



ASSESSMENT OF WATER USE MANAGEMENT OF
COMMUNITY-BASED IRRIGATION SCHEMES *IN KOGA*
IRRIGATION DEVELOPMENT, AMHARA REGION, BAHER DAR,
ETHIOPIA

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This is to certify that this thesis written by Tamiru Gode, entitled *Assessment of Water use Management of Community-based Irrigation schemes in Koga Irrigation development* and Submitted in the Partial Fulfillment of the Degree of Master of Arts to the College of Development Studies (CDS), center of Water and Development complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

Irrigation contributes significantly in increasing availability of farm products, income of households and in reducing poverty. It is one approach to address the weak performance of agriculture sector due to lack of adequate rainfall, variability and duration of rainfall. Koga Irrigation Project is one of the projects designed to satisfy basic needs of society and to ensure self sufficient in food production. It is community-based large scale irrigation. Managing such large scale irrigation scheme is a challenge. This study is aimed to assess and identify the factors affecting the successful implementation and Water Use Management problems of community-based irrigation schemes and to indicate and recommend solutions to the problems. Based on the identified problems I set the objectives: to assess the current community-based irrigation water use management and its impacts on the irrigation development; to examine the constraints and to identify the factors affecting the successful implementation of community-based irrigation development; and finally to identify the type of interventions that should be taken to sustain the irrigation schemes. Based on the objectives appropriate methodologies are designed to investigate them. Lack of access to market, loss of water when irrigating, lack of awareness on irrigation were identified. Moreover, lack of training related to irrigation, low price for the products, crop disease and the high cost of inputs are the constraints encountered in the irrigation schemes. It is recommended that Koga irrigation project office should build strong institution accommodated well experienced marketing expert or a group of experts is/are recruited that can perform market assessment and create market ties with different governmental and public organizations such as hospitals, super markets universities and colleges; try to install agro-processing firms in/around the scheme by organizing the union, taking credit from development banks such as ADB. Farmers should get continuous irrigation, land and water use management training and must be aware of the schemes and they should be informed to safeguard and to develop sense of ownership.

Key Words: Water Supply, Water allocation, Water conflict, Water distribution, Water management, Community-based irrigation, Cash crops, Food grains, Market information system, Market oriented/ proposed crops

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Acronyms

AARI	Amhara Agricultural Research Institute
ADB	African Development Bank
ADLI	Agricultural Development Led Industrialization
AIARC	Adet Institution of Agricultural Research Center
ANRS	Amhara National Regional State
ABA	Abay Basin Authority
ASE	Amhara Seed Enterprise
AWWCE	Amhara Water Works Construction Enterprise
BOARD	Bureau of Agriculture and Rural Development
DA	Development Agent
FAO	Food and Agriculture Organization
FGD	Focus group discussions
FMIS	Farmer Managed Irrigation Systems
GoE	Government of Ethiopia
Ha	Hectare
IWUCs	Irrigation Water Users Cooperatives
Kada	Local unit for measuring land (1Kada= 0.25ha)
KDIP	Koga Dam and Irrigation Project
KIDO	Koga Irrigation Development Office
KIWMP	Koga Irrigation Watershed Management Project
KIWUCU	Koga irrigation water users' cooperatives Union
MoARD	Ministry of Agriculture and Rural Development (the then)
MoA	Ministry of Agriculture (the present)
MoFED	Ministry of Finance and Economic Development
MOM	Management, Operation and Maintenance
MoWE	Ministry of Water and Energy (the present)
MoWR	Ministry of Water Resources (the then)
NSR	Night Storage Reservoir
PLC	Program Lode Controller

QCs	Quaternary Canals
TCs	Tertiary Canals
TL	Team Leaders
WUCs	Water User Cooperatives

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CHAPTER ONE

1. INTRODUCTION

1.1. Background

Irrigated agriculture is one of the critical components of world food production, which has contributed significantly to maintain world food security and to the reduction of rural poverty. In addition to food security, irrigated agriculture significantly contributes towards generating rural employment and maintaining rural livelihoods. There is evidence emerging that irrigation has contributed significantly to increase farm income, reducing income inequality and reducing poverty in irrigated agriculture in Asia (FAO 2000).

Ethiopia covers a land area of 1.13 million km², of which 99.3 percent is a land area and the remaining 0.7 percent is covered with water bodies. It has 12 river basins with an annual runoff volume of 122 billion m³ of water and an estimated 2.6 - 6.5 billion m³ of ground water potential (MOWR 2012).

Currently the government of Ethiopia 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 5.1 million hectares of land that can be developed for irrigation through pump, gravity, pressure, underground water, water harvesting and other mechanisms (MOFED 2010). According to BOARD (2010) and Awulachew et al. (2005) the total irrigated land in the Amhara region is 347,725 hectares.

From the master plan studies, the Amhara Region has potential of an estimated 250,000 ha for small-scale irrigation and 450,000 ha for medium and large-scale irrigation. According to (MoWR 2007), the Koga Irrigation Project includes watershed management, irrigation development, and capacity building components. The command area of the irrigation was planned to cover about 7,000 ha but currently it reached 7,004 ha.

1.2. Statement of the Problem

Irrigation is a means to increase both yields and productivity. In order to increase food production three methods should be incorporated: increasing agricultural yield, increasing the area of arable land, and increasing cropping intensity (number of crops per year). Irrigation has the potential to increase both yields and cropping intensity in Ethiopia (Awulachew et al. 2010).

Even though a number of modern irrigation schemes were developed in the Amhara region, the irrigation schemes have not achieved their primary objective. Most irrigation schemes are poorly operated and managed so that they are not successfully implemented and developed. The most important aspect of irrigation development is not only the construction but also the knowhow of the operation, how to organize and manage community participation in scheme management.

Different irrigation related problems such as lack of coordination, access to market, lack of irrigation practice and farmers' awareness, water loss were problems encountered in the irrigation schemes. Moreover, lack of training on irrigation, low price for the products, crop disease and high price of agricultural inputs are the existed constraints in the study area.

Even if all these impacts are shining in the project, the scheme is under performing. In order to understand the causes of the underperformance: examining the physical irrigation system, institutional arrangements and environmental concerns of the scheme; and to provide evidence on how to minimize the risk and to maximize intended benefits of the community.

In order to attain the desired objective; to investigate and identify the type of constraints encountered and the type of interventions that should be taken to sustain community-based irrigation schemes; I suppose to study 'The Assessment of water use management of community-based Irrigation schemes, particularly in Koga Irrigation development, Amhara Region, Ethiopia.

This study tries to shade some lights on assessment and identification of factors affecting community-based irrigation developments and to design alternative means to achieve the objective(s); by participating and asking farmers about existed problems that hinder the irrigation development and to recommend short and long term solutions to the problems.

1.3. Significance of the Study

The Koga irrigation development is the first community based large scale irrigation scheme in Ethiopia that has greater contribution in poverty alleviation, food security and economic development through balancing micro-level livelihoods of the population, environmental issues and sustainable use of water resources. In order to acquaint farmers with modern irrigation systems and with appropriate irrigation technology, it is important to give emphasis and create awareness to farmers and concerned bodies, actors of the sector and irrigation developers.

Therefore, as this study tries to assess the current community-based irrigation water use management, major constraints and its impacts on the irrigation development: to identify the type of interventions that should be taken to sustain community-based irrigation water use management; it will give some insights to practitioners in the sector to analyze the situations and take corrective actions if necessary. In addition the study will serve as a spring board for further academic research and knowledge building.

1.4. Research Questions

- What kind of problems and constraints do exist within the current community-based irrigation water use?
- Is the current community-based irrigation water use and management equitable and fair in distribution?
- What factors affect the community-based irrigation development?
- What kind of corrective measures should be used to reduce water use-related problems and conflicts between water users in order to resolve conflicts?
- What interventions and measures should be taken to sustain the community-based irrigation development?

1.5. Objective of the study

The general objective of this research is to assess the water use management on community-based Irrigation schemes, particularly at Koga Irrigation development, Amhara Region, Ethiopia.

The Specific objectives of the research are to:

- I. assess the current community-based irrigation water use management and its impacts on the irrigation development;
- II. investigate the type of constraints encountered in the community-based irrigation schemes;
- III. identify the factors affecting the development of community-based irrigation; and
- IV. identify the type of interventions that should be taken to sustain community-based irrigation development

1.6. Scope and Limitation of the Study

Though the number of beneficiaries in the scheme is very large, existence of common and repeated problems, the researcher is obliged to limit the sample population size to one hundred households. According to the information gathered from Senior Experts, Agronomists, Development Agents (DAs) and farmers about the common problems observed in the specific schemes, the limited number of sample household size may not affect the degree of representation. Regarding to access to written documents, as Water User Cooperatives (WUCs) are recently established and having less experience a well organized document cannot be readily available. This may put an impact and limit the preparation and organization of this document. Similarly, the timely availability of good quality data and information is critical to the successful completion of the study. However, problem of documented data availability at the Woreda level also makes the research scope to be limited. In addition, KDIP as pioneer large scale community-based scheme, created problems in getting in sight and experiences to inculcate in the research.

1.7. Organization of the Thesis

The paper is organized under five chapters. The first chapter consists of introductory part which includes background information: statement of the problem, objective of the research, research questions and significance of the study.

Chapter two discusses about review of related literatures: irrigation related issues such as water and agriculture, irrigation development, etc.

Chapter three illustrates the materials and methods used that includes description of the study area, methods of data collection and methods of data analysis.

Chapter four describes about results and discussions of the results and the last chapter describes about the conclusion and Recommendation parts of the research area.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Water and Agriculture

Water, soil, air and sunshine are the four main determinants for plant growth. Therefore, water is essential to plant-growth and crop-production (Widtose 2001). All sectors depend on water. Water is a basic need for human beings and animals. According to Dupriez and De Leener (2002), the sources of water for crop production are rainfall and irrigation water. The two types of agriculture seen from the perspective of water management are rain-fed cultivation and irrigated cultivation. Rain-fed cultivation is agricultural production of crop depending entirely on the rain. It relies on the rainfall timing and distribution. Irrigated crops benefit from man-made watering with the help of water pipes, canals, reservoirs and pumps (Dupriez and De Leener 2002).

Safeguarding and developing water resources for rural development require a combination of inputs or interventions in the following major dimensions:

- The *upstream-downstream* dimension, which recognizes that each water use or water user potentially impacts on all the other uses and users.
- The *institutional* dimension that needs to consider how planning, policies, rights, regulations, monitoring, water user organizations, etc., need to be designed and implemented to enhance the effective functioning of organizations at basin and system levels as well as at the level of individual uses or users.

2.2. Irrigation Development

Irrigation is generally defined as the application of water to the land for the purpose of supplying moisture essential to plant growth. It is an age-old art.

According to the MOA (2005) and Awulachew et al. (2007), Amhara region has 770,000 hectares of irrigation potential. Different development activities have been underway to utilize these resources. The irrigation schemes developed cover an irrigated area of 8,469 hectares with 17,443 beneficiaries. Of these total irrigated areas, 5,719 hectares are from small-scale and 2,751 are from medium-scale irrigation schemes.

2.3. Participatory Irrigation Management

Improved irrigation access will increase crop yield and production, and in turn, result in increased farm income. The access to consistent irrigation water can enable farmers to adopt irrigation technologies. Irrigation facilitates the intensity of cultivation that leads to an increase in agricultural productivity and greater returns from farming. The expansion of irrigation opens up new employment opportunities in the household that increase the efficiency of labor and land. This improves farm income, livelihood, and the quality of life in rural areas (Hussain and Hanjra 2004).

Since the early 1990s, many efforts have been made worldwide to explore the potential benefits of a more participatory mode of irrigation management in existing large-and medium-scale irrigation schemes. It was assumed that devolving management responsibility, with or without some form of scheme ownership to the irrigating farmers, improves scheme performance, water distribution, and productivity, while saving public resources for agencies to carry out such tasks.

A major driver of this global endeavor was the growing recognition of farmers' own initiatives and capacity to take up irrigation, without public assistance. Studies on Farmer Managed

Irrigation Systems (FMIS), for example, highlighted how farmers constructed and maintained their own river diversions, intakes, canals and other infrastructure and developed highly effective and quite equitable ways of water sharing, for many centuries (Merrey, 1997; van den Dries, 2002). Farmers' own rule setting, fully tailored to local constraints and opportunities, and peer-control in enforcing these rules, appear generally more effective than rules imposed by outsiders (Ostrom, 1990; 1992).

Lack of 'sense of ownership'; inadequate operation and maintenance skills due to lack of participatory processes that facilitate training or the incorporation of indigenous knowledge into planning; lack of maintenance or spare parts of scheme machinery; and lack of access to input and output markets. From the perspective of the recipient communities, the main reasons for failures are limited or lack of community consultation, which precludes the inclusion of indigenous knowledge or local know-how in scheme planning and construction.

2.4. History of Irrigation

2.4.1. History of Irrigation Practice in Ethiopia

According to Zewdie et al. (2007) irrigation has been practiced in the Nile Valley for a long period of time. Ethiopia has a long history of traditional irrigation systems. Simple river diversion still is the dominant irrigation system in Ethiopia.

There is no documented history of water management for agriculture. Remnants of old water storage structures for non-agricultural use around Axum in Tigray show the oldest usage of water in a controlled manner. However, there is no well documented resource material on water use for irrigation in Ethiopia. Modern irrigation development in Ethiopia is not having centuries old history. There is no written history on how Ethiopia has used irrigation technologies to secure agricultural production. Irrigation is an ancient practice in Ethiopia, as an integral part of agriculture, dating back several centuries while modern irrigation was started at the beginning of

the 1950s by private and government owned schemes in the middle Awash valley where big sugar, fruit and cotton estates farms are found (FAO, 1997).

The main purpose of irrigation development in Ethiopia was to provide industrial crops to the growing agro-industries in the country, many of which were established by foreign investors, and to thus also boost export earnings. Initially, irrigation was seen as part of the modernization of the country's agricultural economy.

Private concessionaires who operated farms for growing commercial crops such as cotton, sugarcane and horticultural crops started the first formal irrigation schemes in the 1950s in the upper and lower Awash Valleys. In the 1960s irrigated agriculture was expanded in all parts of the Awash Valley and in the Lower Rift Valley (Metaferia, 2004).

Although drought and famine were also regularly occurring during the imperial regime, the government did not consider irrigation development as a way of mitigating drought induced famine (Teshome, 2003). In the 1980's with the recurring cycle of drought and environmental hazards, the need for small scale irrigation development expanded to other parts of the country to address drought and food shortages, and the need for more food for the internal market.

During the Derge era, private farms were nationalized to establish the so-called state farms, thereby ending the embryonic private sector. The government pursued the development of medium and large-scale irrigation schemes in a number of river basins in addition to expansion in the Awash Valley. The Amibara Irrigation Project in the Middle Awash, Alwero Irrigation Project in Gambella, Gode-West Irrigation near Gode town, the Omorrate Irrigation scheme in Southern Omo, the Tana Beles, the Fincha Sugar State, etc are some of the expansions.

Irrigation development, including large and medium scale irrigation development, as public schemes, commercial farming and for small holders are getting importance under the current government, particularly since 2004 (Metaferia, 2004).

As strategy of developing irrigation sector, the plan of the government targets to develop a total of additional 274,612 ha of land which brings the total irrigated area of about 478,000 ha by 2015. There is a growing attention to the irrigated agricultural sector. The revised strategy even plans to put more irrigated land in short period of time.

Small-scale irrigation is a policy priority in Ethiopia for rural poverty alleviation and growth (MOFED, 2006), as well as climate adaptation (GoE, 2007). Only around 5% of Ethiopia's irrigable land is irrigated (World Bank, 2006), and less than 5% of total renewable water resources are withdrawn annually (FAO, 2005).

2.4.2. Irrigation Status in Ethiopia

The total area under small-scale irrigation (only in the Amhara region) is about 75,785 ha in 2001 and this has showed a steady increase in both yield and area coverage. The yield per unit area also showed a 28% growth in the region. Compared to the reports by Wondimkun and Tefera (2006) these figures are high. The total 6,219 small-scale irrigation schemes, which cover a total of 76,131 ha of irrigated land, exist in the region.

Small-scale irrigation schemes are labor intensive; less environmental impact (e.g., does not require big dam construction) makes the small-scale irrigation to be one of the techniques for water management in the Blue Nile Basin (Awulachew 2006).

Erosion, sediment transport and sedimentation are critical problems/challenges in the Blue Nile Basin. The problems are compounded by a range of factors, not only related to the hydraulic properties of the river, but also to various social, institutional and political problems. Erosion and sediment problems are strongly related to land use policy, natural resource management, level of development, degradation and deforestation of the basin as well as cultivation practices, conservation measures, etc.

2.4.3. Classification of Irrigation Schemes in Ethiopia

The classification in this document is based on the size of land area irrigated, MOWR (2002).

A) Traditional Irrigation

Traditional schemes – schemes which are developed and managed by community traditionally and usually characterized by non fixed structures and practiced traditionally. They are generally well organized and effectively operated by farmers who know each other and are committed to cooperating closely to achieve common goals.

B) Small-Scale Irrigation

Small-scale irrigation schemes in Ethiopia are understood to include traditional small-scale schemes up to 100 ha and modern communal small-scale schemes up to 200 ha.

C) Medium and Large-Scale Irrigation

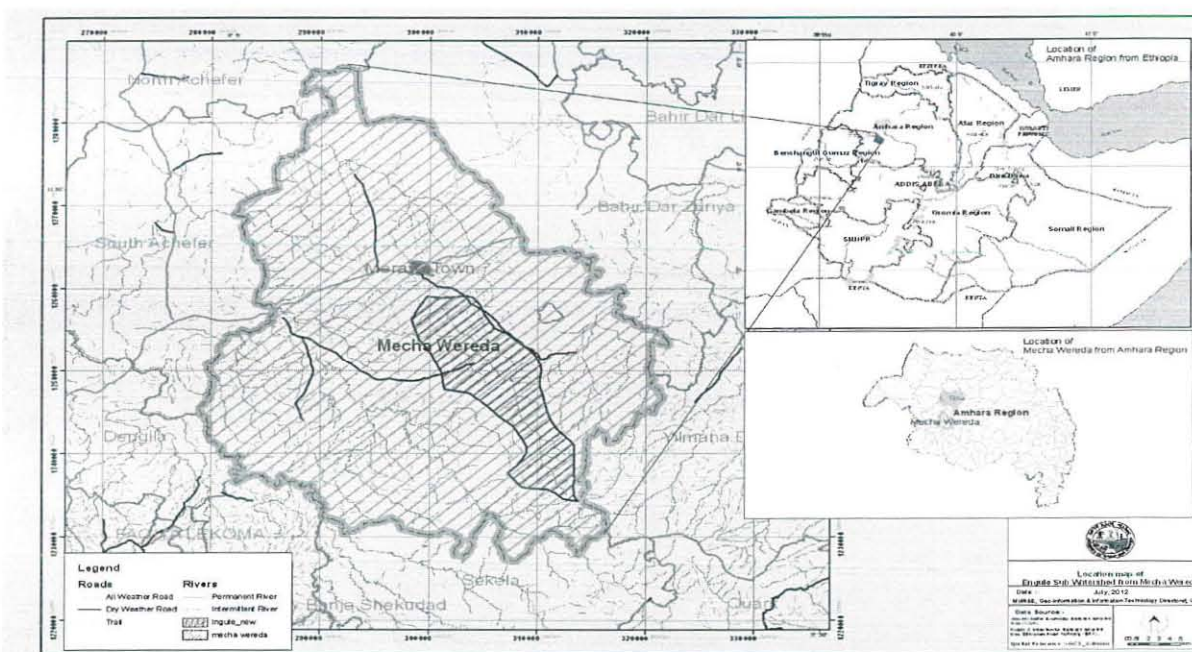
Irrigation projects in Ethiopia are identified as medium-scale if it falls in the range of 200 ha to 3,000 ha and large-scale irrigation if the command area is greater than 3,000 ha.

CHAPTER THREE

3. MATERIALS AND METHODS

3.1. Description of the study area

The study area, Koga irrigation development is located in Mecha Woreda, West Gojam Zone of Amhara National Regional State about 35 km South West of Bahir Dar, capital city of the Regional State and 520 km from Addis Ababa.



Source: ANRS Water Resources Development Bureau

Figure 1: Map of Mecha Woreda

The Koga Irrigation development scheme was constructed by fund obtained from African Development Bank (ADB). The dam is constructed to store and collect water from the Koga River. It is located in the Koga River Valley and is a large-scale scheme within the Amhara Region of the Blue Nile Basin. It involves a dam (21.5 m high, 1,860 m in length and 83.1

million cubic meters volume) and a reservoir submerging 1,859 ha of grazing land. The command areas of Koga lie some kilometers to the west of Merawi town.

The Koga River is the source of irrigation water for the schemes. It is a perennial river having reliable water discharge throughout the year. The dam is constructed along the river within a 22,000 ha catchment area with a reservoir area of 2,000 ha, has an estimated annual gross water storage capacity of 83.1Mm³. The life time of the dam is 50 years.

The study area is about 3-7 km away from Merawi Woreda. According to the information obtained from the Woreda, the area of Koga irrigation schemes cover about 8,000 ha, including the non-irrigable area. Its elevation is about 1900 meters above sea level. The annual rainfall distribution in the area ranges between 1,520.16 mm to 1578.3 mm and the mean annual evapotranspiration is about 1500 mm per annum. The monthly mean temperature ranges from 11.6 degree centigrade to 26.7degree centigrade. Latitude: 11.41 ° North, Longitude: 37.42 ° East. Currently, the population of the study area is comprised with in 8 Kebeles and is about 12, 000.

3.2. Methods of Data Collection

3.2.1. Sampling Design

Purposive sampling and stratified sampling techniques were employed as the major methods of sampling. In addition, random sampling methods have been used to draw sample households for interview survey from the stratified sampling frame. The sampling techniques were also used for the selection of key informants and focus group discussion members. The number of the interviewees depended on the size of the Water Group/ scheme and the number of members of that Water Group.

During the reconnaissance visit, discussions took place with two Agricultural Experts, one Cooperatives Organizer and Trade facilitator expert, and with the only dam and Watergate operator. The visited schemes are spatially distributed along the 12 IWUCs.

Interviews were carried out with three irrigation experts/ Agronomists from Koga Irrigation Development Office (KIDO) and from the Abay Basin Authority (ABA); two Watergate operators; from Agriculture Office; 3 Agronomists; one member of 'Ketena' Coordination Committee and water distribution groups; and the head of water committee; two irrigation water users/farmers and Development Agents (DAs) working on the irrigation schemes.

Focus group discussion was also carried out with village elders (two from each water users' group), who were believed to be knowledgeable about the irrigation activities and the existing problem. Both sex categories from each water group were included.

The selection of sample population for the household interview was carried out through stratified sampling followed by the random sampling technique. The researcher's intention was to include at least 10% of the irrigation user household heads in the sample population. The total number of households using irrigation in the schemes, this year is about 10,000. Hence, 10% of the 10,000 irrigation water users is too big. Instead of taking this exact calculation, the researcher found it more useful to decrease the percentage for the schemes as they are almost homogenous in their levelness (low sloped), fertility of the soil and level of access to water in the same blocks, make the sample size to 100 household heads; from each block 8 household heads ($8 \times 12 = 96$) plus 4 additional household heads from the largest schemes were been overviewed.

At the beginning, it was planned by the researcher to accommodate 15 female and 85 male beneficiary household heads but because of the less number of female household head in the irrigation activity; out of the total, 100 sample size (3 female and 97 male) household head respondents were selected. Thus, the total sample size of the household survey was limited 100.

3.2.2. Data Source and Methods of Data Collection

Both primary and secondary data have been gathered and used for the study. The research was conducted between January 2012 and May 2013 on the site at different times. The past irrigation water use trend was studied by asking farmers, sight agronomists (DAs) and experts from the Woreda water desk and agriculture offices. In order to undertake the household survey, to collect data four assistant enumerators, for general support were recruited from the surrounding area. They were trained how to handle their jobs. The help and the support of relevant professionals, experts were good.

3.2.2.1. Primary Data Collection

The main data source for the study was primary data. It was collected through structured questionnaire from randomly selected officials and experts working in the irrigation schemes and by questioning farmers from selected sample households. Discussion has been made with key informants including executive committee members of irrigation water user's cooperatives, DAs and experts from both agricultural and water bureau. The irrigation schemes have been visited.

3.2.2.2. Secondary Data Collection

Secondary data: information from books, articles, documents and journals were used as well to assess the problems encountered. Documents from concerned offices, such as Regional and Woreda Water Bureaus, Regional and Woreda Agricultural offices, Amhara Agricultural Research Institute, MoWE and different literatures from different related sectors were assessed.

3.3. Methods of Data Analysis

The portion of data that is readily quantifiable (information obtained from close-ended questions of the questionnaire) has been entered into the SPSS program and the result has been discussed using tabulation and cross-tabulation of variables with percentage values in descriptive statistics. In addition, information gathered by open-ended questions, key informant interviews, observation and focus group discussions with water users, DAs, FGD and the respective stakeholders, the process of analysis has been carried out by using qualitative approach.

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

4.1. Characteristics of the Respondents

In this section, demographic characteristics such as variables: sex, age, marital status, family size and level of education of sampled households of KIDO are discussed and summarized based on the data obtained from the field survey and questionnaires collected in the study area.

Table 1: Sample size for household respondents

Frequency Table

Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Male	97	97.0	97.0	97.0
Female	3	3.0	3.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Data from Table 1 shows that out of the total respondents 97% of them are male and the remaining 3% are female headed households.

Table 2: Household (family) size of the respondents

Family size	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Single	2	2.0	2.0	2.0
1-3	23	23.0	23.0	25.0
4-6	40	40.0	40.0	65.0
7-9	23	23.0	23.0	88.0
Above 9	12	12.0	12.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

From the sample household survey, Table 2, it is clearly seen that of the total, 40 % of the respondents have a family size ranging from 4-6, while 12% of the respondents have a family size above 9 members.

Table 3: Educational Status of Household heads

Educational status	Frequency	Percent	Valid Percent	Cumulative Percent
Unable to read and write	50	50.0	50.0	50.0
Only read and or write	30	30.0	30.0	80.0
Grade1-6	12	12.0	12.0	92.0
Valid Grade 7-10	2	2.0	2.0	94.0
Grade 11-12	2	2.0	2.0	96.0
Diploma and above	4	4.0	4.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

With reference to educational status (Table 3), it is clearly seen that 50 % of the respondents were unable to read and write, while 30 %, of the respondents were able to read and/or write and those 4% of the respondents are professionals having educational status of diploma and/or above.

Table 4: Membership of water user cooperatives (WUCs)

Membership	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	79	79.0	79.0	79.0
Valid No	21	21.0	21.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

From the total number of the respondents, (Table 4), 79% of them are members of the irrigation water user cooperatives, while the remaining 21% are not. The number of members is increasing day by day as farmers are aware of the advantages obtained by being member of the cooperative.

4.2. Water Governance

4.2.1. Water Allocation

The irrigation schemes get water from the dam constructed along the Koga River is the source of irrigation water for the schemes. It is a perennial river having reliable water discharge throughout the year. The irrigation water allocation issue comprises of components such as dam, canals, night storages, etc. These components are stated briefly as follows:

Canals

Water reaches to the schemes through different canals. There are different canals: primary, secondary, tertiary and quaternary canals. The Water Outlet Tower has an instrument called Program Lode Controller (PLC), which controls the intake tower hydro mechanical and electrical system of the dam. It is used to add or decrease the water. It has data recording system, a data base. It records the amount of water release. One can know how much water is released at which particular day or time since it was constructed. It can also record the type of operational problems occurred: at which time, the type of measures taken, etc are recorded.

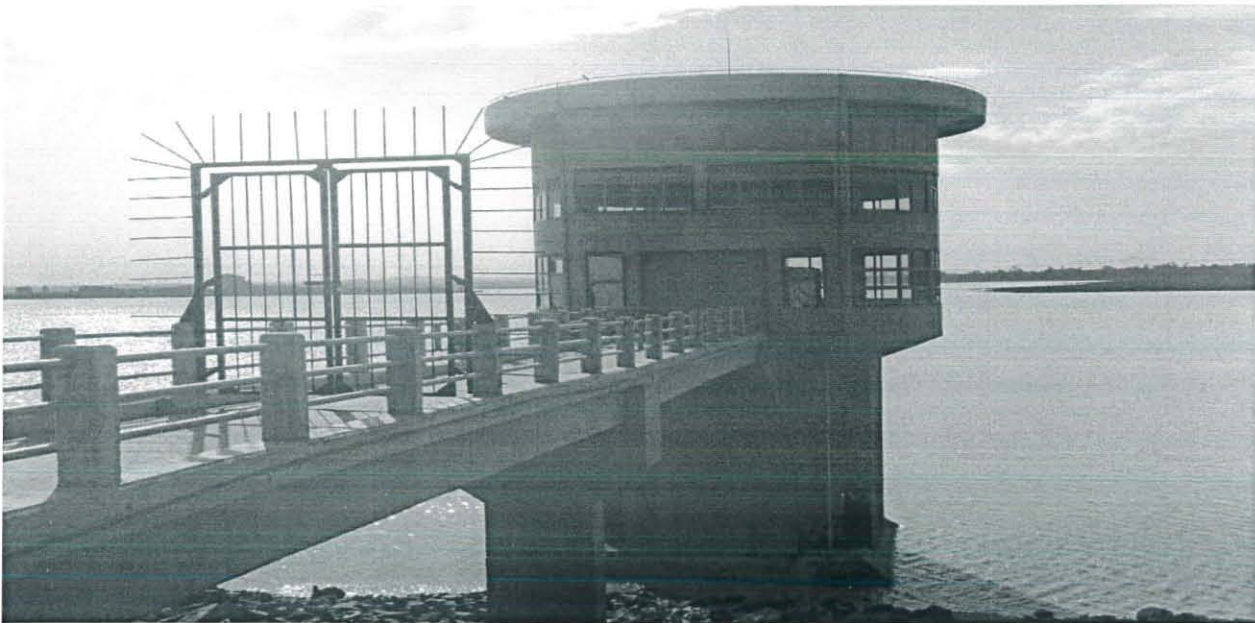


Figure 2: Water Outlet Tower

Main Canal

The length of main (primary) canal is 19.7 km. There are four gated cross regulator structures. The main canal is designed for 24 hours continuous supply when the irrigation is required. Main canals are lined with concrete mixture.

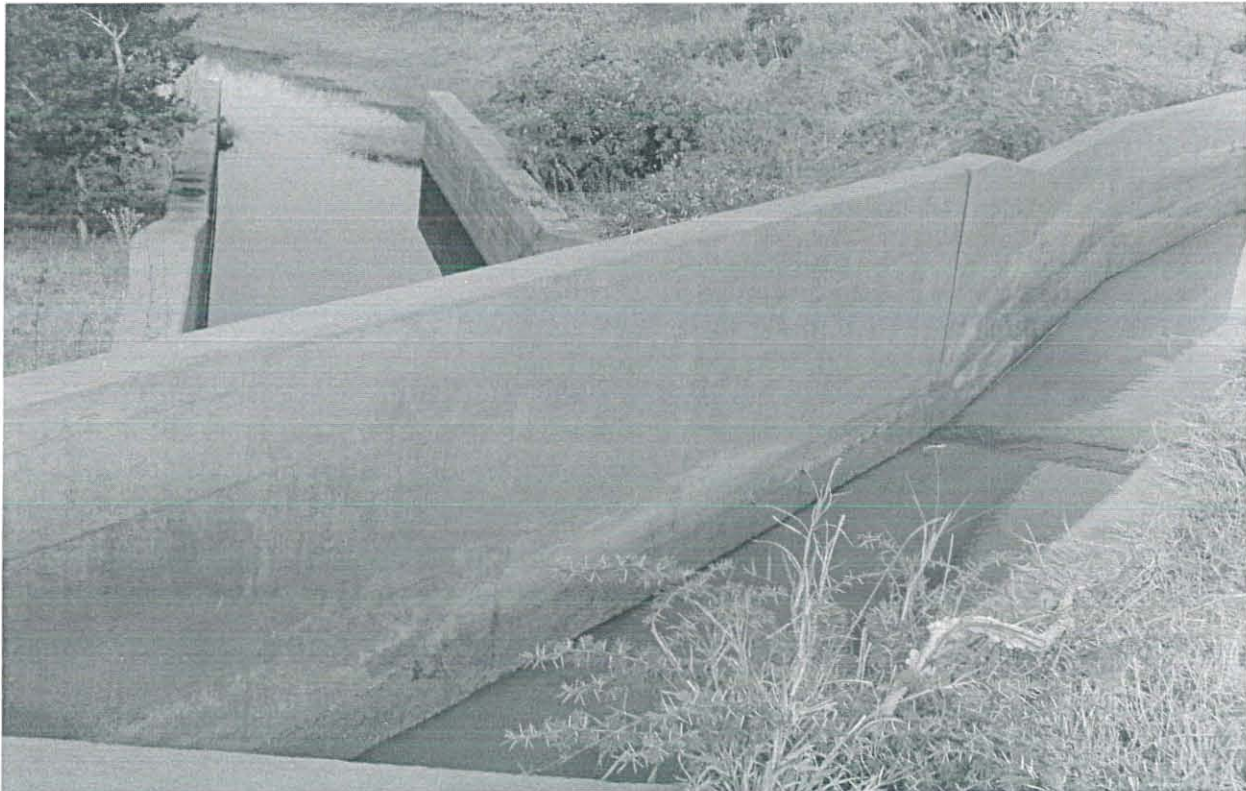


Figure 3: Lined Main canal

Secondary Canal

There are 12 secondary canals and their total length is 42 km. Secondary canals off- take from the Main Canal and night Storage Reservoirs; they deliver water to the individual command area. Secondary Canals are designed for 12 hrs irrigation supply at the downstream of Night Storage Reservoirs. They are lined with concrete mixture.

Night Storage Reservoir (NSR)

The collected water from the dam transferred through the canals and stored in the night storages. There are eleven night storage reservoirs and escape spill weirs. They collect and store water from secondary canals during the night time and release to the farm lands during the day time. Night storages have different storage capacity. The largest night storage has a capacity to irrigate 848 ha and the smallest one to irrigate 295 ha. The first night storage is located at the 3rd km where as the last storage is located at 19.7 km distance.



Figure 4: The Largest Night Storage Reservoir

Tertiary Canal

These canals start from Secondary canals (Tertiary canal head regulator) and deliver water to each tertiary blocks. Tertiary canals are designed for 12 hrs irrigation water supply. Some of the Tertiary Canals are unlined (not in concrete mixture).



Figure 5: Unlined Tertiary canal

Quaternary Canals

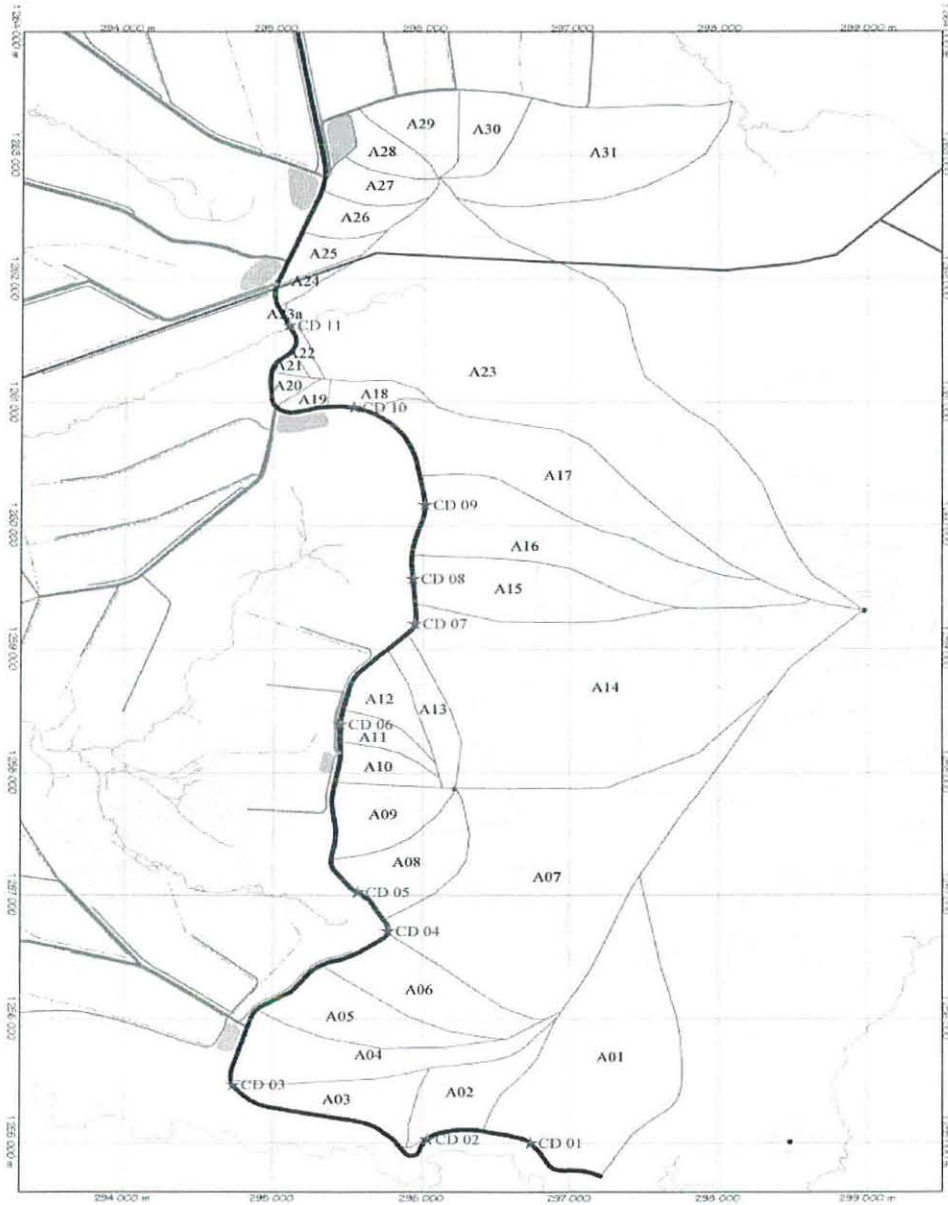
These are unlined cut of fill canals which off take from tertiary canals. They are designed to serve 8 hrs irrigation water supplies.

The Quaternary canals are being constructed / under construction by the Amhara Water Works Construction Enterprise (AWWCE). The construction started in December 2012 and it is expected to be completed by 2013/14. The length of the Quaternary canals is 783 km long.

Field Canals

Field canals off-take from quaternary canals and designed to serve an area of 2 hectares per one day irrigation time with a flow of 30 l/s.

Figure 6: Location of Main Canal Sub Catchments



Source: ANRS Water Resources Development Bureau

4.2.1.1. Irrigation Water Supply

Farmers get irrigation water directly from the night storages, not directly from the canals. During the night time, water is stored in the night storages. The stored water from these night storages will be distributed to the farmers, to the irrigation schemes during the day time. The process of storing and distribution of irrigation water continues in such a way.

Water Charge

From the household Survey interview and questionnaire results all, 100 % of the respondents answered that they do not pay for irrigation water charge for the irrigation water supply or service so far, except that they paid once Birr 130.00 for membership fee at the beginning. Water charge for irrigation water is being now studied.

4.2.1.2. Water Discharge

Totally, there are 469 discharge outlets in the schemes in which each outlet discharges 15 liters per second; paired outlets have a capability to irrigate 2 hectares of farm land for 12 hours. 90% of the outlets are serving to develop 16 ha every day. Each outlet is arranged in Water User groups. For one Water Group 16 ha is assigned. Each Group has 2 leaders: one Head and one vice leader.

Water in the quaternary canals is discharged daily 30 l/s / 2 ha /12 hrs. One quaternary canal (QC) has a capacity to irrigate 2 ha daily; within 8 days interval it can develop / irrigate (2x8=) 16 ha of land. The maximum capacity of water release from the dam is about 9.1 m³/ s but for the existing 7,004 ha farm land, 8.5m³/s irrigation water release is enough, on duty.

4.2.1.3. Water Distribution

Water distribution schedule was designed earlier by the water bureau, but at the present time it is prepared by Koga Irrigation Development office (KIDO). According to the interview held with KIDO officer, Ato Worku, the amount and time or duration of irrigation water distribution is based on the average size of individual's farm land, hectare-based. One who owned *1Kada*^{*}, which is equivalent to 0.25 ha, the smallest land hold, gets a 3 hour water distribution, and one who owns 4 Kada (one hectare) gets a 6 hrs; one who owns 2 hectares of land gets the maximum water allocation, a 12 hours distribution. The irrigation water is distributed to the schemes within 8 days interval according to the schedule. The farm land holding size of farmers ranges from 0.25 ha to 3 ha; most of the farmers, in average have 0.5 ha land.

Irrigation water user cooperatives are grouped in 'Ketana' and 'groups'. The 'Katana leaders' and group leaders have the list of water users and the schedule which describes that who gets, how much water, and when to get the water. Farmers also know their turn when to get water, when to irrigate.

*'Kada' * is a local unit, which is equivalent to: 1 Kada= 0.25 ha, 2 Kada=0.5 ha, 4 Kada=1 ha*

4.2.1.4. Water Shortage and Water Loss

Water Shortage

From the project document, the amount of irrigation water of Koga River is more than enough to irrigate the existing 7,004 ha farm land, thus, there is no water shortage.

Table 5: Availability of water on the schemes at a required time

Water Availability	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	80	80.0	80.0	80.0
Valid No	20	20.0	20.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

From the survey results, Table 5, it is clearly seen that 80 % of the respondents responded that irrigation water reached on their schemes at a required time while 20 % of the respondents answered that it did not reach on their schemes at a required time because of different reasons. Those of the 20 % respondents are among those rare end-users, like Teleta, Andenet, Amarit Blocks. The water at the rare ends of Ambo-Mesk Block reaches lately.

Table 6: Reasons for unavailability of water on the schemes

Reason for water problems	Frequency	Percent	Valid Percent	Cumulative Percent
Shortage of water	16	16.0	16.0	16.0
Valid There is no program	27	27.0	27.0	43.0
Mismanagement	57	57.0	57.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Table 6 illustrates that 57% of the respondents responded or assumed that the reason for water reaching late on their schemes is mismanagement issue of the responsible bodies or officers; while 27% of the respondents responded that the existing poor program/schedule or lack of good program is the reason for water reaching late. 16% of the respondents responded as there was shortage of water.

Table 7: Users' feeling on fairness of irrigation water distribution

Fairness on distribution	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	76	76.0	76.0	76.0
No	24	24.0	24.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Data in Table 7 shows that 76% of the respondents believe that the irrigation water distribution is fair, while 24% of the respondents responded that it was unfair. These (the 14%) respondents are of Amarit and Teleta Blocks' dwellers, the last Blocks (tail-end users), who get less water distribution. At Ambo-Mesk Block water also reaches lately. The unconstructed QCs and the distant of their farm land from the NSR were considered as the reason for the unfairness.

Water Loss



Figure 7: water loss in transferring from tertiary canal to the farm land

Table 8: Existence of water loss

Water loss	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	23	23.0	23.0	23.0
No	77	77.0	77.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

According to the data from Table 8, most of , 23 % of the respondents believed as there was a water loss in transferring from the QCs to the farm lands and the remaining 77 % of the respondents believed as there was no water loss at all. The researcher during his field visit had observed some water loss during water transfer and when irrigating as seen in Figure 7.

The implementation and administration of water allocation is done by the KIDO. According to Ato Worku, KIDO coordinator, at the beginning water loss was observed because of farmers' lack of awareness and lack of irrigation experience, but now farmers are aware of it and develop sense of ownership; it is decreased. The researcher observed water loss.

Causes for Water Loss

From the discussion held with AARI senior expert, Agronomist; Ato Minilik Getaneh and experts from KIDO and with farmers; the causes for water loss in the irrigation schemes are summarized as follows:

- ✓ Evaporation,
- ✓ Infiltration,
- ✓ Unlined quaternary canals (not in a concrete mix),
- ✓ The characteristics of the furrow: length, width, depth, etc are not the same throughout the schemes;
- ✓ Farmers' limited irrigation skill and lack of training (irrigation management)
- ✓ Farmers trial to irrigate from the tertiary canals,
- ✓ Leaving/abandon the irrigated water after using the water,

-
- ✓ Over usage,
 - ✓ Misuse/ Mismanagement,
 - ✓ Silt problem in the dam
 - ✓ Lack of/ less appropriate penalty measures

Water Loss Controlling Mechanisms

Appropriate penalty:

- ✓ If one is found pouring water unnecessarily and illegally, the water system to that particular Quaternary Canal, which is the cause for water loss will be closed completely from the slave that supply to that farm land; and as a result that group will not get water for some times. Water loss will be controlled in such a way.
- ✓ If one is using excess water beyond his share, he/she will be penalized by the rules and regulations of the cooperatives. If the offence is repeated, the offended individual even will be discharged, purged out from the cooperative.
- ✓ Canal clearing is so far conducted every year after the end of the rainy season by the budgeted money by hiring daily laborers. Farmers participate in some QCs clearing and remove silt from canals in order to control silt problem and the overflow of water out of the canals, to secure water loss.

4.2.1.5. Water Effectiveness

On the project document, at the beginning it was planned to cultivate 6,000 ha using irrigation but currently 7,004 ha is cultivated, hence in the case of cultivated area coverage it is achieving more than planned. The crop water requirement of different crops in the study area was clearly specified in the project document, but practically it is not yet implemented. Gross irrigation water requirement and crop water requirement are not yet considered and implemented so far.

The performances of water efficiency and water loss are not being measured, no measuring devices are installed; such system is not yet structured. So that Effectiveness is not achieved.

From the field observation and discussion held with AARI Agricultural expert Ato Menilik Getaneh, Ato Kaleb and with key informants, the distribution of irrigation water is inefficient/not effective. According to Ato Minilik, because of uncoordinated offices, lack of management/mismanagement and farmers' irrigation experience, water loss is observed when irrigating; generally there is no such efficient water use management.

4.2.1.6. Water Use Conflict

According to Ato Worku, KIDO coordinator, at the beginning of the irrigation development, due to lack of awareness and lack of farmers' irrigation experience, some water use conflicts were faced, but now it has become decreased; and it can be said almost there is no water use conflict. Because of structural problem, farmers located at the rare end of the scheme faced some water shortage problem, because of unconstructed QCs.

Table 9: The existence of conflict between water users

Water Conflict	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	32	32.0	32.0	32.0
Valid No	68	68.0	68.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

From table 9, it is clearly seen that 68% of the respondents answered as there was no water use conflict; while the remaining 32% responded as there existed conflict between water users related to water issues; conflict arose from time interval or overlap of farmers' water turn time.

Table 10: The causes of conflict between water users

Causes of water conflict	Frequency	Percent	Valid Percent	Cumulative Percent
Scarcity of water	12	12.0	12.0	12.0
Valid Lack of program, Mismanagement	19	19.0	19.0	31.0
Other	69	69.0	69.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

From table 10, The reason given for the causes of water conflict by 69 % of the respondents under 'other' category, was inefficient committee members of the water group and the unstructured canals, 19 % of the respondents raised lack of appropriate schedule and mismanagement as a cause; and the remaining 12 % responded scarcity of water as the cause of water conflict between users.

Table 11: Reasons for the water loss

Reasons for water loss	Frequency	Percent	Valid Percent	Cumulative Percent
Inefficient Distribution Department	4	4.0	4.0	4.0
Valid Misuse	18	18.0	18.0	22.0
other	78	78.0	78.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

As it is clearly seen, Table 11 illustrates that 78% of the respondents responded under 'other' category, to express the unstructured canals that can cause water loss and the loss in transferring from QCs to the farm lands, while 18% of the respondents answered misuse as one of the reasons for water loss and the remaining 4% marked inefficient distribution as the reason for water loss.

According to Ato Kaleb, Civil Engineer, consultant, the characteristics of the furrow: length, width, depth, etc are not the same throughout the schemes; they did not follow scientific method. There must be specific standard throughout the schemes. If not, water will not flow smoothly in its path, it may flow out of the canal, etc, and in general it will result in a water loss.

Figure 8: Interview with KDIPO coordinator

Interview with Ato Worku, KDIPO coordinator

KDIPO prepares the irrigation development physical and financial plan of the project through discussion with the farmers' cooperatives in each irrigation blocks; Prepares irrigation land use plan in each year, considering the water availability in the Dam; Prepares irrigation water scheduling and follow up its implementation with the irrigation water use cooperatives; Prepare cropping pattern and cropping calendar with each block, primary irrigation water use cooperative with the community. At the beginning of the irrigation development, as irrigation was a new trend for the surrounding framers, because of lack of awareness and lack of irrigation experience of the farmers, some water use conflicts were faced, but now it has become decreased.

Conflict Resolution Mechanisms

When irrigation water related problems arise: such as water theft, using water out of the schedule, when one losses water irregularly, etc, there are elected elders by the community to resolve water related conflicts.

Such water related problems and conflicts will be settled and controlled by a committee comprises of elected elders from each water group. They communicate the one who offended and they can put penalty accordingly, give comments and decision to the problems.

Table 12: Technical problems encountered in the irrigation schemes

Technical problem	Frequency	Percent	Valid Percent	Cumulative Percent
Lack of adequate spare parts	1	1.0	1.0	1.0
Lack of technical skill	2	2.0	2.0	3.0
Inappropriate design	21	21.0	21.0	24.0
Valid Inappropriate technology	3	3.0	3.0	27.0
All of these	4	4.0	4.0	31.0
Other	69	69.0	69.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Table 12 illustrates, 69% of the respondents responded under the ‘other’ category, for instance, the unconstructed quaternary canal as one of technical problem encountered in the irrigation schemes. Those who responded as there was inappropriate design are the rare end water users, such as Amarit Block. (the researcher also observed water over flowing in some canals); 21% of the respondents answered inappropriate designs affected the irrigation water distribution by hindering the water in reaching to the farm land which causes conflict between users.

Table 13: Management problems in the irrigation scheme

Management problem	Frequency	Percent	Valid Percent	Cumulative Percent
Poor coordination by water committee	40	40.0	40.0	40.0
Rotation is not strictly implemented	3	3.0	3.0	43.0
Valid Lack of punishment against illegal water users	2	2.0	2.0	45.0
Water theft	1	1.0	1.0	46.0
Other	54	54.0	54.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

According to the data from Table 13, and discussion held with professionals working in the schemes, 54% of the respondents responded under ‘other’ category, the different types of administrative

problems and lack of coordination between the Agriculture and Water offices, while 40% of the respondents answered poor coordination of water group committee members/ Ketana Leaders was one of the management problem encountered in the schemes. Water theft was observed at the beginning of the development but now as farmers are aware of it and because of punishment against illegal water users it is not observed further.

4.2.2. Agriculture

The agriculture office, KIDO is responsible to prepare water schedule for the water distribution. Each farmer prepares his own house hold agricultural, irrigation plan: considering how much, what kind of crops, when and how much labor to be used and/ or purchased from the market, his input availability, etc related to/ his capacity to produce. The sum up plan of farmers will be collected and sent to the Agriculture office. Based up on the schedule, the required water demand will be evaluated and commented by Sight Agronomists (DAs) and finally the allotted, monthly, amount of water will be released. It is prepared and manipulated by KIDO.

DAs work closely with farmers; offer them technical advice and also supplies with the necessary inputs and services. The main aim of extension program is to initiate change to bring about sound agricultural development. Agricultural extension is therefore used as a tool for rural development. But they don't have special training in irrigation water management that enables them to provide proper advice to farmers. The development agents also complain that they have no clear job description.

4.2.3. AAbbey Basin Authority

Abbey Basin Authority (ABA) is established by law, by the Ministry of Water and Energy (MoWE) as a public institution. Its office is based at Bahir Dar. It is responsible to manage, operate and maintain the Koga Irrigation and Watershed Management Project. It also manages the overall water resource development and management in the basin. The institution controls the dam, main canal, secondary canals, night storages, major access road and major drainage

structures. The center has been organized in a way as to follow the operation, maintenance and irrigation water delivery from the dam (reservoir), Main Canal and Secondary Canals.

4.2.4. Cooperatives

There are 12 irrigation Cooperatives established in KIWMP command area. The major aim of these irrigation cooperatives is to enable members to secure their household food. These Cooperatives are mainly managing the tertiary and quaternary irrigation structures and irrigation water use. It is stated in their document that they are responsible in coordinating their members in irrigation water use, operation, maintenance and marketing of farmers produces. They are also responsible in coordinating the overall production planning and scheme administration in their respective irrigation blocks. The Cooperative with the largest scheme has 992 water users and develops about 864 ha: while the smallest one has 318 water users and develop about 294 ha of land.

4.3. Values Added due to Irrigation

4.3.1. Crop Species and Productivity

4.3.1.1. Crop Species

After the introduction of irrigation development to the study area, the number of crop species used in the scheme has increased to 12 types of species. The common ones are: wheat, barley, sorghum, maize, Teff; vegetables: onions, carrots, cabbages, potatoes, red peeper, chilly, etc. Almost all farmers plant maize and barley. Most of the farm land is covered by barley.

4.3.1.2. Productivity

The types of crops cultivated and the productivity have increased compared with those crops cultivated without using irrigation. Currently, about 97% of the cumulative schemes (5,144 ha) is completely covered with crops. The remaining 3% are farmers who are less productive and incapable of cultivating crops regularly due to many reasons, such as lack of awareness, lack of oxen, etc.

4.3.2. Household Income Increment

After the introduction of irrigation in the schemes, the number of crop species and productivity has increased, accordingly the household income and the level of life standard of the household also increased. The household income obtained from sales of cash crops shows that there is an increasing trend in the study area. It indicates that farmers are becoming more interested in the production of cash crops as they are becoming aware of its importance. According to the discussion held with farmers, for example, with Ato Mola Yeneneh, stated as: “Now we are able to produce more crops and as a result we can sale more products and are able to get additional income for our families”.

4.3.3. Market Opportunity

Because of the increased number of crop species and productivity with the introduction of irrigation development, the number of items/ crop species to be sold in the market has also increased and this in turn has created market opportunity for those who have not job, and became a livelihood to those households.

4.4. Institutional and Organizational Arrangement of the Schemes

4.4.1. Institutional Arrangement

4.4.1.1. *Abbay Basin Authority*

Abbay Basin Authority (ABA) is one of the institutions established by law, by the Ministry of Water and Energy (MoWE) as a public institution and the basin office is based at Bahir Dar. The project was monitored by the MoWE; but now it is delegated to ABA to manage, operate and maintain the Koga Irrigation and Watershed Management Project.

The main objective of establishing ABA is to manage the overall water resource development and management in the basin. The institution controls 83.1 million m³ capacity dam (including the tower), 19.7 km main canal, 42.38 km secondary canals, 11 night storages, major access road and major drainage structures. It was established and started its operation in 2011 production season and has defined organizational structure. The main division in the KDIDC includes:

- Operation and Maintenance Division
- Plan, Monitoring and Evaluation Division
- Administration and Finance Division

The center has been organized in a way as to follow the operation, maintenance and irrigation water delivery from the dam (reservoir), Main Canal and Secondary Canals.

Currently, Koga Dam Irrigation Development Administration Center (KDIDAC) has 138 proposed professionals and local staffs; 44 of them are canal/Watergate operators, 3 of them are female and 50 guards. The gate operators are responsible to open, close and control water gates within the 12 irrigation blocks, irrigation canals and night storages. Three of them are stand by operators who control other operators and manage the distribution. The Watergate operators were trained on operation and management of the canal systems and night storages. These Watergate operators closely work with Water Users' Group (WUG)/ Ketena Coordination

Committee and water distribution groups (TL- Team Leaders). One water user cooperative will have minimum 2 and maximum 3 or 4 water gate controllers according to the size of farm land and the number of water users in that cooperative. Currently, there is only one, male, Engineer who is trained as dam/ gate operator, trained by Chinese experts to monitor and control water release/distribution from the dam to primary canal. There is also one additional, female Engineer working on irrigation water distribution, operation and maintenance of canals out of the schemes.

4.4.1.2. Koga Irrigation Development Office

Koga Irrigation Development Office (KIDO) is one of the institutions established by the Amhara Agricultural Bureau to manage and operate the KIWMP irrigation farming activities. The project office is based at Merawi town, near Bahir Dar, which is established and working actively since 2011/2012 production year.

The office incorporates 14 Agronomists, all male, of which 2 of them are senior Agronomists and 12 Sight Agronomists (DAs). There are two Water Users Organizational and marketing experts, both male Agronomists. Their responsibility is to organize and form Cooperatives, to facilitate and create trade ties, evaluate the performance of cooperatives' leaders and give corrective measures; for example, if there is illegal provision of water to farmers by committee members, they will be responsible to adjust the distribution to be fair.

The Management, Operation and Maintenance (MOM) of the Koga Irrigation and Watershed Management system are carried out at two levels:

- ☞ Government through a main system operator be responsible for the MOM of the dam and reservoir, night storages, main and secondary canals and drainage systems, associated road network, and
- ☞ Farmers through their irrigation water user cooperative (IWUC) be responsible for the MOM of tertiary and quaternary canals and drainage systems, including the field channels.

There are 12 command areas (Blocks) in the irrigation schemes; their names, net irrigable area and length of secondary canals of each command area is shown below, in Table 14.

Table 14: Command Areas and Net Area of the Schemes

No	Command Areas	Chaining along main canal (km)	Net Irrigable Area (ha)	Length of Secondary Canal (km)
1	Kudmi	3.238	373	0.875
2	Chihona	9.760	617	3.756
	Ambo Mesk	10.790	812	0.779
4	Adbera Mariam	11.030	803	7.186
5	Tagel Wedefit	11.940	616	8.054
6	Tekele Dib	Extended from Tagel Wedefit	864	2.505
7	Inguti	11.940	393	2.875
8	Lasi	13.780	484	2.641
9	Bered	14.900	468	0.868
10	Amarit	17.240	290	4.472
11	Andinet	17.240	497	5.530
12	Teleta	19.700	787	2.841
	TOTAL		7,004	42.382

Source: Abbay Basin Authority, March 2013 (Booklet prepared by Hibret Andualem)

4.4.1.3. Primary Irrigation Cooperatives

There are 12 primary irrigation Cooperatives established in KIWMP command area and they are at infant stage. In the project document, the major aims of these irrigation cooperatives are to enable members to secure their household food and promote crop surplus. These Cooperatives are mainly managing the tertiary and quaternary irrigation structures and irrigation water use. The Cooperatives are the responsible organizations in coordinating their members in irrigation water use, operation, maintenance and marketing of farmers produces. They are also responsible in coordinating the overall production planning and scheme administration in their respective irrigation blocks.

Due to lack of knowledge and experience of large scale- irrigation scheme management, Koga irrigation water users' cooperatives cannot be efficient in marketing and commercial activities of the project. Especially in 2011/2012 production year marketing of major crops in KIWMP was the challenging issues and beneficiaries were unable to maximize their income.

In order to overcome the marketing and related management problems Koga irrigation water users' cooperatives Union (KIWUCU) is established in June 2012. The union was established with the operation and joint collaboration of the primary cooperatives.

4.4.2. Organizational Arrangement of the Schemes

The scheme is organized based on the command areas (Blocks) arrangement. Each block has its own Irrigation Water User Cooperative (IWUC); i.e. totally there are 12 Cooperatives. These cooperatives formed one Union, named: 'Koga Irrigation Water Users' Cooperatives Union (KIWUCU)' but it is not yet well organized.

The formation of IWUCs is based on secondary canals organization. Each cooperative has its own committee members called 'Katana' Leader which comprises of from 7 up to 14 committee members (executive committees) according to the number of water users in that cooperative. For example, the biggest cooperative, named 'Adebra-Mariam' has 14 committee members; the smallest one, 'Lacy' has 7 committee members. Most of the cooperatives in average have 11 committee members. Each cooperative also has one unit leader and one vice unit leader.

The cooperative with the largest number of water users has about 992 members and the smallest has about 318 members. The number of members of water user cooperatives increases day by day as a newly registered farmers join the cooperatives. Every cooperative has its own water governance rules and regulations.

Few strong cooperatives, such as, 'Kudmi' have constructed their own office and stores. 'Kudmi' is the pioneer irrigation scheme in the study area as it is located near the dam. It is the model in its strong committee members and management unit, in constructing its own office, store, etc.

4.4.2.1. Operation and Maintenance

Operation

The dam, Main Canal and Secondary Canals are mandated and operated by the 'Abay Basin Authority' (ABA). Water administration, water release from the dam to the canals and, maintenance of the primary and secondary canals are also maintained by ABA. The management and administration of Tertiary (TCs) and Quaternary canals (QCs) is mandated to Koga Irrigation Development Office (KIDO).

The dam will be closed during the rainy seasons, from 24th of May up to 10th of October. On Octobers many, excess water will be released to the schemes for those who need water for their crops, as more irrigation water is not required; during this month, crops which need more water can get opportunity to enough water.

There are 44 standby canal / water gate operators who open/close and control the water gates, three of them are stand by online operators, who control other operators and manage the distribution and check the inflow and outflow of water during the night time. Gate operators work in the day time. When the water is closed, at 6:00 p.m., these three operators make the water supply full to the night storages. They check and decide which night storage needs what amount of water to be filled in order to make the night storages ready for the daily distribution. The canal gates are allocated in every/ between 100 meters distance.

The number of operators varies from 2 up to 5 according to the size of the schemes of the blocks and the number of water users. For instance, the larger Blocks, Tekle-Deb and Telta have 5 water operators each, while the smaller ones like Amarit, Enguty and Kudmi Blocks have 2 operators each. Secondary and Tertiary canals are operated by operators and QCs are controlled by farmers.

Maintenance

Maintenance and administration of the dam, primary and secondary canals are maintained by ABA; where as those of the Tertiary Canals (TCs) and Quaternary Canals (QCs) are maintained by KIDO. Canal clearing is performed annually by hiring laborers with the expense of the ABA budget. So far, canal cleaning was not performed by farmers with their cooperatives management coordinators/units in association with agricultural experts as was stated in the project document.

4.5. Factors Affecting the Irrigation Development

Table 15: Factors affecting irrigation development in the study area

Factors affecting Irrigation Development	Frequency	Percent	Valid Percent	Cumulative Percent
Marketing problem	48	48.0	48.0	48.0
Lack of adequate irrigation water	14	14.0	14.0	62.0
Poor management and operation of the scheme	6	6.0	6.0	68.0
Inadequate input supply	28	28.0	28.0	96.0
Low credit service	4	4.0	4.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

According to the data from Table 15, farmers rated the factors affecting Irrigation development in relation to prioritization of their importance; majority of the respondents (48 %) responded that marketing problem for their farm products is the major factor; while 28 % responded inadequate input supply such as fertilizers and pesticides; and 14 % of the respondents responded lack of adequate irrigation water as factors affecting the irrigation development in the schemes.

4.5.1. Constraints in the Irrigation Schemes

4.5.1.1. Lack of Coordination

As the irrigation scheme is newly formed, up to the year 2012 the responsible body of the scheme was not clearly defined; but now MoWE established the Abay Basin Authority (ABA) and gave the mandate and responsibility of KIDO to ABA.

According to Ato Marshet, Civil Engineer, MoWE, there is Institutional and Managerial related constraints; lack of coordination between the Agricultural office (KIDO) and the water bureau (ABA) in administrating the schemes. There is a gap and also overlap on level of duties and responsibilities of both offices. There is no clear demarcation of responsibilities stated clearly.

The distribution of irrigation water is performed by two different bodies. The water part, the main canal and secondary canals are managed and administered by ABA; while the agriculture part, tertiary and quaternary canals including the extension works are managed and administered by the agriculture office, KIDO. KIDO is responsible to prepare the schedule of water distribution but it is not well organized so that better schedule is not so far observed (interviewed Experts). Because of lack of coordination in planning: what to be cultivated in how much rate is not planned at all. Most of the farmers produce the same type of crops at the same time and perishable vegetables such as tomatoes, potatoes, etc.

Table 16: Irrigation Problems observed that influence the schemes

Irrigation problems	Frequency	Percent	Valid Percent	Cumulative Percent
Poor scheme management	6	6.0	6.0	6.0
Lack of fertilizers, pesticides	2	2.0	2.0	8.0
Valid Lack of market	91	91.0	91.0	99.0
Poor drainage system	1	1.0	1.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Table 16 illustrates that 91 % of the respondents responded lack of market to their farm produces is the major challenging problem that influence the irrigation development, as discussed in the FGD too; while 6 % of the respondents responded that poor scheme management was observed and 2 % of the respondents answered as there was lack of access to fertilizers, pesticides related to their price, they are not affordable (very expensive) especially in sowing seasons.

4.5.1.2. Market Ties

At the present time, the major problem in the study area is lack of access to market, which was expressed by all the respondents (100%): by all experts, key informants, in FGD and by both Agricultural and water office coordinators through interview.

All the 12 irrigation water users' cooperatives have got the status of legal entity from the Woreda Cooperatives' Promotion Office. Even though they formed the Union (KIWUCU), it is not well organized: has no enough capital and has no car to transport its members' produces.

Even though, one of the responsibilities of the Union is to assess market, it is not yet arranged and not well organized as it is newly formed so that committee members have no enough experience and are unable to undertake their responsibility properly. So far marketing strategies are not designed and structured at all.

Factors for market problem are:

- ✓ Lack of experience and poor coordination in and between corresponding offices,
- ✓ Unplanned, the same crops cultivated throughout the schemes can cause for price failure,
- ✓ Lack of own means of transport of the Water Users Union to transport farmers' products,
- ✓ Lack of large freezer stores that can accommodate many crops for a long period of time,
- ✓ Unconstructed market ties with different organizations.

4.5.1.3. *Water Distribution*

The agriculture office is responsible to prepare the schedule for the water distribution but it is not well organized so that better schedule is not so far observed (interviewed Experts). Although the crop water requirement of different crops is studied and written in the project document, water distribution is not based on crop water requirement, it is aimed only to attain the hectare coverage of individual's farm land size, which impacts on some types of crops that do not need excess water for their growth, in such crops the growth is disproportional, tall and short ones which results in none or less productive yields.

Early furrow water is very important for some crops in order to wetting the farm land ahead. Farmers need water for their farm land during early farm in order to preserve the land wet. Early furrow water need is not considered. Water is not supposed to release to such demands.

4.5.1.4. *Siltation Problem*

There is a high threatening silt problem. The water near the dam is very turbid. The land is bared. In some places of secondary canals cracks have been observed and this can cause to collect silt at those places and this in turn will cause the water to flow out of its bank, as a result this leads to water loss and conflict between water users.

4.5.2. *Constraints in Productivity*

4.5.2.1. *Input Supply*

Although the Union is mandated to provide farmers with the necessary inputs, as it is recently established, is not well organized and is not yet economically powerful, at the moment it is unable to supply and provide farmers with the necessary agricultural inputs, credit services and arrange markets. Farmers get inputs such as wheat, maize and potato seeds from Amhara Seed Enterprise (ASE) where as fertilizers are obtained from the previous Farmers' Associations.

4.5.2.2. Promotion of Proposed Crops

Crops that are expected or believed to be productive and market oriented, proposed crops are not yet introduced at all. Market assessment study and types of proposed crops were conducted by a certain consultant. Its draft report was prepared but not yet finalized.

From the discussion held with Ato Worku, KIDO coordinator, “As there are no alternative crops provided, farmers are not so far strictly forced not to plant forbidden crops such as ‘Dagusa’, which takes more time to grow. List of high value crops is not yet recommended as there are no alternative crops available”. ‘Dagusa’- family of ‘Teff’/(Teff-like crop) is not recommended, forbidden not to be planted in the schemes as they are taking about 6 months to grow; which hinders or does not allow farmers to cultivate 3 times within a year.

Table 17: Frequency of production using irrigation per year

Frequency of production	Frequency	Percent	Valid Percent	Cumulative Percent
Once	6	6.0	6.0	6.0
Twice	64	64.0	64.0	70.0
3 times	30	30.0	30.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

According to the data from Table 17, it is clearly seen, 64 % of the respondents produce twice in a year; while 30 % of the respondents responded as they produce three times through irrigation and the remaining 6 % of the respondents responded as they produce once in a year. Those who produced once in a year are because of their poorness, have no oxen and incapable to buy inputs.

Table 18: Farmers’ awareness on the existence of proposed crops

Awareness on Proposed Crops	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	24	24.0	24.0	24.0
No	76	76.0	76.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Figure 9: Interview at Amarit Block

Interview with Ato Amare Yeshaw (farmer)

In this regard, we are not aware of proposed crops, and no one advised me about it; simply Amhara Seed Enterprise (ASE) supplies us selected barley seed, after we cultivated it, the enterprise will buy us the resulted yield/crop with better cost, with some additional price than the market price; because of this most of the farmers produce barley and wheat but in this production year as most of the farmers are producing it and the result was not as expected, the price was not as such in the previous year, as the result many farmers are discouraged. Otherwise we cultivate any type of crops that we expect to be productive.

Source: Survey Results, 2013

Table 19: Reasons for not using proposed crops

Reasons	Frequency	Percent	Valid Percent	Cumulative Percent
I am not aware of it	36	36.0	36.0	36.0
Supply problem	62	62.0	62.0	98.0
other	2	2.0	2.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

The data from Table 18 and 19 show that 76 % of the respondents are not aware of proposed crops while, the remaining 24 % answered as they are aware of it and used to it; but these (24%) respondents are taking the barley seed supplied by the Amhara Seed Enterprise in to consideration; about the reasons for not using proposed crops 62 % of the respondents responded as there was supply problem and 36 % of them responded as they are not aware of it.

4.5.2.3. Gaps in constructing Quaternary Canals

Land leveling is one of the basic issues in irrigation schemes to compromise water management. In certain points of the canals, the leveling is not maintained, and not properly structured, which hinders water from reaching to the required farm lands and as a result it can cause and bring unfair water distribution, water loss and conflict.

Due to problems associated with the construction of quaternary canals (QCs), water is not reaching according to the schedule in some rare end users like Amarit Block; it takes the water about 5 hours to reach at these schemes so that farmers try to get water illegally by crossing the water from tertiary canals and this causes water loss, as shown in Figure 2.

4.5.2.4. Lack of Training

Table 20: Training obtained on irrigation

Training obtained	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	38	38.0	38.0	38.0
Valid No	62	62.0	62.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Table 21: The type of training obtained on irrigation

Type of Training obtained	Frequency	Percent	Valid Percent	Cumulative Percent
Irrigation water use	32	32.0	32.0	32.0
Valid Land use	10	10.0	10.0	42.0
other	58	58.0	58.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Figure 10: FGD on Training in irrigation

FGD in Tekle-Dib Block

Regarding to training, training is given to few selected individuals, especially for Ketena Leaders, some members also got repeatedly up to 3 consecutive times but no one will remember the majority farmers. According to Ato Mola Most farmers didn't get formal training; in the contrary few individuals get or attended continuously and they got up to Birr 700.00 at a single training session while he didn't get a single training at all.

Table 22: Duration/ frequency/ of training obtained on irrigation

Frequency of training	Frequency	Percent	Valid Percent	Cumulative Percent
Half a day	4	4.0	4.0	4.0
One day	5	5.0	5.0	9.0
2-5 days	16	16.0	16.0	25.0
Valid other	69	69.0	69.0	94.0
5.00	6	6.0	6.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Table 23: Getting Support from Development Agents (DAs)

Support From DAs	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	94	94.0	94.0	94.0
No	6	6.0	6.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Table 24: The type of support obtained

Type of Support	Frequency	Percent	Valid Percent	Cumulative Percent
Advice/consultation	77	77.0	77.0	77.0
Training	16	16.0	16.0	93.0
Valid Equipments	3	3.0	3.0	96.0
other	4	4.0	4.0	100.0
Total	100	100.0	100.0	

Source: Survey Results, 2013

Regarding training and type of support obtained from DAs, (Table 20-24), 62% of the respondents answered as they didn't get any type of formal training where as 38% of the farmers answered as they were trained in water and land use management. Farmers trained by Agricultural experts and DAs. What the farmers said training is the type of consultation obtained when they gathered in the form of collective manner. According to the discussion held with some farmers, for example, with Ato Mola, most farmers didn't get formal training; in the contrary few individuals got or attended continuously. 58% of respondents answered as they got training in the form of consultation; 32% of them on irrigation water and the remaining 10% in land use management and some farmers were trained in improved cropping practices.

Most farmers, in the study area, do not have irrigation practice at all and very few of them have less irrigation practice. Most farmers are not given enough training and are not aware of the scientific land use and irrigation water management.

Training is given to farmers in two different ways: formally and informally. Formal training was given for the top and medium level leaders once at least once in a year on water use management, operation, agronomic experiences in weeding, cultivation and crop harvesting. Some types of trainings were given to some selected farmers; that is not enough.

Most farmers were given informal training when they gathered in different collective ways, like in the churches, Edirs', etc. which is not sufficient. It was mostly given by extension workers in the schemes but they are not well experienced. The type of training offered to farmers include: crop management, water use management, about the use of organization in cooperatives, etc. Crop management training includes the type of crops to be planted at which time, in what content, etc are incorporated. Trainings on Crop irrigation management and irrigation water application are given by agricultural experts.

4.6. Interventions for Sustainable Irrigation Development

4.6.1. Research Centers and Others Contribution

Research centers in the region, such as the Amhara Agricultural Research Institute (AARI), Amhara Seed Enterprise and Adet Institute of Agricultural Research Center which are responsible to carry out research on crops participate in the study area.

4.6.1.1. Amhara Agricultural Research Institute

AARI has taken plots of farm lands from Koga Irrigation schemes to undertake research on different seeds working on four components in order to help farmers and increase productivity. They are undertaking researches, specifically in Adaptation, Fertilizer limitation, Irrigation water requirements and multiplying selected seeds. AARI also carries out researches in its research center too. The farmers will be invited to observe these selected seed products and to choose that they thought to be the best ones. The process of multiplying and distribution of these selected seeds to the farmers were started this year, 2012/13.

4.6.1.2. Adet Institution of Agricultural Research Center

AIARC has also taken some plots of land from Koga irrigation scheme in order to undertake research on selected crops to adapt, multiply and to distribute the result products back to the farmers and to improve the productivity and to increase production yield. The center is currently undertaking research on selected barley seeds for beer production.

4.6.1.3. Amhara Seed Enterprise

ASE provides farmers with selected wheat and barley seeds and received back, buys the result/output product from the farmers. In order to encourage farmers to produce the selected seed in their farms, the enterprise buy them with additional 15% cost of the market price. The Enterprise

receives the undamaged ones, selects and after packing the products, it distributes the seed to other farmers within the regional state; that's why most of the farm lands are covered with. Farmers are introduced and started to plant crops in line to increase productivity and to use inputs efficiently.

Others Contribution: a certain foreigner has taken about 50 ha plots of land to undertake research on different selected vegetables and crops using modern, well equipped technologies, pesticides and necessary inputs. The yield is very attractive. It would be taken as a bench mark. Farmers will share experience from it and it also initiates them for further development.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The study revealed that the irrigation schemes have been challenged by a number of constraints among which are agronomic, organizational and managerial ones. The findings are summarized as follows:

Because of the unorganized Irrigation Water User Cooperatives Union (IWUCU) the following problems are observed; One of the major and critical problems currently observed in the study area, in which expressed by all the respondents, all experts, key informants, by both Agricultural and the water office heads is lack of market to agricultural products; it is yet not organized; Irrigation Water User Cooperatives (IWUCs) are unable to provide farmers with the necessary inputs and credit services. Absence of saving habits and lack of storage facility are observed problems in the schemes.

There is lack of coordination between the Agricultural office and the water bureau (ABA) and there is also overlap and a gap between shares of responsibilities. Because of unorganized water schedule, arose claims in the distribution between rare end users. The mandate and responsibility of Abbay Basin Authority (ABA) are overlapping with that of the KIDO, both offices are responsible to administrate the irrigation development. The water part, the dam, main canals and secondary canals are administered and managed by ABA where as the Tertiary and Quaternary canals and the agricultural part are administered by KIDO but the system is interlinked.

The existing hectare-based water distribution impacts on some types of crops that do not need excess water for their growth, in such crops the growth is disproportional, tall and short ones which results in none or less productive yields.

Water loss is observed because of unconstructed quaternary canals; farmers try to get water illegally by crossing the water from tertiary canals, as shown in Picture 2.

Most farmers do not have irrigation practice at all and very few of them have less practice. Farmers are not given enough training and are not aware of the scientific crop water requirement and irrigation water use management.

5.2. Recommendations

Based on the findings of the study, in order to achieve the objective, to sustain community- based irrigation development; the following recommendations are forwarded:

In order to overcome the market problem:

- ☞ ABA has to organize strong institution (or KIWUCU), with committed, dedicated committee members who have developed sense of ownership, must be established. Great market ties with governmental and public organizations such as hospitals, super markets, universities and colleges should be created as a short term plan and by far install agro-processing plant in/around the scheme; it is also responsible to arrange and to coordinate the Agricultural office and the water bureau and make clear share of responsibilities and avoid overlaps.
- ☞ The Union has to have its own transport truck in order to transport its products to the nearby town markets. If these, the recommended options are fully utilized I think the prevailing market problem will be solved or minimized and will bring a significant change. Temporarily, if big metal wooden containers that can be used as a daily market shop along the major asphalt road side to Bahir Dar, one at Merawi Woreda, and other two containers in the selected areas at Bahir Dar, to acquaint their product to the public at large, could make their products familiarized by the public and will get better market opportunity;

-
- ☞ Water distribution must be based on schedule, the type of crop and its water requirement, must not be to attain the hectare coverage of the farm land size. (Crop water requirement study for each crop type was studied in the project design report; but it is yet not practical); as there is no water shortage early farming water distribution should be encouraged accordingly and incorporated with the schedule, the type of crops as the farmers' plan to grow for the near future.

 - ☞ To protect the dam from siltation watershed: soil and water conservation activities should be facilitated and must be continual. Canal clearing must be performed regularly at least once in a year; create awareness and develop feeling of sense of ownership between farmers; participate them in the activity and award them for their better performances and achievements will create competition between among them and creates sense of ownership.

 - ☞ Farmers' skill must be supported by providing training through capacity building department. They should be trained and get basic irrigation skills; be aware of land and water use management, soil and water conservation and irrigation related trainings.

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Appendices

Appendix I: SURVEY QUESTIONNAIRE

Appendix 1

SURVEY QUESTIONNAIRE

ADDIS ABABA UNIVERSITY SCHOOL OF GRADUATE STUDIES
COLLEGE OF DEVELOPMENT STUDIES

Part I: Questionnaire to be filled by Water Users (WUs)

The main objective of this study is to assess the performance of irrigation water use management in a community-based irrigation schemes. This questionnaire is prepared to undertake a study, *assessment of community-based irrigation water use management, in Koga Irrigation Scheme*. The purpose of the questionnaire is to assess and gather information about:

- the previous and the current water use trends and its impacts on water resources;
- the major constraints encountered in the irrigation water use management;
- the critical factors affecting the successful implementation of irrigation development.

The aim of the study is to assess the current irrigation water use and to identify problems on the water use management in the irrigation schemes and to recommend the appropriate measures. The research is conducted for M.A Degree in Development Studies at the College of Development Studies of Addis Ababa University. The study is conducted only for the academic purpose and be sure that the information you provide will only be used for this research.

Dear respondents, the result of this study will help different stakeholders and policy makers to make appropriate measures on irrigation development in the future. Your responses are confidential. Therefore, you are kindly requested to provide genuine response.

Thank you for your time and cooperation!

Identifications

1. Name of interviewer _____
2. Date of interview _____
3. Household head name: _____
4. Name of Kebele/ WUA _____
5. Village/ 'Got' _____
6. Name of Water Users Association (WUA) _____
7. Questionnaire identification number /Code _____

March 2013

Part 1: Background Information (General personal data of the members):

Circle the corresponding number of your choice

1. Sex? 1. Male 2. Female
2. Age (in years)? 1. 18-25 2. 26-35 3. 36-45 4. Above 45 years
3. Marital status? 1. Single 2. Married 3. Divorced 4. Widow 5. Separated
4. Household (family) size? 1. Single 2. 1 – 3 3. 4 – 6 4. 7 – 9 5. Above 9
5. Educational status of the House holder:
 1. Unable to read and write (illiterate) 4. Grade 7-10
 2. Only read or/and write 5. Grade 11-12
 3. Some Primary school (1-6 Grade) 6. Diploma and above

Part II. Irrigation Water Use Management / Water Governance

6. Are you a member of water users associations (WUAs)? 1. Yes 2. No
7. What significant benefits you got by being a member? 1. Training 2. Salary 3. Additional irrigation water 4. Agricultural equipments 5. Other (Specify)
8. How many times a day you irrigate water? 1. Once 2. Twice 3. Three times
9. When do you use irrigation water to irrigate your land? 1. In the morning 2. In the afternoon 3. At night 4. Both in (1) and (3)
10. Which technical problems do the community encountered to make the irrigation water supply and management? 1. Lack of adequate spare parts and tools 2. Lack of technical

skill to carry out operation and maintenance 3. Inappropriate designs/poor construction quality 4. Inappropriate technology 5. All of the above 6. If other, specify__

11. What are the management problems related to water distribution in the irrigation scheme?

- 1. Poor coordination by water committee 2. Rotation is not strictly implemented
- 3. Lack of punishment against illegal water users 4. Water theft 5. If any (use codes)

12. What are the major irrigation problems in the irrigation development in the study area? 1.

- Poor scheme management 2. Lack of skill 3. Pump failure 4. Lack of fertilizers, pesticides, etc 5. Lack of market for produces 6. Poor drainage system 7. Any combination

13. How do you evaluate the strength and weakness of irrigation water use management in the schemes ?

Strength

Weakness

Part III. Water Allocation and Distribution

14. Does the irrigation water reach (available) on your plot at a suitable/required time? 1. Yes 2.

No

15. If “No”, what is the reason for being late? 1. Shortage of water 2. There is no program

- 3. Technical failure 4. Mismanagement 5. Specify (if any)

16. Do you think the irrigation water supply and distribution is fair? 1. Yes 2. No

17. Is there conflict between water users concerning water related issues? 1. Yes 2. No

3. I don't know

18. What are the causes to conflicts? 1. Scarcity of water 2. Lack of program, Mismanagement

- 3. Inefficient committee members 4. Specify (if any).....

19. How do you evaluate the strength and weakness of irrigation water distribution in the schemes?

Strength.....

Weakness

Part IV. Input Supply/Access to inputs

20. Which agricultural inputs you use widely? 1. Fertilizers 2. Selected seeds 3.pesticides 4. All of these 5. I use none of these 6. Specify (if any)
21. If you don't use, what is the reason? 1. Lack of access 2. They are expensive 3. Lack of purchasing power 4. They are worthless 5. If any
22. How do you evaluate the strength and weakness of agricultural input distribution?

Strength.....

Weakness

Part V. Water Charge

23. Do you pay any water use fee for the irrigation water supply service? 1. Yes 2. No
24. If your response is "Yes", how much you pay?Birr/month /year or Birr/container.
25. What do you suggest to the level of water fee tariff /service fee? 1. Should be increased
2.Should be reduced 3. Fair 4. If other, specify.....

Part VI. Training

26. Have you ever got training on irrigation? 1. Yes 2. No
27. If 'yes', How many times (Duration/ frequency)? 1. Once 2. Twice 3. Three times 4. If any (specify) .
28. The type of training you got on? 1. Irrigation water use 2. Land use 3. Maintenance
4. If any (specify)
29. How long did it take? 1. Half a day 2. One day 3. 2-5 days 4. If any (specify)
30. Are there local technicians for operation and maintenance work? 1. Yes 2. No
31. Do you get any help from Development Agents (DAs)? 1. Yes 2. No

32. If 'yes', what support you get? 1. Advice/consultation 2. Training 3. Inputs
4. Equipments 5. If any (specify)

33. How do you evaluate the strength and weakness of Training Provision?

Strength.....

Weakness

Part VII. Operation & Maintenance

34. Is the irrigation technology you use simple (simplicity) to operate, maintain and manageable?

1. Yes 2. No

35. Are irrigation spare parts and toolkits easily and readily available to the community? 1. Yes

2. No

36. Where does the community get irrigation spare parts?

1. Purchase from market

2. Zonal Water Beuro

3. Zonal Agriculture Beuro

4. Woreda Water Desk

5. Woreda Agriculture Beuro

6. If any, specify _____

Part VIII. Productivity

37. Do you use (are you aware of) proposed crops/plants? 1. Yes 2. No

38. Which proposed crops you cultivate? 1. Fruits 2. Vegetables 3. Cereals 4. Oil

seeds 5. If any, specify _____

39. If "No", what is the reason? 1. I am not aware of it 2. Supply problem 3. Low purchasing

power 4. Small farm land 5. Low professional Support 6. If any, specify _____

40. Which types of crops you mainly cultivated in your schemes? 1. Maize 2. Potatoes

3. Sugar cane 4. Fruits 5. Vegetables (onion, garlic, cabbages, tomato, pepper)

6. Others (specify)

41. Which factors affecting irrigation development most in the study area?

1. Marketing problem

5. lack of infrastructure

2. Lack of adequate irrigation water

6. inadequate input supply

- 3. Lack of experience and skill in irrigation farming
- 4. Poor management and operation of the scheme
- 7. low credit service
- 8. specify (if any)

42. How do you evaluate the strength and weakness of application of proposed crops/plants (productivity)?

Strength

Weakness

Part IX. Efficiency

43. Is there water loss in provision (during transferring) of irrigation water? 1. Yes 2. No

44. If “yes”, what is the reason for the loss? 1. Opening and closing valve problem
 2. Lack of Monitoring and Evaluation 3. Inefficient Distribution Department
 4. Misuse 5. others (specify)

45. Was there a time the scheme became non-functional since it was put in place? 1. Yes 2. No

46. If your response is “Yes”, how frequent the break downs occur since the time of construction? 1. Monthly 2. Weekly 3. Sometimes 4. Specify (if any)

47. What was the cause of failure? 1. Program fallacy 2. Administrative problem
 3. Inefficient committee members 4. If any (specify).....

48. How do you evaluate the strength and weakness of efficient water use management?

Strength

Weakness

Thank you again!!!

**Appendix II: DUTIES AND RESPONSIBILITIES OF KOGA
IRRIGATION OFFICE**

Appendix 2

DUTIES AND RESPONSIBILITIES OF KOGA IRRIGATION OFFICE

KIDO will independently manage the irrigation farming activities. The main objectives of the office include:

- Prepare the irrigation development physical and financial plan of the project through discussion with the farmers' organization (primary irrigation cooperatives in each irrigation blocks)
- Prepare irrigation land use plan in each year, considering the water availability in the Koga Irrigation Dam
- Prepare irrigation water scheduling and follow up its implementation with the irrigation water use cooperatives
- Prepare cropping pattern and cropping calendar with each block primary irrigation water use cooperative
- Prepare an arrangement to avoid the leakage of irrigation water which is released from the dam
- Prepare a ground for access to produce marketing and create linkage with agro-processors, factories and large consumers such as universities, hospitals and training centers
- resolve and avoid water and land use conflict that arise in water use
- follow up, monitor and conduct the maintenance of 3rd and 4th canals through project beneficiaries mobilization
- provide technical, managerial and other supports to project beneficiaries

Annex

Water Resource Policy and Irrigation Development Strategy of Ethiopia

Irrigation Development Strategy

From the master plan studies, the overall goal of the Ethiopia Water Resource Management Policy (MoWR, 1999) is to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available water resources of the country, to ensure significant socioeconomic development on a sustainable basis.

The specific objectives of the policy include:

- to Promote the development of the water resources of the country for economic and social benefits of the people, on an equitable and sustainable basis;
- to allocate and appropriately apportion the water, based on comprehensive and integrated plans, and optimize the allocation principles that incorporate efficiency of use, equity of access, and sustainability of resources;
- to manage and combat drought as well as other drought associated impacts, and disasters through efficient allocation, redistribution, transfer, storage and efficient use of water resources; and
- to conserve, protect and enhance water resources and the overall aquatic environment on a sustainable basis.

The general policies to irrigation sub-sector are: to

- Ensure the full integration of irrigation with the overall framework of the country's socioeconomic development plans, with particularly reference to the Agricultural Development Led Industrialization (ADLI) Strategy.

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- Promote the development of irrigation based on strong strategic planning to achieve the socioeconomic goals and participatory approach for promoting efficiency and sustainability.

The main elements of the overall water sector strategy related to irrigation development include:

- (i) expansion of irrigation for agricultural production to the maximum possible extent
- (ii) improved knowledge of water resources
- (iii) support for the water-based productive sectors, notably irrigation,
- (iv) expansion of low-cost irrigation schemes with complete water management,
- (v) investment in irrigation to be evaluated in terms of economic costs and benefits,
- (vi) environmentally sustainable and
- (vii) the adoption of an institutional and legal framework. Support to private irrigation development and demand-driven, community or producer-based investment funds are a central feature of the WSDP's strategy for promoting irrigation in Ethiopia.