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Challenges and Opportunities of Small-Scale Irrigation Utilization in Rift Valley Basin, Humbo Woreda, Ethiopia

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Abstract
Ethiopia has abundant water resources, but its agricultural system does not yet fully benefit from the technologies of water management and irrigation. This study was conducted with the aim of assessing opportunities and constraints towards utilization of small-scale irrigation by smallholder farmers' and to assess the organizational set-up of water users association in the study area. In this study multi-stage sampling techniques were used to select 150 target respondents in which 90 irrigation users and 60 non-irrigation users. To collect the required data several methods like interview schedule, focus group discussions and key informant interviews were used. From focus group discussions and key informant interviews, different challenges and opportunities were forwarded and underlined by the participants regarding with household's participation decision on small-scale irrigation. The overall opportunities for the development and management of irrigation water are the availability of high surface water potential, good motivation and willingness of irrigation users to attend scientific trainings and high commitment of the Ethiopia government, donors and NGOs to support irrigation management and development activity. While different constraints were also forwarded related with poor technology choice, too small landholdings, conflicts in water use and use rights, lack of market information and access, lack of training on irrigation technologies, lack of irrigation structure maintenance, poor linkage between research and extension services, poor infrastructures such as roads, lack of adequate credit service and extension packages. Regarding to the organizational set-up of water users association, the general assembly is the highest body in water users' association committee which makes the final decisions based on the bylaws. The composition of the general assembly from all irrigation schemes has chairman, secretary, auditors, operation and maintenance committees. An Executive Committee consists of seven members for overall operation and maintenance of irrigation systems. The executive committees were further decentralized in to three branches. These sub-executive committees comprising two members in each were in charge of control water distribution and coordination of maintenance activities and conflict resolutions. Therefore, to alleviate these constraints and utilize the opportunities towards small-scale irrigation, the concerned bodies should attempt to minimize those factors that hinder productivity of irrigation water in the study area.
Keywords: Challenges, Opportunities, Rift Valley Basin, Water users association.

INTRODUCTION

Water is increasingly recognized as a major component in economic development and poverty reduction. For a country like Ethiopia which is grappling with burgeoning population while the subsistence rainfed agriculture is under the mercy of the erratic rainfall, water resource development is believed to have an imperative role in the agricultural, socio-economic and industrial development (Abebaw, 2015). It has become abundantly clear; therefore, that water development and management can no longer be treated as a sectoral issue for it cuts across a vast number of uses. Nowadays, in Ethiopia, irrigation plays the key role in the performance of agriculture, which increases income growth that is essential for national economic growth (Hussain and Biltonen, 2001).

According to the Ethiopian Growth and Transformation Plan (GTP 2010/11-2014/15), the main objectives of the water sector development plan are to develop and utilize water for different social and economic priorities in a sustainable and equitable way to develop irrigation schemes so as to ensure food security, to supply raw materials for agro-industries and to increase foreign currency earnings. In irrigation sub sector, the country is believed to have the potential of 5.1 million hectares of land that can be developed for irrigation through pump, gravity, pressure, underground water, water harvesting and other mechanisms. Thus, irrigation development, particularly small scale irrigation will be accelerated (MoFED, 2010).

Irrigation has the potential to stabilize agricultural production and mitigate the negative impacts of variable or insufficient rainfall in Ethiopia. In some areas of the country including the study area, delayed entrance of rainy seasons, early withdrawal and mal-distribution of rain were challenges from which great lessons have been drawn to seriously look into expansion of small, medium and large scale irrigation in perspective. Especially, in the study area there are many problems towards the development and management of irrigation schemes such as physical factors, technical factors and socio-economic factors (WBoARD, 2014). Therefore, the purposes of this study were to assess opportunities and challenges for the development and management of irrigation schemes and to assess the organizational set-up of water users association in the study area.

RESEARCH METHODOLOGY

Description of the Study Area

The study was conducted in Humbo Woreda, Rift Valley River Basin which is geographically located from $6^0$42'26'' to $6^0$45'36''N of latitudes and $37^0$46'09'' to $37^0$48'48'' E of longitudes in Wolaita Zone, Ethiopia. The sources of water for the schemes are from different Rivers and Lake Abaya. The dominant soil type of the area is mainly clay loamy with clay texture. The total mean annual flow from the Rift Valley River Basins is estimated at about 5.6 billion meter cube (Awulachew *et al*., 2007).

Mixed agriculture is the main economic activities of the area. The major crops grown in the study area are cereals such as teff, maize, sorghum, cotton and root crops like sweet potatoes, ensete, carrot and fruits like mango, avocado and banana (WBoARD, 2014).

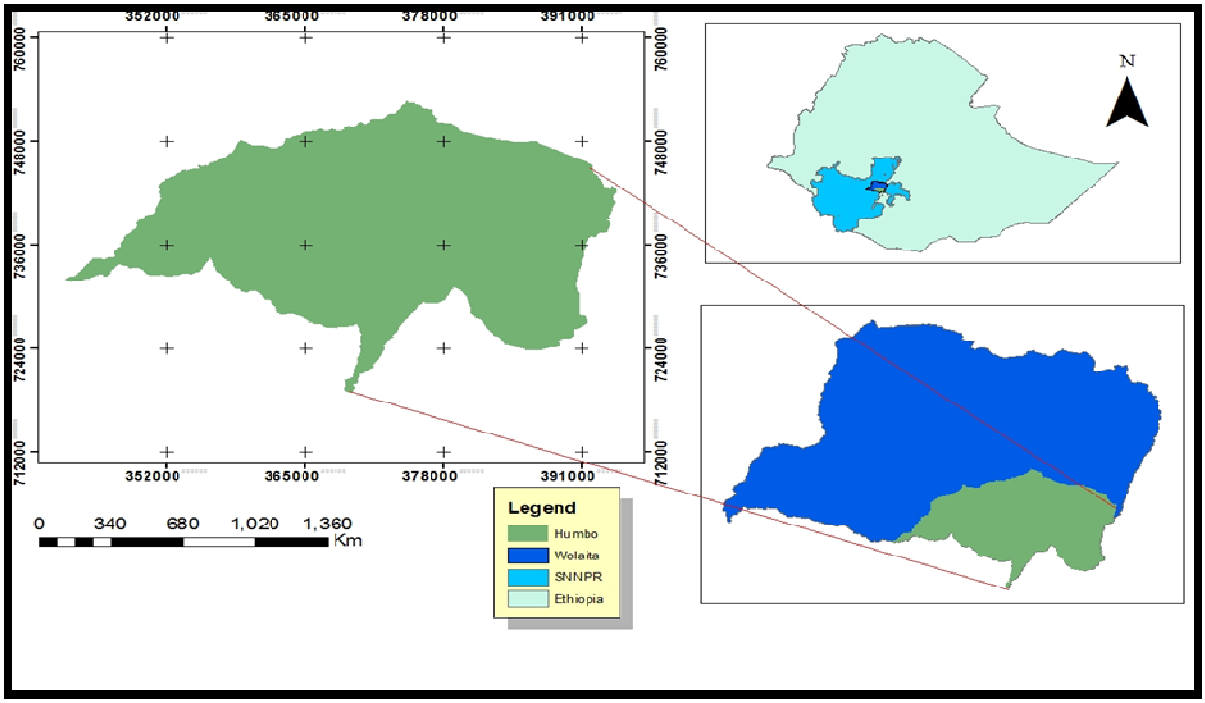

Figure 2: Location of the study area

Sample Size and Sampling Techniques

The research design of the study was cross-sectional survey. In this study, multistage sampling techniques were also used to select the sample respondents. First, out of the potential woredas in Wolaita Zone that has small-scale irrigation schemes, Humbo woreda was purposively selected because the woreda has large number of small-scale irrigation schemes (a total of nine schemes) and the potential of the woreda for irrigation activities. In the second stage, three potential small-scale irrigation schemes were selected purposively due to the potential of the schemes to irrigate the larger command area throughout the production season. In the third stage, the total number of households were listed and stratified into two: Irrigation users and non-irrigation users within the selected irrigation sites based on the household list which was obtained from water users committee at each kebele. Finally, 90 users and 60 non-irrigation user respondents were selected using probability proportional to size. Therefore, a total of 150 respondents were interviewed.

Data and Methods of Data Collection

For this study both qualitative and quantitative data were collected from primary and secondary sources. To collect the required data several methods like interview schedules, focus group discussions and key informant interviews were used. The secondary data were collected from different sources such as relevant books, woreda agriculture and rural development report, internet and journal articles through reviewing the secondary sources.

Methods of Data Analysis

The collected data were compiled by using SPSS Version 20 statistical software. Both descriptive and qualitative techniques were used for data analysis. The data gathered through household survey were analyzed using descriptive statistical methods such as frequency, percentage, mean and standard deviation (SD). Moreover, an independent t-test was used to test mean differences between irrigation users and non-users with respect to continuous variables which affects likelihood of participation in irrigation water utilization. A chi-square test was also used to test the mean differences between irrigation users and non-users with the relevant categorical variables. The qualitative data obtained from focus group discussions and key informant interviews were also organized and reduced into themes; then interpreted, narrated and finally complemented with the descriptive

results.

RESULTS AND DISCUSSION

Results of Descriptive Analysis

Education status of the household head: It was a continuous variable representing different levels of household education status and assumed that it might increase the probability of small-scale irrigation utilization. As it can be seen from the estimated result, there is a positive relationship between household heads education level and small-scale irrigation utilization. That means if farmers are educated, it is easy to search and adopt new technologies and extension services. Education enables farmers to search for new irrigation management practices. Moreover, as the result indicated that majority of irrigation user household heads are educated as compared to non-users. Hence, the t-test result shows that there is a significant mean difference between irrigation users and non-users regarding with the education status of household heads (Table 1). This result is in line with Takele (2008) finding that stated as literacy of a household head has a positive relationship with the use of irrigation water and household income.

Farm size: It was a continuous variable measured in hectares. It refers to the total land holding of the household. It was hypothesized that farmers who have large land holding could more likely involve in irrigation water use. This is mainly because farmers would have ample production opportunities to boost their household income. If small land holding, the only option is intensive production or producing two to three times a year. The t-test result shows that there is a statistically significant mean difference between irrigation users and non-users regarding with farm size (Table 1). Haile *et al*. (2001) also stated that land holding determines the type and amount of production in the context of smallholders.

***Proportion of irrigated land size*:** This is a continuous variable and defined as the ratio of irrigated land holding over the total land holding. Intensive irrigation enables households to diversify their production and practice multiple cropping at different seasons. Large irrigated land would have positive relationship with households' income diversification and poverty reduction (Eshetu *et al.*, 2010). If conditions are favorable availability of large proportion of irrigated land could directly increases households' income (Smith, 2004). The t-test result also showed that there is a significant mean difference between irrigation users and non-users regarding with the proportion of irrigated land size (Table 1). This result is in line with Desta (2004) study that indicated as direct-positive relationship between proportion of irrigated land size and irrigation utilization which has direct impact on households' income.

***Total income*:** The total income in this study refers to all income obtained from farm activities, off-farm and none-farm activities. Those households having better total income have relative better capacity to participate in irrigation activities because it provides a start-up capital. The t-test result also showed that there is statistically significant mean difference at 1% probability level between irrigation users and non-users (Table 1).

Distance of irrigated land from the water source: this shows the distance between irrigation water sources and households' farm plot. In this study, this variable has an implication on costs incurred to get irrigation water. Most of the farmers were using motor pumps to access easily and timely the available irrigation water. In this regards, it was reported that additional costs were incurred in purchasing of long plastic pump as the farm plot is becoming very far from the water sources. Moreover, there was decreased water potential around tail-end and more water was diverted by nearby up-stream motor pump users. This had an adverse impact on participating in irrigation water utilization. Conversely, households who were closer to the irrigation sources do not incur much cost. For instance, upstream users have location advantage to exploit higher volume of irrigation water than the downstream groups (Bahattari *et al*., 2002). Moreover, in this study the t-test result indicated that there is statistically significant mean difference at 5% probability level between irrigation users and non-users (Table 1).

Table 6: The results of continuous independent variables (n=150)

Variables	**Irrigation Utilization**					
	User		**Non-User**			
	Mean	**Std.dev**	**Mean**	**Std.dev**	**t- value**	**P-value**
Age of the household head	38.8	8.26	38.30	6.89	- 0.421 NS	0.689
Education status of household head	5.31	3.31	2.90	2.84	4.587***	0.000
Active labor force	4.65	1.78	4.47	1.62	-0.614NS	0.540
Farm size	0.78	0.36	0.76	0.39	3.591**	0.012
Proportion of irrigated land size	0.56	0.27	0.86	0.49	4.847***	0.000
Total income	17498	8381	10473	4758	5.888***	0.000
Livestock holding	3.76	2	3.36	1.74	-1.248NS	0.214
Farm distance from irrigation water source (Km)	0.71	0.35	0.85	0.39	2.264**	0.025

Source: survey result, 2015; **, *** significant at less than 5% and 10% probability level, respectively; NS = not significant

Sex of household head: It is hypothesized that probability of sex of the farmer would have a positive influence on the use of irrigation water. As indicated from the total result 85 (56.7%) of the respondents were male. The chi-square test result also shows that there is a significant relationship between sex of household head and irrigation utilization (Table 2). Moreover, it was understood during focus group discussion (FGD), female and male households did not participate equally in irrigation farming activities. In line with this, Smith (2004) also detected that there is a positive and significant relationship between sex and irrigation water productivity.

Table 7: Percentage distribution of sample households by Sex

Sex of household head	**Irrigation Utilization**						**χ 2- value**	**P-value**
	User		**Non-User**		**Total**			
	No.	%	No.	%	No.	%		
Female	33	36.7	32	53.3	65	43.3	4.072*	0.064
Male	57	63.3	28	46.7	85	56.7		
Total	90	100	60	100	150	100		

Source: survey result, 2015; * significant at less than 10% probability level

***Financial constraints*:** In addition to its huge labor requirements, irrigation practices require a relatively large amount of money for re-designing of irrigation schemes, irrigation networks and maintenance of the offered irrigation structures. This variable was expected to correlate negatively with irrigation water use decision. The result reveled that majority of the total respondents 130 (86.7%) were reflected that there is financial constraints. Hence, the chi-square test result also showed that there is a significant relationship between financial constraints and small-scale irrigation utilization (Table 3).

Table 8: Relationships between financial constraints and irrigation utilization

Financial Constraints	**Irrigation Utilization**						**χ 2- value**	**P-value**
	User		**Non-User**		**Total**			
	No.	%	No.	%	No.	%		
No	8	8.9	12	20	20	13.3	3.846*	0.084
Yes	82	91.1	48	80	130	86.7		
Total	90	100	60	100	150	100		

Source: survey result, 2015; * significant at less than 10% probability level

***Extension service access and utilization*:** Availability of extension service inevitably plays a crucial role in terms of creating knowledge and skill in using improved agricultural inputs. It also increases awareness among farmers about new farm activities through demonstrations, trials and discussions. Unfortunately, the result from FGDs confirmed that extension agents were reportedly engaged in administrative activities rather than their real profession. This shows weak extension administrative arrangements on the behalf of WBoARD. Moreover, the chi-square test result revealed that there is no significant relationship between extension service access and irrigation utilization in the study area (Table 4).

Table 9: Relationships between extension service access and irrigation utilization

Extension service access and use	**Irrigation Utilization**						**χ 2- value**	**P-value**
	User		**Non-User**		**Total**			
	No.	%	No.	%	No.	%		
No	19	21.1	11	18.3	30	20	0.174NS	0.835
Yes	71	78.9	49	81.7	120	80		
Total	90	100	60	100	150	100		

Source: survey result, 2015; NS= not significant

***Training and Technical Advice*:** Training and technical advice is an important factor to enhance the knowledge and skills of farmers. The more training and technical advice is provided to the farmers, the higher is the probability that farmers adopt the technologies like small scale irrigation to improve their production system. Most rural people lack knowledge about the advantages of new technologies; hence, there is high demand for training and technical advice especially while adopting new technologies. Most of the irrigation users were indentified that they have got training and technical advice. The chi-square test result revealed that there is a significant relationship between training and irrigation utilization (Table 5).

Table 10: Relationship of training and technical advice with irrigation utilization

Training and Technical Advice	**Irrigation Utilization**						**χ 2- value**	**P-value**
	User		**Non-User**		**Total**			
	No.	%	No.	%	No.	%		
No	20	22.2	43	71.7	63	42	36.129***	0.000
Yes	70	77.8	17	28.3	87	58		
Total	90	100	60	100	150	100		

Source: survey result, 2015; *** significant at less than 1% probability level

***Credit service access*:** Input credit was an important institutional service to purchase agricultural inputs and water pumping motors. Omo Microfinance Institution and informal credit institutions like *Equb* provide the credit services as reported. It facilitated the use of new technological innovations like improved seed varieties. In this sense, the findings of Takele (2008) also pointed out a similar result. Irrigation users who accessed credits were maintaining their output if production fails due to risks. The chi-square test result showed that there is statistically significant relationship between credit access and irrigation utilization (Table 6).

Table 11: Relationship between credit service and irrigation utilization

Credit service access and use	**Irrigation Utilization**						**χ 2- value**	**P-value**
	User		**Non-User**		**Total**			
	No.	%	No.	%	No.	%		
No	59	65.6	39	65	98	65.3	4.231*	0.067
Yes	31	34.4	21	35	52	34.7		
Total	90	100	60	100	150	100		

Source: survey result, 2015; * significant at less than 10% probability level

***Access to market information*:** In this study, it was assumed that the respondents who owned radio had better opportunity to access market information on prices of inputs and outputs, and use of radio on current local market information is determinant factor of marketing agricultural products. As a result, owing radio helped some to get information on existing market price. Others reported that owing radio widened their knowledge on new market-oriented production activities. Farmers face low and unpredictable prices for crops because they lack up-to-date information to access high-value markets (Eshetu et al., 2010). Farmers' irrigation use decisions are mostly based on market price information (Abonesh et al., 2006). In line with this, the chi-square test result revealed that there is a significant relationship between access to market information and irrigation utilization (Table 7).

Table 12: Relationship between market information and irrigation utilization

Access to Market Information	**Irrigation Utilization**						**χ 2- value**	**P-value**
	User		**Non-User**		**Total**			
	No.	%	No.	%	No.	%		
No	29	32.2	22	36.7	51	34	4.985**	0.045
Yes	61	67.8	38	63.3	99	66		
Total	90	100	60	100	150	100		

Source: survey result, 2015; ** significant at less than 5% probability level

***Conflict over irrigation water utilization*:** It is a dummy variable in this study representing the quarrel among irrigation users. The quarrel among the members of water users association will reduce the utilization of irrigation water for cultivation purpose. The survey result indicated that majority (78.9%) of irrigation users reported as there is conflict over irrigation water utilization. The chi-square test result also revealed that there is a significant relationship between conflict over irrigation water use and irrigation utilization (Table 8).

Table 13: Conflict over irrigation water utilization among respondents

Conflict over irrigation water utilization	**Irrigation Utilization**						**χ 2- value**	**P-value**
	User		**Non-User**		**Total**			
	No.	%	No.	%	No.	%		
No	19	21.1	56	93.3	75	50	75.111***	0.000
Yes	71	78.9	4	6.7	75	50		
Total	90	100	60	100	150	100		

Source: survey result, 2015; *** significant at less than 1% probability level

Challenges and Opportunities of Small-Scale Irrigation Utilization

Challenges: As per the discussions with woreda irrigation experts, the estimation of small-scale irrigation scheme potential and its productivity in the study area varies from one source to the other, due to different factors such as *technology choice* (i.e. often inappropriate/traditional technology choice, little knowledge on micro-dams, dominated by furrow irrigation and maintenance of infrastructures are difficult to manage by farmers on their own), *poor water management* (i.e. little experience in improving water use efficiency from irrigators), *poor land management* (i.e. knowledge in land management viz erosion, infiltration and poor watershed conservation), too *small land holdings* and continued land fragmentation leads to problems of diversification into high value crops, *conflicts* over irrigation water utilization, poor *marketing access* and linkage, lack of adequate and frequent *training* to handle technologies prior to introduction, *information and database* (i.e. database generation and management about climate data, rainfall, runoff and sedimentation; hydrological data for micro-dams construction are not well identified), *shortage* of improved seed supply, dependency syndrome on government and donors (farmers want construction of diversion and water harvesting technologies from the government and donors rather than introducing such irrigation activities and technologies

using their resources), inefficient utilization of resources such as water and labor, *research* (i.e. lack of research on irrigation water management and poor linkage between research and extension services in irrigation sectors) and inappropriate utilization of inputs are the major challenges in the project area.

During focus group discussions (FGDs) and key informant interviews, respondents were also reported that the governmental water sectors should solve the major small scale irrigation problems identified during the survey include financial constraints especially for the purchase of motor pumps, shortage of agricultural inputs like improved seed and pesticides, design and construction of high cost irrigation structures, supply of spare parts and gabions, technical supports such as maintenance of motor pumps, strengthening value chain, provision of market information and market networks, facilitating infrastructures specially roads and storages and supply of agro-chemicals.

Opportunities: According to the information collected from focus group discussions and key informant interviews, the overall opportunities for the development and management of irrigation water are the availability of high surface water potential and allocated in various kebeles, good motivation and willingness from policy makers for the development of water projects, voluntariness of irrigation users to attend scientific trainings, wide range of technologies are now exists countrywide and can be also adapted to the local situation. These all positive factors and the current natural situations such as climate change (i.e. occurrence of El Nino) and agricultural products market competition are good reasons to utilize the available water resources in the area.

Organizational set-up of water user associations

After the construction of the scheme in all irrigation sites, Water Use Associations (WUAs) were formed and each beneficiary has been member of the WUAs. The WUAs committee is assumed accountable to the general assembly. The main role of organizational structure of the irrigation scheme includes resource mobilization, operations and maintenances, and conflict management as stated in bylaws. The general organizational set-up of WUAs committee was indicated in the following figure. As shown in the figure 2 below, the general assembly was the highest body in WUA committee which makes the final decisions based on the bylaws. The composition of the general assembly from all irrigation scheme sites has chairman, a secretary, auditors, operations and maintenance committees.

An Executive Committee consisting of 7 members responsible for overall operation and maintenance of the irrigation systems. The executive committees were further decentralized in to three branches depending on the layout of the scheme. These sub-executive committees comprising two members in each were in charge of control of water distribution and coordination of maintenance activities and conflict resolutions. As a rule, they were accountable to the executive committee and expected to report to the woreda irrigation and water resource department when regulations in the water distribution bylaws are perhaps violated.

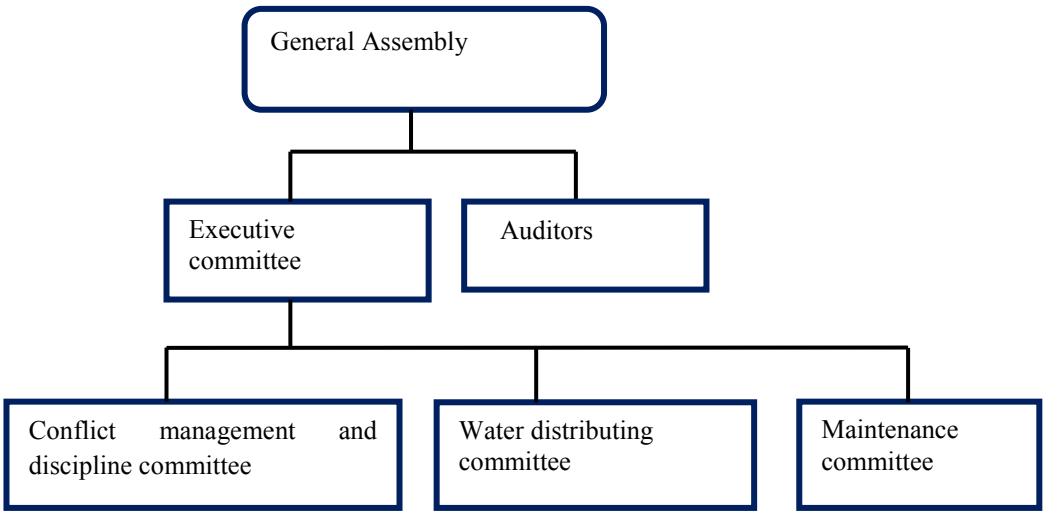

Figure 3: Organizational set-up of Water Users Associations in the study scheme

Operational management and maintenance activities

Irrigation water management activities include three dimensions. These are control- structural activities (design, and post-maintenances of the physical structures), water use activities (allocation and distribution) and organizational activities (communication and conflict management) (Byrnes, 1992).

I. Control Structures Activities

Control structural activities were the design, operations and maintenances of the physical structures of the scheme. In the study area, the communities were involved during planning and implementation of the irrigation scheme. After the construction of the scheme, the WUAs committee was responsible for coordinating the post-maintenance activities. It also expected to regulate the causes of physical structure damages of the scheme in

accordance with the stated bylaws. Farmers undertake canal-cleaning and post-maintenance activities twice a year during dry seasons. In accordance with the bylaws, the first round is expected to undertake at the end of January every year. But, most of the time they conduct canal-cleaning activities at first September, when the rainfall is low. The controlling committee was not properly handling its responsibility and biased by its action due to lack of having independent autonomy. These show that there were weak scheme post-maintenances for simple cleaning of grasses, silts and structural damages.

There was poor resource mobilization in the irrigation scheme. Most of the sampled irrigation beneficiaries responded that they were not willing to contribute financial resources for the scheme management and the farmers do not pay in terms of cash for irrigation access. It was also found that some farmers consider irrigation water as a free good and gift of nature. Canals are not protected against livestock, siltation and sedimentation and are more likely damage the schemes at the lower level when livestock freely graze in the command area.

Table 14: Causes for physical structure damages of the study scheme as perceived by users

No.	Description of the causes	Users	
		No.	%
1	Damage by drinking animals	10	11.11
2	Grasses and silt accumulation	43	47.78
3	Seepage losses due to old age	7	7.78
4	Due to erosion problems	12	13.33
5	Breakage of gates by illegal users	18	20.00
	Total	90	100

Source: Survey result, 2015

The irrigation systems turnouts were far apart and not evenly distributed in some areas. Hence, irrigators breakout the canals and extract water where there is no turnout. These illegal users caused a huge damage on canals and threatened safety and sustainability of distribution and conveyance canals. These offenders have not been held accountable through legal means. These problems remained unresolved since it has been beyond the capacity of the water distribution committee. The discussion also revealed that those irrigation users who had more active family labor in the family steal irrigation water at night, during holidays and market days when the majority of irrigators were off the site.

II. Water Use Activities

There was also limited allocation and distribution of the irrigation water with respect to soil, time and stages of crops. Water was not distributed based on which crop requires what amount at what soil and time. But it was also done through by guess. This was reported due to technical weakness of WUAs executive committees, water distributors and lack of strong assistances from the concerned offices. Rotational irrigation water distribution was practiced. Head-end user takes water at mid day time but tail-ends takes at night time due to evaporation problems. Actually, water distribution shifts were established based on counting dates and complaints rather than right water demands of the cultivated plants. Allocation of water has been formally approved for those who have land rights under the command area.

Table 15: Problems related to water distribution as perceived by the users

No.	Description of the problems	Users	
		No.	%
1	Weakness of water distributor	20	22.22
2	Rent-seeking of the WUAs executive committee	23	25.56
3	Limited technical support by experts	28	31.11
4	Unfair water distribution	9	10.00
5	Turn abuse by illegal users	10	11.11
	Total	90	100

Source: Survey result, 2015

On the other hand, the distribution committee members were sometimes biased in their action due to social relation of power. This was to mean the corrupt behavior of socio-economically powerful users. They deploy their full potential for the access of available irrigation water in unfair rotational basis. These powerful groups also extract and obtain more water by abusing turnouts with creating a severe damage on the scheme and wastage of water available for other users. They release water to the follow tail-end farmers once their fields' have been saturated with water. Nevertheless, they have never been charged through legal process as they resist the committee. This frustrated the water committee members; they become less committed to enforce rules and undertake strict control of water distribution. This problem has also been more serious in the study scheme. Thus, powerless beneficiaries were forced to produce staple crops rather than vegetables which need less amount of water. They were powerless because of lack of access to adequate financial (cash) and human capitals (labour).

There were water distributers in each main outlet who responsible for every day operations of the scheme. But, they were discouraged and became weak in coordinating and fairly distributing the available water to the beneficiaries. This was reported due to lack of incentives to be provided to undertake the regular daily rotational operations. Therefore, they fall under unfair actions and being careless on the actions of socio-economically powerful users.

III. Organizational Activities

In the study area, conflict was the frequent phenomena which demands higher attention. According to discussions that was made with the WUAs committee the types of conflicts in the irrigation scheme include the conflicts among the water users, between legal and illegal users, costs associated with maintenance works (absence of equal labor contributions) and between scheme beneficiaries and non-beneficiaries, who claim drinking water demand for their animals. The conflict management committee was meant to administer the conflict management activities. They have not handled them effectively. The sources for conflict as perceived by beneficiaries were illustrated as follow (Table 11). The discussion also revealed that conflict arising from water allocation and distribution was rampant within groups and between groups. It was also expressed that lack of enforcement of bylaws has been one of the most important source for conflict than mere water scarcity. Illegal abstraction through pumped uptake has also been among the prime factors for water disputes.

Table 16: Sources of the conflict in the study irrigation system

No.	Description of the sources	Users	
		No.	%
1	Water theft (illegal abstraction)	14	15.56
2	Water scarcity due to misuse of water	18	20.00
3	Lack of enforcement of by-laws	41	45.56
4	Non -users animal drink	3	3.32
5	Mere water scarcity from the source	5	5.56
6	Unequal maintenance contribution	9	10.00
	Total	90	100

Source: Survey data, 2015

The management committee was very weak in passing sanctions on illegal users. Thus, rich and powerful farmers frequently violated the rules and resisted both conflict management committees and WUA committees. These rich and powerful farmers who grow vegetables and chat in the upper area of the irrigation systems extract and capture more water by abusing turnouts. They did not respect the rules for rotational distribution and did not release on time to the less powerful users to which they belong and tail-end users. This resulted in misuse (over supply or undersupply) of irrigation water rather than mere scarcity as a cause for the conflict.

Regarding the resolution of the conflicts, the responsible body was conflict management committee under the assistance of government employed irrigation experts and peasant association (*kebele*) court. However, in the study scheme, the water committees were unable to control and penalize illegal water users, and the *kebele* courts was not cooperatively working with the WUAs committee. This was reported due to social inconsistency, that the powerful farmers were able to regulate the actions of WUAs' executive committee and *kebele* court.

CONCLUSION AND RECOMMENDATIONS

From the field observations made during the field work and the results presented and discussed in the earlier sections, the following conclusions are made:

The overall opportunities for the development and management of small-scale irrigation schemes are the availability of high surface water potential, good motivation and willingness from policy makers for the development of water projects, voluntariness of irrigation users to attend scientific training, wide range of technologies are now exists countrywide and can be also adapted to the study area. While different challenges related with poor technology choice, too small land holdings, conflicts in water use and use rights, lack of market access, lack of training on irrigation technologies, lack of irrigation structure maintenance, lack of adequate infrastructures and poor linkage between applied research and extension services in the area of irrigation water management and development were forwarded by the participants. Organizational set-ups are structures or frameworks by which the human behavior guiding principles are expected to flow for the effective and efficient irrigation water management. After the construction of the scheme in all irrigation sites, Water Use Associations (WUAs) were formed and each beneficiary has been member of the WUAs. The main role of organizational structure of the irrigation scheme includes resource mobilization, operations and maintenances, and conflict management as stated in bylaws. The composition of the general assembly from all irrigation scheme sites has chairman, a secretary, auditors, operations and maintenance committees in the study area.

As recommendation these all challenges needs high logistic and continuous applied research activities. Therefore, future work with experimental research and more resource needs to be designed by considering with different irrigation water management and development techniques. In addition, based on the data that obtained

directly from field observation and respondents feedback, farmers are used only surface irrigation system as source of irrigation water and each scheme are not well lined starting from the conveyance structure to the end of field channels. This indicates that more intensive in water losses and less irrigation efficiencies. It is therefore recommended that future work be done using both ground and surface water as source of irrigation water, surveying activities to extend the productivity of command area and production of market oriented irrigation crops.

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