JIMMA UNIVERSITY

INSTITUTE OF TECHNOLOGY

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

HYDRAULIC ENGINEERING STREAM

ASSESSMENT OF WATER RESOURCE MANAGEMENT PRACTICE FOR SMALL-SCALE IRRIGATION: (CASE STUDY ON GOLINA IRRIGATION PROJECT, AMHARAREGION, ETHIOPIA)

A THESIS SUBMITTED TO THE SCHOOL OF GRAGUATE STUDIES OF JIMMA UNIVERSIY IN PARTIAL FULIFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN HYDRAULIC ENGINEERING

By**:** Yaregal Belete

.

November, 2015

Jimma, Ethiopia

JIMMA UNIVERSITY

JIMMA INSTITUTE OF TECHNOLOGY

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

HYDRAULIC ENGINEERING STREAM

ASSESSMENT OF WATER RESOURCE MANAGEMENT PRACTICE FOR SMALL-SCALE IRRIGATION: (CASE STUDY ON GOLINA IRRIGATION PROJECT, AMHARAREGION, ETHIOPIA)

A THESIS SUBMITTED TO THE SCHOOL OF GRAGUATE STUDIES OF JIMMA UNIVERSIY IN PARTIAL FULIFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN HYDRAULIC ENGINEERING

BY**:** Yaregal Belete

Advisor**:** Dr.-Ing Tamene Adugna (PhD)

Co-Advisor Mr. Shimelis Asefu (Msc)

November, 2015

Jimma, Ethiopia

Declaration

This thesis is my original work and has not been presented for a degree in any other university

…… …… …….. ……..

Candidate Signature Date

This thesis has been submitted for examination with my approval as a university supervisor

……. ……. ……

Advisor Signature Date

…….. ……... ……

Co-Advisor Signature Date

ABSTRACT

Crop production in Ethiopia mainly depend on rain-fed non-the less of countries high impaction potential. Besides of low level of irrigation development different Authors complaining about low level performance of existing irrigation scheme in Ethiopia. Thus thesis report is aimed at to assess the existing management practices of community managed Golina small scale irrigation scheme to identify area of challenges, opportunity and highlight area of intervention in order to improve management practice to sustain the Golina small scale irrigation project (Amhara Region; Ethiopia). Secondary data review, key informative interview, focus group discussion and structured and semi structured questionnaire were used as method of data collection. Both qualitative and quantitative data were collected from selected respondents coded and analyzed using appropriate statistical tool and there results were presented in tables and graphs. The increasing exposure of natural resources to degradation is among the challenges to the sustainability of irrigation scheme. Water resources in the catchment are limited and poorly managed in Kobo woreda agriculture and rural development office. This study attempts to find out existing irrigation management practice problem in Golina small scale irrigation scheme. The major problem with the small scale irrigation is the repeated damage caused by the sediment transport in the diversion weir and irrigation infrastructures by floods. As a result farmers had been engaged in the repeated maintenance of the weir and its infrastructures and the irrigation system will fails to divert the designed amount of water and will be affects by heavy siltation problem. The WUAs should be find way to manage and organize the users to keep the safety of the small scale irrigation scheme. The general held belief that the community involvement during initiation and construction of the small scale irrigation scheme is the most crucial factors in the success of the existing management practice in the study area.

Key words: *assess, existing, Golina, irrigation, management, practice, resource, small scale,*

ACKNOWLEDMENT

First of all, I would like to express my sincere thanks to the Almighty God – the Father and the Son and the Holy Spirit – for his love, benevolence, forgiveness, and generosity and for the pray of Blessed Virgin Mary, Mother of God. Oh my God! You helped me to realize my dream! I do not have words to express my thanks! I honor your name, now and forever! Oh Holy Mary, Mother of God! Like a good mother, you always hear me when I call to you. You hear me now, at this very moment! I ask you for your help now and forever!

Gracious thanks and appreciations are due to my principal academic advisor Dr.-Ing Tamene Adugna, for his encouragement, insights, guidance and valuable comments. Successful accomplishment of this research would have been very difficult without his generous time devotion from the early design of the research proposal to the final write-up of the thesis. My deepest gratitude is also to my Co-academic advisor Mr Shimelis Asefu (Msc) for his valuable comments from which I benefited much.

I lack appropriate words to express my gratitude for their unreserved support without which my success in higher education would have been impossible. Thank you my dad for your help, love, discipline, patience, and strength amidst adversity all showed me a path of fortitude. Thank you my mom for your unique maternal affection! I owe to you! I also thank my sisters, brothers and friends for their sincere love and passion they provide me all the time.

.

TABLE OF CONTENTS **PAGE**

ABSTRACT i

ACKNOWLEDMENT ii

LIST OF FIGURE vii

LIST OF TABLE viii

CHAPTER ONE 1

INTRODUCTION 1

1.1 Back Ground 1

1.2 Statement of Problem 4

1.3 Objective of the Study 5

1.3.1 General Objective of the Study 5

1.3.2 Specific Objective of the Study 5

1.4 Research Questions 5

1.5 Significance of the Study 5

1.6 The Scope and Limitation of the Study 6

CHAPTER TWO 7

LITERATURE REVIEW 7

2.1 Irrigation Development in Ethiopia 7

2.2 National Policy 8

2.3 Irrigation Categories 9

2.4 Current Status of Small Scale Irrigation System 10

2.5 Irrigation Water Management 12

2.6 Management of the Irrigation Scheme 14

2.7 Institutions for Irrigation Management 15

2.8 Modernized Irrigation System 18

2.9 Water Users Association and Collective Action 19
2.10 Factors Affecting Irrigation Development Activities 20
CHAPTER THREE 22
MATERIAL AND METHODS 22
3.1 Description of the Study Area 22
3.2 Data Collection 23
3.3 Study Design 24
3.3.1 Primary Data Collection 24
3.3.1.1 Qualitative Data Assessment 25
3.3.1.2 Focus Group Discussion 25
3.3.1.3 Key Informative Interview 25
3.3.1.4 Questionnaires Pre-Test 25
3.3.2 Secondary Data Collection 26
3.4 Sampling Design 26
3.4.1 Sampling Size Determination 27
3.5 Data Analysis 27
CHAPTER FOUR 28
RESULT AND DISCUSSION 28
4.1 Characteristics of Respondent 28
4.1.1 Gender 28
4.1.2 Age 28
4.1.3 Marital Status 29
4.1.4 Level of Education 29
4.1.5 Family Size 29
4.2 Water Resource Management Practice for Small Scale Irrigation Scheme 30

4.2.1 Water Management 30
4.2.1.1 Water Allocation 30
4.2.1.2 Water Distribution 31
4.2.2 Conflict and Conflict Management 34
4.3 Community Participation 37
4.3.1 Ownership Filling 37
4.3.2.1 Maintenance 38
4.3.2.2 Viability of the Water User Association for Management of Small Scale Irrigation Scheme 38
4.4 The Contribution of the Water Committee in the Irrigation Scheme 38
4.5. Limitations of Users for Community Management of the Irrigation Scheme 39
4.5.1 Rain Fall Shortage 39
4.5.2 Farmers Capacity 40
4.5.3 Disfavoring Market System and Related Constraints 40
4.5.4 Prevailing of dominant figures in the water committee 40
4.5.5 Absence of a Water Users Association (WUA) 40
4.5.6 Provision of fertilizer and improved seeds 41
4.6 Area of Intervention 41
4.6.1 Farmers Intervention on the Small Scale Irrigation Scheme 41
4.7 Agrarian Structures 42
4.8 Construction Quality 43
4.9 Sedimentation Problem 45
4.10 Challenges that Hinder the Sustainability of the Small Scale Irrigation Management 45
4.11 Factors Affecting Sustainablity of the Scheme 46
4.12 Irrigation Management Issues 46

4.13 Constraints in Irrigation Water Management in the Study Area 47
CHAPTER FIVE 49
CONCLUSION AND RECOMMENDATION 49
5.1 Conclusion 49
5.2 Recommendation 53
REFERENCES 56
APPENDICES 61

LIST OF FIGURE

Figure 1: Map showing location of study Area..... 23
Figure 2: Owner ship 37
Figure 3: Improved SSI..... 42
Figure 4: Damaged canals..... 44
Figure 5: Gate of the weir 44
Figure 6: Irrigations users 46

LIST OF TABLE

Table 1: Respondent gender (Source field survey: 2015) 28
Table 2: Age of respondent (Source field survey: 2015) 28
Table 3: Marital status of respondent (source field survey: 2015) 29
Table 4: Level of education 29
Table 5 : Family size of the respondent 29
Table 6: The reasons why respondents do not get enough water **(**Source field survey: 2015**)** 31
Table 7: Farmer's response in major Causes of water scarcity (Source field survey: 2015) 32
Table 8: Water user's opinion about the performance of water committee for water distribution (Source field survey: 2015) 33
Table 9: Irrigation water user's opinion about major management problem related to water distribution (Source field survey: 2015) 33
Table 10: Beneficiaries' farmer response to the presence and causes of conflict over irrigation water (Source field survey: 2015) 35
Table 11: The farmer's opinion about the performance of water committee in resolving conflicts in the irrigation scheme (Source field survey: 2015) 36

ACRONOMY

ADLI	Agricultural Development Led Industrialization
AQUASTAT	FAO'S Global Information System of water and Agriculture
AWRDB	Amhara Water Resource Development Bureau
BOARD	Bureau of Agriculture and Rural Development
CARE	Cooperative for Assistance and Relief Everywhere
CCA	Cultivable Command Area
CO-SAERAR	Commission for Sustainable Agricultural and Environmental Rehabilitation Amhara Region
CRs	Catholic Relief Service
CSA	Central Static Authority
DA	Development Agent
DRWH	Domestic Rain Water Harvesting
EPA	Environmental Protection Authority
EVDSA	Environmental Conservation Studies and Research Desk
FDRE	Federal Democratic Republic of Ethiopia
FDG	Focus Group Discussion
FMIS	Farmer Managed Irrigation System
FSC	Farmers Service Cooperative
FTC	Farmers Training Center
GC	Gorgonian Calendar
GDP	Gross Domestic Product
IDD	Irrigation Development Department
IWUAs	Irrigation Water User Association
LSI `	Large Scale Irrigation
MA	Master of Art
MOA	Minister of Agriculture
MOWE	Minister of Water and Energy
MOWR	Minister of Water Resource
MSI	Medium Scale Irrigation
O&M `	Operation and Maintenance

PA	Peasant Association
RWH	Rain Water Harvesting
SCADA	Supervisory Control and Data Acquisition
SSI	Small Scale Irrigation
USAID	United States Agency International Development
WC	Water Committee
WRM	Water Resource Management
WUA	Water user Association

CHAPTER ONE

INTRODUCTION

1.1 Back Ground

Irrigation is one of the oldest techniques of agricultural production where it was supposed to be developed before 2500 B.C around the Indus River. It has been also under practiced in Ethiopia since long time. But the specific time when and where small scale irrigation started was not yet known: - However large scale irrigation development has been started since 1960s in the central southern parts of the country following the establishment of sugar factories using Awash River for industrial raw materials supply (Desalegn, and Rohmato, 2000).

The agro-industries were established by foreign investors and had the objective of increasing export earnings. During the 1960s, irrigation was seen as part of the modernization of the country's agricultural economy. It was considered as an important investment for improving rural income through increased agricultural production. But, in 1975 the rural land proclamation was introduced in the country. Following the rural land proclamation, the irrigated private farms were nationalized and converted to state farms by the Derg regime.

By early 1985 in Ethiopia, some 7.7 million people were suffering from drought and food shortages. More than 300,000 died in 1984 alone, which is equivalent to two folds of life loss during the drought a decade before. Before the worst was over, 1 million Ethiopians had died from drought and famine in the 1980s (Desalegn, 2000). The recurring cycle of drought produce the need for small-scale-irrigation development expansion to other parts of the country to address drought and food shortages, and the need for more food for the internal market.

The major lesson that emerges from country experiences is that for agricultural growth to occur, a number of factors need to be addressed in the rural sector such as, social services, technology, marketing infrastructure, and seasonal credit availability, along with the building of an appropriate institutional environment (UNDP, 2007).

The Ethiopian government has undertaken various activities to expand irrigation in the country. The country's Agricultural Development Led Industrialization (ADLI) strategy considers irrigation development as a key input for sustainable development. Thus, irrigation development, particularly small-scale irrigation is planned to be accelerated (MoFED, 2010).

Ethiopia is believed to have the potential of 5.3 million hectares of land that can be developed by irrigation through pump, gravity, pressure, underground water, water harvesting and other mechanisms (MoFED, 2010). According to the bureau of Agriculture and rural development (BOARD, 2010), and Awulachew et al the availability of water for irrigation in communities helps boost food production. It increases the potential for producing more food consistently in drought-prone and food-insecure areas (FAO, 2003).

One of the challenges Ethiopia is facing in attaining food security and reducing poverty is high dependence on rain fed agriculture. The country's economy which was highly dependent on agriculture is very much weakened by recurrent droughts. The major problem associated with the rainfall-dependent agriculture in the country is the high degree of variability and unreliability of the rainfall pattern. To overcome the problem, the country needs to utilize all its potential water resources so that it can feed the alarmingly growing population. As a result the Ethiopia government has placed particular emphasis on the development and expansion of irrigated land (Mitiku, et al, 2001).

The Amhara Region is one of the drought prone areas of the country. Up to 85 percent the population of the region lives in rural areas and depends on subsistence agriculture (ARARDB, 2001). Due to the unreliable and erratic nature of rainfall most of the region is food insecure and seriously threatened by droughts. In order to ensure food security, the regional government has repeatedly formulated ambitious goals of water resource development activities. To overcome the shortage of water for agricultural production, the regional government devised strategies to conserve water when it falls abundantly during the short rainy season and then to store it and use it for irrigation in the dry season.

Attentions were given both by government and non-governmental organizations so as to provide and adopt different methods of water harvesting structures on farmer's field. The

recent national focus on water resource development is the continuation of what had been done in the past decades. Since 1991, following the new administrative structure is formed: Small scale irrigation is a unique form of irrigation, predominantly found in arid and semi-arid regions where occasional heavy floods of short duration is diverted in to farm fields using earth, boulders and brushwood (Peter Stern, 1997). In (2005) the total irrigable land in the Amhara region accounts for 347,725 hectares. There are 310 modern small scale irrigation schemes developed in the region. The irrigation schemes developed have covered an irrigated area of 8,469.2 hectares with 17,443 beneficiaries. Out of these total irrigated areas 5,718.68 hectares is from small-scale and 2,750.58 hectares from medium-scale irrigation schemes.

Thus Amhara National Regional State, Commission for Sustainable Agriculture and Environmental Rehabilitation (Co-SAERAR) has been established to study, design and construction of small and medium scale irrigation schemes and micro dams. On the other hand, the management and operation of irrigation schemes is undertaken by Bureau of Agriculture and beneficiary farmers. Small Scale-Irrigation (SSI) is often community-based and traditional methods, covering less than 200 hectares. SSIs include household-based RWH, hand-dug wells, shallow wells, flooding (spate), individual household-based river diversions and other traditional methods; Medium-Scale irrigation (MSI), is community based or publicly sponsored, covering 200 to 3,000 hectares and Large-Scale Irrigation (LSI) is typically commercially or publicly sponsored covering more than 3,000 hectares.

Small scale irrigation project is practiced by self-organized farmers usually on a small scale by constructing diversion structures made of locally available materials. This type of irrigation is playing a significant role in improving agricultural production in the low land areas of the project is modernizing by diverting the flood water that comes from the neighboring highlands. Therefore, harvesting and making use of the seasonal runoff in the low lands through proper planning and designing of appropriate water harvesting technologies is one option of boasting agricultural production and improving of the livelihood of the farmers in the project. The small scale irrigation is used to improve the socio-economic of the irrigation users in the study area.

The study area is (Golina irrigation project) characterized by absence of good irrigation management practice, damaged irrigation structures, less participation of community in irrigation development and operation practice of awareness. Hence this research is proposed to conduct detailed investigation in the above problems and to highlights area of intervention to sustain the irrigation project.

1.2 Statement of Problem

Agricultural production in Ethiopia largely depends on erratic and unreliable rainfall, which threatens crop production and food security ever growing population in the country. Irrigation has the potential to stabilized agricultural production and mitigated the negative impacts of variable or insufficient rain fall. In spite of government attention to develop farmers managed small scale irrigation projects different investigations highlighted on their poor performance in different areas of the country due to different reasons of which irrigation management practice took the lion share. Therefore, this study was aimed to identify the existing farmer's management practice in Golina irrigation project so as to the identify problems and highlights area of intervention which in turn contribute largely to the sustainable development of the project.

The serious problem in the existing irrigation management practice in Golina small scale irrigation scheme is poor organization and structure, because the commitment of community, water user association and institution to manage the scheme in the study area is under expected and also the major problem with the small scale irrigation in the study is the repeated damage caused by the sediment transport in the diversion weir and irrigation infrastructures by floods. As a result farmers have been engaged in the repeated maintenance of the diversion weir and its infrastructures as the irrigation system fails to divert the designed amount of water due to siltation problem.

Up to the best of the researcher studies that were conducted in our country on the issue of irrigation concentrated on its impact on food security. Their study did not show the managerial aspects such as water management, conflict management, operation and maintenance and how the users are organized for community management. This is, therefore, the reason why the researcher becomes motivated to work on irrigation management practices.

1.3 Objective of the Study

1.3.1 General Objective of the Study

To assess existing small scale irrigation management practice of Golina irrigation project in order to identify bottle neck problem and to show area of intervention that are needed for the sustainable development of the project.

1.3.2 Specific Objective of the Study

1 To analyze the management of small scale irrigation scheme such as water management, conflict management and maintenance of the irrigation scheme

2 To identify the major challenges that hinders the sustainability of the irrigation scheme

3 To assess the contribution of Water User's committee in the management of the irrigation scheme

4 To assess how users are organized for community managed irrigation and analyze the constraints they are facing

5 To assess the intervention need for the sustainability of the project

1.4 Research Questions

The specific research questions are:

1 How is the existing management of the irrigation system going on?

2 What are the major challenges that hinder the sustainability of Golina small scale irrigation scheme?

3 What are the functions of Water User' committee in the management of the irrigation scheme?

4 How is water users organized for irrigation management? What are the key constraints?

5 How intervention is needed for the sustainability of the project

1.5 Significance of the Study

The main purpose of the study is to look at how the small scale irrigation is managed at institution and community level in the study area. The results of this study will be used as source of information for policy maker and regional administrative bodies on the level of

the performance of community managed Golina small scale irrigation projects so as to plan intervention areas for further improvement of the scheme.

1.6 The Scope and Limitation of the Study

This study was based on a cross-sectional data for the time period of 2015GC aimed at analyzing irrigation management practices of Golina Small Scale irrigation scheme. It is true that there are different woredas where irrigation is practiced in Amhara region. Had there been abundant resources (including work force, time and finance) for this study, the researcher would have unreserved interest to conduct the study in every woredas. To conduct this study, a census was used and research tools such as household questionnaire as well as interview and focus group discussion were employed. This study was confined only to the managerial aspect of the scheme.

CHAPTER TWO

LITERATURE REVIEW

2.1 Irrigation Development in Ethiopia

It is difficult to know exactly how much irrigated land exists in Ethiopia, however recent estimates put the total area of land at 160 000–198 000 has. This estimate includes traditional, communal, private and public schemes.

Modern irrigation had started at the beginning of the 1960's by private investors and was concentrated in the middle awash valley. Then to expanded the Awash basin and Wabi – Shebelle basin. At the beginning of the 1970s, about 100 thousand ha of land was estimated to be under modern irrigation in Ethiopia, about 50% of which was located in the Awash Basin (Wetterhall, 1972). With the 1975 rural land proclamation, the large irrigated farms were nationalized and placed under the responsibility of the Ministry of State Farms while small scale irrigation schemes were transformed into Producers' Cooperatives. After the major famines of 1984/85, the Ethiopian government began to focus on the potential of small-scale irrigation as food security and started promoting farmer and community-oriented small scale irrigation by providing assistance and support to local communities for rehabilitating and upgrading traditional schemes, (Habtamu G, 1990).

The Irrigation Development Department (IDD) of the Ministry of Agriculture (MoA) was established and is responsible for the development of small-scale irrigation starting from 1985 onwards. SSI development was traditionally seen as infrastructure development, and grouped with rural roads and similar construction teams and largely staffed with engineering oriented personnel. Seventy five percent of the staff of the IDD, as described by Habtamu in 1990, was engineering cadres. The typical Irrigation and Rural Water Supply Team under the IDD was comprised of three brigades: earthen dam construction, diversion weir construction and land development. The department struggled over the years with less than optimal, centralized funding and staffing limitations to meet the challenges and opportunities of SSI development in Ethiopia. With the change in the government in 1994, the IDD was dissolved and replaced by the Regional Commission

for Sustainable Agriculture and Environmental Rehabilitation (CO-SAER) being promoted under the new federalist structure in a number of regions (Gebremedhin B. and D.Peden, 2002). These new organizations have embraced the promotion of small-scale irrigation as their primary mandate and they are channeling millions of Birr each year into such development and construction activities. The focus within these organizations and the overall approach remains engineering oriented encompassing three phases and a changing of institutional players. At the design phase, a combination of regional bodies, the Regional Bureaus for Agriculture, Energy, Water and Mining, and Health, together with the project proponent participate. Once the basic project document is approved, the CO-SAER or the Cooperating Sponsors take charge and work with the community and concerned Woreda Council, in the construction of the basic infrastructure, headwork, dam or weir and primary canals. After these civil works are completed, the scheme is handed over to the communities concerned and the Regional Bureaus (Agriculture, Energy, Water and Mining, and Health) for the implementation of the irrigation system. Then the community is expected to complete the secondary and tertiary canals and begin to use the system, with the advice and assistance of the Development Agents provided by the Regional Bureau of Agriculture through a Water Users Association created among the user community. The other two bureaus of Water, Energy and Mining and Health are expected to ensure that head works are properly maintained and health concerns are addressed, respectively.

2.2 National Policy

The development of the country's irrigation potential is an important part of a major program for the intensification of agriculture launched by the new Federal Government (EPA, 1997).

As part of this effort, Water Resources Management Policy to guide water sector development has now been operational. The stated goal of this policy is:

To enhance and contribute its share in all national efforts towards the attainment of prosperous, healthy and socio-economically developed society with all its human dignity by promoting sustainable management of water resources of the country, without endangering and compromising the capacity of water resources base for regeneration in

the services of future generations (MoWR, 1998).” More specifically, the objectives of the policy underline the need for the development, conservation and enhancement, provision of basic necessities, and the allocation of water.

These objectives are based on comprehensive and integrated plans and principles that incorporate efficiency of use, equity of access and sustainability of the resources. The policy objectives are also expected to ensure that environmental protection measures are taken into account in the course of studies, planning and implementation and operation of water resources and water resources systems (MoWR, 1998)”. The policy has also addressed the issue of basins development by giving due emphasis and showing a direction for its inclusion as an integral part of the overall water resources management. The agricultural sector policy and strategy also give special enfaces regarding water development in the country.

The national science and technology policy does not specifically address water in its policy framework. However, the policy document contains priority sectors and programs, which emphasize the water sector development.

2.3 Irrigation Categories

Irrigation development could be defined as a case of agricultural development in which technology intervenes to provide control for the soil moisture regimes in the crop root zone in order to achieve a high standard of continuous cropping (EVDSA, 1996). Regarding the ways of supplying water, flood irrigation, furrow irrigation, sprinkling or spray irrigation and drip irrigation are identified (Nigussie, 2002). With respect to the area irrigated, scale of operation and type of control or management, irrigation is categorized either as small, medium or large scale (Seid, 2002). Irrigation may also be categorized using other criteria such as ownership, economic objective and modernity.

Although tank irrigation, small dam irrigation and shallow or deep tube well irrigation are generally termed as small-scale irrigation schemes (Smith, 1998), some considerations of the criteria of classifying irrigation in terms of scale may vary from country to country. For example, In India an irrigation scheme of 10,000 hectares is classified as ‘small’ while in Ghana, the largest irrigation scheme is 3000 hectares. However, in most cases,

large-scale schemes are formally planned and typically managed by government departments delegated with necessary authority for fairly comprehensive control while small scale schemes are mostly user managed.

Most authors, however, agree that concepts of local management and simple technology should be combined with size, and the best working definition seems to be that used by the UK Working group on Small Scale Irrigation (SSI): small scale irrigation is 'Irrigation, usually on small plots, in which farmers have the major controlling influence and using a level of technology which the farmers can effectively operate and maintain'. There is also a case for using the term 'farmer managed irrigation systems (FMIS), as used by the International Water Management Institute (IWMI), which removes the confusion with authority managed small-scale irrigation.

Irrigation in Ethiopia is classified in to three classes. They are small, medium and large-scale irrigation schemes. Small-scale irrigation schemes are those which have less than 200 hectares of area. Medium- scale schemes cover an area of 200-3000 hectares while large-scale irrigation schemes involve those with total area of over 3000 hectares (MoWR, 2001b). Dejene and Yilma (2003) confirm the definition that small-scale irrigation is an irrigation project set up on a command area of up to 200 hectares. The development of small scale irrigation schemes for farmers and rural communities to be managed by water user associations, farmer co-operatives or water committees, is the responsibility of the regional water resources bureau and the Ministry of Agriculture and Rural development. Whilst Medium and large scale schemes to be owned and operated by private investors individually or in partnership, companies or public enterprises are the responsibility of the Federal Ministry of water resources.

2.4 Current Status of Small Scale Irrigation System

Irrigation in Ethiopia is classified in to three classes. They are small, medium and large-scale irrigation schemes. Small Scale supplies a total command area of under 200 ha as opposed to medium and large scale, which are 200-3000, and above 3000 ha respectively (MoWR, 2001b). The present most frequently cited estimate of small-scale irrigation estimated area is about 65,000 ha (MoWR, 1998; CSA, 1998; AQUASTAT, 1998; IDD/MoA, 1993 as cited in CRS, (1999).

The present levels of total area estimated to be under SSI is currently less than one percent of the total area currently being farmed. A similar analysis could be carried out on the basis of population and small-scale irrigation users.

Small-scale irrigation systems vary in type based on water source and distribution technology.

These systems are diversion, spate, spring and storage systems and are defined as follows by (CRS, 1999):

- River diversion systems are off-take systems and are the most common form of irrigation system in Ethiopia. Diversion systems utilize natural river flow; however, regulation of river flow via a permanent structure in the riverbed is also a common practice to increase the off-take. Diversion systems abstract water over a sustained period of time and are able to deliver regular irrigation throughout the cropping regime. A key characteristic of diversion systems is the adequacy of water supply during the dry seasons and the ability to irrigate a dry season crop in addition to providing supplemental irrigation during the rainy seasons.
- Spate systems make use of the occasional flood flows of streams and operate during part of the year and there are two types of spate systems. The first referred as a run-off system, divert flood flows originating in high land areas. The second, most common on foothill sites in arid and semi-arid areas, divert flood flows originating in highland areas. Spate systems have proven difficult to rehabilitate due to difficulty of designing weirs to divert flows that change over a short period of time and which also resist structural damage from flood flows.
- Spring systems use small spring flows. Water is often shared with household and livestock users and stored overnight in small reservoirs and emptied daily
- Storage systems are earthen dam that store water for an extended period behind dams.

In Ethiopia, storage systems are a recent introduction and pose technical and production challenges. It is important to consider the catchments flow and amount of sediment in designing storage systems. Cropping must be planned according to the amount of water

stored and available for irrigation. Typically the irrigable area is much larger during the rainy seasons than during the dry season.

- Lift systems is extracting water from rivers, irrigation canals, reservoirs and wells. Lift systems have lower development costs. Manual or motorized pumps are used.

Irrigated agriculture in the form of spate systems capturing the run-off from the Ethiopian highlands along the Red Sea Coast has been a land-use choice in the Horn of Africa for more than a thousand years (USAID, 1996). These early schemes were the precursors to the small scale, traditional irrigation schemes, including spate, diversion and very small storage systems, now widely practiced under local community arrangements throughout the country.

2.5 Irrigation Water Management

Water is a precious natural resource vital for sustaining all life on the earth. Due to its multiple benefits and the problems created by its excesses, shortages and quality deterioration, water as a finite resource requires special attention (Pinderhughes, 2004). WRM is defined as essentially the modification of the hydrological cycle for socio-economic development. It involves not only the beneficial use of water resources, but also the prevention, avoidance or minimization of the effects of water excess (flood) or deficiency (drought) (Olokesusi, 2006). The major areas of concern pertaining to WRM are related to poor watershed management, inadequate water accessibility and quantity, poor water quality and inadequate institutional capacity, and in addition, as with other sectors of Ugandan economy, there are institutional weaknesses and lack of infrastructure to effectively manage water resources (Syngellakis and Arudo, 2006).

Monitoring of the soil moisture status and the crop water needs at different growth stages is not getting sufficient attention. In most cases, farmers are irrigating their fields with prolonged intervals not appropriate for most vegetable crops, since it entails negative consequences on crop yields. As it has been observed from the field, on-farm irrigation water management is generally poor, due to absence of flow measurement structures. Factors such as crop types, soil characteristics, irrigation methods, crop development stages and their specific crop water needs, water availability, and others, which are essential for proper determination of irrigation scheduling, are not considered seriously.

However, these are very crucial factors in determining how much water and when it should be applied to a given crop.

Field observations revealed that irrigated fields are either over or under irrigated. In both cases, negative results are inevitable. When the field is over-irrigated crop roots are not properly functioning and are not able to take up adequate amount of nutrients from the soil. As a result of over-irrigation, soil nutrients, particularly nitrogen will leach down beyond the active rooting depth of plants and thus results in a significant amount of nutrient loss and yield reduction. Over irrigation causes water logging and a significant loss of the available resource which could be used even to irrigate extra field and thus could result in the net increase of the irrigated area.

In areas, where there is adequate irrigation water available, farmers are tending to over-irrigate their fields without clearly understanding the associated risks and damages to the land. As a result of over-irrigation salinity is becoming the potential problem, which deteriorates the land quality and significantly reduces crop yields. Salinity is becoming the potential problem, particularly, in the lowlands where there is shortage of rainfall for maintaining natural leaching.

The most widely used irrigation methods in Ethiopia are grouped under surface irrigation methods such as wild flood, controlled flood furrows and to a limited extent low-cost gravity fed and pressurized irrigation systems. However, the most pressing challenge is the poor water management practice, which is very common in most irrigation schemes, The major causes for such poor practices include: poor land preparation and leveling, improperly designed main and field canals, absence of water level measuring devices, poor maintenance of main and field channels, and limited know-how and inadequate practical skills of farmers on crop water needs, soil types and climatic conditions which are instrumental in choosing the more appropriate irrigation methods.

Farmers are not paying attention to the water losses through seepage, deep percolation and evaporation. Environmental degradation is also crucial, due to water logging and salinity problems resulting from selection of inefficient irrigation methods. Even sometimes, soil erosion is a potential hazard in some irrigated fields, due to poor land leveling and lack of maintenance of furrows strictly across the contour. Cropping rows

and planting methods sometimes affect proper layout of the selected irrigation methods. Farmers are not sometimes maintaining the recommended inter-row spacing and planting methods considering the crop characteristics and the irrigation methods to be used for proper water application.

2.6 Management of the Irrigation Scheme

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 1998.The sustainability of the weir for irrigation scheme is largely depends on the institutional capacity to manage and maintain the projects. This may include the presence of sufficiency skilled human resources, efficient management tools and appropriate policy and legal frame work. But these aspects are not properly implemented in Golina in general and in the study sites in particular.

The study sites do have local and institutional set-up, operational and maintenance policy and legal frame works in that place. But the role of the institutions in the proper management of the irrigation schemes is inadequate. The modernization operational and maintenance rules and regulations are not functioning properly. The management tools in general and the irrigation scheduling in particular are inadequate. The water management committee only distributes the water among the farmers and the individual farmer decides the delivery time. This is two-fold on the one hand, irrigation will be wasted and less area irrigated. On the other it may cause waterlogging and gradual accumulation of salts on the fields. The lack of training of farmers in areas related to water management and crop agronomy may also play a negative role. The absence of regionally implemented institutional set-up and irrigation policy can take as a major factor to poor performances as the scheme level. If the institutional and water management issues continue in the same way, the land and water development efforts of the region can be jeopardized. The immediate formulation and implementation of a compressive and participatory regional irrigation policy will have to be given priority for the assessment of the strengths and weakness of the management of the operational of weir irrigation schemes is very important in this regard.

2.7 Institutions for Irrigation Management

The term institution and organizations are often used interchangeably. However, some writers maintain some difference the two concepts for instance, Synne Movik (1999) citing Upoff (1986), writes, and "An organization comprises structures of actors bound by a common purpose". On the other hand, he defines institutions as complexes of rules, norms and behavior that exist overtime, because they are valued as well as useful.

Hayami and Ruttan (1985) define institutions as the rules of society or organizations that facilitate coordination among people by helping the farm expectations, which each person can reasonably hold in dealing with others. According to Pejovich (1985), institutions are legal, administrative and customary arrangements for repeated human interactions. For Nee, institutions define as web of inter related rules and norms that given social relationships, comprise the formal and informal social constraints that shape the choice set actors (Nee, 1997).

Others provide a broader definition to the term "institutions; and maintain that institutions comprise not only the arrangements. Nabil and Nugent (1989a), for example, say that formal, organizations such as labor unions and employers′ organizations are institutions because they provide sets of rules governing the relationship both among their members and between members and non-members. Clague further maintains that broadly defined, institutions can be organizations or sets of rules with in organizations (Clague, 1997). However, an adhoc group that farms itself to achieve a single short-term objective and then dissolves is not an institution (Merry, 1997).

From the above, it may be observed that an organization is not necessarily an institution, and vice- versa. An organization is taken as an institution when it provides social constraints that shape the choice set of actors in a farm of legal, administrative or customary arrangements that exist over time for they are valued as well as useful. Thus, the term "institution" refers to both such organizations and the sets of rules governing the social relationships.

Strong local levels development organizations compromising governmental organizations and non- governmental organizations, cooperatives, credit and saving groups, community based institutions, and self-help groups are critical generally in local level social

development (Alila, 1998 in Tegegn and Asfaw, 2002). "The role of organizations become even more crucial when government services and market resources are not accessible to all members of the community"(Tegegn and Asfaw, op, cit: 26). In such cases, the community must have its own organizations which are capable of initiating their own projects to replaces or supplement the services delivered by the government and market, and provide the resources and services needed in the community.

There is a growing body of evidence that such organizations are productive. For instance among the different World Bank projects, the success of the Muda irrigation project in Malaysia was attribute to the grass-roots institutional development which carefully and patiently established the water users' organization while the negative rate of return in the Hivini agricultural development in Benin was mainly caused by the disintegration of the network of cooperatives that has been designed as the institutional support promoted activities (Cernea, 1987). The World Bank study of 25 completed agricultural projects reported by the same author found local grass-roots organizations to be a prime factor contributing to the long term sustainability of project benefits, while their absence was identified as an important cause of non- sustainability (Uphoff,1991). Furthermore, Greenhill (1995), in a study of Brazilian coffee, demonstrates that institutions improve efficiency by reducing uncertainty in exchange arrangements. Seid (2002), in his local study for M.A thesis, reports that poor coordination between institutions dealing with irrigation development in three schemes in North Wollo has resulted in management failure.

Irrigation systems are highly inter dependent as the ability of individual farmers to appropriate water is greatly influenced by the behavior of the other farmers in the study area.

Most of the new initiatives for farming WUAs and management strategies do not evolve from the traditional systems. The long run sustainability of those institutions often remains questionable. In general, it seems desirable to use existing local organizations. If existing organizations are insufficient or inadequate for the purposes careful analysis should lead to design of facilitating organizations congruent with local culture (Cernea, 1991).

Institutions for governing irrigation usually have some basic features in common. Mein Zen Dick and Cerneal (1994), state that the common features found in many successful institutions for water management have been those of: role specialization, i.e., the members of the management committee having clear duties and responsibilities that pertain only to their position; accountability the organization is accountable to its members and federations, if there are any. The organization design must provide specific means to fulfill the four functions of any irrigation organization: non routine maintenance, and management of conflicts (Freeman and Lowdermilk, 1991).

The power of any organization lies in the agreement among members that rewards and punishments will be employed in certain ways to get members to do what they would not do if detached from the network. The joint agreements about the use of rewards and punishments in the collective interest are critical for at least two reasons.

1. Such agreements on action constrain brute coercive force
2. They constraints the use of money to its proper share in the market place and prevent it from unjustly distorting the distribution of non-market resources through corruption, connections and political exchange.

As a formal institution, the WUAs will have organizational charter, which be defined and accepted by the users of the irrigation before operations begins. According to Freeman and Lowdermilk (1991), it is always disastrous to proceed with the physical technology to get the water flowing with only vague notions about what joints agreements should be devised for rehabilitation, allocation, maintenance, and conflict resolution. The reasons for this is that when water flows, some farmers are in better initial positions then others to take advantage of the resource. They quickly employ their good fortune to consolidate disproportionate advantages, and then oppose latter attempts to reform the situation usually with success because of their hold on critical resources. The same authors add that the social organization of an irrigation system must provide for a local council or water court capable of adjudicating the interest of members and managers. This judicial council rules in specific cases of conflict and then passes on its interpretations to organizational executives for implementation. Water users associations are usually responsible for matters related with water allocation, water distribution, maintenance,

rehabilitation and conflict management. However these are not the only issues to be managed in irrigation matters like those inputs and outputs marketing conditions are decisive for success. Thus, a further strengthening of water users associations so that they can accomplish the management of such issues or establishment of independent cooperatives is critical.

2.8 Modernized Irrigation System

A modernization of irrigation system is recognized as an essential transformation in the management of irrigation systems contained by agricultural areas. Such transformations may comprise improved structures, physical or institutional or both, rules and water rights; water delivery service; accountability mechanisms and incentives (Molden and Makin 1997).

Burt and Syles (1999) defined irrigation modernization as a process of technical and managerial upgrading (as opposed to mere rehabilitation) of irrigation systems combined with institutional reforms, if required, with the objective to improve resource utilization and water delivery service to farms.

Modernization of irrigation systems virtually always involves modifications of three things (Plusquellec, 2002).

1. Everyone in the systems, from the lowest adopt the concept of providing good service. This requires that they understand the service concept, and truly have a desire to provide as high a level of service to their customers as possible.
2. Hard ware must modify in order to provide better service. The hardware changes are the results of a deliberate analysis of service requirements. Hardware modifications may be as simple as replacing undershot gates (orifice) with manual long crested overshot gates (weir) for water level control, or the proper installation of flow control points. In some cases, it requires more advanced supervisory control and data acquisition (SCADA) systems and automation. The desired level of water delivery service, existing budget and other constraints will define the required hardware, and not vice versa.

3. Operation rules must be changed. The way that water is ordered and delivered, the farm and their buses, and the way various control structures are manipulated on an hourly or daily basis must be changed to match the defined service objectives.

2.9 Water Users Association and Collective Action

A water users' association, or WUA, is a non-government, non-profit organization initiated and managed by a group of farmers and other water users along one or more hydrological subsystems or watercourses. By organizing themselves, water users can exert their financial, material, technical, and human resources needed to manage, operate, and maintain an efficient irrigation and drainage system in their locality (USAID, 2006). According to the report of USAID on water users association in Afghanistan in 2006, the major benefits and functions of having a WUA are as follows:

- Creation and enforcement of a unified set of water use rules within the area it serves;
- A more responsive, better understood, and well-respected water management system for farmers and other water users;
- A more equitable distribution of water among farmers regardless of their location, type and size of farm, and status (whether a WUA member or not);
- A much more reliable water supply for particular crops and other needs;
- More efficient use of water that will minimize waste and prevent erosion, water logging, and over-watering of irrigated lands;
- Prevention of illegal water theft;
- Faster and more efficient resolution of disputes between and among WUA members and non-members over the distribution and use of water, the management of irrigation and drainage infrastructure, and the operation and maintenance of equipment;
- Better maintenance of irrigation canals, drainage and other infrastructure, operating and maintenance equipment, and other properties owned by the WUA;
- Better protection of the environment;

According to Von Benda -Beckmann and Von Bendci-Beckmam, 2000 quoted in B. Van Koppen 2002, irrigation institutions are defined as the collective arrangements at scheme

level for water control and use which include water distribution, construction of infrastructure, maintenance and rehabilitation. Water is derived from streams, dam, river diversion or groundwater, then allocated and distributed.

Identifying factors that create attainable and effective of collective action for the event of irrigation will facilitate to spot where collective action will be established simply and effectively and it is necessary to spot conjointly where efforts are required for the institution and effectiveness of collective action. The thematic analysis areas concerning collective action for irrigation management embody how individuals organize themselves with respect to irrigation water, what consistent policies and different instruments will be utilized to rework stakeholder's manner, and the way common property management be used to facilitate and initiate native organizations for water management. Individuals will learn from the success of traditional irrigation systems, particularly from the institutional, managerial and legal facet of water administration and management. Understanding the evolution, development and functioning of ancient water uses associations ought to provide necessary insights on a way to organize and develop trendy irrigation associations (Gebremedhin et.al, 2003).

International expertise with farmer irrigation management suggests that, for a successful community management of irrigation schemes, the economic and money prices of sustainable self– management should be a little proportion of improved income, the transaction price of the organization should be low, and irrigation should be central to the development of livelihoods for a major range of members. Developing native leadership skills for irrigation management conjointly seems to be a key issue for successful collective irrigation management (ibid, 2003).

2.10 Factors Affecting Irrigation Development Activities

The successes of SSI generally depend on the cooperation of larger range of government institutions and individuals, such as, for instance, the departments of irrigation, extension and rural works, local development agents. Unsurprisingly, development issues are interrelated and water resource developments by nature have interrelation with many factors. Consequently, irrigation developments are also determined by many factors for their success.

As stated by Brown Nooter (1995), the performance of irrigation schemes depends on: cropping pattern, market accessibility, maintenance and spare parts, social and political, and land tenure policies. Some of the major factors that negatively affect irrigation development based on previous empirical studies are:

1. Salinity: in the long term irrigation can increase the salt content of the soil and may cause the land not to be used for cultivation any more

2. Siltation, which is the process of filling canals and reservoirs with soil and sands leached from their respective up streams mostly due to poor catchments management (FAO, 1997).

3. Depletion of water resource and dependent life systems (i.e., ecological problem of surface and ground water development for marginal water quality areas).

4. Conflicts (e.g., trans-boundary, between upper and downstream users, between management and users, implementers and donors etc) (Desalegn, 1999).

5. Flood and erosion: appropriate surface drainages and effective operation are, therefore, critical for productive and sustainable irrigation in particular since canals are long, and it is difficult to adjust head diversions. Since some are vulnerable to excess water, irrigation system must be responsive not only to the problems of little rainfall but also to problems of too much rain

6. Drainage challenges, renewability issues, seepages, canal lining, theft and vandalism of control structures (Donald Campbell, 1995).

7. Market prices for crops: irrigation projects may exhibit negative net present value (NPV) upon implementation due to change in market prices of goods from what is expected during the time of feasibility studies.

9. Change in interest rate: such huge investments are sensitive to cost of capital fluctuations.

10. Maintenance challenges and quality of design: the quality of design and maintenance system can also determine their sustainability.

11. Water borne diseases: resulting from an irrigation projects are examples of diseconomies/ external costs imposed by the project to the society. In support of this, FAO (1986) indicates that water related diseases and threats to flood plain ecosystem are other high environmental costs.

CHAPTER THREE

MATERIAL AND METHODS

3.1 Description of the Study Area

Golina irrigation project is located in North Wollo administrative zone, Kobo woreda in Abuarie Kebele, at 13km south east of Kobo town along the gravel road crossing the command area. It is located at about 50 km from Woldia Town, 170km from Dessie Town and 570km North of Addis. It's geographically location at $12^{o}04'81''$North, $39^{o}37'65''$East with mean elevation of 1486m.a.s.l. at the irrigation scheme's weir site.

Golina catchment is one of the sub basins of Danakil basin in North part of Eastern Amhara. The command area is bounded by Hormat River (seasonal) in the North and North East Zobel mountain ridges in the East. Golina River in the south and in the west part of the gravel road from Kobo town and Golina water shed that lies in both Kobo and Gidan woreda. Golina small scale irrigation project is a river diversion irrigation project studied and designed by Kobo-Alamata Agricultural and rural development project and funded by Ethiopian government, Italian governments and United Nations Development program (UNDP) in 1985. In 1986, the head work, Weir and delivery canal construction was started by Ethiopian Water Works Construction Enterprise; however, it was suspended for some years due to security problems and finally completed in 1998.

Design of the infrastructure was carried out by the Ministry of Water Resource Development, and in 1998 the construction was started by Chinese Construction Company and completed in the year 2000. The development of irrigation scheme began in the dry season of 2001. The scheme has command area of 350 ha which of currently only 200ha of land were under irrigation. Due to the failures of designed. The diversion weir is located upstream of Golina bridge (bridge constructed on the Addis Ababa to Mekelle road). The total length of the delivery canal is 1.3 km; of which 0.6km lined and 0.7km unlined or earthen. The delivery canal operates continuously for 24 hours, providing water during all the day to the 1.4km main canal #1 and during the night to the night storage reservoir, which flows to the 2km main canal #2, each irrigating 66.66 ha.

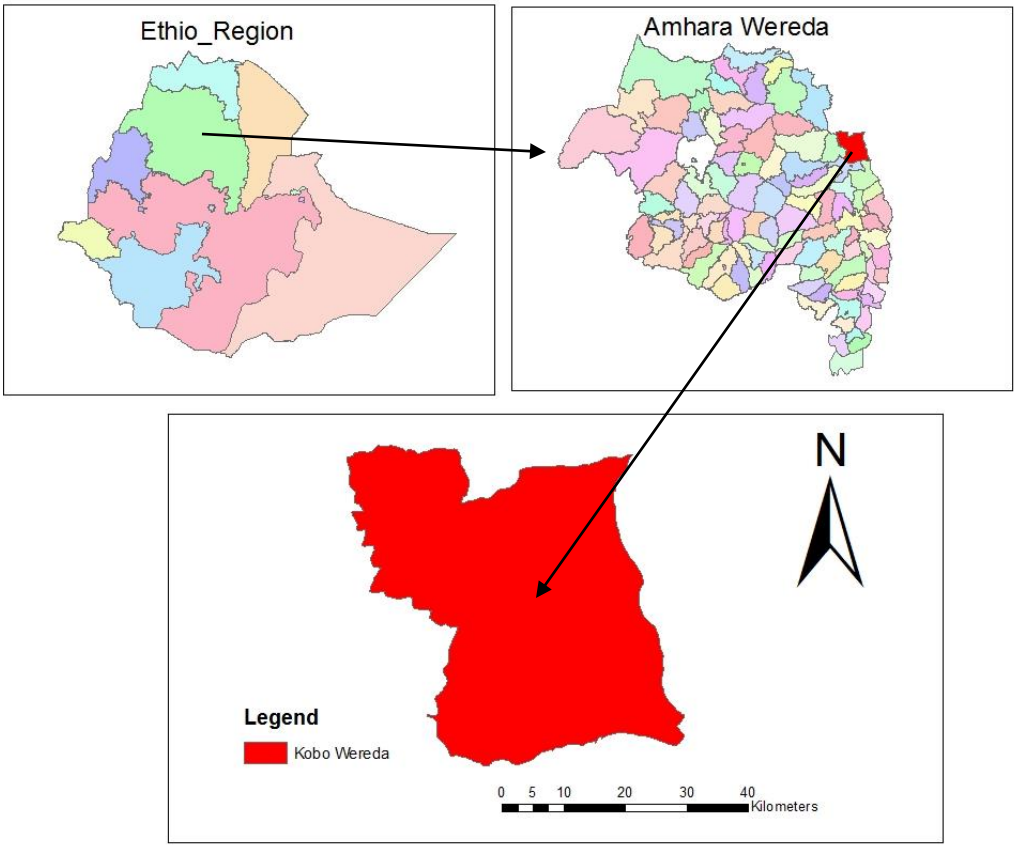

Figure 1: Map showing location of study Area

3.2 Data Collection

This study used a combination of both qualitative and quantitative research method. A descriptive community- based cross-sectional study design complemented by focused group discussion and field observation in the study area was conducted. Structured questionnaire was used as data collection tool, after it had been translated in to the local language (Amharic). Using questionnaire information on the socio-economic characteristics of the respondent, demand responsiveness and sustainability factors of the service, type of participation of the beneficiaries and women and issues of cost sharing and recovery, community training and awareness creation, level of consumer satisfaction for the service provided, physical condition of the small scale irrigation scheme under the study willingness of the beneficiaries to sustain the scheme maintenance and rehabilitation issues were collected. A field observation using a structured checklist was

also held in order to get information related to physical condition of the scheme, level of protection, construction quality and protection mechanisms. A focus group discussion was conducted with water user association members, woreda irrigation expert staff, community leaders and cultural association leaders to collect qualitative data using a semi- structured questionnaire guide and note taking. The study design, sampling procedures, and their source are discussed below.

3.3 Study Design

This study was done by collecting data from representative samples as conducting the study for all population is indispensable. Representative sample selection was made by stratified sampling techniques to select representative sample from top, bottom and mid irrigation scheme. However, random sampling was employed to select representative sample with in top, bottom and mid of the scheme. Moreover, purposive selection technique was employed in order to collect data from irrigation professionals DAs and elder residence. Hence both qualitative and quantitative data's were gathered through structured and semi structured questionnaire and analyzed using appropriate statistical tool of which its result finally presented by using table and graph.

3.3.1 Primary Data Collection

During primary data collection informal survey to the study area were held to overview the status of the existing management practice of the scheme, and practices related to the water distributions techniques. Accordingly designed questionnaires consisting of interrelated questions was employed and administered by semi-trained enumerators. Sample households head were the units from whom quantitative information was collected.

The enumerators were employed to conduct the survey under the close supervision of the researcher. The enumerators were development agents in the irrigation scheme and kebele. Prior to the launching of the survey, enumerators were briefed about the survey and familiarized with the questionnaire. Development agents were chosen as enumerators due to their knowledge and acceptance among the community that help the researcher get reliable data.

3.3.1.1 Qualitative Data Assessment

The qualitative assessment added useful information in depth and perspectives in understanding issues that could not be obtained from quantitative survey method. Qualitative data collection methods are used to obtain insights, thoughts and attitudes of peasants concerning the small scale irrigation management in the study area. In a more practical sense, information gathered using these methods include management and operation processes of the scheme, past experiences and role of the community in the small scale irrigation management practice, the role of irrigation in preventing the adverse effect of drought in the past decades, problems and constraints of irrigation management practice, etc.

3.3.1.2 Focus Group Discussion

Focus group discussion with peasants was one of qualitative data collection methods in this study. Each group comprised 8 individual who are live in the village in the study area.

3.3.1.3 Key Informative Interview

Individuals who were considered knowledgeable and rich in experiences about irrigation activities and irrigation management condition of the community in the study area were identified and interviewed individually. The informants interviewed include elder people, local religions leaders, water committee members, kebele officials, development agents, woreda, and zonal experts. Moreover, my personal observation of the site helped me to understand the overall process of the existing management practice of small scale irrigation and crosscheck data gathered through household survey and key informant interview in the study area.

3.3.1.4 Questionnaires Pre-Test

The prepared questionnaires were pre-tested on 2% samples in order to check clarity of language, acceptability of questions, accuracy of translation, and time needed to answer the question needed to pre-categorize some answers need for additional instructions.

3.3.2 Secondary Data Collection

In addition to primary data, secondary data were also used in this study. Secondary data from unpublished records and reports were obtained mainly from the following institutions. North Wollo Department of Water Resource, Energy and Mining,North Wollo Department of Agriculture and rural development, Kobo Woreda Agriculture and rural development Office, Kobo-Girana Valley Development Program Office and NGOs working in the Woreda. Literatures related to irrigation development and food security issues from libraries and other institutions had also been reviewed.

Secondary sources like Sirika Research Center, Amhara irrigation development bureau, Ministry of water resources and the design document of the irrigation project was also used as a source of information on the investment costs of the irrigation projects.

3.4 Sampling Design

The technique of selecting a sample is of fundamental importance in sampling theory and it depends up on the nature of investigation. Purposive sampling and two-stage stratified sampling techniques have been employed as the major methods of sampling. In addition, random sampling methods have been used to draw sample households for interview survey from the two-stage stratified sampling frame.

The purposive sampling techniques had been used for the selection of scheme, key informants and focus group discussion members. The selection of the scheme depended on the data from reconnaissance results. During his reconnaissance visit, the researcher had discussions with Agricultural Experts, Development Agents and irrigation users with reference to the scheme visited. The scheme visited is spatially distributed along the region. The scheme selected for the study is Golina.

For the key informant interview, the agronomist or irrigation expert from the Woreda Agricultural Office, the PA chairperson, and the head of water committee, irrigation users initially affected because of weir construction and a development agent working on irrigation development at the ‘Golina’ had been met.

.

3.4.1 Sampling Size Determination

The sample size, which can statistically represent the selected population of was used. Where *Nr* = required sample size, *p* = proportion of the population having the characteristic, *q* = 1-*p* and *d* = the degree of precision

By using national statistical service calculator

Confidence level =95%	upper limit = 0.064000
Population size = 816	lower limit = 0.36000
Proportion =0.5	standard error = 0.07143
Confidence interval =0.14	relative standard error = 14.29

Then got the sample size 47 to take the sample size 50 is possible

Now that the households have been stratified down to the desired two stages (in terms of sex of household head, and socio-economic), a total of 50 irrigation user household heads (15 female and 35 male) were selected from the scheme through random sampling (the lottery) method.

3.5 Data Analysis

Qualitative and quantitative data were analyzed through systematically organizing the information and give attention to local situations, options, and preferences of households at the study area. Qualitative data analyses were carried out using the computer Software known as Statistical Package for Social Science (SPSS) and simple and relevant descriptive statistical methods such as average, percentage and frequency. In order to see the existing water resource management practice of the irrigation scheme, comparative analyses were made between irrigators and non-irrigators.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Characteristics of Respondent

During the data collection process, the majority of respondents were member of water user associations (WUAs) in the community. The respondent were categorized according to their age, marital status, household/ family size, education status.

4.1.1 Gender

Higher portion of males (70%) than females (30%) were interview (table1) this is attributed due to the fact that water resource management activity need participation of both male and female. However, the higher percentage of males than females is an indication that men are more involved in household activities than women.

Table 1: Respondent gender (Source field survey: 2015)

Gender	Frequency (n= 50)	Percent
Male	35	70
Female	15	30
Total	50	100

4.1.2 Age

The majority of the respondents (32%) were in the age range of 25-35 followed closely by 36-45 age range which amounts for about 30% of the respondents. Detailed age compositions of the respondents are presented in table 2 below.

Table 2: Age of respondent (Source field survey: 2015)

Age	Frequency (n= 50)	Percent
25-35	16	32
36-45	15	30
46-55	10	20
56-65	6	12
66-70	3	6

Total	50	100

4.1.3 Marital Status

Majority the respondents (66%) were married and about (34%) widowed

Table 3: Marital status of respondent (source field survey: 2015)

Marital status	**Frequency (n= 50)**	**Percent**
Married	33	66
Widowed	17	34
Total	50	100

4.1.4 Level of Education

Majority of the respondent 62% attained primary education, and only 38% of the respondent are illiterate, unable to read and write.

Table 4: Level of education

Level of education	**Frequency (n= 50)**	**Percent**
Attained primary education	31	62
Illiterate	19	38
Total	100	100

4.1.5 Family Size

Family size is useful for formulating various development plans as the family member can be considered as source of labor. Average family size at the national level in Ethiopia was 4.7 (CSA 2007). In the study area the average family size was 4.5 with a minimum 2 and maximum of 8 family members in the household. Details of the respondent family size in the study area are given in shown table 5 below:

Table 5 : Family size of the respondent

Family size of respondent	**Frequency (n= 50)**	**Percent**

3-4	20	40
5-6	23	46
7-8	7	14
Total	50	100

4.2 Water Resource Management Practice for Small Scale Irrigation Scheme

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

4.2.1 Water Management

4.2.1.1 Water Allocation

Water may be supplied on a continuous or rotational basis in which the flow rate and duration may be relatively fixed. In those cases flexibility in irrigation scheduling is limited to what each farmer or group of farmers can mutually agree up on with in their command area. With this regards Golina small scale irrigation is adopting rotational system and secondary canals receive water by turns and the individual farmers sharing the same secondary canal receive the water as presented.

Based on the amount of water stored in the reservoir each year after the rainy season, the size of irrigation area is determined by the local beneficiaries with the close assistance of woreda agricultural experts. Then after those farmers whose farm land included in the delineated area will group in to several groups and elect group leaders. The beneficiaries discussed with woreda agricultural experts and development agents and develop the rotational system by setting sequential irrigation turns of each group starting from the head end of water source.

In the study area, the water committee was in charge of water allocation and coordination of rotational water distribution. Irrigation agronomist 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 requirement of different crops and irrigable plot area

and measurement of the yearly water supply, the water committee calls a meeting monthly and coordinates maintenance and canal cleaning activities.

Water allocation and rotational schedule, which was prepared and implemented by the water committee, had got limitations in terms of its implementation.

4.2.1.2 Water Distribution

The respondents were asked about the distribution system whether they receiving enough irrigation water or not and the reasons for not getting enough irrigation water. About 60.5% of the respondents didn′t receive enough amount of water for their crop and only 39.5% of the respondents are satisfied with the delivered water.

Table 6: The reasons why respondents do not get enough water **(**Source field survey: 2015**)**

Do you have enough irrigation water?		**Frequency n= 50**	**Percent**
Response	Yes	20	39.5
	No	30	60.5
	Total	50	100
What are the major reasons for not getting enough water		Frequency = 30	Percent
Response	Water scarcity	20	40
	Poor coordination of water distribution	5	11
	Water theft	3	5
	Water does not reach to the tail-end irrigators	2	4.5
	Total	30	60.5

Moreover, about 40% of the respondent believed the existence of water scarcity, whereas the rest 20.5% believe the shortage is due to poor coordination and management which resulted in loss like tail water loss and water theft.

The study result identified that the scheme has water committee. The water committee is responsible for coordinating the water distribution. The water committee nominates the individual who are responsible to open the water gates as per the irrigation of each groups (formed based on their farm location). The monthly salary of the gate keeper is 100 birr and this responsibility is in addition to open and closing of the gate, he is responsible for keeping turn and protecting water theft. Each group gets water based on time limit (scheduling).

As shown in Table 6 39.5% of the respondents said that they get enough water when needed for their agricultural activities. However significant number of respondents 60.5% said 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. Of the 60.5% of the irrigation water users who complained not get enough water, 40% said the shortage is due to water scarcity. This problem may be created due to the erratic nature of annual rainfall, evaporation, and presence of plants around the masonry canals, the weakness of the gate keeper to keep the farmers, turn for; water, 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 rats in the command area and there are under age children assigned to irrigated the farm in the study area and they could not manage water use properly and water is lost. These in turn results in water scarcity in the command area. Moreover, water scarcities, poor coordination of water distribution by water committee and water theft were most important problems that constrained the supply of adequate water in the command area of the irrigation scheme.

Table 7: Farmer's response in major Causes of water scarcity (Source field survey: 2015)

If there is water scarcity what are the most important causes for you	**Frequency n= 20**	**percent**

Causes	Seepage	8	16
	Increasing number of irrigation user	2	4
	Declining level of water from reservoir	6	12
	Poor scheduling of distribution	4	8
	Total	20	40

According to table above 12% of the respondent 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 a shortage of rainfall and high evaporation in the study area. The other cause of water scarcity in the command area is seepage loss 8%.

Table 8: Water user's opinion about the performance of water committee for water distribution (Source field survey: 2015)

What do you feel about the performance of the water committee in the management of water distribution	**Frequency n=50**	**percent**
Enough water is not received due to miss utilization of water (adequacy)	26	52.5
Water is not received when needed (time lines)	18	35
Water distribution is unfair (equity)	6	12.5
Total	50	100

More than half of the water users 52.5% witnessed that they could not obtain enough water due to inefficient utilization 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 detail water distribution conditions are shown in table 8 of above.

Table 9: Irrigation water user's opinion about major management problem related to water distribution (Source field survey: 2015)

What are the major problems related to water distribution		Frequency n= 50	percent
Opinions	Sanctions not imposed against water users	22	43.4
	Rotation does not accomplished equity	9	17.5
	Rotation is not strictly implemented	8	15.8
	Poor coordination of water distribution by water committee	11	23.3
	Total	50	100

User's perception about the major weakness of the water committee on water management, of the total respondents 43.4% reported that sanctions are not imposed against illegal water user's i.e. irrigators that extracted and use more water by abusing turns. Some of illegal water users may be intimate friends or relatives of water committee members. Hence sanctions may not be imposed on them. 23.3% of the respondent 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 results also show that 17.5% and 15.8% of irrigation users did not obtain the quantity of water that they need because, among others, rotation does not accomplish equality. This may be due to the fact that rotations based on the types of crops and vegetables planted and the size of the farm land in the command area as a result of this rotation were not strictly implemented. Moreover, the study shows that the general performance of the water users committee in terms of managing the scheme was triply poor.

4.2.2 Conflict and Conflict Management

With regarding Golina small scale irrigation, Water users, water committee members and key informants explained that conflict a rising from water allocation and distribution are a common phenomenon among irrigation users within and between groups. Hence, according to Gashaye (2007) institutional arrangement on irrigation is required to

overcome problem related to irrigation water as a common property resource, for example, to provide incentives to disciplined members.

Table 10: Beneficiaries' farmer response to the presence and causes of conflict over irrigation water (Source field survey: 2015)

Have you ever faced any conflict over irrigation water		**Frequency n= 50**	**percent**
Response	Yes	30	60
	No	20	40
	Total	50	100
What are the causes of water conflict?		Frequency n= 30	percent
Causes	Water theft	7	14.2
	Water scarcity	13	25.8
	Competition due to increasing number of irrigation water users	3	5.8
	Lack of proper control of water distribution	7	14.2
	Total	30	60

Table 10 above show 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, and lack of proper control of water distribution 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 volume of water conveyed in 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 the lack of enforcement by laws for water allocation has also been one of the most important

constraints that led to un necessary water disputes they also expressed that the stated by laws are good in written from but when we see them I practice, they are not 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 conflicts a rises due to lack of proper control of water distribution (increasing numbers of water users) respectively.

Table 11: The farmer's opinion about the performance of water committee in resolving conflicts in the irrigation scheme (Source field survey: 2015)

How do you evaluate the performance of the water committee in resolving conflict?		**Frequency n= 50**	**percent**
Opinions	They take immediate actions incases	30	60
	Conflict management has improved	2	3.3
	They suspended cases	18	36.7
	Total	50	100

Table11 above presents that a significant number of beneficiary farmers 60% respond that the water committee takes immediate actions, on cases to resolve conflicts when it arises. The rest 36.7% said that water committee suspended cases. This may be due to the fact that whenever there are violators; the water committee takes such perpetrators to kebele social court. Nevertheless, the court always demands witnesses for the offences done, because of the procedural problems, cases may be suspended. Informants also indicated that when follow farmers who had witnessed the wrong doing (the wrongdoer in action) are asked to stand as witness; they refuse from cooperating; in case the perpetrator might resent against them. Most of the beneficiaries of the scheme do not want to risk consequences from such feeling of resentment from only one endured legal

action for being found guilty, so the committee often finds itself powerless to ensure observance of the regulation 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 chair person 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 kebele social court.

4.3 Community Participation

4.3.1 Ownership Filling

The respondent farmers were asked about the owner of the irrigation infrastructure. Out of the respondents 45% believed irrigation project is their own property, whereas 39% believe the irrigation scheme as property of the government and the rest16% have no idea, about ownership of the scheme.

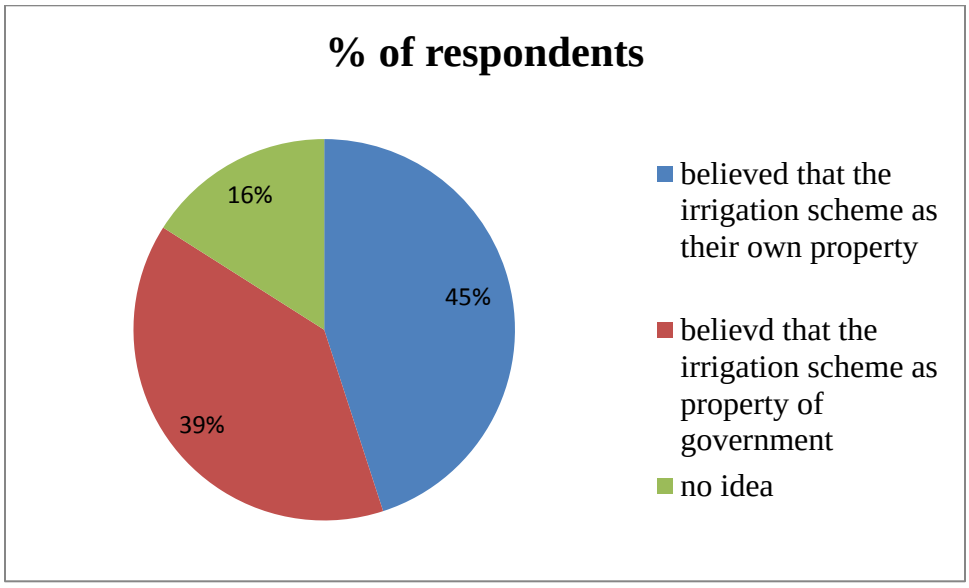

Figure 2: Owner ship

4.3.2.1 Maintenance

The respondents were asked about their participation on maintenance and their perception on the existing management system. Half of the respondents perceive the existing maintenance as poor 30% of the respondent said average, whereas 10% of the respondent said well, and the rest 10% of the respondent said very well. Moreover the respondents were asked about the frequency of scheme maintenances including offseason time and about 36% of the respondent said 1-3 times, whereas 30% the respondent said 4-6 times and the rest 24% respondent said more than 7 times.

4.3.2.2 Viability of the Water User Association for Management of Small Scale Irrigation Scheme

The responsibility of running management of the irrigation system was delegated to Golina in the hope of enhancing effectiveness, equity and responsiveness in irrigation management and to ensure sustainability. Nevertheless, they were not organized in such a way that they can ensure these objectives of decentralized management though good organization is one of the social requirements for good irrigation governance. They have efficiencies in their management structures. They have also recognized legal power and the roles, responsibilities and authorities of the different positions along the management structure were not clearly defined and even it was totally missing from bylaws. The committee lacks transparency, accountability to users which is on the implication of poor scheme management. Constituencies (water user) accuse committee members of for power abuse, selfishness, and lack of commitment and for not observing the internal by laws. Nevertheless, the respondents reported that they were not held accountable through legal process.

4.4 The Contribution of the Water Committee in the Irrigation Scheme

The water committee is to be formed through election by the irrigation beneficiary community members every year to manage the irrigation. The first water committee was formed through election by community members in Golina SSI Scheme at the time Golina was completed in 2000 G.C.

The members of the committee are: Chairperson, Vice chairperson, Secretary, Treasury, Auditor and two operators. The system has a by-law in the kebele judiciary (social court) written and legalized in 2000 G.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.

4.5. Limitations of Users for Community Management of the Irrigation Scheme

Key reflections captured during focus group discussion with irrigators, interview with key informants and interview with the water committee members on the constraints of users for self-management of the irrigation are discussed below:

4.5.1 Rain Fall Shortage

The reduced quantity and irregularities of the annual rainfall did not only affect the rain fed cultivation but also caused reduction of irrigated land due to shortage of irrigation water in the Weir (reservoir). This has been a repeated phenomenon at Golina SSI Scheme following a low rain fall season during most of the past years. The effect of low rainfall, and thus low runoff yield, has been a decline in the irrigable area. As a result, the target community could not fully benefit from the scheme. Among other things, the extreme scarcity of water supply adversely influences farmers' participation in water committee or other formation of coming together for collective benefits. Therefore, under such situations each family may be forced to fend for themselves.

4.5.2 Farmers Capacity

Water scarcity is not only caused by low rainfall but also it is lack of capacity for sustainable management and use of the available water. The extension supports in water management and irrigation agronomy are weak due to limited technical capacity.

Research and extension support in farm management, irrigation water management, irrigation agronomy and marketing is poor or with inadequate coverage. Even if there is FTC (Farmers Training Center) in Golina, it does not provide any training about water management. Failure to give full support for the establishment of WUAs is another drawback of the extension system.

4.5.3 Disfavoring Market System and Related Constraints

One of the main challenge of farmers in relation to market is that they often sale their products at lower prices as decided by the merchants. This is mainly because of the marketing system and unbalanced bargaining power involved in the transaction process, which usually disfavors farmers. Despite the expressed constraints of community members regarding the inconveniences related to marketing of their products, the available services of FSC (Farmers' Service Cooperative) do not include marketing of agricultural products. The main reason that the FSC is not providing agricultural marketing services is because of its limited capacity.

4.5.4 Prevailing of dominant figures in the water committee

Since 2000G.C (Golina weir was completed), there is an election of the water committee by the beneficiaries every year to manage the irrigation. Nevertheless, some of the initial members are still serving as the water committee members i.e. they have not been fully changed since the initial election except a few replacements of individual committee members who left the committee for different reasons. This reflects a sign of dominant figures prevailing in the committee.

4.5.5 Absence of a Water Users Association (WUA)

Despite the existence of a water committee and its efforts to manage the SSI Scheme, it does not have the required strength to effectively manage and ensure realization of a sustainable livelihood for the beneficiaries as well as contributing to the socioeconomic

development of the community in the area. In addition, the absence of a WUA presents a major gap in terms of having formal institutional arrangements for governing the irrigation scheme. Had the WUA existed, there would have been a creation of reasonable product price for the products produced.

4.5.6 Provision of fertilizer and improved seeds

Most of the focus group discussion members and key informants have indicated the availability of fertilizers during both irrigated and rain fed cropping seasons despite their high prices. In addition, inadequate provision/ supply of improved seeds both in quality and quantity are one of the constraints farmers raised during the FGD.

4.6 Area of Intervention

4.6.1 Farmers Intervention on the Small Scale Irrigation Scheme

The farmer's intervention includes on-farm soil and water conservation management structures, river diversions works primarily using local materials (stone, including gabions, brush wood, soil) for run –off and water harvesting technologies. There was the other community members have recommendations that should be considered in the improvement of the small scale irrigation system out of the respondent 47 % of the respondent said yes and the rest 53 % of the respondent said no. The recommendation and suggestions with regarded to the improvement of this small scale irrigation system are: How to manage the small scale irrigation system**,** to elect the water user association to lead the small scale irrigation system, where the head structure was constructed and how to distributed water to field. The recommendation and suggestions of farmers were taken in to considering by the designers during planning and implementation out of the respondent 34 % of the respondent said yes, whereas 23 % of the respondent said no and the rest 43 % of the respondent said partly. The strong resistance from the community side opposing the improvement of the small scale irrigation system out of the respondent 53 % of the respondent said yes and the rest 47 % of the respondent said no. The conflict resolved out of the respondent 38 % of the irrigation respondent said the community was consulted and persuaded with full consent and participation, whereas 32 % of the irrigation respondent said it wasn't resolved as the project designers went on with the process and the rest 30 % of the irrigation respondent said the community internally

opposed; however eventually yielded in as it didn't have the power. The improved of the small scale irrigation scheme denied farmer beneficiaries or brought new users out of the respondent 49 % of the respondent said denied farmers beneficiaries, whereas 33 % of the respondent said have brought new beneficiaries and the rest 18 % of the respondent said both

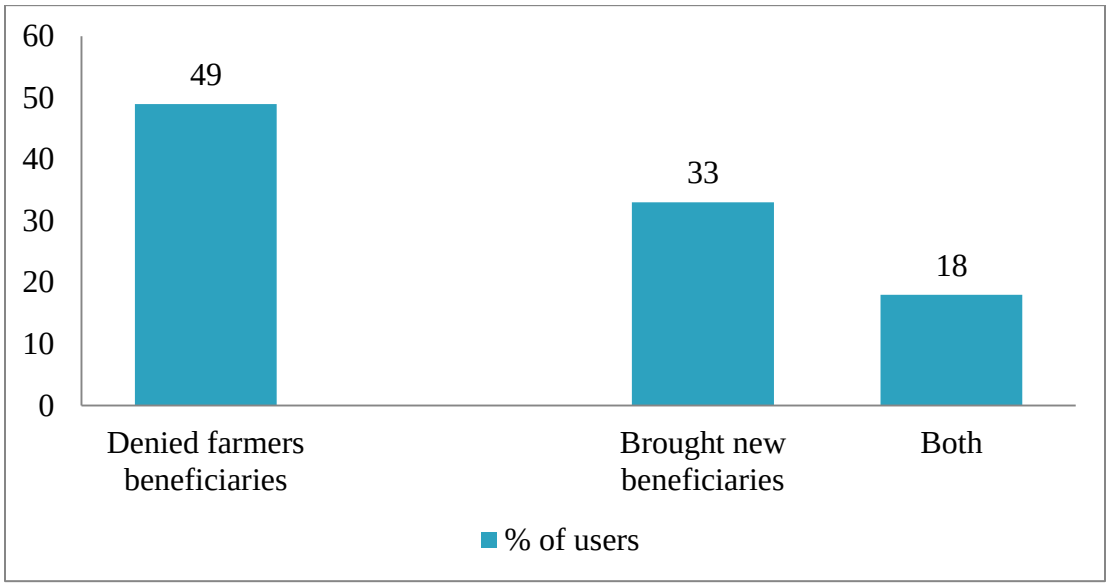

Figure 3: Improved SSI

The farmers think that the main problems with regard to the infrastructure of the traditional small scale irrigations in order to importance's are the materials used to the construction is not good, the construction done by traditionally, lack of skill manpower and lack of willingness

4.7 Agrarian Structures

Major crops grown during main seasons are: Onion, Maize, Teff and Barley whereas the Major crops during second seasons are: Wheat, Tomato, Gesho, Mango and Banana. In the study area the diverted water is used both supplement rain fall and fully satisfy crop growth 51% of the respondent and the rest 49% of the respondent use as only source of water for crop production.

4.8 Construction Quality

According to different literature, appropriate construction offal irrigation structure at reasonable quality is fundamental in order to make the small scale irrigation scheme sustainable. In the study area, different organizations participated in the construction of the small scale irrigation scheme and they had their own approach in implementation. These approaches lead difference in sustainability of small scale irrigation scheme implemented by different organizations. The organizations that were participating to constructing the site were: - Ethiopia government, Italian government, United Nation Development Program, and Chinese Construction Company. But it lead to damage the structure of the scheme due to the changing of the construction company that mean the head structure constructed by Ethiopia government, Italian government, United Nation Development Program and the rest structure constructed by Chinese Construction Company.

Sustainability of the irrigation scheme was partly affected by the design and construction problem because there is no consistently design and construction that mean there was a gap to construct the head work and the rest part of the structure. Hence the head work constructed during 1986 by Ethiopia, United Nation Development Program and Italian Government and the rest part of the structure were started to construct in 1998 by Chinese Construction Company and completed in 2000. The development of the irrigation scheme began in 2001 GC.

Figure 4: Damaged canals

Figure 5: Gate of the weir

4.9 Sedimentation Problem

Sedimentation problem in the study area was high. So it decreases the flow irrigation water, changes flow direction, leading to damages of canal, and also affected crops like onion, tomato and potato.

To protect the irrigation scheme from sedimentation problem by constructing bund, tracing, check dam, gabion and planting trees like elephant grass.

4.10 Challenges that Hinder the Sustainability of the Small Scale Irrigation Management

Number of factors hider the sustainability of Golina small scale irrigation scheme. Some of them were presented below

- Poor water distribution /scheduling and fail to deliver sufficient water for down streams users according to design due to extravagant use of head-end irrigators or water scarcity due to rainfall shortage, some farmers use water for their famers regardless of crop water requirement of each crop type.
- Weak water committees that fail to effectively managed water distribution schedule.
- Water volume decrease because of the prevalence of inadequate run off in to reservoir, farmers could not get enough irrigation water for their farm activity.
- Low level of awareness about the use of irrigation water together with the long term consequences have great importance in smoothing the operation of the scheme under operation. However, irrigators were not well aware of about the water requirement of different type of crops and hence, frequently conflict arises among them.
- Lack of adequate external support (in water and conflict management, technical assistance and capacity buildings) by local development agents and the other concerned partners even though the regional institutional frame work states that the management and operation of the small scale irrigation scheme were a joint responsibility.
- Poor coordination of scheduling, inadequate coordination of water distribution and increasing number of water users in the command area were cause of water scarcity.

4.11 Factors Affecting Sustainablity of the Scheme

Majority of the irrigation users (36%) reported poverty to be a major factor limiting households and institutions from minimizing water resource shortages (in managing water resources), 20% attributed this to lack of water storage facilities (this is linked to poverty) and 13% attributed it to lack of information on efficient use and management of the available water resources. Similarly, 11% attributed it to illiteracy of the masses as compared to 13% who attributed it to lack of government intervention and 7% to limited community cooperation.

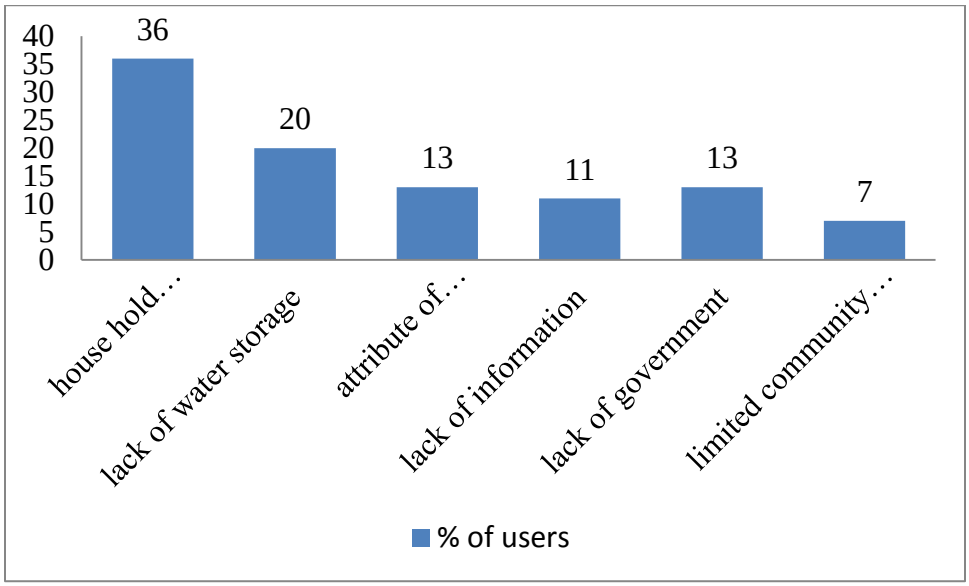

Figure 6: Irrigations users

4.12 Irrigation Management Issues

The irrigation water users association (IWUAs) at Golina has obtained registration certificate in 2009 the below were formulated by the executive committees with the support of project staff and experts from extension organizations of the districts (Golina).

The General Assembly is the highest body in which all members of the irrigation systems collectively discuss the highest level issues and give the final decision. This body meets four times a year, and if necessary the executive committee cans an urgent meeting. There are also other responsibilities of the general assembly that are indicated in the laws of the irrigation system.

The executive committee is a body elected by the general assembly, which is responsible to undertake day to day activities of the general assembly. Generally, the committee is responsible for the following major activities. Take care of physical structures such as water gates, canals and other properties of the association.

Supervising water distributions and execute other related issues specified by law. Organize the users how to manage the sharing of water distributions

Organizational functions of furthers decentralized to teams in order to make the scheme operation more effective. Accordingly the irrigation land has been divided in to blocks that constitute a work team and all members of the association are grouped in one of it. Every team elects its own team leader, accountable to the executive committee in any issues concerning their respective team. The most important function is distributing irrigation water for the team members and ensures the activities are under taken in accordance with the established water use schedule.

There is also a control committee elected by the general assembly which is accountable to it. The overall responsibility of this committee is to monitor the activities of the different bodies of the association whether they are operating in accordance with the law. Farmers were given assistance during the period of government intervention such as inputs provision and training by the project developers after which it has been weaned. Therefore, irrigators through their IWUAs collectively raise funds to carry out the organization and management work necessary.

There is a slight difference in the sources of income and expenditure items in the IWUAs of Golina small scale irrigation. The source of income for Golina small scale irrigation includes registration fee, two percent charge from the total incomes of the sales of irrigated crops from each harvest season and penalties. According to the information obtained from the records of Golina IWUA, the expenditure of the association is limited to canal maintenance, perdiem and stationary.

4.13 Constraints in Irrigation Water Management in the Study Area

As briefly discussed earlier, Golina farm type is a small subsistence oriented farm. Which have at least some elements of commercialization? Farmers generate some amounts of

cash by selling their horticultural crops to purchase essential items. However, there are a number of limiting factors that challenges farmers.

Critical problems affecting irrigation management and performance as rated by farmers are: Irrigation water storage, lack of credit facility, in availability and high cost of modern input, market problem for cash crop produce, shortage of oxen, lack of skill training of irrigation, and lack of farm implements used to undertake irrigation operation.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The findings from the study reveal that households in Golina catchment mainly use water for agriculture purpose with little use in domestic. This was mainly due to the limited water resources (sources) in the catchment. In addition, the management of the small scale irrigation, considering the drivers of water resources scarcity identified includes; climate change, poverty, population growth, pollution, lack of information on water management and poor land use practices. Climates were found to be mostly responsible for water shortages in the catchment. This presents the case for coming up with innovative approaches to act as a buffer against climate-linked water shortages. In this regard, water shortage appears as a powerful incentive to change, eliciting major adaptations and coping strategies from users.

Improved access to agricultural water supply plays critical role in the sustainable livelihoods of rural people. Irrigation is one of the options which increases yield and output, facilitates diversification, reduces vulnerability and creates employment opportunities. Community natural resource management (for instance in the case of communal irrigation water) is increasingly recognized as a viable alternative to privatization or state ownership of the resource. As a result, local level resource management institutions and organizations to enforce them are receiving greater attention. Irrigation water development in Ethiopia during the imperial and military regimes focused on the development of large scale irrigation schemes. This trend was reversed by the Ethiopian government, which emphasized the development of small-scale schemes. Since then many new small-scale communal irrigation schemes have been constructed. In addition, the old ones also cleaned up and rehabilitated and handed over to the community. However, the history of irrigation development in Ethiopia has been characterized by emphasis on technical and engineering aspects, with inadequate attention accorded to policy, institutional and socio-economic factors.

Today, the issue of food security is a serious concern especially in arid and semi-arid regions, which are vulnerable to climatic instability and frequent droughts. To ensure food security in the region, the Amhara Regional Government has focused on adopting and constructing various water harvesting technologies, and Golina small scale development project is one of the different irrigation development projects in the region.

Today, the issue of food security is a serious concern especially in arid and semi-arid regions which is vulnerable to climatic instability and frequent droughts. In these regions there are usually little doubts about the need to use water for agriculture, where traditional rain-fed farming is a high risk enterprise to ensure stable production.

A briefly historical account shows that irrigation has played a key role in enabling sustainable food production were it is well managed by lowering the risk of crop failure. Irrigation also help to prolong the effective crop growing period in areas with day season by permitting multiple cropping per year where only a single crop could be grown otherwise. Furthermore, irrigation reduces the risk expensive agricultural inputs like fertilizers from being wasted as a result of crop failure caused by shortage of water.

A major constraint in the irrigation development is top-down approach by the government and NGOs which took farm population as beneficiaries rather than stakeholders. The technical experts and administrators make decisions on behalf of the farmers. The farmer's involvement in irrigation planning should be considered from the beginning

Small scale irrigation plays role in meeting the growing demand for food and to achieve long term food security. The high yields obtained irrigation and other benefits such as increased incomes, employment creation, and food security are an indication that irrigation can bring sustainable agriculture and economic development without sever effect on the environment.

As briefly discussion in the main body of this study, Golina small scale irrigation is found in one of the most draught-prone and food insecure areas in the region. Until recently, the study area was identified as food insecure and receives food aid distributed by the regional government. In this regard, although irrigation is not a long tradition in

the study area, it role as coping mechanism to mitigate the effects of draught cannot be under estimated. The majority of irrigator's farmland is under rain fed cultivation and little is only cultivated by applying irrigation water. This is due to shortage of water as well as inefficient irrigation water management and also it had come out clearly that irrigation cannot be well designed and in sound technical state and had land allocation, population pressure, input supply, market situation, and health situation affects the sustainability of the irrigation scheme. The problems of the irrigation water management practice for the study area. Farmers do not paid for water fee, farmers do not used water efficiency, the canal breaks and damaged. Due to this reason the farmers lead to different conflict.

Since irrigation has positively affected farmers' livelihood through its effect on increasing diversification and intensification of production, the development of well managed small scale irrigation systems that involves improved on-farm, water management, organizational and other infrastructural development is required. As the study revealed, the types of crops and vegetables and the number of farmers who grew a wide range of crops and vegetables have substantially increased after the introduction of irrigation.

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 Golina 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 miss utilization of water and the rest 12.5% of water users acknowledged that there is also inequality in water distribution between locations and 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 of poor water management and water scarcity.

In Golina SSI Scheme, a significant number of beneficiaries (60.5%) 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 undertaken by mass mobilization on average once 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 was observed.

The water committee is to be formed through election by the irrigation beneficiary community members every year to manage the irrigation. Currently, the water committee has seven members (Chairperson, Vice chairperson, Secretary, Treasury, Auditor and two operators) who are responsible for the overall management of the irrigation system. The system has a by-law in the kebele judiciary (social court) written and legalized in 2001 G.C. 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. However, the water committee allocates water by guess because of lack of technical capacity and support from the farmers training center. These in turn resulted in a major problem in the

implementation of rotational distribution of water by the committee. This self-organization for the management of the irrigation scheme was constrained by rainfall shortage and variability affecting the irrigated agriculture, capacity limitations in irrigation agronomy and water management, disfavoring market system and related constraints, prevailing of dominant figures in the water committee, price escalation and inadequate supply of fertilizer and improved seeds and absence of a Water Users Association (WUA).

Although the weir was meant to irrigate three hundred fifty hectares of the vast command area along the downstream, it irrigates about 200 hectares on average and that is small as compared to the potential. The study identified that water scarcity and shortage of labors were the most important factors responsible for underuse of the potential irrigable land.

Since irrigation has positively affected farmers' livelihood through its effect on increased diversification and intensification of production, the development of well managed small scale irrigation systems that involves improved on-farm water management, organizational and other infrastructural development is required. As the study revealed, the types of crops and vegetables and the number of farmers who grew a wide range of crops and vegetables have substantially increased after the introduction of irrigation.

However, in the study area farmers faced constraints that hinder the production diversification. Such factors include weakness in water management, prevalence of disease because farmers have not regularly been supplied with improved adaptable seeds of vegetables and crops that work under irrigation and continuous decline in the amount of water conveyed into the scheme.

5.2 Recommendation

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

- WUAs should be find way to manage and organize the users to keep the safety of the small scale irrigation scheme.

- 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 strengthening 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.
- In spite of lack of strong system management, water scarcity, disfavoring market system and related constraints and price escalation and inadequate supply of fertilizer and improved seeds, acceptable commitment of farmers and the impact of the implemented SSI on farmers' livelihood was observed. Hence, small scale irrigation should be promoted where it is most demanded. But farmers' priorities and interest, compatibility of irrigation with the environment and farming system of the area and opportunities of irrigation should be understood before intervention.
- Lack of regular supply and high price of inputs were one of the constraints of users for community managed of the scheme. The regional government, therefore, should take prompt measure to avail inputs regularly at an affordable price to the irrigators.
- The major factors for the underperformance of Golina Small Scale irrigation scheme is water loss as a form of seepage and water scarcity. Therefore, the sustainability of the scheme should be secured by reducing the seepage water loss rate through expansion of cemented canal in the command area and beneficiaries should introduce technologies that minimize water scarcity like drip irrigation.
- There has been a continuous decline in the quantity of water conveyed in to the dam. This may lead to progressive degeneration and collapse of irrigation in the lower-catchment area. Hence, the Government and Non-government actors involved in small scale irrigation development should design means of enduring the sustainability of the agricultural activities in the lower-catchment area by using motor pump that can suck water from the underground. To ensure this, the integration among all stakeholders (regional water bureau, woreda agricultural

and rural development office, kebele development office and beneficiaries) has to be strengthened.

- In the study area, water scarcity, and shortage of labor were the most important factors responsible for the underutilization of the potential irrigable land. Hence, beneficiaries should take loan from the nearby microfinance institutions (For instance, Kobo Microfinance) to overcome these problems.
- Strong regulatory mechanism should be designed to overcome problems related to irrigation water to provide incentives to committed and disciplined farmers whereas disincentives to defaulters.
- The transport of water from a weir to the farms needs an efficient canal networks to tackle problems such as water logging, water scarcity and soil salinity. Hence, training should be given to farmers in techniques of water management, irrigated agriculture, and conservation of resources.
- Better training of farmers on improved irrigation management practice, agronomic practices, crop protection aspects, booking, irrigation practices, and product market is required to increase crop productivity, price bargaining power and profitability of small scale irrigation scheme in the study area.
- Strengthening or establishing institutions for irrigation management practice, input supply, output marketing and credit service to allow rapid, progress in the introduction and adoption of productivity improving technologies and farming practice.
- Regular supervision and monitoring are needed, from Woreda Agricultural and rural development office and NGOs to improve transparency of WUAs and prevent corruption.

REFERENCES

Abrham Melese Endalkachew, August 2009. Optimum Utilization of Ground Water in Kobo Valley, Eastern Amhara, Ethiopia. A Thesis presented to the faculty of the School of Cornell University in the partial fulfillment of the requirement for the degree of master of professional studies (MPS).

ACQUASTAT (1998). FAO's Global Information Systems of Water and Agriculture.

Awulachew SB, Merrey D, Van Koopen B, and Kamara A. 2010. Roles, Constraints and Opportunities of Small-Scale Irrigation and Water Harvesting in Ethiopian agricultural Development: Assessment of Existing Situation. ILRI workshop; 2010 March 14-16; Addis Ababa, Ethiopia: International Water Management Institute (IWMI).

Awulachew SB, Merrey JD. 2005. Assessment of Small Scale Irrigation and Water Harvesting in Ethiopian Agricultural Development [abstract]. International water management institute: Colombo, Sri Lanka.

Awulachew S.B., Yilma A. D., Loulseged M., Loiskandl, W., Ayana M., Alamirew T. (2007). Water Resources and Irrigation Development in Ethiopia. IWMI working paper, 123, Colombo, Sri Lanka.

Brown, E.P., & Nooter, R., (1995). *Successful Small-Scale Irrigation in the Sahel*. World Bank Technical Paper No. 171, Washington D.C

Burt, C.M. and Styles, S.W., 1999. Modern Water Control and Management Practices in Irrigation: Impact on Performance. Water Reports No. 19. International Program for Technology and Research in Irrigation and Drainage. The World Bank. FAO, Rome.

Cernea, M. (ed.) 1991. Putting people First: Sociological Variables in Rural Development. The World Bank.

Clague, C. (ed). 1997. Institutions and Economic Development: Growth and Governance inLess Developed and Post-Socialist Countries. The John Hopkins University Press: Baltimore and London

Co-SAERAR (Commission for Sustainable Agriculture and Environmental Rehabilitation in Amhara Region), 1998. Design Documents of Watershed, Headwork and Infrastructure.

CRS (1999) Programmatic Environmental Assessment of small scale irrigation in Ethiopia. Cooperating Sponsors. Baltimore, Maryland, USA.

CSA (Central Statistics Authority).1998. CSA Statistics. CSA, Addis Ababa, Ethiopia

FAO, (1997). *Farm Management for Asia: A Systems Approach*, Department of Agricultural and Resource Economics, University of New England, Australia.

FAO, 2003. Working Towards Unlocking the Water potential of Agriculture, Rome, Italy.

Dessalegn. R.(1999). *Water resource development in Ethiopia: Issues of sustainability and* participation. Forum for social studies Addis Ababa, Ethiopia

Freeman, D. and M. LowdermiLk. 1991. "Middle-level Farmer Organizations as Links between Fuad Adam 2001. Small-Scale Irrigation and Household Food Security: A Case Study from Central Ethiopia. Forum for Social Studies. Addis Ababa.

Gashaye, C. (2007). *Technical and Institutional Evaluation of Geray Irrigation Scheme in West Gojjam zone, Amhara Region*, M.Sc, Thesis.

Gebremedhin, B. & Pedon, D. (2002) Policies and institutions to enhance the impact of irrigation development in mixed crop-livestock systems, In: Integrated water and land management research and capacity building priorities for Ethiopia. *Proceedings of MoWR/EARO/IMWI/ILRI international workshop.* Addis Ababa, Ethiopia, ILRI.

Greenhill, R.G. 1995. "State Intervention in the Brazilian Coffee Trade during the 1920s: A case study for New Institutional Economics?" in Harris, J., J.Hunter and C.M. Lewis, (eds). The New institutional Economics….

Habtamu, G. (1990) Problems and Constraints in the Study, Construction and Management of Small-Scale Irrigation Projects. *Presented at the National Irrigation Policy and Strategy Workshop.* Addis Ababa.

Hayami Y. and Ruttan V. 1985, Agricultural Development: An International Perspective. 2nd edition .Johns Hopkins University Press, Baltimore, USA

Meinzen-Dick, R. 1995. Timeliness of irrigation. Irrigation and Drainage System 9: 371–387.

Merrey, D., 1997. "Expanding the Frontiers of Irrigation Management Research: Results of Research and Development." IIMI Publications, Colombo, Sir Lanka.

Michael, A.M., (1978). *Irrigation: Theory and practice*. Vikas Publishing House pltd New Delhi, India.

Ministry of Water Resources (1998). Ethiopian Water Resources Management Policy. Addis Ababa, Ethiopia.

Mitiku, H., Merga, S. N., 2001. The Experience of Water Harvesting in the Drylands of Ethiopia: Principles and practices, December 28-30, 2001 Mekelle, Ethiopia, (Report No. 19).

MOA (Ministry of Agriculture). 1993. *Information regarding activities of small-scale irrigation (in Amharic).* Irrigation Development Department, MOA, Addis Ababa, Ethiopia.

Molden, D.J. and I.W. Makin. 1997. Institutional change in support of modernization and management transfer. Modernization of irrigation schemes: past experiences and future options, RAP publication 1997/22, FAO. Rome,Italy.

Molden D. J., Sakthivadivel R., Perry C. J., and Charlotte de Fraiture. 1998. *Indicators for Comparing Performance of Irrigated Agricultural Systems.* Research Report 20. International Water Management Institute. Colombo, Sri Lanka.

MoW (Ministry of Water Resources). (2001b). Water Sector Development Program Methodological Framework. MoWR, Addis Ababa, Ethiopia.

MoWR (Ministry of Water Resources). 2002. Water Sector Development Program (WSDP), Addis Ababa: Ethiopia

Olokesusi, F. (2006). Survey of Indigenous Water Management and Coping Mechanisms in Africa: Implications for Knowledge and Technology Policy. African Technology Policy Studies Network

Pejovich, S. 1995. Economic Analysis of Institutions and Systems. Kluwer Academic Publications: London.

Peter, S., 1979. Small- Scale Irrigation: A manual of Law-Cost Water Technology. Nottingham,UK

Pinderhughes, R. (2004). *Alternative Urban Futures: Planning for Sustainable Development in Cities throughout the World*. Rowman and Littlefield Publishers Inc. New York. Oxford, Toronto and Lanhawn.

Plusquellec, H. 2002. How design, management and policy affect the performance of irrigation projects: Emerging modernization procedures and design standards. Food and Agriculture Organization of the United Nations, Regional Office for Asia and the Pacific. Bangkok. Thailand. pp: 174.

SAERAR (1989), Kobo-Girana Valley Development Study Project FeasibilityPhase Report, Volume iv. Socio-Economics. SAERAR. Bahar Dar.

Seid, Y. (2002). Small -scale Irrigation and Household Food Security: A case study of Three Irrigation Schemes in Guba Lafto Woreda of North Wollo Zone, Amhara Region. A Thesis for M.A Degree in RLDS. Addis Ababa University.

Syngellakis, K. and Arudo, E. (2006). Uganda Water Sector Policy overview paper. Energy for Water-Health-Education.

USAID, Environmental Guidelines for Small-Scale Activities in Africa- Environmentally Sound Design for Planning and Implementing Humanitarian and Development Activities, Technical Paper 18, Washington, D.C.: USAID/AFR/SD, June 1996.

Uphoff, N. 1986. Getting the Process Right. Improving Water Management with Farmer Organization and Participation. Working paper. Cornell University, Ithaca.

Van Koppen, B., (2002). *A Gender Performance Indicator for Irrigation: Concepts, Tools and Applications,* Research Report 59, International Water Management Institute, Colombo, Sri Lanka.

Wetterhall H. (1972). Government and land in Ethiopia. Ministry of Land Reform and Administration, Addis Ababa, Ethiopia (un published report).

APPENDICES

Annex- I Questionnaires

Questionnaire and discussion checklists for the assessment of water resource management practices for small scale irrigation: case study on Golina irrigation project in Amhara Region; Ethiopia

: The case of Small scale irrigation

By: - Yaregal Belete

Part I

Questionnaires to sample farmers

A. General Information

Name of the irrigation scheme _____

Enumerator_____

Date _____

1. Sex _____

2. Age _____

3. Religion 1= Orthodox 2= Islam

B. Operational and management Arrangements

1. Location of the Farm

1=Head

2=Middle

3=Tail

2. Who do you think is the owner of the irrigation infrastructures?

1= community

2= government

3= No response

3. When do you think small scale irrigation begin in your locality?

_____

4. Do you have Water User Association or small scale irrigation committee in your irrigation scheme?

1= Yes 2= No

5. If yes to question 4 how do you elect the committee?

1= by organizing meeting and voting

2= are selected by the elderly in the community

3=they appointed themselves because of their influence in the community

4=other specify _____

6. What do you think are the main functions of the WUA and the small scale irrigation committee?

WUA	Small scale irrigation committee
1. _____	1._____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____

7. How do you evaluate the performance of the small scale irrigation committee with regard to the following functions?

1= Leadership Poor ( ) Average ( ) Good ( ) V. Good ( )

2= Resource Mobilizations Poor ( ) Average ( ) Good ( ) V. Good ( )

3= Infrastructure Maintenance Poor ( ) Average ( ) Good ( ) V. Good ( )

4= Equity in Water Distribution Poor ( ) Average ( ) Good ( ) V. Good ( )

5= Resolving conflicts poor ( ) Average ( ) Good ( ) V. Good ( )

8. Have you ever had a conflict related to small scale irrigation water utilization with your individual neighboring farmers?

1= Yes 2= No

9. If yes to question 8 please mention all cases and their causes you remember.

1. _____

2. _____

3. _____

4. _____

5. _____

10. How do you resolve the conflict you face with your neighbouring farmers? (Please specify the resolving procedure from simple to serious conflicts that may require the involvement of other bodies)

1. _____
2. _____
3. _____
4. _____
5. _____

11. What hostile activities do you think are there among the community members that can potentially result in conflict with down/ up steam users?

1. _____
2. _____
3. _____
4. _____
5. _____

12. Does the WUA in your small scale irrigation system have rules and regulation on how to use the diversion water?

1= Yes 2= No

13. If yes to question 12 would you please mention some of your rights and duties as a user?

Rights Duties

1. _____ 1._____
2. _____ 2. _____
3. _____ 3. _____
4. _____ 4. _____
5. _____ 5. _____

14. Who decides on how many times should a plot in the command area irrigated in a season?

1= Individual farmers

2= Water committee

3= Agreement made between/ among farmers

4= Specify _____

15. Do you have abandoned the scheme infrastructures near to your plot?

1= Yes 2= No

16. If yes to question 18 what are the main reasons

1= _____

2= _____

3= _____

4= _____

17. Does the river course in your irrigation scheme system change direction?

1= Yes 2= No

18. If yes to question 17 what are the main reasons?

1= _____

2= _____

3= _____

4= _____

19. What are the main risks involved in small scale irrigation agriculture?

1= No discharge season (Dry year)

2= exceptionally high flood

3= High sedimentation that settle in the canals and fields

4= any combination of the above in order of importance _____

5= other risks specify _____

20. Do you use diversion water for other purpose than crop production?

Yes = 1 No = 2

21. If the answer for question 20 is yes for what other purposes?

1. _____

2. _____

3. _____

4. _____

22. Have you had any training in the following aspects?

1= irrigation water management (Yes *I* No)

2= the irrigation scheme infrastructure management (Yes/ No)

3= Crop Management (Yes *I* No)

Specific questions to farmers in improved small scale irrigation systems

23. How do you evaluate the small scale irrigation water availability after the construction of the new small scale irrigation infrastructure?

1= Highly Satisfied

2= Moderate Satisfaction

3= No Change from the traditional

4= Reduced spate water supply from the traditional

C. Maintenance and rehabilitation Issues

1. Are you involved in maintenance and rehabilitation of small scale irrigation infrastructures?

1= Yes 2= No

2. How many times do you participate in maintenance of the small scale irrigation scheme in a rainy season?

1= 1 – 3 times

2= 4 - 6 times

3= more than 7 times

3. How frequently does the structure get damaged with in a season?

_____

4. What is/are the main cause/s of structure damage in your small scale scheme? List down in order of importance.

Main intakes (canals) secondary/ Field canal structures

1. _____ 1._____

2. _____ 2. _____

3. _____ 3. _____

4. _____ 4. _____

5. _____ 5. _____

5. How do you contribute labour in maintenance and rehabilitation of small scale structures?

1= According to family labor size

2= According to irrigated farm size

3= There is equal labour contribution

4= others specify _____

6. Do you hire labour for operation and maintenance works during peak labour demand period?

1= yes 2= No

7. What is the size of your land?

1= 0.0 - 0.5 ha

2= 1 .0 - 2.0 ha

3= 0.5 - 1 .0 ha

4= > 2.0 ha

8. What part of your cultivated land is accessible for small scale irrigation?

1= All

2= Half

3= other specify _____

9. Do you irrigate all of your land accessible for small scale irrigation?

1= Yes 2= No

10. If not, why?

1= Shortage of river water

2= Getting sufficient produce from rain feed agriculture

3= Because of poor operation and maintenance works

4= others specify _____

Specific Questions for Farmers in improved Small scale irrigation Systems

11. How do you evaluate the operation and maintenance work frequency and work load before and after construction of the new small scale irrigation infrastructure?

1= Decreased

2= Increased

3= No difference

12. If the answer for question 13 is “increased” what kind of operation and maintenance works are taking you more time?

1= Maintenance of diversion wire

2= Silt moving from canals

3= Construction of farm bunds

4= others specify _____

D. Distribution of Small scale irrigation Water

1. Are you receiving enough river water up to your field end?

1= Good supply

2= Sufficient

3= Insufficient

2. Do you feel you share equal water with every user in the scheme?

Yes=1 No =2

3. If no to question 1 the reason is

1= Because of your plot’s location

2= Because of the unfair distribution in the scheme

3= Become of reluctance to participate in maintenance rehabilitation activities

4= other / specify _____

4. If there is inequality, which groups of people in the scheme get more?

1= the farmers near to the main in take

2= the farmers who participate in maintenance rehabilitation activities

3= the farmers who violate the rules and regulations

4= others specify _____

5. How do farmers react when they feel that they are getting less irrigation water?

1= Apply to the spate water committee

2= Conspire with similarly affected farmers and try to get more irrigation water

3= independently break the rules and regulations to get more irrigation water

4= others specify _____

6. What punishment do small scale irrigation water rules and regulation defaulters receive in your system?

1= _____

2= _____

3= _____

4= _____

5= _____

7. Do you believe the rule and regulations are enforced in the way they are formulated?

1= Yes 2= No

8. If no, what are the weaknesses? Please, list down in order of importance

1= _____

2= _____

3= _____

4= _____

5= _____

9. Who should enforce the rules and regulations in your small scale system?

1= Water Users Association

2= Water Committee

3= others specify _____

10. How many diversion flows do you experience in one diversion season?

	Main season	Second season
1= Good Season	_____	_____
2= Fair Season	_____	_____
3= Bad Season	_____	_____

11. How is river water distributed in your scheme?

1= spreading water through guided canals in to the command area

2= field to field technique – by breaking upper bunds

3= controlled system - each field having its own intake

4= others Specify_____

E. Gender Issues

1. What is the contribution of women in small scale irrigation activities?

_____

_____

_____

2. How do women farmers irrigate when small scale irrigation water occurs during the night time?

_____

_____

_____

3. What major problems do female farmers face in the small scale irrigated agriculture?

1= _____

2= _____

3= _____

4= _____

F. Improvement intervention issues

Specific questions for farmers in improved small scale irrigation schemes

1. Where you happy when you first herd that the small scale irrigation system is going to be upgraded?

1= Yes 2 = No 3=Indifferent

2. If yes to question 1 why?

_____

_____

3. If no to question 1 why not?

_____

_____

4. Where you consulted/ participated during the planning stage of the improvement project?

1=Yes 2=No

5. If yes to question 4 in what aspect did you participate?

1= simply attended meetings about the project

2= attended meetings and actively expressing feelings, ideas, views, etc.

3= other _____

6. Did you/ other community members have recommendations that should be considered in the improvement of the small scale irrigation system?

1= Yes 2= No

7. If yes to question 5 what were your recommendations and suggestions with regard to the improvement of this small scale irrigation scheme?

1= _____

2= _____

3= _____

4= _____

8. Were your recommendation and suggestions taken in to consideration by the designers during planning and implementation?

1=Yes 2=No 3= partly

9. Was there strong resistance from the community side opposing the improvement of the small scale irrigation system?

1= Yes 2= No

10. If yes to question 9, how was the conflict resolved?

1= the community was consulted and persuaded with full consent and participation

2= It wasn't resolved as the project designers went on with the process

3= the community internally opposed; however eventually yielded in as it didn't have the power

4= others, specify _____

11. Have the improved small scale irrigation scheme denied former beneficiaries or brought new users?

1= Denied formers beneficiaries

2= Have brought new beneficiaries

3= Both

Specific questions for farmers from modernized small scale irrigation schemes

12. Have your community ever requested to any institution to upgrade/ modernize the small scale irrigation system you are currently using?

1= yes 2= No

13. Do you support if any institution shows the tendency to upgrade you're your modernized small scale irrigation infrastructure?

1= Yes 2= No

14. What advantages do you think the modernized small scale irrigation system has as compared to the traditional ones?

1= _____

2= _____

3= _____

4= _____

G. Agrarian Structure

1. Major Crops grown during main Season

1= _____

2= _____

3= _____

2. Major Crops during Second Season

1= _____

2= _____

3= _____

3. In which way do you use diversion water for crop production?

1= as supplementary to rainfall

2= as a only source of water for crop production

4. Do you have sedimentation problem in your crop field as a result of the small scale irrigation?

1= Yes 2= No

5. If yes to question no 4 how do you manage it?

_____

_____

_____

6. Do you thing that sedimentation has any benefit anyway?

1= Yes 2= No

7. If yes to question 6 what benefits does it have?

1= _____

2= _____

3= _____

8. What season do you experience diversion flow?

1= Kiremit (winter)

2= Bega (summer)

3= Meher

4= Tsedey

5= any combination of the above_____

9. Is the woreda Agricultural office helping you in small scale irrigated agriculture?

1= Yes 2= No 3= Not significantly

10. If yes, in what ways is it helping you?

_____

_____

Part II

Interview Checklists

A. Interview checklists for discussion with Water Committee members

Interview checklists to the Water Committee Heads/ Fentaw Asres

Date _____

Name of Irrigation Scheme _____

1. How is the WUA/ Water committee in your community formed?
2. What are the major objectives on which the WUA/ Water committee is formed?
3. How frequently do the WUA/ Water committee conduct meetings?
4. What are the dominant issues that are discussed during the meetings?

B. Interview checklist for focus group discussion with beneficiary farmers

Name of Irrigation Scheme _____

Date _____

Group Members

Name Age Sex

1. _____ _____ _____
2. _____ _____ _____
3. _____ _____ _____
4. _____ _____ _____
5. _____ _____ _____
6. _____ _____ _____

1. History of small scale irrigation in the community
2. What are the major social organizations in the community that help the productive utilization of small scale irrigation?
3. How is the small scale irrigation water are distributes to different canals and individual farmers?
4. What are the procedures of establishing Water Users Association and water committees?
5. How are small scale irrigation water related conflicts resolved?
6. How are the rules and regulations related to small scale irrigation water utilization codified and applied in the community?
7. Resolving conflicts between/ among different water committees (upstream and downstream users)
8. What are the kinds of penalties applied to defaulters?
9. What are the strength and weaknesses of the modern small scale irrigation systems?

C. Interview checklists for discussion with Woreda irrigation experts

Date _____

Woreda _____

Interviewee _____responsibility/ position_____

1. under whose management is the small scale irrigation system?
2. What is the contribution of your office in managing the small scale irrigation system?
3. What technical support do you provide to the small scale irrigation schemes in the woreda?
4. What identified ladders of the management bodies exist in the irrigation system?
5. How do you evaluate the effectiveness of improving the modernized small scale irrigation schemes in your woreda?