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RESEARCH ARTICLE

HOW DO SMALLHOLDER FARMERS ORGANIZE THEMSELVES TO MANAGE SMALL-SCALE IRRIGATION SCHEMES?

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ABSTRACT

Irrigation schemes are essential policy options chosen by the government to eradicate poverty and secure food security in Ethiopia. Areas which faced erratic rainfall should expand irrigation projects that enable them to have high agricultural productivity. Irrigation has a great impact on the livelihood of rural community where agriculture is the bedrock of their life. To see the positive effect of irrigation on livelihood, therefore, it is important to understand how farmers or irrigation scheme beneficiaries organize and cooperate in order to manage issues in relation to water management, conflict management and canal maintenance. However, the managerial aspect of irrigation is overlooked and high emphasis has been given to construction of irrigation dams and handover to the users. Therefore, the main aim of this study was to understand how smallholder farmers organize themselves to manage small scale irrigation schemes with reference to Qorrir Small-scale irrigation scheme, Tigray, Ethiopia. In order to carry out this research, a multiple of data collection techniques such as household questionnaire, focus group discussion and key informant interview were employed. In order to analyze the already collected data, both qualitative and descriptive analysis techniques have been used. In the result of the study, it is understood that the water committee is responsible for water allocation and distribution, coordinating canal maintenance activities and conflict management in the irrigation scheme with support from development agents and extension workers. However, the water committee was found to be inefficient in managing water distribution in terms of adequacy, timeliness and equity in the supply of water. According to the research result, conflict within and between groups was persistent due to water scarcity, water theft, lack of proper control of water distribution and increasing number of user that created competition. The irrigation scheme was expected to irrigate hundred hectares. However, since a significant number of beneficiaries (61.7%) have faced acute shortage of irrigation water for their agricultural activities, its capacity to irrigate has limited to fifty hectares.

INTRODUCTION

Water is a common property resource and is critical for sustainable livelihoods. Water resources can play a significant role in improving food security and household income. Irrigation is the most common means of ensuring sustainable agriculture and coping with periods of inadequate rainfall and drought (Dessalegn, 1999). The problem of food security has been keenly felt especially in the Sahel countries and Ethiopia, both of which have become increasingly drought prone. The food crises of the 1960s, 1970s and 1980s have drawn attention to the issue of environmental vulnerability and the need for its mitigation. In many of the drought prone countries, the concentration of the human population is relatively high and cannot be adequately supported by rain-fed agriculture alone. Thus, where rainfall is insufficient or unreliable and rain-fed agriculture cannot fully support food production, irrigation schemes or water management schemes have been considered to be sound investments. Such investments, it is argued, will help stabilize agricultural production and promote food security (Dessalegn, 1999). To ensure food security and boost agricultural production, participatory irrigation management has been considered as the driving force in the effective and efficient irrigation management by participating and involving the farmers in planning, operation and maintenance of the irrigation system (Gulati *et al*., 2005). Effective collective action of farmers is required for the management of irrigation water, resolve conflict over the sharing of irrigation water and canal maintenance when it is necessary. To reach the millennium development goals (such as eradicating poverty in half by 2015) much more efforts must be undertaken to increase the productivity in agriculture and the value of products produced, since farming is the foundation of the rural poor. To reduce the risks linked with rainfall unpredictability and to increase the yields of food crops, more public investments in yield-enhancing technologies—such as small-scale irrigation and irrigation

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management practices—have been suggested as one important rural development and poverty reduction strategy (Andersen and Lorch, 2001). Since irrigation is an arena of struggle where social actors negotiate and decide on the technology choice and management of the water, it is true that the management aspect of irrigation must be taken in to account. However, Ostrom (1990) complained that 'the initial plans for many of irrigation projects in developing countries have focused almost exclusively on engineering designs for the physical systems. Distribution of water for farmers and subsequent maintenance were frequently not addressed'. In line with Ostrom idea, the same is true in Ethiopia. After the construction of the irrigation infrastructure, some form of irrigation management should be in place to run the irrigation system. In many irrigation projects, the issue of irrigation schemes management should be considered at the same time as the physical works (Woldeab, 2003).

In Ethiopia, modern small scale irrigation schemes can be constructed by the federal or regional government in order to overcome the catastrophic climatic change and drought since 1973. Such schemes involved dams and diversion of streams and rivers. Subsequent to construction, usually dams are transfer to water users' association for management, function and maintenance with the support of personnel from regional bureaus (IWMI, 2005). Moreover, long established water committees, locally known as 'water father', administer the water distribution and coordinate the maintenance activities of the schemes (FAO, 1986). According to the Plan for Accelerated and Sustained Development to End Poverty (MoFED: PASDEP, 2006), the main development objective of the Ethiopian Government is poverty eradication and hence the country's development policies and strategies are tend towards this objective. To reach this objective, in the last 15 years the government of Ethiopia has been made efforts to expand irrigation schemes all over the country. The country's Agricultural Development Led Industrialization (ADLI) considers irrigation as a mean to increase agricultural production and food security in the country. Although the government exerts its effort to expand irrigation, the country has still not achieved sufficient irrigated agriculture to overcome the problem of food security and poverty in Ethiopia (Haile, 2008).

Woldeab (2003) argued that although both the human and physical aspects interact in the irrigation domain, the management aspect of irrigation is often ignored while priorities are given to the construction of irrigation. Gebrehaweria (2004) also supported the idea of Woldeab (2003) that irrigation development in Ethiopia has been overwhelmed by the emphasis on the agronomic, engineering and technical aspect of water projects whereas little consideration has been given to the managerial and beneficiary participation aspects of the irrigation scheme. He also added that the experience of irrigation water development in the last five decades in Ethiopia suggests that several measures need to be taken to support farmer managed small scale irrigation projects. According to the Woreda Agriculture and Rural Development Office (WARDO, 2010), Qorir Small Scale Irrigation Scheme was meant to irrigate over an estimated 100 hectares of the vast command area along the downstream. Nevertheless, irrigated areas from the water collected in the dam have never exceeded an estimated 72 hectares of irrigated area during years of its best run off yields. This could be because of water scarcity and a number of illegal water abstractions in the irrigation scheme. However, to get the necessary impact and economies of scale, FAO (1986) argued that a substantial area usually needs to be developed and it must be cropped intensively. Therefore, to achieve a sustainable production from irrigated agriculture, it is true that the managerial and participation of beneficiaries issue must be taken in to account otherwise the sustainability of the scheme will be endanger. The study therefore aimed to analyze how irrigation water beneficiaries or smallholder farmers organized and cooperated in the allocation of water, conflict management and canal maintenance in the study area.

Literature Review

Irrigation is the artificial application of water to soil for the purpose of crop production. Irrigation water is supplied to supplement the water available from rainfall and the contribution to soil moisture from ground water (Michael 1997). Irrigation management is normally defined as "a process by which institutions or individuals set objectives for irrigation systems, establish appropriate conditions and identify, mobilize and use resources so as to attain these objectives while ensuring that all activities are performed without causing adverse effects" (IIMI, 1992). In irrigated crop production a number of interrelated activities ranging from designing and constructing of the irrigation infrastructure to water acquision and watering crops are carried out (Wodeab, 2003). Uphoff (1986) cited in Woldeab (2003) identifies three categories of irrigation management activities and organizational activities. The first involves water acquisition, distribution, and drainage. The second focus on design, construction, operation and maintenance. The third focuses on conflict management, communication, resource mobilization and decision making. The management aspect of irrigation is often neglected while priories are giving to the construction of irrigation infrastructure, although both the human and physical aspects interact in an irrigation domain. Byrnes (1992) conjointly classified irrigation management activities in to a few dimensions. These are water use activities, management structure activities and organizational activities. Water use activities: are management activities that are focusing on the provision of water to crops in an adequate and timely manner include acquisition, allocation, distribution and drainage.

- Acquisition is the first management activity concerned with the acquisition of water from surface or subsurface sources, either by creating and operating physical structure such as dams' weirs or wells or by actions to obtain some share of an existing supply.
- Allocation on the other hand is heavily refers to the assignment of rights to users thereby determining who shall have access to water.
- Distribution refers to the physical process of taking the water from a source and dividing it among users at certain places, in certain amounts, and at certain times.
- Drainage is important where excess water must be removed.

Even though irrigation in Ethiopia dates back a number of centuries, if not millennia, especially in some parts of the country like the Konso community, modern water development schemes are a relatively new phenomenon in the country (Dessalegn, 1999).The country's irrigation potential ranges from 1.0 to 3.5 million hectares of irrigable land, of which between 160 –190 thousand hectares (5-10%) is estimated to be currently irrigated (Gebremedhin and Peden, 2002).The overall irrigated area by traditional small scale irrigation scheme is estimated to be about 138,000 ha and about 572, 000 farmers are involved. Long-established water committees, locally known as 'water fathers', administer the water distribution and coordinate the maintenance activities of the schemes (FAO, 1986).

The Imperial government took the first initiative in water resource development in the second half of the 1950s. Large-scale water projects for agricultural purposes and power generation were constructed from the end of the 1950s, and were concentrated in the Awash valley as part of the agro-industrial enterprises that were expanding in the area at the time. They subsequently spread to the Rift Valley and the Wabe Shebelli basin. Essentially, the government's interest at the time centered almost entirely on large-scale and high technology water projects: hydro-power dams, irrigation schemes, and water supply projects for Addis Ababa and a few major towns. Since then, all large-scale schemes in the country have been constructed at the initiative of the government, and managed by state or para-statal enterprises (Dessalegn, 1999). At the beginning of 1970's, about 100 thousand hectares of land was estimated to be under modern irrigation. During the imperial regime, the main objective of irrigation was to provide industrial crops to the growing agro-industries in the country, many of which were controlled by foreign interests, and to increase export earnings (Gebremedhin and Peden, 2002). For much of the lifetime of the Derg, very little attention was paid to small-scale and traditional irrigation schemes constructed and managed by peasant farmers.

With the nationalisation of industrial and agricultural enterprises, the government's emphasis was to promote high technology water development schemes managed by state-controlled agro-industrial and agricultural enterprises. It was only in the second half of the 1980s, as a result of the devastating famine of 1984/85, that the Derg began to show interest in small-scale water management schemes. The establishment of the Irrigation Development Department (IDD) within MoA at the end of 1984, a body entrusted with the development of small-scale irrigation projects for the benefit of peasant farmers, signaled a new approach to water development by the military government (Dessalegn, 1999). However, progress was slow. From the mid-1980s to the fall of the Derg in 1991, IDD was able to construct some 35 small schemes (MoA, 1993), of which nearly one-third were formerly traditional schemes used by peasants. After 1991, when EPRDF took power, the focus on large-scale irrigation development and the neglect of small-scale schemes was reversed. The EPRDF government has given more attention to the development of small-scale irrigation schemes and improvement of farmer–managed traditional schemes at the forefront of its water development policy. The establishment of MoWR (Ministry of Water Resources) enables the unification of public agency for water resources development. Irrigation Development Department (IDD) was dissolved in 1994 and was replaced by Regional Commissions for Sustainable Agriculture and Environment Rehabilitation (Co-SAERS) in a number of regions. The primary mandate of the Co-SAERs also remained rather technical–oriented, with inadequate attention accorded to policy, socio-economic and managerial issues (Gebremedhin and Peden, 2002). In sum, irrigation development planning in Ethiopia has been beset by the emphasis on the agronomic, engineering and technical aspects of water projects, with little consideration to issues of management, beneficiary participation, availability of institutional support services such as credit, extension and input supply, and marketing. The experiences of irrigation water development in the last five decades in Ethiopia suggest that several measures need to be taken to support farmer-managed small-scale irrigation projects in Ethiopia (Gebremedhin and Peden, 2002).

MATERIALS AND METHODS

Description of the Study Area

Qorir SSI Scheme is located near Qorir village within Genfle Kebele Administration of Klite-Awlalo Woreda in Eastern Zone of Tigray. Qorir village is also close to Wukro town, the administrative centre of Klite-Awlalo woreda, about 45 Km North of Mekelle along the Mekelle-Adigrat main highway. One may find Qorir SSI Scheme and the small earth dam supplying its water (Qorir Dam), driving north from Mekelle and turning right at about 3 killo meter just before reaching Wukro town; and reaches the scheme at 2.2 Km east of the main highway. The command area of the scheme itself begins from the edge of the main road and extends up to the foothills of Qorir mountain chains where Qorir Dam is positioned. In terms of geographical coordinates, the site can be located at 0566124E and 1519682N. In 1983 E.C, Co-SAERT (Commission for Sustainable Agriculture and Environmental Rehabilitation in Tigray) built an earth dam near Qorir village to collect the runoff from the seasonal rainfall. It was intended to provide irrigation water for the village community and it was named "Qorir Small Scale Irrigation Scheme". The dam meant to irrigate over an estimated 100 hectares of the vast command area along the downstream. Nevertheless, irrigated areas from the water collected in the dam have never exceeded an estimated 72 ha of irrigated area during years of its best runoff yields.

In accordance with the policy frame work for SSIS development in Ethiopia, management and operation of SSIS is the joint responsibility of the state irrigation agency, cooperative promotion and input supply disks, districts and village level administrative and legal entities and farmers and their organizations. Along with the completion of irrigation development projects carried out by Co-SAERT in many parts of Tigray around late '90's; the need for devolution of responsibilities to the lowest appropriate level through transfer of (small scale) irrigation management to the intended beneficiaries of the irrigation scheme was came. Qorir SSI scheme being one of such projects in Klite- Awlalo woreda,

the woreda administration laid down the formal structure to facilitate the process for transfer of the irrigation water management activities to local farmers (beneficiaries). Accordingly, the woreda administration office issued a letter addressed to Genfel Kebelle administration on the subject of a directive for utilization and management of irrigation schemes, which was enclosed with the letter; Ref.No.906/26/92, dated 10th October 1999. The letter was advising Genfel Kebelle Administration regarding issuance of the directive for utilization and management of irrigation schemes; and, for the letter to implement/ adopt it in the management of the irrigation scheme within its auspices (e.g. Qorir SSI Scheme). The letter was also copied to Wukro woreda court, social courts in 5 Kebelle Administrations and woreda justice office, which imply that these judiciary bodies are providing their supports of legal enforcement for implementing the regulations described in the directive. Among other things, the directive indicates that the two committees will be formed as irrigation committee and water committee to function at kebelle administration and Qushet (village) levels respectively. The two committees' roles and responsibilities are defined to involve, respectively, as overseeing overall governance and management of irrigation schemes in the Kebelle administration and the management of (small scale) irrigation activities within a scheme.

According to the directive, the irrigation committee to be formed at Kebelle administration level was described as comprising pre-designated members including a chairperson (assumed by the Kebelle Administration chairperson), a vice chairperson (Kebelle Administration Development committee chairperson), a secretary (a representative of DAs in kebelle administration) and other 4 committee members including the Kebelle administration's propaganda chief, SAERT engineer, SAERT site-mobiliser, chairperson of the service cooperative and the chairpersons of water committees of the irrigation schemes in the kebelle administration. Currently, there is no trace of the irrigation committee, except the water committee.
The water committee, on the other hand, is to be formed through election by the irrigation beneficiary community members every year to manage the irrigation. The first of the water committee was formed through election by community members in Qorir SSI Scheme at the time the Qorir dam was completed in 1997G.C.

The members of the committee are: Chairperson, Vice chairperson, Secretary, Treasury, Auditor and two operators. The system has a by-law in the kebelle judiciary (social court) written and legalized in 1992 E.C. The directive defines the roles and functional procedures of the water committee as well as the rights and obligations of the irrigation beneficiaries; along with the types of offences that are considered punishable and subsequent fines. Accordingly, the water committee is responsible to manage the scheme and its main roles include protecting the infrastructure from being damaged (misuse or otherwise), facilitating scheduled water use by the irrigation beneficiaries and monitoring any attempt involving violation of established regulations by users such as defaulting agreed water access schedules and trying to divert water while it is not their turn. In addition to the above mentioned roles, the water committee is also responsible for resolving disputes related to water, land and maintenance based on the by-law. The water committee and the water users groups were formed in the hope for good management of the irrigation scheme. All water users are organized in to 13 groups, each group comprising 13-32 members. The organization of irrigation beneficiary farmers into groups are based on the relative position of their plots relative to the headwork. Accordingly, it starts from those who own plots at the headwork (group 1) and continues towards the downstream users. The size of each group is based on the cumulative land size owned by each group members.

Data Sources

To carry out this study, the researcher employed both primary and secondary data. The primary data were collected by employing triangulation method such as key informant interview using semi-structured checklist, focus group discussion, expert interview; semi structured household questionnaire and observation of events in the irrigation scheme. Secondary information that could supplement the primary data were collected from published and unpublished documents obtained from different sources. These included policy statements, proclamations and regulations, project appraisal documents, reports and past case study papers on irrigation. The study started with brief review of the regional and national irrigation policies, the policy and legal frameworks regarding irrigation, land and water rights. To collect the above mentioned data sources, in this study, questionnaire, key informant interview and focus group discussion has employed.

Sample Size and Sampling Technique

The number of beneficiaries of Qorir Small Scale irrigation scheme depends on the amount of annual rainfall or the volume of water runoff into the reservoir (dam). Hence, according to Kilte-Awlalo Woreda Agriculture and Rural Development Office in 2010 G.C., the number of beneficiaries of Qorir Small Scale irrigation scheme was 120 in number. For this study, therefore, all beneficiaries were taken and studied.

Data Analysis Technique

Both qualitative and descriptive analysis techniques were used for data analysis. The data generated through household questionnaire was analyzed by employing the computer Software known as Statistical Package for Social Science (SPSS Vs. 16.0) and Stata 10. The descriptive statistical methods such as frequency, percentage, mean, and standard deviation and X^2-statistic were used for analyzing the data generated through household questionnaire.

Validity and Reliability of the Study

Ensuring validity and reliability is the most important issue in research. Reliability is defined as 'the extent to which results are consistent over time and an accurate representation of total population under study, and if the results of a study can be reproduced under similar methodology, the research instrument is considered to be reliable' (Joppe, 2002 as cited in Bashir *et al*, 2008). Reliability is highly related with the degree

of consistency of results, stability of results over time and result's similarity within a given time frame. For this study, reliability has been guaranteed by preparing questionnaire and interview guides by avoiding questions having varied meaning. After a careful and rigorous design of questionnaire, pre-test was made before conducting the research. Every steps of data collection has been documented well. These have made this research reliable. Even if reliability is necessary for this research, it is not sufficient. Validity has also been ensured.

Validity 'determines whether the research truly measures what it was intended to measure or how truthful the research results are' (Bashir *et al*, 2008). In this research, validity has achieved by avoiding leading and provoking questions from the questionnaire. Construct and content validity was also achieved by developing interview guides and questionnaire on the indicators and variables. Moreover, by spent enough time on the field and also by employed multiple data collection techniques to support the findings, validity has achieved and bias has also minimized.

RESULTS AND DISCUSSION

In the study area small scale irrigation management activities include water use activities such as allocation and distribution, control structure activities which refers to construction, operation and maintenance and organizational activity which includes activities like resource mobilization, conflict resolution and decision making.

Water Management

Water Allocation

Water may be supplied on a continuous or a rotational basis in which the flow rate and duration may be relatively fixed. In those cases, the flexibility in scheduling irrigation is limited to what each farmer or group of farmers can mutually agree upon within their command area. With this regard, Qorir small scale irrigation is adopting rotational system which are secondary canals receive water by turns and the individual farmers within a given area receive the water at the pre-set time. Based on the amount of the water stored in the reservoir each year after the rainy season, the size of irrigable area is determined by the local beneficiaries with the close assistance of woreda[1] experts. Then after those farmers whose farm land included in the delineated area will group into several groups and elect group leaders, the beneficiaries discussed with close assistance of woreda experts and development agents, and develop the rotational system by setting sequential irrigation turn of each group starting from the head end of the water source. In the study area, the water committee is in charge of water allocation and coordination of rotational water distribution. Irrigation agronomists and development agents are also supposed to provide technical assistance to water committee in water allocation, in preparing the annual schedule of water distribution and in defining the water rights of members based on study on water requirements of different crops and irrigable plot area and measurement of the yearly water supply. Monthly, the water committee calls a meeting and coordinates maintenance and canal cleaning activities. Water allocation and rotational schedule, which was prepared and implemented by the water committee has got limitations in terms of its implementation. The focus group discussion with beneficiaries revealed that in terms of implementation, water allocation is based on guess. Beneficiaries do not know when to irrigate their farm and the communication that inform who is going to irrigate next (whose turn is next) is verbal and not translated to each farmer. As a result, farmers come to irrigate their farm after their turn is passed and the operator is forced to release the water even for one farmer. Amount and time of water supply are not defined with the water requirement of different crops grown and area of irrigable plots managed by households. This resulted in a major problem in the implementation of rotational distribution of irrigation water.

Water Distribution

Table 1. Responses Related to Getting Enough Irrigation Water and Reasons for Not Getting Enough Irrigation Water

	Do you get enough water?	Frequency=120	Percent
Responses	Yes	46	38.3
	No	74	61.7
	Total	120	100
What are the major reasons for not getting enough water?		Frequency N=74	Percent
Reasons	Water scarcity	48	40
	Poor coordination of water distribution	13	10.8
	Water theft	9	7.5
	Total	74	61.7

Source: Field survey, 2011

The study identified that the scheme has water committee. The water committee is responsible for coordinating the water distribution. The water committee nominates two individuals who are responsible to open the water gate as per the program of each of the groups (formed based on their farm location). The monthly salary of each gate keeper is 45 birr[2] and their responsibility is, in addition to opening and closing of the gate, they are responsible for keeping turn and protecting water theft. Each group gets water based on time limit (scheduling).

According to table 1, 38.3% of beneficiaries said that they get enough water when needed for their agricultural activities. The table also clearly shows a significant number of water users (61.7 percent) said that they have faced a problem of water shortage in the irrigation scheme; they said that they could not get enough water for their farm activities when they need. Out of the 61.7 percent of irrigation water users who complained not to get enough water, 40 percent said that the shortage is due to water scarcity. This problem may be created due to the erratic nature of annual rainfall, evaporation, the presence of plants around the earthen canal, the weakness of the gate keepers in keeping the farmers' water use turn, negligence of the water committee in coordinating water distribution, beneficiaries use the water in the reservoir for their livestock consumption, the presence of holes created by rates in the command area and there are under age children assigned to

[1] It is one of the tiers in the administrative structure of Ethiopia

[2] Birr is the currency of Ethiopia. One Birr is equivalent with 0.05072USD as of Tuesday 13, August, 2014 source: http://www.nbe.gov.et/market/banksexchange.html accessed on 8/12/2014

irrigate the farm in the study area and they could not manage the job so it is means of water losses. These in turn results in water scarcity in the command area. Moreover, water scarcity, poor coordination of water distribution by the water committee and water theft were the 1st, 2nd and 3rd most important problems that constrained the supply of adequate water in the command area of the irrigation scheme respectively.

Table 2. Farmers' Response on Major Causes for Water Scarcity

If there is water scarcity, what are the most important causes for you?		Frequency N=48	Percent	Rank
Causes	Seepage loss	9	7.5	3rd
	Increasing number of users	3	2.5	4th
	Declining level of water from the reservoir	24	20	1st
	Poor scheduling of distribution	12	10	2nd
	Total	48	40	

Source: Field Survey, 2011

According to table 2, 20 % of the respondents expressed that declining level of water from the reservoir was one of the factors responsible for water scarcity in the command area. This may be due to shortage of rainfall and high evaporation in the study area. The second cause of water scarcity in the command area is seepage loss (7.5%). This may be due to the fact that in the study area except some parts of the main conveyance canal made from cement (150 meter), the secondary canals are earth canals and malformed due to lack of timely and proper maintenance activities. As a result of this excessive seepage was observed during the study time. Moreover, poor coordination of scheduling, inadequate coordination of water distribution and increasing number of water users in the command area have had contribution for the problem of water scarcity in the study area.

Table 3. Water Users' Opinion about the Performance of Water Committee in Water Distribution

What do you feel about the performance of the water committee in the management of water distribution?		Frequency N=120	Percent
Opinions	Enough water is not received due to misutilization of water (adequacy)	63	52.5
	Water is not received when needed (timeliness)	42	35
	Water distribution is unfair (equity)	15	12.5
	Total	120	100

Source: Field survey, 2011

According to table 3, more than half of the water users (52.5 percent) witnessed that they could not obtain enough water due to misutilization of water by some careless irrigators. The other 35% and 12.5% irrigators said that they could not receive water when they need and water distribution is unfair respectively. This is because according to the information obtained from the water committee chairperson, special infancies is given to vegetables, that is any farm covered with vegetables can irrigate whenever the plant required without following the rotation. As a result, farmers who have plot covered with crops and perennials may not get water when they need. The water committee consists of seven members to coordinate and control water distribution in the command area of the scheme. However, according to the most important performance indicators in the distribution of irrigation water designed by World Bank in 2000 include adequacy, timeliness and equity in the supply of water, the water committee was found to be inefficient in managing the water distribution in terms of the three performance indicators.

Table 4. Farmer's Responses about Socioeconomic Groups That Get More Water in the Irrigation Scheme

If there is unfair distribution of water, which socioeconomic groups get more water in the irrigation scheme?		Frequency N=15	Percent
Groups	Farmers with large family	6	5
	Farmers with large farmland	7	5.8
	Rich farmers who grow perennials	2	1.7
	Total	15	12.5

Source: Field survey, 2011

According to table 4, 5.8% of the beneficiaries said that farmers with large farmland obtained more water because they have large farm land and there is no time limit how long each farm has to irrigate. As a result of the above mentioned reasons, farmers having small farm land size are suffering from lack of irrigation water. 5% of beneficiaries were also complained that farmers with large family received large volume of irrigation water and the rest 1.7% were reported that rich farmers who grow perennials got more water. Moreover, during the focus group discussion the beneficiaries also indicated their disappointing experience that the performance of the scheme has been declining over the past years to a level where it is no more making a difference in their farming practices. These problems were happened due to the weak performance of the water committee in water distribution. The prevalence of unfair distribution of irrigation water that means certain socioeconomic groups obtains more water for their farm activities than others. As a result, the target community could not fully and equally benefit from the water as it had been anticipated.

Table 5. Users' Opinion about Major Management Problems Related to Water Distribution

What is the major management problems related to water distribution?		*Frequency N=120*	*Percent*
Opinions	Sanctions not imposed against illegal water users	*52*	*43.4*
	Rotation does not accomplish equality	*21*	*17.5*
	Rotation is not strictly implemented	*19*	*15.8*
	Poor coordination of water distribution by Water committee	*28*	*23.3*
	Total	*120*	*100*

Source: Field Survey, 2011

Table 5 presents users' perceptions about the major weaknesses of the water committee on water management. Of the total users, 43.4% reported that Sanctions are not imposed against illegal water users i.e. irrigators that extracted and used more water by abusing turns. Some of the illegal water users may be intimate friends or relatives of the water committee members. Hence, sanctions may not be imposed on them. 23.3% of the beneficiary farmers stated that they were not able to obtain water in a reliable manner because of poor coordination of water distribution by water committee. The research result also shows that 17.5% and 15.8% of irrigation

users did not obtain the quantity of water that they need because, among others, rotations does not accomplish equality this may be due to rotation is based on the type of cops and vegetables planted and the size of the farmland in the command area as a result they are not strictly implemented respectively. Moreover, the study shows that the general performance of the Water Users committee in terms of managing the scheme was terribly poor.

Conflict over Irrigation Water and Its management

With regard to Qorir SSI scheme, water users, water committee members and key informants explained that conflicts arising from water allocation and distribution are a common phenomenon among irrigators within and between groups. Hence, according to Gashaye (2007) institutional arrangement on irrigation is required to overcome problems related to irrigation water as a common property resource, to provide incentives to disciplined members, disincentive to free riders/ violators.

Table 6. Beneficiary Farmers' Response to the Presence and Causes of Conflict over Irrigation Water

	Have you ever faced any conflict over irrigation water?	Frequency N=120	Percent
Responses	Yes	72	60
	No	48	40
	Total	120	100
	What are the causes for water conflict?	Freq. N=72	
Causes	Water theft	17	14.2
	Water scarcity	31	25.8
	Competition due to increasing number of water users	8	6.7
	Lack of proper control of water distribution	16	13.3
	Total	72	60

Source: Field survey, 2011

Table 6 shows the results of household questionnaire that majority of beneficiaries, 60% acknowledged the presence of conflict arising from distribution and allocation of irrigation water. They mentioned water scarcity, water theft, lack of proper control of water distribution and competition due to increasing number of water users as the prominent factors for water conflict. 25.8% of the beneficiaries reported that due to the erratic nature of rainfall and the declining of volume of water conveyed in to the dam (water scarcity); there had been intense competition and conflict over water. 14.2% beneficiaries stated that water theft has also been one of the prime factors for water disputes within groups and between groups. Informants also expressed that lack of enforcement of bylaws for water allocation has also been one of the most important constraints that led to unnecessary water disputes. They also expressed that '*the stated bylaws are good in written form but when we see them in practice, they are not well applied. Some irrigators break the bylaws and commit water theft but the penalty is not proportional to the mistakes that they made. This is because the violators build a strong relationship with the water committee members'.* The remaining 13.3% and 6.7% of irrigators said that the conflict arises due to lack of proper control of water distribution and competition (increasing number of water users') respectively. Furthermore, the beneficiaries ranked the causes of water conflict as water scarcity, water theft and lack of proper control of water distribution as the first, second and third respectively.

Table 7. Farmers' Response on Conflict over Irrigation Water by Their Farm Location

Have you ever face any conflict over irrigation water?		Where is your farm location from the water source?				
		Head-end	Middle-end	Tail- end	Total	
Responses	Yes	15	23	34	72	X^2-value 37.3747*
	No	35	11	2	48	
	Total	50	34	36	120	

Source: Field survey, 2011 *=Significant at 1%

Table 7 shows that water users in the tail-end area of the irrigation scheme were faced disputes over irrigation water. From this we can understand that conflict over irrigation water is becoming severe when we go from head-end to tail-end of the water source. As a result of this, most tail-end beneficiaries responded that they faced conflict over irrigation water. When a farmer's farm location is far from the water source, the probability of getting enough irrigation water is low. This in turn results in water scarcity, the major causes for water conflict. The chi-square test also revealed that conflict over irrigation water and farm location from the water source has a significant relationship at 1% significant level.

Table 8. Farmers' Opinion about the Performance of Water Committee in Resolving Conflicts in the Irrigation System

	How do you evaluate the performance of the water committee in resolving conflict?	Frequency N=120	Percent
Opinions	They take immediate actions on cases	70	60
	Conflict management has been improved	4	3.3
	They suspend cases	44	36.7
	Total	120	100

Source: Field survey, 2011

Table 8 presents that a significant number of beneficiary farmers (60%) responded that the water committee takes immediate actions on cases to resolve conflicts when they rose. The rest 36.7% said that the water committee suspended cases. This may be due to the fact that whenever there are violators, the water committee takes such perpetrators to kebelle social court. Nevertheless, the court always demands witnesses for the offences done. Because of these procedural problems, cases may be suspended. Informants also indicated that when fellow farmers who had witnessed the wrong doing (the wrongdoer in action) are asked to stand as witnesses; they decline from cooperating; in case the perpetrator might resent against them. Most beneficiaries of the scheme do not want to risk consequences from such feelings of resentment from any one endured legal actions for being found guilty. So, the

committee often finds itself powerless to ensure observance of the regulations set for the irrigation water management. 3.3% of beneficiaries said that conflict management has been improved in the irrigation system. This is due to the presence of support from development agents on the issue of conflict management. The researcher also conducted an interview with the water committee chairperson about the enforcement of the by-law on the guilty farmers. The interview revealed that for instance, if the person is guilty on water theft, he/she will be penalized based on the appearance of the plant. If the plant is endangered due to water scarcity and if the person is trying to save the life of the plant, he/she will be penalized less than the expected penalty. If the case is beyond the capacity of the water committee, it will be submitted to the kebelle social court. He added some ideas through proverb that *"Jib ende hageru yichohale"* meaning they are trying to solve the problem according to the weight of the case

Operation and Maintenance of canals in the study area

According to the information obtained from the water committee members, maintenance of the canals are undertaken by mass mobilization, on average, ones in a month and according to their by-law those beneficiaries who are absent in the maintenance work will be penalized up to 50 ETB (Ethiopian Birr) based on the wage of daily laborer. In addition to this, rebuilding of temporary diversion structures are done by the users own initiatives annually; usually at the beginning of the irrigation season. Moreover, farmers undertake canal cleaning and system maintenance activities monthly under the leadership and coordination of the water committee and local development agents. The most important reason they suggested for the maintenance and farmer commitment was the role of irrigation in the life of farmers in the area. Nevertheless, the irrigation beneficiaries defer major maintenance works that require input of expert skills and industrial product (e.g. cement) to the government agencies to do it for them. In order to look after violators, the committee has hired two guards who are paid through contributions of the irrigation beneficiaries. Each of the irrigation beneficiaries owning a plot size of 0.125ha ($1/8^{th}$ of a hectare) contributes ETB 10/ year.

The contribution varies according to the plot size of individual beneficiaries. That is, it could be higher for those holding plot size more than 0.125 ha or lower for those holding less size of land. The money remaining after paying the salaries of the guards is used for minor maintenances of the irrigation infrastructure. Qorir small scale irrigation is furrow irrigation system which comprises some on and off-farm infrastructure which perform several important functions like turning the flow to a field on and off, conveying and distributing the flow among the fields. The main canal with length of 150 meter is lined and is performing in a good condition. This canal feed two secondary canals and one tertiary canal. Drops in the main canal are also in a good condition.

But the secondary canal is not in a good condition. With reference to Table 9, a significant number of beneficiaries (60%) were responded that maintenance of the irrigation scheme is in a good condition.

Table 9. Beneficiaries Opinion about the Maintenance of the Scheme

How do you evaluate the maintenance of the scheme?		Frequency N=120	Percent
Opinions	Very good	20	16.7
	Good	72	60
	Acceptable	19	15.8
	Poor	8	6.7
	Very poor	1	0.8
	Total	120	100
If your answer is poor or very poor, what are the causes?		Frequency N=9	Percent
Causes	Siltation	3	2.5
	Poor imposition of sanctions on reluctant users	2	1.7
	Absenteeism of some members on maintenance days	2	1.7
	Breaching of canals by illegal water users	1	0.8
	Poor coordination of maintenance activities	1	0.8
	Total	9	7.5

Source: Field survey, 2011

However, according to beneficiaries who said the maintenance of the scheme is poor and very poor (7.5%), siltation (2.5%), poor imposition of sanctions on reluctant users (1.7%), absenteeism of some members on maintenance days (1.7%), breaching of canals by illegal water users (0.8%) and poor coordination of maintenance activities (0.8%) were some of the major causes. The water committee is to be formed through election by the irrigation beneficiary community members every year to manage the irrigation. The first of the water committee were formed through election by community members in Qorir SSI Scheme at the time Qorir dam was completed in 1997G.C. The members of the committee are: Chairperson, Vice chairperson, Secretary, Treasury, Auditor and two operators. The system has a by-law in the kebelle judiciary (social court) written and legalized in 1992 E.C. The directive defines the roles and functional procedures of the water committee as well as the rights and obligations of the irrigation beneficiaries; along with the types of offences that are considered punishable and subsequent fines.

Accordingly, the water committee is responsible to manage the scheme and its main roles include protecting the infrastructure from being damaged (misuse or otherwise), facilitating scheduled water use by the irrigation beneficiaries and monitoring any attempt involving violation of established regulations by users such as defaulting agreed water access schedules and trying to divert water while it is not their turn. In addition to the above mentioned roles, the water committee is also responsible for resolving disputes related to water, land and maintenance based on the by-law.

Conclusion

The major findings of the study are summarized hereafter using the objectives and/or the research questions as guides.

- The water committee is responsible for water allocation and distribution, coordinating maintenance activities and conflict management in the irrigation scheme with support from development agents and extension workers. Nonetheless, the water committee in the irrigation scheme is found to be inefficient in managing water distribution in

terms of adequacy, timeliness and equity in the supply of water. In Qorir small scale irrigation scheme, 35% of households did not obtain the amount of water they needed, 52.5% beneficiaries witnessed that enough water is not received due to misutilization of water and the rest 12.5% of water users acknowledged that there is also inequality in water distribution between locations and between socioeconomic groups. The result indicated that access to adequate irrigation water is more unlikely if the beneficiary farmers' irrigable plot is in the tail-end area because poor water management and water scarcity.

- In Qorir SSI Scheme, a significant number of beneficiaries (61.7%) faced a problem of water shortage for their agricultural activities. Water scarcity, poor coordination of water distribution, water theft and farm location from the water source were the most important reasons for not obtaining the required quantity of water for irrigation over the command area of the irrigation scheme. There are also technical problems that negatively affected water distribution in the irrigation scheme. There are some hill topographic areas in the command area of the scheme that are not reached with water because of slope.
- The research result revealed that conflict over irrigation water persistently occurs among the irrigators within and between groups. The interviewed households reported that water scarcity, water theft, lack of proper control of water distribution and competition due to increasing number of water users as the responsible factors. The chi-square test also revealed that conflict over irrigation water and farm location from the water source has a significant relationship.
- Maintenance of the canals are undertaking by mass mobilization on average ones in a month. Nevertheless, the irrigation beneficiaries defer major maintenance works that require input of expert skills and industrial product (e.g. cement) to the government agencies to do it for them. In the study area, better operation and maintenance of the irrigation system were observed.
- Although the dam was meant to irrigate hundred hectares of the vast command area along the downstream, it irrigates about 50 hectares on average and that is small as compared to the potential. The study identified that water scarcity, shortage of labor and shortage of oxen were the most important factors responsible for underuse of the potential irrigable land.

Recommendations

To enhance irrigation management practices and to maximize the socioeconomic benefits of Qorir Small Scale Irrigation Scheme, the following recommendations and policy options are proposed.

- The water committee in the irrigation scheme is found to be inefficient in managing water distribution in terms of adequacy, timeliness and equity in the supply of water. Hence, strong institutional setup which can manage the system has to be developed or strength the existing one i.e. the existing water committee has to be transformed to Water Users' Association (WUA) and periodical training and frequent follow up has to be conducted to Water Users' Association.
- The major factors for the underperformance of Qorir Small Scale irrigation scheme is water loss as a form of seepage and water scarcity. Therefore, the sustainability of the scheme should be determined by reducing the seepage water loss rate through expansion of cemented canal in the command area and for the water scarcity, there should be a detailed hydrological study on the water source. In addition, prioritizing crops and vegetables to be grown, which require frequent watering, should be given priority. This can be a solution for water scarcity in the command area.

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