

Assessment of Communal Irrigation Scheme Management System, In the case of Agarfa Woreda, Bale Zone, Oromia Regional State, Ethiopia

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DOI: 10.29322/IJSRP.8.5.2018.p7750

<http://dx.doi.org/10.29322/IJSRP.8.5.2018.p7750>

Abstract- The study was conducted in Agarfa district, Oromia regional state Ethiopia. A total of 120 farmers were selected in the study area. The χ^2 and t-test were used to analyse the independent dummy and continuous variables respectively. Generally, farmers have showed favorable response in participating in the community managed irrigation scheme utilization and management system. Binary logit model was applied to analyse the factors affecting farmers' participation in communal irrigation management system. The findings of this study indicate that any effort in promoting communal irrigation scheme management system should recognize the socio-economic, household, institutional, and others factors for better use of community managed irrigation scheme. Taking the specific characteristics of farmers into account in introducing and promoting community managed irrigation scheme projects may help policy makers to come up with projects that can win the hearts and minds of the farmers.

Index Terms- irrigation, farmers, communal management system

I. INTRODUCTION

To feed itself, Ethiopia now a day depends highly on rain-fed agriculture with limited use of irrigation. High variable and inadequate rainfall, highly frequent floods and droughts, and lack of water harvest technology place Ethiopia at risk of drought and chronic food shortages (Darout, 2004). When agricultural production become decrease because of inadequate and unfair distribution of rain fed, it is necessary to maximize the agricultural production in the next coming decades, effective and efficient irrigation would be needed. The water lost is never available for irrigation in places and during times of water scarcity. Irrigation expansion has slowed down drastically over the past two decades and the worldwide emphasis has been on the rehabilitation and management improvement of existing schemes. The potential for irrigation is high, but its potential for negative impact, if mismanaged, is also apparent. Thus, irrigation expansion is needed with effective and efficient utilization (Plusquellec, 2009).

According to Zeleke (2012), community managed irrigation method and water management system consumes much of energy and times to the rural farmers to generate appropriate income and improve rural livelihoods. In Ethiopia, although irrigation has

been practice for long at different farm levels, there is no efficient and well-managed irrigation water practice (Mihret and Ermias, 2014). However, the loss of excessive water (amount of water for irrigation use), lack of awareness of water users, absences of the trial site in locality for irrigation utilization and lack of new technology utilization are the great constraints which hinder the improvement of rural farmer's households to increase income generation and food security (FAO, 2005).

In order to attain sustainable agricultural production from irrigation, it is important to managed and utilize the resources like land, water and others in good manner. According to Mihret and Ermias (2014) state that lack of Integration among socio-economic, existing local community water management practices, institutional, technical and policy weaknesses the communal irrigation practices become inadequate performances. To manage irrigation in appropriate manner, the water needs to be gauged and properly utilized; According to (Mihret and Ermias, 2014) states that both excessive and inadequate water applications have negative effects. Gauging the water and matching the plant water requirement and the amount of water applied were observed as an inevitable operation in some finger-counted highly performing irrigation schemes in the country (Mihret and Ermias, 2014).

The government has allocated considerable amount of resources for the promotion and construction of communal irrigation scheme structures in the study area. In spite of the investments from the government in community managed irrigation scheme utilization, there is no a decision making factor on the farmers' side. The end users were not involved in verifying and evaluation of the performance of the community managed irrigation scheme utilization as well as to foster awareness and to reduce economical risk and undesirable consequences of wide application of the common pool resources. Here the use of common pool resource has to be operationally explained as the decision to use the resources judiciously and need based (FDRE 2009). That aspect is not studied in detail. Therefore, the overall objective of this study was to assess the communal irrigation management system in the study area. Consequently, the result of this research would be expected to fill a research gap on community managed scheme management system in Bale Zone.

II. METHODOLOGY

2.1. Description of the Study Area

Agarfa district is one of those 18 districts is found in Bale zone of the Oromia National Regional State. The district has 19 kebeles and also known by community managed irrigation activities. The District were exists between Latitude 7017'N and Longitude 39⁰49'E Physically, It was bound by Genale river basin to the South, South East and South West, and Wabe Shabele river basin in North and North West. In addition, there are numerous tributaries of the two river basins. (AWARDO, 2014).

2.2. Study Design

For the successful accomplishment of the study in three Districts, Cross-Sectional Research Design was implemented. Therefore, primary data regarding the communal irrigation scheme management system were collected from the respondents to achieve the study objectives.

2.3. The Sample size and The Sampling Technique

The sampling procedure applied to this study was multi-stage sampling procedure. At the beginning, from the total 18 districts of Bale Zone, Agarfa District was purposively selected because, it is one of the areas that manifested with many problems concerning communal irrigation management system, which impede the progress of addressing rural farmers in the zone. In the first stage, out of 19 rural kebeles and two urban kebeles of Agarfa district, 3 kebeles were selected purposively based on their irrigation potential, large number of community managed irrigation utilization. In the second stage, households from selected kebeles were stratified in to two strata, community managed irrigation users and non users. In the third the households from selected as users again stratified in to two strata, continuously utilizing irrigation system and dropout to use now. In the fourth stage, simple random sampling was used to select the respondents and the key informants were selected from kebeles purposively. Finally, the 118 sample size were determined using the formula given by Yemane (1967) in drawing an adequate sample size from a given population at 95% confidence level, 0.09 degree of variability and 9% level of precision.

$$n = \frac{N}{1+N(e)^2}$$

Where; n = sample size
N = population size (total household size),

e = level of precision

The respondents were selected for each kebele by using proportional methods.

2.4. The Data Sources and the Methods of Data Collection

Both primary and secondary sources of data were used in the process of the study. Primary data was collected from sample respondents through structured interview schedule using face to face interview, which was designed to generate data on social, institutional and economic aspects of the households. In addition, primary qualitative data were collected through focused group discussions from six groups of households from sampled respondents and the twelve key informants' information were selected and discussion were collected through a checklist. To supplement the primary data, personal observation of physical features, and informal discussions with experienced farmers,

kebeles officials, water user association, committee members, Development Agent's and Woreda irrigation sectors bureau were made discussion. Secondary data were collected from published and unpublished documents, Bale Zone and Agarfa district Agricultural and Rural development Bureau, Books, Journals, Government reports and other relevant information sources.

2.5. The Methods of Data Analysis

Descriptive statistics were used to assess the collective management efficiency in communal irrigation managed system. The specific methods of data analysis were involved which included the descriptive statistics such as sample mean, sample standard deviation and percentage were applied to treat the data from the respondents. In addition, the SPSS software was employed in order to analyze the data collected. The collected and analyzed data were presented using tables and graphs. The qualitative data were gathered and analyzed through narrating and documenting. The inferential statistics like chi-squared and t-test were used for dummy and continuous variables respectively. They used to determine the relationship, cause-effect, significant differences between communities managed irrigation users, and dropout to use communal irrigation managed system in the study area.

2.6. Econometric model

Importance of Econometric Analysis at Community Level

To analysis the common property resource management at individual level can be too difficult because, the common properties resource cannot be owned by an individual at household level rather than at community level. In other way the collective of individual may be uses the common properties resources together but, not allowed to use individually. Therefore, the econometric analysis was employed at community level. With regard to these concepts, there are at least two reasons why collecting survey at community level is appropriate a, as compared to individual level. The first reason is that the when small number of social unit was formed; they built capacity to govern the administration and utilization of the common pool resource by themselves-like irrigation water. Secondly, when communal managed irrigation water has the attribute of a common pool resource without inclusion of farmers within the command area it is difficult to manage easily and the resource will become exhausted. Thus, in arranging collective action is important to manage common pool resources like communal irrigation. However, there are two main problems faces in order to manage common pool resources like irrigation water; these are problem of provision and appropriation. A provision problem arises from facilitating in construction and maintenance of its canals and secondly the problem of appropriation may arise from water distribution arrangement. Thus, the adequate structural communal irrigation water management could be the collective practices of farmers in the group rather than any single household irrigated farm.

III. RESULTS AND DISCUSSION

3. 1. Management Systems in Communal Irrigation Schemes

3.1.1. Structural administration of irrigation water

There are a number of factors that organization covers in order to managed Irrigation water such as managerial skill, farmers commitment, institutional structures (regulatory apparatus, conflict resolution mechanisms and profit distribution etc)

3.1.1.1. Organizational Framework

Organizational framework of irrigation water sector in Ethiopia can be briefly described by key actors playing different roles at the national, at regions and at household level.

At national level the government Ethiopia provides strategy with adequate experts to monitor and identify gaps in order to construct communal irrigation water and financial support within identified key areas.

Regional Water Resource Bureau (Oromia) provides oversights of the irrigation sites. It also provides financial support for maintenance at the outlet and system level like canals, with the assistance of the community and other local non government. Similarly, the woreda agricultural office with irrigation and water resource office provider of technical assistance for beneficiary farmers at large.

3.1.2. Collective Action nature irrigation use- as a common pool resource

3.1.2.1. Members Participation

As focused group discussed with the respondents, like in any other common pool resource, collective action arrangement in irrigation water use has two form the first one is about water user association(beneficiaries) and the second one is the water user committee(management class). In communal irrigation management system the water users were participate in the following activities. These are cleaning irrigation canals (the main canal, lateral and sub-lateral canals), decide water distribution program, discussion over contribution (in cash, incentives and labour), when and how irrigation water distribution may takes place in intervals. The role of water user committee is to facilitate each household water distribution program, to submit water user contribution, to manage if conflict happened, to report any activities related to communal irrigation management system to the districts of irrigation and water resource office.

Participation of Members in Meetings- According to focused group discussion with key informants farmers themselves directly solve problems in their group discussion once in the months at farmers level and water user committee at fortnight to discuss over the problem and set solution for identified problems. However in practice it is very difficult case. Only in occasion farmers and water user committee try to discuss over the issues like when they clean canals, when they contribute for water distributors, when negotiation comes for the problems related to communal irrigation and what action needed for identified problems.

All farmers are equally participate in the meeting, specially for problem identification and solution to be taken, the water user committee only facilitate the discussion and decide the final solution. In the most of the time the farmers may represent their family can be allowed for meeting. In addition, all members of water users association (women and men) have equal right to vote and to be elected to serve as an water user committee, as water distributor or as block leader.

3.1.2.2. Water Distribution System

In the selected areas, the irrigation water can be distributed in rotational system. Rotational water distribute means the application of irrigation water for the beneficiaries in a given amount, at the given time and in proper order for all farmers with enough water to irrigate their fields at intervals. The distribution of irrigation water design may vary according to according to the existing system layout and actual topographic conditions. So that rotational irrigation water can be delivered into each block or group accordance with pre- decided programs. Thus why dividing each group of farmers land in to different blocks in communal irrigation site is important to distribute in intervals. But in actual practices the water distribution may handle only based on the number of complaints and counts the programme set but, not on the requirements of the water by the plants. Also the water distribution may varies from season to season, especially during winter the amount of the water become decrease and the amount of water in stored reservoir become limited, therefore the water distribution intervals may become extended from three –seven days. This may damaged their irrigated crops and exposed for extra expenditure. In the selected three kebeles, efficient and effective use of river is an important source of irrigation water namely *weib* and *shaya* rivers. Another problem related to water user in communal irrigation is that they lack water requirements rates for irrigating their plots. Thus as some respondents discussed in the focused group discussion, they believed that more water gets more product but, the application of water did not consider types of crop grown, soil type, stage of crop to be grown etc.

3.2. Indicators of collective Action to Manage the Irrigation Schemes

Table 1, show that indicators of collective action in communal irrigation management system in the selected kebeles helps to identify whether the farmers are communal irrigation users or dropout to use communal irrigation scheme. The average area of irrigated in communal irrigation scheme per households is 2.99 ha/household, this may be due to high population exists in the area, especially potential area for agricultural production like wheat, barley and horticultures. To manage the communal irrigation system and to pay the salary by cash, labour and other kind contribution. In addition all Farmers (water user) must contribute the annual total average value of contribution per household for the resource management that is nearly 150 *Birr*. The most common members' contribution is in the form of cost sharing about 50%, labour contribution about 15%, and 35% others kind, that members clean and maintain canals collectively in a number of times in a year.

As group discussion made with key informants, participating in cleaning, maintenance and minor construction of canals, water gates and spill ways were the obligation of all of the beneficiaries in irrigation user. The most favorable time and months to clean the canals are in September and February. This can be done by classifying the size they clean and maintain by the water user committee. If the group can't agree on time and size they work, then the group will be punished either by cash or labour or in a kind.

In most of the developing country like Ethiopia the government ability to provide cost recovery is the most important

(FDRE 2009). As respondents discussed in focus group discussion the beneficiary charge for canal construction nearly zero charges. However, they only collected money to cover some operations and maintenance costs and payment for guards and water distributor. Water user committee may organize community participation for minor maintenance.

In the district, the interview and discussion with the district experts reveals the contribution of beneficiary in labour for cleaning canals and for mobilizing resources are no more problems with farmers. But the informal discussion with beneficiary may make participation tail-enders which mean more labour contributions on beneficiary than head-enders.

According to focused group discussion made by beneficiaries, Farmers can be clean the canal from two-four times in a year for preparation of the next irrigation season mostly in dry. As respondents revealed that in in the group discussion in most case the cleaning canals start from upper stream and then continue to the lower stream with water user labour contribution. The water user committee facilitate the beneficiary and follow-up the activities.

Table 1: The Indicators for collective action to manage the irrigation schemes

Indicators	Continuously Participate		Dropout		χ^2 value
	YES	NO	YES	NO	
Area of irrigated land per household (ave)	2.66		2.34		0.010**
If there is formal written rule(Yes/No)	71	4	40	3	0.132 ^{NS}
If there is contribution?(Yes/No)	42	1	75	0	113.72**
What kind of contribution? (cash, labour, kind)	2	41	75	0	3.876 ^{NS}
Are you benefiting from CMI? (Yes/No)	0	43	75	0	10.196*
Is there a guard? (Yes/No)	40	3	72	3	93.517**
Got equal distribution of water? (Yes/No)	3	40	72	3	93.517**
Are you contributing to water distributor? (Yes/No)	1	42	75	0	113.72**
Do you believe you get enough water? (Yes/No)	28	15	52	23	0.223 ^{NS}

Source: own survey result, 2017. NS- Not significant, ** and ***- significant at 5% and 1% probability level

3.3. Water use Rights

The importance of water rights are the mechanism to allocate and provide accountability for the user to decrease the conflict among households and resource scarcity among water user communities. However, As key informant discussed in

Ethiopia unfortunately, there is no legal framework for irrigation water use rights. But conventionally the individual who are access to the water may have the rights to use for their irrigation purpose.

3.3.1. Legal framework

Respondents revealed in the focus group discussion, in the study area, for several decades traditional institution have been managed water for irrigation purpose by diversions rivers and user in manual to harvest irrigation water for their crop specially during spring. To manage the irrigation water the institution have it own roles . Especially the institutions are form informal customs and convention in order to share the water their responsibility and benefits among community based irrigation water management. However, as respondents discussed in focused group discussion now a day the government of Ethiopia attempts to give special emphasis by making integration among formal and informal institution arrangement to provide valuable insights for irrigation water management specially designing organizational arrangement to fill the institutional gaps that exists at grassroots' level.

Key informant respondents state that the communal irrigation water utilizes for a long periods of time before modern irrigation comes in to the districts. For likes the rivers *Weib river, Zambaba, Hinzera, Jamjam, Hursa, Wabe*, etc are the rivers that have been used for long period of time with indigenous knowledge and without professionalism on how to utilize effective and efficient . It is a recent phenomenon that farmers in the woreda have begun to cultivate cash crops such as onion, cabbage, tomato, carrots, garlic, ginger etc.

Communal irrigation water management system can be practiced in beneficiary are collectively prepare some agreements and decide to agree on the rules to be set out which makes the water user make arrangements of the water user in their plots. Sometimes the rules may restrict beneficiaries from access to the water use. The rules to be agreed may be executed by the water user committee.

As respondents states that the existence of formal written rules, 94% of the sampled kebeles in the woreda have formal written rules. These rules and regulations uses to operate communal irrigation water management system by the beneficiaries in collaboration with woreda agricultural office and irrigation and water resource sector. But as respondents discussed in focus group discussion revealed that these formal arrangement rules and regulation are only documented at woreda agricultural offices and irrigation and water resource sector.

As Ostrom, (1994) in her research of governing the commons in Kenya, Guatemala, Nepal, Turkey, and Los Angeles stated that there are eight principles helps to managed communal resources such as: define clear group boundaries; match rules governing use of common goods to local needs and conditions; ensure that those affected by the rules can participate in modifying the rules; make sure the rule-making rights of community members are respected by outside authorities; develop a system, carried out by community members, for monitoring members' behavior; use graduated sanctions for rule violators; provide accessible, low-cost means for dispute resolution and build responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system.

However, in the woreda, in all the irrigation schemes the components have the rule and regulation (by the law) they vary from one scheme to another. In general the following are some of the common formulated written by-law constitutes, which have three parts. The first is the obligation of the of the beneficiaries are the following:-the water beneficiaries should abide by the stated rule and regulations; the beneficiaries should use irrigation water for crop cultivation; beneficiaries should leave appropriate borders/ roads to transport fruits and vegetables; acrossing on the farmers land with cattle is strictly forbidden; every farmers should have responsibility to for maintaining and keeps from live stocks; all beneficiaries should pay contribution on time for guard and water distributors.

Secondly, there are a number of rights those beneficiaries' attempts to gain. These are all water user have rights to cultivate any crops based on their preferences; all farmers should sell their products to any markets either local or unions; they also have rights to vote and selected in the committee and finally each beneficiaries may raise any issues related to communal irrigation water and comment on the rule and regulation.

Thirdly, there are a number of penalties that takes places when the beneficiaries are not abiding by the rule and regulations. These are all beneficiaries should take advice before cultivating any types of crops; all beneficiaries should leave border for the road, if not the beneficiary may punish in cash by the water user committee, if it is beyond water user committee, the case shall be posted in to local court; the plants like eucalyptus and cactus trees are not allowed, if it planted the case attempts for penalty; all beneficiaries should participate in canal cleaning and maintenance, if not penalty may raise; all beneficiaries should pay annual payment *150 birr* and contribution for guards and water distributors (in cash, labour or in kinds) on time, if not penalty may arise; if guards are fail to protect the site as well as water distributors did not distribute in fair the penalty should followed etc.

IV. CONCLUSIONS AND RECOMMENDATION

4.1. Conclusions

In spite of being the dominant sector of the Ethiopian economy, agriculture in the country is characterized by low productivity in general and low yield per unit area in particular. Many people attribute the problem to the growth of population-at a rate faster than what the means of sustenance would guarantee-to drought, environmental degradation, poor cultural practices, limited accessibility and the use of improved technology, insufficient infrastructure and ill-thought-out policies. This low performance of the agricultural sector, coupled with rapid population growth, has had an impact on household food insecurity and profound effect on per capita food production. There is, therefore, a desperate need for increasing productivity of Ethiopian agriculture, since its effect is reflected in the overall economy of the country. More recently, Ethiopia is trying to expand small scale irrigation schemes, especial those that can be constructed and managed at community levels. Among the means to accomplish this objective is promoting community managed irrigation practices at community levels. However, there is no study as such which can indicate the status of

promotion and use of community managed irrigation scheme works across potential users.

4.2. Recommendations

Some implications of this study were found to be relevant. The importance of expanding small scale irrigation schemes at community levels for sustained development of the agricultural sector becomes growing especially at the concerned experts and political leaders level. The results of this study have shown that the socio-economic, institutional, and others factors are responsible for the current sub-optimum for farmers participation in community managed irrigation scheme utilization. The following recommendation are forwarded based on the finding of the study

Farmers should participate in community managed irrigation scheme management system such as participating users in training, farmer's field day, field visits, visits to other villages and other community managed irrigation scheme and experiential sharing related issues of community managed irrigation scheme management system are essential element to modify farmers' participation in community managed irrigation scheme managed positively. To accomplish this responsibility, the government has to first equip the pertinent experts who are working specially at kebeles, district and regional levels with the necessary technical knowledge about the uses and means of implementing community managed irrigation scheme management system. Moreover, the individuals, groups as well as policy makers should work towards making the people aware of the uses of water harvesting activities to fight against drought and food shortages.

Community managed irrigation scheme utilization involves the use of different practices which require knowledge and skill of application and management system. Participating in the community managed irrigation scheme utilization, as it increases the probability of behavioral change of individuals and thus enhances ability to acquire and use information required for production and marketing.

Based on the result of the model and different group interview & focus group discussions, the major problem facing communal irrigation scheme users were non functional rule and regulation and conflict resolution methods. Hence the concerned bodies should give emphasis to organize to rule and regulation to sustain community managed irrigation scheme management system.

Lack of irrigation water, as a result of lack of appropriate management & technical problems in relation to the way the head works and channels are constructed was also another problem, hence efforts should be made to find better way to manage the water, so that it will be possible for farmers to use the water uniformly and thus it will be used efficiently. Moreover, farmers must be involved in the design process particularly in decisions about boundaries, the layout of the canals, and the position of outlets and bridges to make the use of the structures sustainable and cost effective, in addition timely maintenance is very crucial. Purposive intervention should be made to increase the participation of farmers, specifically female households in the management issues and other related activities regarding water use. The other major constraints were lack of availability of inputs on time, so that it will give the needed

service in providing inputs on time as well as relevant and timely information.

Finally, it would be necessary to indicate a farmers' participation in community managed irrigation scheme utilization based on the characteristics of a plots. As plots vary in various biophysical factors, the adoption decision of farmers among farmers participation in community managed irrigation scheme utilization groups also vary following the variation in characteristics of plots. Therefore, experts and policy makers should consider developing and community managed irrigation scheme utilization with structured groups focusing on the characteristics of a particular area and locality.

Finally the researchers recommended that further research should be done on examining the extent of farmers participation in communal irrigation management system and the extent to which socio-economics, institutional (such as credit service, land size, extension services, etc), and other factors affect the intensity of farmers' participation in communal irrigation management system decision using time series data.

ACKNOWLEDGMENT

First for all I would like to say my unshared thanks to the Almighty God for providing me the opportunity and smoothening of all aspects regarding my study. Secondly, I would like to thanks my advisor Erick Ndomo Okoyo (PHD) and all my partners for their commitment in doing this research.

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