the village level and the Rahad Scheme level. The Extension and Technology Transfer Department in the Rahad Scheme can work to create the linkages between both actors at the Administration of Rahad Scheme level, while farmers committees can weave connections between Farmers' Union and Pastoral Union at village level.

Information on finance comes mainly from finance institutions within the Rahad Scheme, specifically the Sudanese Agricultural Bank. Farmers are indirectly connected to these institutions through agro pastoral organizations.

To strengthen connections between farmers and the Sudanese Agricultural Bank, the bank can establish branches or offices in the villages. Farmers' Committees can help disseminate information to farmers and can facilitate these branches' work on the ground

More connections from local people towards the bank can be gained through establishing branches or offices of the bank in the villages. These offices will make bank services closer to local's people; local people can also be trained on projects the bank is financing and how to deal with financial issues. In this way individuals or families will be well-monitored or followed in finances.

The Saving and Social Development Bank actor thinks the community needs awareness on handling micro finance-projects, and awareness is acquired from society; however, his institution can bring the service (interview4, paragraph 88), therefore Extension Department in Rahad Scheme can be the facilitator in conducting training workshops for farmers on micro finance projects.

The Farmers' Union and Pastoral Union are related negatively to each other in regards to livestock keeping and farming activities. Each actor had its own ideas about the better function of farming and animal keeping in the area. Therefore, both actors poorly communicate on these issues. To facilitate communication between both actors, there is a need to create connections between the both actors. This connection can start from the village level and the Rahad Scheme level. The extension department in the Rahad Scheme can work to create the linkages between both actors at the Rahad Scheme level, while farmers committees can weave connections between Farmers' Union and Pastoral Union at village level

The researcher thinks that the roles of the Farmers' Union in the Rahad Scheme reflect a strongly organized union in the scheme. What is missing is the union's need to stretch linkages to the other relevant actors, especially women's groups, youth, and the Pastoral Union. Extension within the Rahad Scheme can work as a facilitator in this linking

Farmers' committees have strong connections with some actors in the Rahad Scheme. Strong connections can increase access to more information within the network. Creating a relationship between the Pastoral Union and the farmers' committees can lead to access to more information and better possibilities for animal keepers within the Rahad Scheme.

Although there are negative comments given by farmers on the role of farmers' committees, farmers' committees are still important actors in exchanging information on farming within the scheme. However, in order to share information on farming with more actors, farmers' committees need to extend their connections to other actors in the scheme, especially Pastoral Union members. In this way the innovation of the Rahad scheme can perform with better information circulation and thus better ideas and better problem solving.

If the Pastoral Union is to get involved in decision making regarding farming in the scheme, it needs to be considered as an equal and parallel farmer organization. In this regard, connections need to be created between the Pastoral Union and Farmers' Union, and between farmers' committees and the Pastoral Union. Therefore, weaving connections between the Pastoral Union and Farmers' Union is suggested by the researcher as a part of many connections needed for better performance of agricultural innovations in the Rahad Scheme; Extension department and farmers committees can weave this connection. See figure 2.

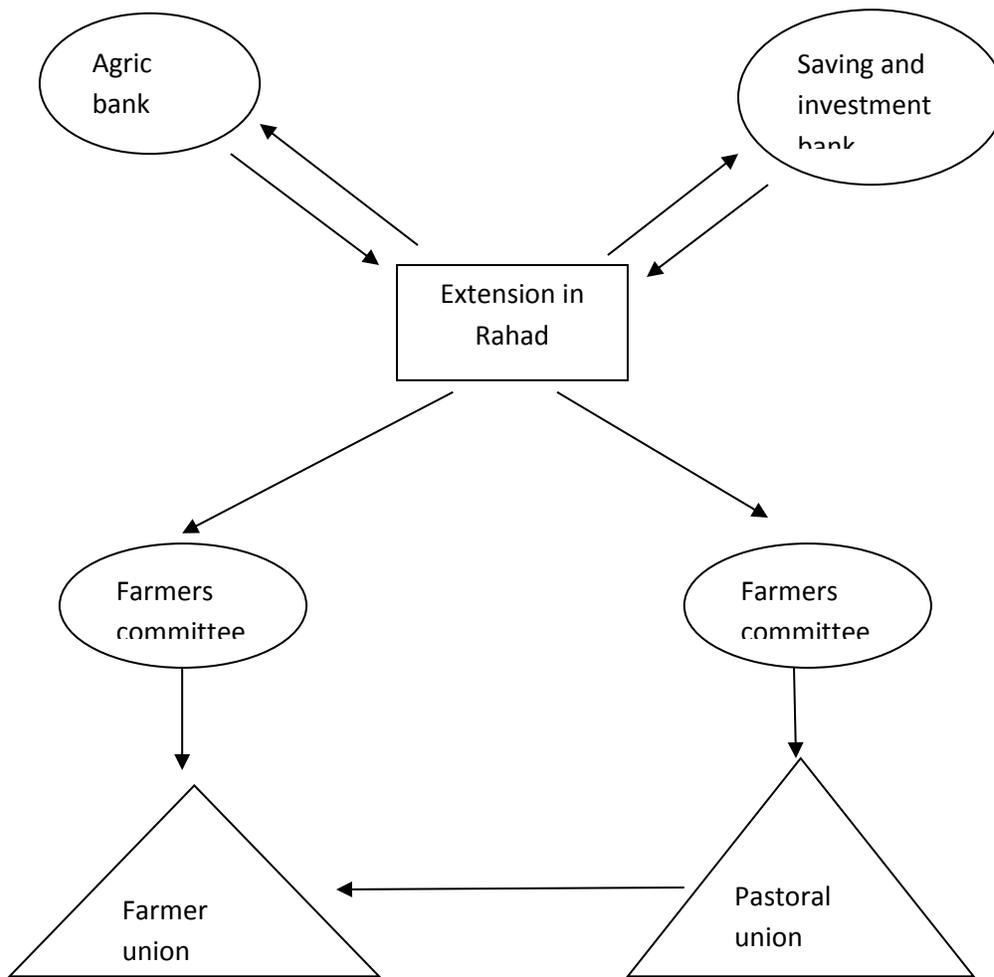


Figure 2: Connections built between agro-pastoral organizations and finance institutions through relations conducted by extension officers in the Rahad Scheme. Farmers committees in this figure is playing the major role in connecting Farmers' Union and Pastoral Union to each other and to extension and then to finance institutions in Rahad Scheme. In the same manner extension is connecting finance institutions to agro pastoral organizations through farmers committees.

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