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**The Contribution of Irrigation Development on  
Household Poverty Reduction in Ethiopia: A Case  
Study of Adiha Irrigation Scheme, Kola- Tembien  
Woreda, Central Zone Of Tigray, Ethiopia**

**By: Gebrehiwot Belay**

**July, 2010**

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**By: Gebrehiwot Belay**

**Advisor : Ali Hassen (PhD)**

**In Partial Fulfillment of the Requirements for the  
Research Thesis for the Degree of MA in Development  
Studies, Rural Livelihood and Development**

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**ADDIS ABABA UNIVERSITY  
SCHOOL OF GRADUATE STUDIES**

**COLLEGE OF DEVELOPMENT STUDIES  
(CDS)**



***Title***

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Zone of Tigray, Ethiopia.***

**By**

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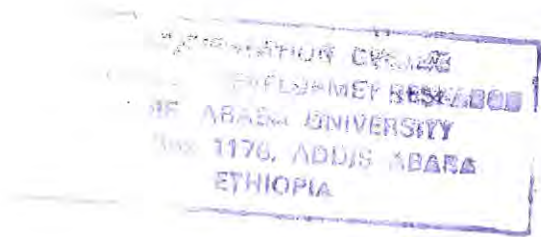
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## ACRONYMS

ADB	Asian Development Bank
CSA	Central Statistical Authority
CTA	Technical Center for Agriculture and Rural Development Cooperation
DA	Development Agents
DECSI	Debit Credit and Saving Institute
EPA	Environmental Protection Authority
EVDSA	Ethiopian Valley Development Studies Authority
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
HH	Households
HHH	Household Head
KTWARDB	Kolla Temben Woreda Agricultural and Rural Development Bureau
MoFED	Ministry of Finance and Economic Development
MoWR	Ministry of Water Resource
NGO	Non-Governmental Organization
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
REST	Relief Society of Tigray
SSA	Sub-Saharan Africa
TBFED	Tigray Bureau of Finance and Economic Development
UN	United Nations
WB	World Bank
WUA	Water Users Association

## ABSTRACT

*To tackle the problem of dependency on nature dictated agriculture and improve the food security situation of the population, the government of Ethiopia gave due emphasis to irrigation development. Accordingly, a number of irrigation schemes were constructed. This study was conducted with the general purpose of assessing the contribution of irrigation development on household food security in Kola Tembien Woreda, Adiha Tabia. Primary data was collected through household survey, key informants interviews, focus group discussion and personal observation. Relevant secondary data was also reviewed. Both quantitative (descriptive statistics) and qualitative data analysis methods were employed. While comparing the irrigation users and rain fed households, the majority of the irrigation users were found to have been able to feed themselves (38% 12 months, 24.3% more than 10 months) from their own production while the non-irrigators only feed themselves from six to nine months. The trend of owning assets is in a better position for irrigators (21 out of 37 irrigators) than for non-irrigators (16 out of 69). In terms of modern input utilization, the irrigators have utilized a relatively higher amount than the non irrigators. When comparing the labour utilization, 63% of the irrigation users and 23% of the non-irrigation users employed hired labour in their field. This signifies irrigation demands more labour and as a result it creates job opportunities for the surrounding population. The major challenges that inhibit the optimal utilization of the irrigation scheme are lack of market, poor infrastructure, failure or cultural resistance to adopt modern technologies, inefficient water utilization, inadequate government support and very high fertilizer price.*

# CHAPTER ONE

## Introduction

### 1.1 Background of the Study

Agriculture is the mainstay of the Ethiopian economy in terms of income, employment and generation of export revenue, its contribution to GDP, although showing a slight decline over the years has remained very high, at approximately 44% (Fitsum et al., 2009)

Heavy reliance on rain fed agriculture, under conditions of very variable rainfall and recurrent droughts, affects agriculture and, hence, has adverse effects on the economy of Ethiopia. In fact, the World Bank (2006) estimated that hydrological variability currently costs the economy over one third of its growth potential and has led to a 25% increase in poverty rates. Enhancing public and private investment in irrigation development has been identified as one of the core strategies and to enable sustainable growth and development (World Bank 2006, MoWR 2002, MoFED, 2006). In government policy documents, irrigation development has already been identified as a source of sustainable economic growth and rural development, and is considered as a cornerstone of food security and poverty reduction (MoWR 2002, MoFED 2006).

Ethiopia has an estimated irrigation potential of 3.5 million hectares (Seleshi et al., 2007). During 2005/2006 the total estimated area of irrigated agriculture in the country was 625,819 hectare which in total constitutes about 18% of the potential (MoWR, 2006). It is planned to expand irrigation development in the country by an additional 528,686 ha by the year 2009/2010 which will constitute about 33% of the potential (Atnafu, 2007, MoWR, 2006, MoFED, 2006).

Irrigation contributes to the national economy in several ways. At the micro level, irrigation leads to an increase in yield per hectare and subsequently increases in income, consumption and food security (Bhattarai and Pandey, 1997; Vaidyanathan et al., 1994; Ahmed and Sampath, 1992; Lipton et al., 2003; Hussain and Hanjra, 2004). Irrigation can enable smallholders to diversify cropping patterns, and to switch from low value subsistence production to high value market oriented production (Fitsum et al., 2009). Irrigation can benefit the poor specifically through higher production, higher and all year round farm and non-farm employment (Hussein and Hanjra, 2004).

Micro level impacts manifest themselves through agricultural impacts on economic growth. At the aggregate level, irrigation development act as production and supply shifters, as they push the production frontiers to a higher level and render production possible which is otherwise, risky, if not impossible, because of a shortage of moisture and thereby have a positive effect on economic growth (Fitsum et al, 2009)

Studies in Asia show that agricultural growth served as an “engine” of overall economic growth (Van Koppen *et al.*, 2005, Franks et al., 1999) and irrigation led-technological changes were identified as the key drivers behind productivity growth in the agricultural sector (Hussain and Harjra, 2004; Alagh, 2001; Dhawan, 1988)

Nevertheless, irrigation has been poorly developed in Ethiopia and other developing countries, in spite of high potential, in many developing countries the success of irrigation is highly affected by policy and social factors (Berhanu et al, 2003). Although Ethiopia has more than 3.4 million hectare of irrigable land and more than 50 years of experience with modern irrigation, its actual irrigated area is still far from enough due to policy problems of the different regimes (Getahun, 2003). For instance, the main purpose of irrigation during the imperial period was to provide industrial crop to agro-processing industries

opportunities and plays critical role in achieving household food security (Cornic et. al, 2003 cited in Azemer, 2006 and Mengistu, 2008).

Agricultural production in Ethiopia predominantly depends on rainfall. In addition, drought is becoming frequent and many people have been repeatedly exposed to hunger and famine. To alleviate the deep rooted poverty at household level, the Ethiopian government is practicing different drought proofing strategies. Among these strategies the development of different water harvesting schemes for the farmers to be able to produce enough for the whole year round is one. Hence, starting the last decade, both government and non-government organizations in Ethiopia have been initiating and implementing irrigation development projects. Accordingly, the Adiha Irrigation Project (AIP) was constructed with the objective of increasing agricultural productivity to improve the food security situation of the farming communities as a social solution to combat the repeated drought and to reduce dependency on the erratic rainfall. However, in spite of some indications of improvements on the ground, in the study area there are not sufficient studies under-taken to assess the contribution of this irrigation investment on household food security. Hence, this study was undertaken to evaluate the contribution of the project on the food security status of the beneficiaries’.

### **1.3 Objective of the Study**

#### **General Objective**

The overall objective of this study is to assess the contribution of irrigation development on household food security in Kola Tembein *Woreda* of the Central Zone of Tigray.

#### **Specific Objectives:**

The study has the following specific objectives:-

- To assess the contribution of the irrigation development on households agricultural yield improvement.
- To explore the effect of irrigation on cropping pattern, types of crops and adoption of yield enhancing inputs and technologies.
- To assess the impact of irrigation on household asset creation.
- To assess the existing managerial and constraints faced by the irrigation users.

#### **1.4 Research Questions**

1. Do the irrigation beneficiaries show changes in types of crop, cropping pattern and use of inputs compared to the non-irrigators?
2. Is modern irrigation development easily adoptable and manageable by the local communities?
3. What is the role and extent of the contribution of modern irrigation development for household food security?
4. What are the challenges and constraints that affect the performance of the modern irrigation system in the study area?

#### **1.5 Significance of the Study**

Conducting the study would have the following contributions.

- It contributes to the theoretical and empirical body of knowledge available on irrigation development for household food security.
- Moreover, it will serve as a spring board for further research on the issue.
- The result of the study will help local authorities and development agents to formulate appropriate intervention mechanism.

## **1.6 Scope and Limitation of the Study**

The paper tried to assess the contribution of irrigation development for household food security in Kola Tembein Wereda, central zone of Tigray by taking only one irrigation project site as a case study.

In Kola Tembein Woreda , there are four irrigation schemes, However, due to limited resources (budget, time, and facilities) the study was limited to only one irrigation project site.

## **1.7 Organization of the Paper**

This thesis is organized in to five chapters. The first chapter comprises the introduction part of the research consisting of statement of the problem, objectives of the study, research questions and hypothesis and significance of the study. The second chapter deals with overview of the literature on the impact of irrigation development on poverty reduction. The third chapter provides methodology of the research which consists of description of the study area, sampling procedure, source and method of data collection, and method of data analysis. Chapter four presents the findings and discussion part of the research, and finally conclusion and recommendation are presented in chapter five.

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## CHAPTER TWO

### Review of Related Literature

#### 2.1 Concepts

##### 2.1.1 Definition of Concepts

**Irrigation Development** - Irrigation development could be defined as a case of agricultural development in which technology intervenes to provide control for the soil moisture regimes in the crop root zone in order to achieve a high standard of continuous cropping (EVDSA, 1996). More to the point, FAO briefly defines irrigation “the supply of water to agricultural crops by artificial means, designed to permit farming in arid regions and to off set the effect of drought in semi-arid region” (FAO, 1997). Even in areas where total seasonal rainfall is adequate on average, it may be poorly distributed during the year and variable from year to year. Where traditional rain-fed farming is a high risk enterprise, irrigation can help to ensure stable agricultural production (FAO, 1997).

**Food Security**- is defined as a situation in which all house hold have both physical and economic access to adequate food for all members and where households are not at risk of losing such access and a situation in which people do not live in hunger or fear of starvation. World-wide, around 852 million men and children are chronically hunger due to extreme poverty, while up to two billion people lack food security intermittently due to varying degrees of poverty (FAO, 1996b, 2003).

According to the world Bank ,food security is attained when all people at, all times have physical and economic access to sufficient, safe, and nutritious food to be healthy and active (WB, 1986).

According to the same source, to be food secured as identified by Max well and Smith includes the following four conditions/ concepts,

- Sufficiency – the calories required for an active and healthy life
- Security – the balance between vulnerability, risk and insurance
- Access to food – through production, purchase, exchange or gift,
- Time – where food insecurity can be chronic, transitory and cyclical (max well and smith,1992).

Food self- sufficiency refers to a condition where productions of crops or livestock by households cover their annual food consumption requirement (Degefa, 2005). Bringing the concept into local context, attempts were made to differentiate self- sufficiency from food security. According to Degefa (2005) self- sufficiency is a concept that deals more with availability, while food security in addition to food availability deals with issues such as access to utilization and security.

**Poverty-** is a highly complex problem, with multiple causes and manifestation (Deborah and susace, 1995). There is no generally or officially accepted consensus or a single and official definition of poverty (ADB,2002:6), and it was a major problem with many previous attempts to measure poverty (David et al, 2003:6). On a common sense level, to be poor implies that either an individual or family lacks the resources necessary to satisfy some measure or basic needs such as food, clothing, and shelter. Yet while this definition might appear to be straight forward at first glance, all sorts of difficulties surface in its application.

Poverty depends not only on income but also on access to social services, and poverty is a wide spectrum encompassing the over all denial of choices and opportunities and is a violation of human dignity (UN, 1995). Absolute poverty is a condition characterized by severe deprivation of basic human needs including food, safe drinking water, sanitation facilities, health, shelter, education and information (UN, 1995). It is a consumption based measure referring to the inability to secure the minimum basic needs for human survival

(Wolday, 2001:3) or the number of people in a given society and/or who are unable to command resources to satisfy or to meet their basic needs (Todaro and Smith, 2003).

Poverty is relative in manifestation as well. This means poverty is pronounced deprivation in well being, involving a lack of something generally held to be desirable and a state of observable and demonstrable disadvantage relative to the local community or the wider society or nation to which an individual, family or group belongs (David et al, 2003:6).

Poverty can be said to exist in a given society when one or more persons do not attain a level of material well being deemed to constitute a reasonable minimum by the standards of the society (Ravallion, 1992), and people affected by poverty are those unable to lead a decent life (Todaro and Smith, 2003). Even though these definitions seem to be general and possibly accepted by many, it varies with culture, realization and social value system in each country, it conceives of indeterminate terms in different societies and the poor people do not form a homogeneous group (Deborah and Susane, 1995). Social science researches have also shown that all cultures have a concept and definition of poverty although these definitions often vary (David et al, 2003).

Furthermore, the World Bank (2005) stated poverty is not only a state of deprivation; it is equally a state of vulnerability. The most striking and direct expression of poverty are related to the ability to survive (Dercon, 1997:4). The people living in poverty as Wolday (2001) indicated are highly vulnerable to adverse events outside their control.

## **2.1.2 General literature**

### **2.1.2.1 Perspectives and Objectives of Irrigation Development**

A reliable and suitable irrigation water supply can result in vast improvements in agricultural production and assure the economic vitality of a region. Many civilizations have been dependent on irrigated agriculture to provide the basis of

their society and enhance the security of their people (FAO, 1998). Accordingly, many countries depend on surface irrigation to grow crops for food and fiber. Without surface irrigation their agricultural production would be drastically lower and problem of unreliable food supply, insufficient rural income and unemployment would be wide spread (Jurries et al, 2001).

Even though the most important objective of irrigation is to maintain the soil moisture reservoir, how this is accomplished is an important consideration. The technology of irrigation is more complex than many appreciate. It is important that the scope of irrigation science is not limited to diversion and conveyance systems, or solely to the irrigated, or only to the drainage path ways. Irrigation is a system extending across many technical and non technical disciplines. It only works efficiently and continually when all the components are integrated smoothly (FAO, 1998).

#### **2.1.2.2 Socio- Economic Impact of Irrigation Development**

Impact studies differ in terms of geographic coverage, scale of analysis, and approach adopted in measuring impacts. Accordingly, the scale of analysis varies among different studies, ranging from household to village, region, national and international level. The approaches adopted to study the socio-economic impacts of irrigation in various studies can be classified into three major categories:

1. "Before and after" comparisons
2. "With and with out" comparisons.
3. "More and less" comparisons (Hussein and Hanjira ,2004: 11)

According to Hussein and Hajira, (2004:5), irrigation benefits the poor through higher production, higher yields, lower risk of crop failure and higher and year round farm and non farm employment. Irrigation enables smallholders to adopt more diversified cropping patterns, and to switch from low -value staple or



subsistence production to high value available and affordable for the poor. Since irrigation investments leads to production and supply shifts, indirect linkages operate through regional and national level and have a strong positive effect on the national economic growth benefiting the poor.

The same authors reported that past interventions in irrigated agriculture have yielded immense benefits, for instance, cereal production in Asia has more than doubled between 1970 and 1995, from 300 million tons to 650 million tones Hussein and Hanjira ,2004:2).

Access to reliable water can enable farmers to adopt new technologies and intensify cultivation, leading to increased productivity, over all higher production, and greater returns from farming. This, in turn, opens up new employment opportunities, both on farm and off- farm, and can improve incomes, livelihoods, and the quality of life in the rural settings.

Hussein and Hanjira, (2004:4) identified five key interrelated linkages of how access to good irrigation water contributes to socio-economic uplifts of rural communities and alleviates poverty. These are production, income and consumption, employment, food security, and other social impacts contributing to over all improved social welfare. They added that access to good irrigation allows poor people to not only increase their production and incomes, but also enhances their opportunities to diversify their income base and to reduce their vulnerability to the seasonality of agricultural production and external shocks.

The strong complementarities between returns to irrigation and household education, specifically adult primary education, have been uncovered by Vande walle (2000) in the case of rural Vietnam. The study hints at the pro-poor character of irrigation investments, given the right economic environment. An increased investment in adult education would generate gains accruing primarily to the poor and would have a strong equalizing effect on returns to irrigation investments, that is, returns to irrigation would be higher for the poor than non-poor, given the right level of adult education. Therefore, a properly

targeted adult education program would have a substantial equalizing effect through its impacts to returns to irrigation investment. Conversely, in the presence of inequalities in educational endowments, returns to irrigation for the poor are likely to remain lower: knowledge poor will remain income poor.

According Ragapopal,(1991), socio-economic factor like social group, associations, control overland ,oxen power ownership , educational level, family labour, on farm and off-farm income etc, affect the ability of various groups to command the resources needed for irrigated farming and perhaps even their ability to get water. It has also a bearing on the willingness of users to take part in collective action on water management (Pender and Berhanu, 2005).

### **2.1.3 Irrigation Development and Environmental Consequences**

Irrigation development has both positive and negative impacts on the environment. To be sustainable, irrigation projects must avoid the negative impact starting from the design of the project till its implementation (EPA, 2004). The major problems are: alkalinity, salinity, water logging, run-off of fertilizers into rivers that significantly cause water pollution, soil erosion problems and water-related diseases.

Empirical evidence on this has been documented in many case studies. Yudelma(1989), reports case of salinity affecting crop-yields in irrigated zones of the Indus river (Pakistan), the Nile Delta in Egypt, part of Iraq, Peru, Mexico and the interior communities of North East Brazil. In India, over 87% of irrigated areas were reported to be water-logged and saline, forcing 29% of croplands out of production and reducing rice and wheat yields by over 50% and 78%, respectively (Joshin and Dayantaha, 1990).

Poorly planned irrigation schemes will result in the alternation of the various components of the environment. In order to construct large-scale irrigation, the vegetation cover in the surrounding environment need to be cleared (Ahmed, 2007). The same author also states that “developing countries concern less for

vegetation cover than for irrigation". So, natural vegetation (one component of the environment) will be negatively affected, which in turn results soil erosion, wildlife destruction etc. The conflict between irrigated agriculture and wildlife conservation has reached at global scale (Lemyly et al, 2000 cited in Molden et al, 2004).

Irrigation projects can also affect soil fertility via salination. As the population of the world increases in alarming rate, food demand inevitably grows. This will force people to obtain increased production from a particular plot of irrigated farm. So, they use chemical fertilizers, pesticides and other modern inputs to gain higher amount of yields. This practice in turn seriously degraded soil fertility. For instance, salinization in Mexico is estimated to reduce grain yields by about one million tones per year, which is sufficient to feed nearly a million people (Stockle ,2001).

Some scholars oppose and others are in favor of the role of irrigation on the reduction of household's poverty though cultivating two to three times a year to boost agricultural production. Opponents of irrigation development argue that expansion of irrigated agriculture creates a number of environmental and social problems associated with irrigation such as land degradation, water logging, salinity and water-born and related disease. These problems impede improvements of or endanger the existing poverty level of irrigation user rather than improving it. In this respect some studies indicate that agricultural production, productivity and income growth not to be identified as positive effect of irrigation investment. Resegrant and Everson (1992), in their study, were unable to find any positive relationship between investment in irrigation and agricultural productivity in India. Similarly, Jet *et al*, (2002) found no correction between irrigation and the total factor productivity growth of any major grain crops in China from 1981 to 1995.

The above findings are reinforced by the empirical studies of Yasuyuk, s, and Naoki,s (2003) in Sri Lanka which indicated that the impact of irrigation investment on poverty reduction have rather a negative impact. In other words, the irrigation beneficiaries found to be the poorest compared to those who used the rain-fed agriculture. Berhanu and Pender (2002) indicated that irrigation has limited impact on the use of fertilizer from irrigation. However, they suggested that further and careful study on the technical, institutional governance and managerial aspect of irrigation to improve productivity of farming practices.

On the other hand, although they don't deny some associated problems when irrigation water is used for agriculture production, there are a considerable pro-irrigation literature that show irrigation is vital to the well being of the people in this world and play significant role in the local, national, and international economics (Schilfgaarde, 1994). This implies that irrigation development has served as a prime driver behind growth in agricultural productivity and improvement in the living standard of households. Supporters of irrigation for poverty reduction argue that the presence of many evidence at the ground in different countries suggest that irrigation is a powerful tool for diversification of crops, crop intensification, and in increasing in land and crop productivity, creation of farm labour employment and improvement of household poverty. This fact is fully supported by Hussein and Hajra (2004) in their review of the empirical evidence on irrigation and poverty alleviation and argue that irrigation enables smallholder farmer to adopt more diversified cropping patterns, and to transform from the subsistence to high value and market oriented production, reduce the risk of crop failure using supplementary irrigation on the rain-fed crops and creating on-farm and non-farm employment.

#### **2.1.4 Irrigation Development and Food Security**

The main cause of rural poverty is the fluctuation in the amount and distribution of rain fall (Regassa et al, 2006). Then to tackle the problem

associated with the erratic nature of rainfall, alternatives should be sought to get dependable production from agriculture.

The issue for food security of many developing countries is of serious concern. Widespread denudation and accelerated soil erosion diminish the productivity of both cultivated and grazing rain fed lands. The problem of food security is exacerbated by the rapid growth of population and hence of the demand for food, FAO (1987).

In recent years an increased awareness of the importance of small – scale irrigation development has been observed and it is now organized as a viable option for poverty alleviation FAO, (1998).

In FAO (2000:p16), it was reported that smallholder irrigation has brought many successes to farmers. These are:

1. the schemes helped in reducing rural to urban migration by offering the rural population an alternative source of employment,
2. it enabled farmers to grow high value crops and increase their income, hence improve their livelihoods,
3. in arid area where drought is frequent phenomenon, irrigation helped as a strategy to cope with the problem,
4. with a more integrated approach smallholder irrigation can be the basis for other rural infrastructure to be developed in areas, which could otherwise have remained with out roads, telephones, schools, and clinics,
5. Small holder irrigation has developed a commercial mentality,
6. Crop yields and farmers incomes have gone up manifold due to irrigation.

Food security is defined as a situation in which all house hold have both physical and economic access to adequate food for all members and where households are not at risk of losing such access and a situation in which people do not live in hunger or fear of starvation. World-wide, around 852 million men and children are chronically hunger due to extreme poverty, while

up to two billion people lack food security intermittently due to varying degrees of poverty (FAO, 1996b, 2003).

According to the world Bank ,food security is attained when all people at, all times have physical and economic access to sufficient, safe, and nutritious food to be healthy and active (WB, 1986).

According to the same source, to be food secured as identified by Max well and Smith includes the following four conditions/ concepts,

- Sufficiency – the calories required for an active and healthy life
- Security – the balance between vulnerability, risk and insurance
- Access to food – through production, purchase, exchange or gift,
- Time – where food insecurity can be chronic, transitory and cyclical (max well and smith,1992).

Food self- sufficiency refers to a condition where productions of crops or livestock by households cover their annual food consumption requirement (Degefa, 2005). Bringing the concept into local context, attempts were made to differentiate self- sufficiency from food security. According to Degefa (2005) self- sufficiency is a concept that deals more with availability, while food security in addition to food availability deals with issues such as access to utilization and security.

Many development writers underline the importance of irrigation as a viable strategy to raise crop yields and to achieve food security in these third world nations including Ethiopia where there is ample irrigation potential. This statement sounds convincing, because it is difficult to effectively utilize agriculture in developing counties in the face of water uncertainty and erratic rainfall distribution, unless we invest in water development. According to Dessalegne (1999), investment on water management schemes will stabilize agricultural production and promote food security in areas of uncertainty and scarcer rainfall. Irrigation also makes possible agricultural intensification. In

condition of low land- man ratio besides giving the chance of growing marketable crops.

Irrigation provides the means of maximizing production with multiple cropping taking the advantages of modern technologies and high yielding crop varieties (Seid, 2002). In summarizing, as already revealed in the previous sections, irrigation is a vital tool to achieve food security through increasing agricultural products, intensifying the cropping patterns, increasing income by producing high value crops and protecting soil in developing countries where agriculture takes the lion's share of their economy.

### **2.1.5 Irrigation Development in Ethiopia: Potential, Rationale and Policy**

Most of the available studies indicate irrigation development in Ethiopia is at its early stage despite the country's immense potential and long time experience in irrigation. Ethiopia started modern irrigation agriculture some decades back with the purpose of producing industrial crops or cash crops on a large scale basis; however its progress has been limited (MoWR, 1998). Although Ethiopia has 50 years, experience with modern irrigation and about 3.7 million hectare of irrigable land, the actual irrigated area is only 3-4 percent of the potential total.

However, traditional irrigation practices have been practiced for centuries by diverting rivers in dry seasons to produce subsistence food crops (MoWR, 1998). The irrigation development policy during the imperial and the dreg periods was on large scale schemes- aiming at producing marketable crops to the neglect of peasant agriculture. It is only in the 1980s that due emphasis began to be given to small - scale irrigation with the aim of producing crop for local consumption.

The current government has formulated a policy to develop a total of 274,612 hectare with in a period of 15 years from 2002 to 2016 under short, medium and long term emphasis, with the aim of improving food security and food self-

sufficiency, nutritional status, contributing to the supply of industrial raw materials, improving rural employment opportunities ( MoWR,1998).

Ethiopia can not hope to meet its wide and large food shortage through rain fed agriculture alone. Enhancing by high rate of population growth, food problem in Ethiopia has been caused mainly by drought and out side interest between the land and the peasant (Dessalegne, 2009: 22,).

Furthermore, Ethiopia would require 1.4 million tons of seed cotton, and 1.8 millions tons of sugar by 2016, to ensure these demands, MoWR (1998) has announced that Ethiopia needs to develop 1.8 million hectares of land under irrigation in 2016. The Ethiopia Interim poverty Reduction Strategy paper (2002/03) emphasized also the need for agricultural growth in general and irrigation development as the sub- part of the sector in order to reduce the level of poverty and improve food security situation of the country, thus, in the strategy paper, it has been stated that irrigation would be introduced in a significant way for a sustainable attainment of food security at all levels. Therefore, one of the rationales for the development of irrigation in Ethiopia is to reduce the diffidence in food security and as a result, to achieve food security and food self – sufficiency.

#### **2.1.6 Challenges and Constraints of Irrigation Development**

Although the irrigated area is increasing in Ethiopia, the growth rate is rather slower. There are a number of constraints related to the slow movement of irrigation development, such as weakness in management, equity issue, cost recovery and agricultural productivity (ODI, 1995) and social, technical, economic, institutional and policy problems are general constraints for the development of small scale schemes (shawki and Leguy,1990, FAO, 1986, Woldeab, 2003). Poor design and management have contributed to the failure of few peasant irrigation systems in SSA countries (FAO, 1986, World Bank, 1986). CTA (2003) reported that small scale irrigation schemes in Ethiopia are

generally characterized by low efficiency, lack of finance, inadequate marketing and weak extension services.

### **2.1.7 Empirical studies of Irrigation in Ethiopia**

Tadesse *et al*, (2004) also conduct a study on the economic importance of irrigation in Donny and Bato Degaga small holder's irrigation schemes in the Awash Valley of Oromiya Regional state with the objective of investigating the impact of these irrigation schemes on food security and drawing lessons that can be learned from the success and failure of irrigation. As the result of the study indicated, the main cash crops produced were onion, tomato and pepper.

The production of irrigation agriculture highly increased irrigator's access to basic needs in those irrigation schemes. The finding indicated that the challenges of small-scale irrigation are; low fertilizer application, poor on-farm management, inequitable distribution of labour for the maintenance of irrigation canals, irrigation water loss, tendency of considering irrigation infrastructure as government's property and market problems. The findings, further, indicate that irrigation can become a source of employment and income generation for the local people.

More to the point, Gebrmedhin and Pender (2002) in their study of policies and institutions to enhance the impact of irrigation development in mixed crop livestock system in Ethiopia, disclosed that most problems of small-scale irrigated agriculture that hamper further development of this sub sector arise from its Operational method and not from its construction and design.

They pointed out that in Ethiopia; irrigation development planning gave emphasis to the agronomic, engineering and technical aspects of irrigation schemes, with little consideration to issues of management, beneficiary participation, availability of institutional support services such as credit, extension in-put supply and marketing.

Wagnew (2004) conducted a case study using a formal survey on socio-economic and environmental impact assessment of four community based small-scale irrigation in the Upper Awash Basin of Ethiopia, concluded that rural credit system, institutional support, monitoring of irrigation schemes, training in water management, marketing and general crop production, empowerment of local communities, economic evaluation of optimal plot size, cropping patterns for agronomic practices and resources utilized in the irrigation schemes were necessary conditions for viable and sustainable irrigation schemes.

According to Girmay et al (2000) in their study on management and institutional considerations of small-scale irrigation in Tigray, the absence of well-understanding of economics of small-scale irrigation, difficulty in the provision of inputs services and technical advice, lack of efficient utilization of water resources, lack of viable product markets and marketing institutions were some of the reasons for low level of efficiency and lack of sustainability in small- scale irrigation schemes.

Azemer (2006) also studied food security and economic impact of irrigated agriculture in Teletle irrigation scheme of North Shoa Zone. The main objective of the study was to investigate the impact of small- scale irrigation on food security and economic status of the house hold. The finding of his study demonstrated the better performance of irrigated agriculture in crop production and productivity than rainfed agriculture. Use of irrigation also demonstrated a change in the livestock holding capacity of irrigators than pre- irrigation and it also signified that higher food availability, accessibility and better income in irrigators than non- irrigation beneficiary households.

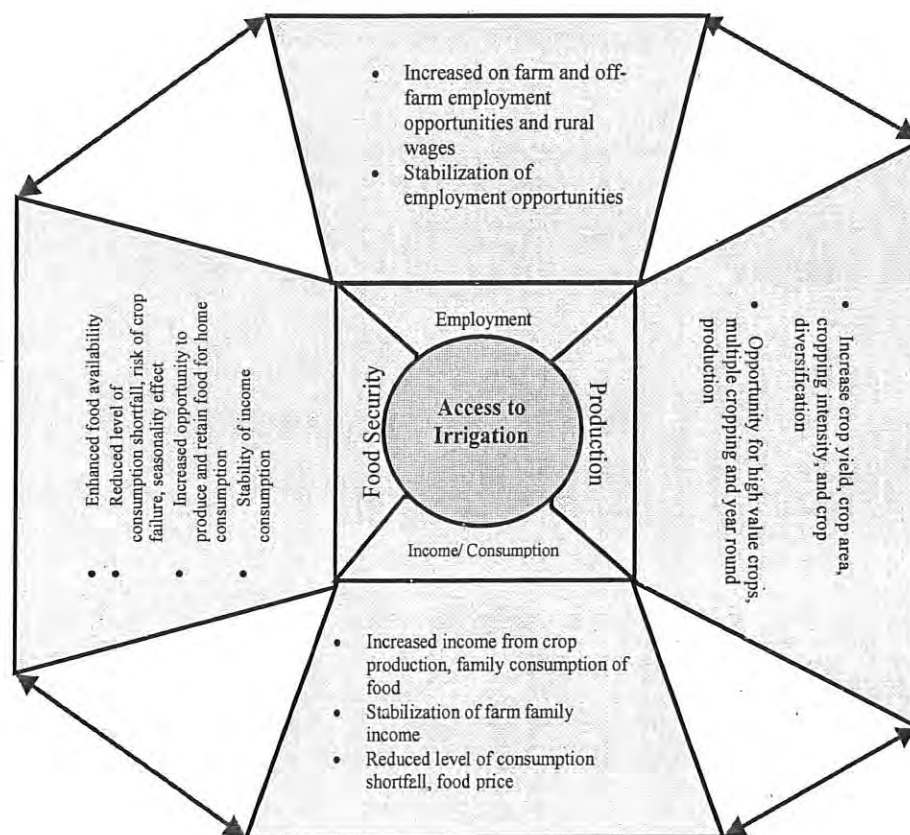
### **2.1.8 Conceptual Framework of the Research**

Irrigation, as indicated in the research hypotheses, has positive impact on household poverty reduction through enhancing agricultural performance,

using inputs and high value crops that give rise to increase in production which in turn gives rise to household food security and finally to poverty reduction.

Hassain (2004) emphasized that the development of irrigation is to create among others, an economic environment, such as crop intensification, and diversification towards high value crops, then increased crop productivity and production; improve and sustain employment opportunities and higher wage rates, improved income and expenditure per household, implying enhanced food security. Hence, the conceptual framework (see figure 2.1) the researcher has adopted in the present study helps understand the main highlights of the study. Meaning, the framework simplifies the analysis of linkage between irrigation and poverty reduction at household level.

Fig 2.1- Interlink between Irrigation and poverty reduction.



Adapted from Hassian and Hanjra, 2004

## CHAPTER THREE

### Research Methodology

#### 3.1 Study Area Description

**Location:** Kola Tembein *Woreda* is located at the southern part of central zone of Tigray. It has 27 *Tabias*, 83 *Kushet* and found in the nearby town, Abiyi-Adi which is 908 kilometers away from Addis Ababa. The *Woreda* of Kola Tembein is an enclave inside Tembein *Woreda*. The *Woreda* is bordered on the North by Weri-Leke, in the East Hawzen and Dega Temein, in the south Tanka Abergele and in the West Tselemti and Naeder Adet.

**Population and Area size:** The *woreda* is one of the populous *woreda* in the zone. It has an estimated total population of 138,115 of which 68,377 are male and 69,738 are female. The *woreda* has a total of 26,494 households with an average family size of five people. Total area of the *woreda* is 147,000 hectare of which 31,021 ha., is arable, 2,252 ha bush land, 69,624 ha., grazing, 20,150 ha wasteland and others are natural forest, areas and residences (KTWARDDB,2007).

**Economic Activities:** From the information above, it can be said that the majority of the population is living in rural areas making their livelihood from agricultural production. The major cereal crops grown in the area are maize, sorghum, teff and millets.

**Topographic Condition:** Topographic condition of the *woreda* is mountains, plateaus, undulating and rugged characteristics. Its elevation ranges from 1200 – 2300 m a s l. Annual rainfall of the *woreda* ranges from 550 – 800 mm (the research site ranges from 400 mm – 600mm) and rainfall type is erratic and uneven. Therefore, it is clear that moisture shortage is broadly seen in the *woreda*. Soil type of the area is mainly sand, and clay and silt loam that cover 62%, 26%, 3% and 9% respectively (KTWARDDB, 2007).

### **3.2 Selection of the Study Area**

The researcher selected Adiha Tabia as a research site using purposive sampling techniques because of the following reasons:

- The researchers' familiarity with the *woreda* and knowledge of the local language and culture.
- As per the researcher information, no study has been conducted in the *woreda* regarding the evaluation of irrigation development for household poverty reduction.

### **3.3 Data Type and Source**

The study requires a wide variety of information that would help answer the major research question. Such as crop yields, cropping pattern, crop diversification, cropping intensity, quantity and type of product per hectare, land holding per household (irrigated and non-irrigated), number of labour days and household numbers engaged in the irrigated and non-irrigated cultivable lands, marketed products, inputs used, input and output prices, household asset holdings, household total income per year, consumption expenditure per year on food and non-food items, number of food gab months per year. Data input for this study was collected from primary and secondary sources. The primary sources of data were obtained from household survey of both beneficiaries and non-beneficiaries, and field level observation. The secondary source of data was gathered from the irrigation project area, *Tabias, woreda*, zonal agriculture and rural development offices, books, journals, internet and other published and unpublished sources.

### **3.4 Sampling Method**

After deciding the sampling area and the sampling design, it was important to fix the sample size. Sample population was stratified into two groups, the beneficiaries and non-beneficiaries of irrigation households. Then, sample has

been drawn proportionately by using simple random sampling technique. The overall sample size was 120 households, 37 from irrigator households and 83 from non-irrigator households. The sampling population has been drawn from a total of 764 households in irrigation group and 1700 households from non-irrigation group. Therefore, the sample size is believed to be representative and can generate reliable and empirical information since each group of households are homogeneous in their socio-economic settings.

### **3.5 Method of Data Collection**

#### **3.5.1 Primary Data Collection**

Primary source of the data has been collected by the following data collection instruments.

**Household Survey**-To assess the impact of irrigation development for poverty reduction at household level and related issues, data that could help answer the research questions or meet the research objectives has been collected using carefully prepared and structured questionnaire which comprised open ended and close ended questions.

The household survey covered crop yield, cropping pattern, crop diversification, cropping intensity, land holding per household, number of labour days and household members engaged in the irrigated and non-irrigated cultivated lands, input applied, household asset holdings, household total income per year, and consumption expenditure on food and non-food items.

**Key Informants Interview**- The researcher has employed key informant interviews particularly using semi-structured interview schedule for topics prepared to guide the specific questions during the interview. To collect necessary information regarding the impact of irrigation development for poverty reduction in the rural households, such as crop yields, cropping pattern, crop diversification, cropping intensity etc. The key informants interview has included elderly people, local religious leaders, scheme committee

members, development agents, *woreda* and *kebele* officials and zonal experts. Some key informants who are rich in knowledge on the issue have been interviewed.

**Focus Group Discussion (FGD)-** Focus group discussion with the peasants was one of the qualitative data collection methods in this case study. Each focus group comprised four to seven individuals who are from the beneficiaries of irrigation and non-irrigators separately. This enabled to get data about the impact of irrigation for poverty reduction at household level and to obtain opinions, attitudes and views from the group discussion participants and it helped elaborate, clarify and crosscheck ideas, experiences and arguments that has been gathered through other methods.

**Direct Observation-** The researcher observed the situation at field level and transect walk to observe the irrigation and its contribution to employment, income, production and food security of households.

### **3.5.2 Secondary Data Collection**

The secondary source of data has been gathered from the already mentioned earlier in the data source section.

### **3.6 Method of Data Analysis**

After the data has been gathered through the aforesaid techniques and tools, the researcher has employed qualitative and quantitative methods to analyze the collected data. The qualitative data was narrated and the quantitative data was analyzed by using an SPSS package software program.

## **CHAPTER FOUR**

### **Findings and Discussions**

#### **4.1 Demographic and Socio-economic Characteristics of the Sample Households**

In this section, the sample households demographic and community characteristics are discussed so as to understand the various characteristics among the study households. Specific reference is given to family size, educational level and land holding, access to credit, extension, market infrastructure service and housing condition. Such analysis is essential to ensure an understanding of the context in which results were obtained.

##### **4.1.1 Family Size of the Households**

The average national family size according to 2007 population and housing census results is 4.7 and for that of the rural Ethiopia is 4.9 and for Tigray 4.6 (CSA,2008). In the case of the study area, the average household size was found to be 5.88 people per household.

##### **4.1.2 Age of the Households**

The study revealed that the age of the sampled respondents range from 18 to 74. The average age of the respondents was found to be 44.03 years. The dependency ratio of the sampled households was found to be 2.5 and 3.1 per household for irrigation and non – irrigation beneficiaries respectively. Besides the survey demonstrated that the average dependency ratio per household was found to be 2.94 implying that one adult person on average will feed 2.94 people in the household.

##### **4.1.3 Educational Status of Household Members**

Human capital is the basis for the development of the economy of individual in particular and that of the country in general. Education has significant role in

developing countries like Ethiopia for accelerated technology transfer and adoption of modern production system. This is true for both groups, irrigators and non-irrigators. It equips the productive force with the necessary skill in improving the productivity level. Education according to Philips (1994 as cited by Haile, 2008), helps arm people with the necessary skills and knowledge to actively participate in different economic activities of their surroundings, and promote entrepreneurship. Thus, it is expected that farmers with basic literacy and numeracy level can easily adopt new and productive agricultural technologies.

The study revealed that 91.9 % of the irrigator household members are literate while 8.1% of them are illiterate. On the other hand 65.2% of the non-irrigator sample households are literate and 33.33% of them are illiterate. The differences of status of education between the two groups of the household members under study were found to be significant. The number of educated who can read and write are high is , this might be the result of irrigation users having supplementary sources of income to cover education costs water than non-irrigation water users.

Table 4.1 Literacy level of sample households

<b>Description</b>	<b>Literacy level of the household members</b>		
	<b>Illiterate</b>	<b>Literate</b>	<b>Total</b>
Non – irrigators	23(33.33)	46(65.2)	69(100)
Irrigators	3(8.10)	34(91.9)	37(100)
Total	26	80	106

Source : Own survey, 2010

#### **4.1.4 Land Holding**

Land is one of the key and important productive asset need to be owned by farming households in order for them to be capable to produce crops for consumption as well as for marketing purpose. The study results depicted that the mean land holding for the irrigation users and non- users is 4.43 Tsimdi and 4.29 Tsimdi respectively. Despite the presence of mean difference in land holding between the irrigation beneficiaries and non – beneficiaries, it is statistically insignificant.

#### **4.1.5 Access to Social Services**

Access to social service is a paramount factor which indicates the living condition of the population in a given area. The survey result on access of the subject under study to social services indicated that the mean one way distance to input supply shop, health center, live stock market, crop market, veterinary clinic, primary school, potable water and grinding mill was found to be about 21, 1.5, 21, 21, 21, 1.5, 3 and 1 kilometers for the whole communities in the study area respectively.

#### **4.1.6 Access to Credit**

With regard to access to credit the survey result revealed that 88.9 percent of the irrigation users and 50 % of the non-irrigation user households were able to take credit in the year 2009/10 mainly from DECSI because DECSI is the only credit provider throughout rural Tigray.

The analysis further demonstrated that most of those who borrowed the money guaranteed by group collateral and/or land certificate. This was initiated by the government to fulfill the planned household package program under implementation by the regional government to realize household income to be Birr 18,250 per household per year in 2009 (TBFED, 2006).

Table 4.2 Respondents' access to credit (N= 106)

<b>Description</b>	<b>No. who took credit</b>	<b>% of the sample HH who took credit(from their respective group)</b>
Irrigation Beneficiaries	32	86.49
Non-irrigation Beneficiaries	31	44.92

Source: Own survey

In the study area, results revealed that 13.1% of the irrigation beneficiary and 55 % of the non-irrigation beneficiary sample households were not taking loan. The main reason for not taking credit by the majority of the sample households was reasoned out that the interest rates are too high and the credit institution is too far. This big differences is because the irrigators have group collateral from their irrigation cooperative and the non irrigators have only individual or land certificate collateral.

Table 4.3 Reasons for not taking credit (multiple responses are possible).

<b>Reason for not taking credit</b>	<b>Irrigators (N= 5)</b>		<b>Non-irrigators (N= 38)</b>	
	<b>No</b>	<b>Percent</b>	<b>No</b>	<b>Percent</b>
Not interested	0	0	5	13.16
Too high interest rate	5	100	21	55.26
Credit institution is too far	1	20	5	13.16

Source: Own survey

The result further revealed that from those who took credit, 15.6% of the irrigation beneficiaries and 26.47% of the non-irrigators used the loan to buy oxen, 100% of the irrigators and 55.88% of the non-irrigators used the money to buy fertilizer, 34.4% of the irrigation users and 67.64% of the non irrigators used the money to buy seed, while 3.1% of the irrigators and 17.64 % of the non-irrigators used to buy animal feed and 15.6 and 20.58 respectively used it for other purposes. The finding shows that fertilizer is a critical modern input for productivity in the study area followed by seed.

Table 4.4 Purpose of the loan (multiple responses are possible)

Purpose of the loan	Irrigators (N= 32)		Non-irrigators (N=31)	
	Frequency	percent	Frequency	percent
To buy fertilizer	32	100	19	55.88
To buy seed	11	34.4	23	67.64
To buy oxen	5	15.6	9	26.47
To buy animal feed	1	3.1	6	17.64
Other purpose	1	15.6	7	20.58

Source: Own survey, 2010

#### 4.1.7 Access to Extension Services

Extension service was one of the policy focus taken by the Ethiopian government in general and that of the Tigray regional state in particular as a vital tool for the peasants to be transformed from the traditional to modern agricultural system and hence improve the well-being of the poor household through increasing productivity per unit area of land. To this end numerous training centers for extension agents have been opened and thousands of them have been trained and assigned three to four extension agents per *tabia*, so as

to able to transfer the necessary technical support and provide training on day to day basis. Moreover, different yield enhancing technologies such as inputs and post harvest management technologies are being introduced.

Training is one essential factor that should be given to peasants to facilitate adoption of the new technologies introduced in the planned speed and level. For this reason, the survey tried to assess the condition of training given to the users of irrigation.

Table 4.5 Households received training (multiple responses are possible)

<b>Type of training</b>	<b>Irrigators (N= 38)</b>	
	<b>Frequency</b>	<b>Percent</b>
Organizing and management of cooperative	11	29.7
Water management	22	59.5
In put use	16	43.2
Crop harvest	14	37.8
Post harvesting management	2	5.4
Marketing related	5	13.5

Source: own survey

The findings showed that, majority of the irrigators (59.5) have taken training on water management, 43.2 of them received training on input use, 37.8 on crop harvest and 29.7 percent on organization and management of cooperatives. A few of them also reported that they have attended training on market related and post harvesting management (13.5% and 5, 4% respectively). The result of the study showed that irrigators have been given due

attention to take training on water management activities compared to other types of training so as to enhance their productivity.

## **4.2 The Irrigation Scheme and Institutional Setup**

### **4.2.1 Structure of the Irrigation Scheme, Irrigation Land Holding and the Distance of the Scheme from Residence of the Households**

The irrigation scheme used earthen canal for the conveyance of the irrigation water up to the field and application of the water at the field used by flooding and furrow. It was constructed by REST and OXFAM U.K. The irrigation scheme became operational in 1993 E.C. Currently 110 ha of land is cultivated using the irrigation water.

The mean irrigable land holding at the study place was found to be 0.45 ha, per household. The minimum being 0.32 hectare and the maximum 0.57 hectare per household.

The average distance from the residence to the irrigation site in the study area was found to be about 2 kilometers. The minimum and maximum distance of the irrigation plot from the residence was found to be 0.5 kilometer and 2.5 kilometers respectively. The nearer the distance from their home to the irrigation area, the more likely for the households to work longer hours on their field and make a frequent visits to follow up the progress and take immediate measure to protect crops from pests, diseases and thieves. In relation to this, the survey revealed that for over 86% of the irrigation beneficiaries the maximum distance of their field from their residence were found to be not more than 1.8 Kilometer.

### **4.2.2 Labour Utilization**

The study revealed that 62.16 % of the irrigation users and 23.18 % of the non-irrigation users employ hired labour in their field. More irrigators used hired labour mainly because of the fact that irrigation demands more labour

compared to the nature dictated agriculture. Moreover, the mean temporary labour employment used in the study site was found to be 43 %. This goes in line with the study by Gebrehaweria and Regassa (2006); Hassein and Hanjira (2004).

Table 4.6 Labour utilization by the study population for the year 2008/09

<b>Type of the beneficiary</b>	<b>frequency</b>	<b>percent</b>
Non - Irrigation beneficiary (N= 69)	16	23.18
Irrigation Beneficiary (N= 37)	23	62.16

Source: Own survey

Furthermore, the result demonstrated that 59.5(22) of the irrigation beneficiaries were found to increase use of their family labour because of the start of the irrigation.

#### **4.2.3 Management and Institutional Characteristics of the Scheme**

Irrigation, as a common pool resource to be used by different stakeholders or farmers, must be properly coordinated to bring about the necessary benefits for the beneficiaries. Proper coordination in water use and an adequate institutional set up can ensure the smooth operation of the irrigation system, minimizing water conflicts among the irrigation users, creating strong input market outlets and immediate action in maintenance and related activities.

Insufficient attention to the institutional set up to the areas where an irrigation activity takes place leads to built – in defects in operation and management. (Lemma,2004, Amdissa,2008). According to Peter H. Stern, cited by Lemma

(2004). The possible problems that could prevail in the absence of appropriate institution include:

- Lack of clear definition of roles and responsibilities of different organs related to irrigation infrastructure management;
- Lack of coordination in water use leading to anarchy
- Lack of arrangements for cost recovery and operation and maintenance of irrigation infrastructure.
- Absence of effective association to represent the interest of the irrigation users when dealing with other actors etc...

The focus group discussion held with key informants from irrigators showed that the distribution of the irrigation land per household is almost equal except for a few farmers who received more at the very start of the irrigation scheme. The non - irrigator informants explained that in order to get irrigable land at the irrigation site, one has to give a plot of land from his holding as a replacement or exchange to the irrigable land.

As indicated in the bylaw document of the irrigation cooperative, the cooperative had a general assembly, meets only once in a year. This is the highest body in which all members of the irrigation beneficiaries meet to discuss the highest level issues, election of committee, decision on the amount of fee for the irrigation guard, establishment of work group to facilitate the activities of the cooperative, decision on dividend sharing and settlement if disputes among the irrigation beneficiaries. If necessary the executive committee can call an urgent meeting. There is also a management committee which meets at the end of every month.

However, as will be demonstrated later in this study there are many issues that need to be resolved, such as market linkage and price bargaining power and lobbying government to improve infrastructure and to convince farmers to use

modern technologies. The structure of meetings does not allow time for discussion and decision-making on these matters, with the aim of improving water utilization and household livelihoods in general.

#### **4.3 Challenges and Constraints Hindering Efficient Utilization of the Irrigation Water**

The Survey found that the main problem of the scheme for farmers was lack of access either to a road or transportation to take their produce to a market. This problem was confirmed by the discussion held with the irrigation cooperative committee, DAs and individual irrigation beneficiaries. The second essential problem was the absence of demand for their products due to both the lack of market and the low price of products. From the survey result in the study area, the problem of water utilization was also mentioned. Since the conveyance of the irrigation water is via earthen canal, there is always wastage of water because a lot of water sinks into the earth before it reaches the irrigable plots. This problem frequently happens because of the absence of the government support in providing cement and spare parts for the maintenance of the canals, even though this problem in the study area was reported to the regional agricultural office by the extension agent, *wereda* level agricultural and rural development, cooperative office experts and *wereda* administration. Finally the FGD participants came to terms with the fact that due attention would not be paid and efforts would not be made by the government to improve the irrigation scheme with regards to the canal. They added that the main problem hindering their irrigation development is that the Relief Society of Tigray (REST) did not allow other NGOs to participate directly into their irrigation site. Because REST wants NGOs to participate not directly, but indirectly through making an agreement with REST rather than the societies and this has a negative impact on the functioning of the irrigation scheme. On the other hand, one among the FGD informants explained that “we would not need other types of government support if the government subsidised fertilizer because the price of the modern input is very high”. The other problem that contributes to low utilization of

irrigation water is the reluctance of the irrigators to use commercial fertilizers and improved seeds. The reason for not using the commercial fertilizers as illustrated during the FGD, was the unavailability of financial capacity for purchasing them. The other reason is the negative attitude of the peasants towards using commercial fertilizer due to the belief that if they once begin using commercial fertilizer, they will not be able to stop using it since the chemical fertilizer kills the natural nutrients. So, this perception is a challenge for the efficient utilization of irrigation.

Development of market access is a determinant for the productivity and sustainability of irrigation farm. Market access reduces the price of seeds, fertilizers, chemicals and increases the farm gate prices for the produced goods. Market access does not only provide ease of entry to markets by which producers may enter or exit markets, or the options of markets available to them, but it also sustains the irrigated farm and can be an incentive to producers. Many farmers and the FGD participants complained that the market is very far from the irrigation site and the road is bad and old even if some traders want to come to their area from Mekelle, Abi – Adi and Adwa to buy their products. So market facility is low in the study area if they cultivate more perishable crops. Therefore, they will be obliged to sell their produce at the farm gate at the local price which is, they explained, lower than their investment in the irrigation plot.

#### **4.4 Impacts of Irrigation on Cropping Pattern, Adoption of New Technology**

##### **4.4.1 Impact of Irrigation on Cropping Diversity**

Irrigation is very reliable in producing the necessary crops at any given time during the dry season. According to Saletetal (2003), cited by Haile (2008), the presence of year round irrigation water supply is taken as a power factor in providing better opportunity for increasing cropping pattern, multiple cropping

and crop diversification. Therefore, the study has made analysis of the use of river diversion irrigation on crop diversification.

Table 4.7 Percentage distribution by crop type grown by Irrigators multiple response are possible)

<b>Crop type</b>	<b>Frequency</b>	<b>Percent of the HH</b>
Pepper	18	48.65
Maize	8	21.62
Lettuce	11	29.73
Total	37	100

Source: Own survey

As it can be seen from the table above, pepper is the most important crop produced by 48.65 % of the irrigation beneficiaries. The findings safely explained that irrigation beneficiaries have improved from food to cash crops and are able to produce them two to three times during the dry season. This is consistent with the finding of Hussien and Hiujra, 2004, and Tsegabirehan, 1999. Although farmers have post harvesting storage and could keep the vegetable until the next market day, the production of the same vegetables by many irrigators leads to lower market prices and hence lower income to growers of pepper, as it was explained by key informants and by the focus group discussants. This effect is exacerbated by the lack of a strong cooperative to find and link farmers to better market price or link to traders and the neglect by the government to rehabilitate or to upgrade the road. Moreover, 21.62 % was found to produce one type of crop which is mainly maize. The study also illustrated 59.46 % and 18.92 % of the irrigation beneficiaries produce two and three types of high value crops respectively. The reason for producing traditional crops, as confirmed by the FGD and key informants, is that they like to plant mainly maize for its dual purpose, that is for consumption and animal

fodder. This shows the need for further attention and effort on extension services by the government.

Table 4.8 Diversification of the crops in the irrigation scheme

<b>Types of crops grown in the irrigation scheme</b>	<b>Frequency</b>	<b>Percent</b>
One type (Maize)	8	21.62
Two type (Orange and Mango)	22	59.46
Three type (Pepper, Lettuce and Tomato)	7	18.92
<b>Total</b>	<b>37</b>	<b>100</b>

Source: Own survey

#### **4.4.2 Effects of Irrigation on Adoption of New Technology**

One of the essential productivity enhancing technologies is the use of fertilizer, pesticide and herbicide. The government wants to promote increased use of agricultural technologies by smallholder farmers. This initiative which was began by the program of sasakawa 2000, has led to increase the adoption these inputs from time to time. In order to see whether the use of fertilizers and other modern inputs has increased because of irrigation, comparison on the use of agricultural technologies between irrigators and non – irrigators has been done. The result has depicted that more irrigators than non – irrigators were users of fertilizers. In the other modern inputs such as the herbicides and pesticides, although still higher in the case of the irrigation beneficiaries, there was not as much difference as was seen in the case of fertilizers.

The mean amount of fertilizer and chemical used by irrigators and non – irrigators were found to be 60 K.g, 72 kg and 42 k.g, 56 kg per a year respectively.

Table 4.9 Fertilizer, herbicide and pesticide used by sample HH

Input used (kg)	Fertilizer, herbicide and pesticide used by sample HH in Kg	
	By Irrigators	By Non-irrigators
Fertilizer (kg)	60	42
Pesticide & herbicide (kg)	72	56

Source: Own survey

Concerning to the source from where the farmers were able to get the inputs, the findings indicated that of the irrigation beneficiaries 83.8% and 75.9% of the non – beneficiaries have received inputs from the agricultural service cooperative of the *woreda*. The second main source for irrigators was found to be traders at the farmstead.

Table 4.10 Source of the inputs

Source of inputs	Irrigators (N= 37)		Non – irrigators (N= 58)	
	Frequency	Percent	Frequency	Percent
Do not use	1	2.7	10	17.24
Traders at farmstead	5	13.5	4	6.9
Agricultural Services Cooperative	31	83.8	44	75.86

Source: Own survey

However, the idea from the focus group discussion with community representatives and cooperative union and cooperative experts confirmed that

sometimes the inputs supplied by the agriculture services cooperative are expired ones and hence not recommended by users.

## **4.5 Impact of Irrigation on Housing Conditions and Food Security**

### **4.5.1 Housing Condition of the Sample Households**

The level and value of household income sources is directly related with household housing type and material used in the household. In this regard, the survey results revealed that out of 37 irrigator households 21 are living in houses roofed with corrugated sheet and 16 are living in grass roofed house. According to the survey result again, out of 69 non – irrigator households 13 are living in a house roofed with corrugated sheet but 56 of the non – irrigator households are living in a house roofed with grass covered house. Thus, the better housing condition of irrigators might be using the income from the sale of cash crops. The qualitative data obtained from key informants and FGD further reinforces this data. In the words of the interviewees and the discussants, when asked about the important outcomes of irrigation, it was responded that irrigators are able to construct better houses. Some further indicated that there are irrigating farmers who have built new living rooms and more than two houses in near by towns for rent.

Table 4.11 Housing conditions of the study area

<b>Type of house owned by the sample household</b>	<b>Irrigators</b>	<b>Non – irrigators</b>
Grass roofed	16	56
Corrugated sheet roofed	21	13
Total	37	69

Source: Own survey

#### 4.5.2 Impact of Irrigation on Food Self – sufficiency

The survey depicted that 38 percent of the irrigator households were found to have been able to feed themselves throughout the year during the survey year from their own production, while 24.3 percent of them feed ten months from their own production. On the other hand, majority of the non-irrigator households were found to have been able to feed themselves from their own production for about six to nine months during the survey year.

Table 4.12 Months of the year feed from own production

Description	Months Feed from Own Production			
	Irrigators		Non- irrigators	
	Frequency	Percent	Frequency	Percent
1	1	2.7	3	4.35
2	1	2.7	1	1.45
3	2	5.4	1	1.45
5	1	2.7	1	1.45
6	2	5.4	11	15.94
7	0	0	12	17.39
8	4	10.8	14	20.29
9	3	8	14	20.29
10	9	24.3	10	14.49
12	14	38	2	2.9
<b>Total</b>	<b>37</b>	<b>100</b>	<b>69</b>	<b>100</b>

Source: Own survey

This variation implies that access to irrigation can reduce the level of consumption shortfall and improved the number of months a household can feed itself from its own production. This could be because the irrigation water users produce at least one more crop than the non – irrigators, during the dry season, as well as yield per hectare could be higher in the irrigated plot.

#### **4.5.3 Impact of Irrigation on Dependency on Food Aid and Safety Net Programs**

It is considered that irrigation needs more labour and hence not only needs family labour but also demands hired labour. In the safety net program, the targeting those who should involve, in the direct and public work is very clear and has a comprehensive guideline developed to be used all over the country. This guideline has also been distributed to all *Tabias* of Tigray being translated in to the local language. According to the guideline, the main targeting criteria for households for the program are households that are chronically food insecure, i.e. those that earn below one dollar per day, or households below the poverty line. Hence, the principle is that government as part of its food security program, targets food insecure households to participate in food for work programs in return for cash or in kind (wheat) payments. It has been assessed whether irrigation users and non – irrigation users are targeted separately in food aid and safety net programmes.

Table 4.13 Participation in safety net program and food aid

<b>Description</b>	<b>Participation in FFW/PSNP in %</b>			
	<b>Food aid</b>		<b>PSNP</b>	
	<b>No</b>	<b>percent</b>	<b>No</b>	<b>Percent</b>
Irrigation beneficiaries	10	27.02	22	59.46
Non – irrigation beneficiaries	54	78.26	52	82.6

Source: Own survey

The finding revealed that 27 % of irrigator and 78 % of non – irrigator households were found to have participated in food aid or safety net program in their respective area. The degree of participation was quite different between the irrigation users and non – irrigation users. For this reason, participation of households in safety net/PSNP is seen to depend to a certain extent on whether they have access to irrigation or not, which implies that irrigation reduces consumption shortfall. The figures imply that if irrigation activities were increased, food aid dependency would be proportionally reduced.

Table 4.14 Income from FFW/PNSP and non – agricultural activities

<b>Description</b>	<b>Types of beneficiary</b>	<b>Mean</b>
Income from food for work	Irrigation beneficiaries	410 birr
	Non – Irrigation Beneficiaries	425 birr
Income from off-farm activities	Irrigation beneficiaries	452 birr
	Non – Irrigation Beneficiaries	511 birr

Source: Own survey

According to the table described above, the mean income earning from food for work or PSNP by both irrigation users and non – irrigation users was found to be Birr 417.5 and 481.5 respectively.

#### **4.5.4 Impact of Irrigation Development on Household Coping Mechanism**

When a household faces food shortage, different coping mechanisms are used to cope up in order to fill the gap up to the next harvest season. This has been assessed to see if there is any differences in coping mechanism between the users of irrigation and non – users of irrigation.

The first coping mechanism practiced by the those who have no access to irrigation was found to be participating in food for work or government support /aid, sell of their livestock and followed by requesting a credit from relative and food self deprivation.

Table 4.15 Rank of the most important coping mechanism

<b>Rank</b>	<b>Irrigation beneficiaries</b>	<b>Non - irrigation beneficiaries</b>
1	Sale of animals	Food for work
2	Food for work	Sale of animals
3	Food self deprivation	Food self deprivation
4	Credit from relative	Credit from relative

Source: Own survey

In the case of the irrigation beneficiaries, the first coping mechanisms was found to be selling of their animals, Food for work and followed by food self – deprivation and finally ask credit from their relatives and friends. In this case selling of animals comes first probably because they have enough livestock that can be easily used for sale during shortage of food and necessary expenditure for their household consumption.



## **CHAPTER FIVE**

### **Conclusion and Recommendation**

#### **5.1 Conclusion**

The history of irrigation shows that irrigation has played a key role in increasing farmer's income where it is well managed by lowering the risk of crop failure. Irrigation development aims to increase agricultural income and to improve the economic welfare of the rural societies. Irrigation plays a big role in filling the gap in food shortage and to achieve long-term food security. The high and market oriented yields obtained from irrigation and other benefits such as creation of employment opportunity, reduced consumption shortfalls and food security are an indication that irrigation can bring about development and the end of poverty.

As briefly discussed in the main body of this study, the WUAs committee is in charge of the coordination and management of the irrigation scheme. The WUAs has its own institutional management and bylaws which all members have understood in rules and regulations to be respected and implemented by each member of the irrigation scheme. The WUAs committee is responsible in taking care of the management irrigation but they are always biased in giving the irrigation water first to their family and relatives, even if they have watering time schedule.

The major challenges of the irrigation development in the study area are:

- water conveyance problem which cannot be afforded by the local farmers,
- lack of access to market - the problem of getting a decent price for their produce and the problem of planting the same crops at the same time, absence of demand for their products,
- poor infrastructure such as road and transportation to take their product to the market centers and to attract traders to the farming place ,

- failure to adopt modern technologies,
- the problem of optimal utilization of water because of the earthen canal conveyance of the water,
- lack of government support and
- unfair price of improved technologies affects the full utilization of the irrigation.

As compared to other household living conditions between the irrigation users and rainfed households, the majority of the irrigation users were found to have been able to feed themselves from their own production (38% of them 12 months, 24.3% of them more than 10 months) while the non-users of irrigation were found to have been able to feed themselves only from 6 to 9 months. This latter group relied more heavily on food aid during times of hardship. This signifies that irrigation plays a key role in improving the growing demand for food and to achieve long term food security to reduce the level of consumption shortfall.

Irrigator households were found to be a better position in owning asset comparing to non irrigator households. According to the survey, 21 out of 37 irrigator households were found to live in houses roofed with iron corrugated sheet while 16 out of 69 non irrigator households were found living in houses with corrugated sheet. This indicates that irrigation disproportionately contribute in the improvement of asset creation by taking the types of houses and its material used as a proxy asset creation

Irrigation has contributed to reduce unemployed people through increased employment opportunity for the non irrigators. The survey result depicted that 63% of the irrigation water users and 23% of the none-irrigation users employed hired labor mainly because of the fact that irrigation demands more labour compared to the nature dictated agriculture.

## 5.2 Recommendation

Based on this study, the following general recommendations are forwarded.

- During the focus group discussion it has been emphasized that the irrigation water distribution is very unfair since the WUAs members always give the water schedule first to their family and relatives. Therefore, the government should participate during the irrigation committee election so as to avoid partiality to enhance the production and productivity of the irrigation scheme.
- During the data collection it has been observed that the irrigation water sank into the earth before it reached the irrigable land, which was confirmed by the key informants. Therefore, the government and other concerned bodies should give support to the canal improvement to maximize the optimal utilization of the irrigation so as to enhance food security situation.
- Availability of fair price and product market is of paramount importance to the success of irrigated farming. In this regard, the existing pricing in the study area is very low and the market is far from the irrigation site. Therefore, government and other development sectors should give due emphasis to product marketing and prioritize the development of low price inputs to increase crop productivity, price bargaining power and profitability of the irrigators.
- Access to the water resource is vital to the productivity and improvement of food security of rural peasants. But in the study area, it was found that farmers cannot have access to irrigation without the replacement of their land cultivated by rainfall in order to get irrigable land at the irrigation site. Thus, an alternative means for the use of water resource should be devised to encourage these farmers to become involved in irrigation and benefit from their resource.

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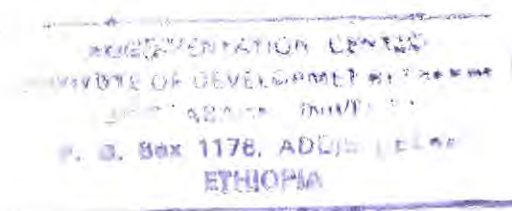
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## Appendix one

### **Subject: To Assess the Contribution of Irrigation Development on Household Food Security**

#### **Dear Respondents:**

The purpose of this questionnaire is to collect data on the contribution of irrigation development on household food security for my thesis in the partial fulfillment of the requirements for the degree of master (MA) in Development Studies Rural Livelihood and Development in Addis Ababa University. The results of this study are expected to help different stakeholders including the irrigation beneficiaries, policy and decision makers to take appropriate measures to further improve the irrigation management and draw lessons in expanding similar activities. The questionnaires are fully for the academic research purpose so that any information you provide will be kept confidential. Therefore, I kindly requested to provide a genuine responses.

With best regards

Gebrehiwot Belay

**Section 1: Household Survey**

1.1. Woreda: \_\_\_\_\_

1.2 Scheme : \_\_\_\_\_

1.3 Respondents of the \_\_\_\_\_

1.4 Relation to head \_\_\_\_\_

1. Head, 2. Spouse, 3. Son, 4. Daughter, 5. Other

1.5 Marital status :

1. Single \_\_\_\_\_ 2. Married \_\_\_\_\_ 3. Divorced \_\_\_\_\_  
4. Widowed \_\_\_\_\_

1.6 Sex 1. Male \_\_\_\_\_ 2. Female \_\_\_\_\_

1.7 Age \_\_\_\_\_

1.8 Number and Sex Composition of the Household Members

1. Male \_\_\_\_\_ 2. Female \_\_\_\_\_ 3. Total \_\_\_\_\_

1.9 Age Composition of the Household Members 1. 0-5 \_\_\_\_\_ 2. 5-14 \_\_\_\_\_

3. 15-64 \_\_\_\_\_ 4. Over 64 \_\_\_\_\_

1.10 Educational Level of the Household Head:

1. Illiterate \_\_\_\_\_
2. Read and Write only \_\_\_\_\_
3. Elementary School \_\_\_\_\_
4. High school \_\_\_\_\_
5. Diploma \_\_\_\_\_

1.11 How many children in your household are in the school age

Girls \_\_\_\_\_ Boys \_\_\_\_\_ Total \_\_\_\_\_

1.12 Of those of the school age children how many are enrolled in school \_\_\_\_\_

1.13 If not enrolled in school give the reason

1. The school is too far from home \_\_\_\_\_
2. Lack of finance to cover school related expenses \_\_\_\_\_
3. Need for child labour \_\_\_\_\_
4. Other (specify ) \_\_\_\_\_

1.14 What is the major occupation of the household head?

1. Farming \_\_\_\_\_
2. Guarding \_\_\_\_\_
3. Petty trading \_\_\_\_\_
4. Pensioner \_\_\_\_\_
5. Other (specify) \_\_\_\_\_

1.15 Do you have additional income that supplements your major occupation?

1. Yes \_\_\_\_\_
2. No

1.16 If your answer is yes which of the following is your income source?

1. Earning from daily labour work
2. Sale of fuel wood and charcoal
3. Petty trading
4. Sales of local drink
5. Sales of pottery
6. Remittance/gift

1.17 What is the one-way distances (in minutes) from residence to nearest infrastructure and services

	Walking distance (for a single trip only)	
	(Minutes)	(Km)
Input supply shop		
Veterinary clinic		
Human clinic (health center )		
Livestock market		
School		
Grain mill		
Potable water supply		
Other(specify)		

1.18 Were you or any member of your family ill last year?

1. Yes \_\_\_\_\_ 2. No \_\_\_\_\_

1.19 If your answer for Q 1.18 is yes, how many times were they ill?

Family Members	Number of People	Type of illness	Frequency of illness	Treatment		Place of treatment
				Yes	No	
Children						
Adolescents						
Adults						
Old People						

**ILLNESS:**

- |                                |                        |
|--------------------------------|------------------------|
| 1. diarrhea                    | 6. malaria             |
| 2. dysentery (acute diarrhea ) | 7. respiratory problem |
| 3. trachoma                    | 8. common cold         |
| 4. skin(rash problem)          | 9. fever               |
| 5. schistomiasis               | 10. other              |

1.20 If you did not treat any of the family illnesses what is the reason?

1. absence of money to cover the medical expense\_\_\_\_\_
2. the illness was not serious \_\_\_\_\_
3. distance of the health center is far from home \_\_\_\_\_
4. others (specify)

**Section 2: Household Asset Holding**

2.1 Number of buildings owned by household

Type of roof	Number	When Bought (year)?	Approximate Value (in Birr)
Corrugated iron			
Mud/ sand/ plastic stone			
Thatched roof			
Separate stall			

2.2 Livestock owned to date

Type of animal	Quantity	Approximate value(in Birr)
Calf		
Ox		
Bull		
Heifer		
Cow		
Sheep		
Goat		
Mule		
Donkey		
Camel		
Chicken		
Others (Specify)		

2.3 Do you have cultivable land? 1. Yes \_\_\_\_\_ 2. No \_\_\_\_\_

2.4 If your answer for Q 2.3 is yes fill in the following table using the codes below: for the year 2009

Land holding (*Tsimad*)

Land holding	Owned Cultivated	Rented in	Rented out	Share cropped in	Share cropped out	Total
Crop land	Rain fed					
	Irrigated					
Pasture land / grazing						

2.6 Crop production and productivity in the year 2008/2009

Plot name	Season	Type of crop	Grain yield (Qt)	Price birr/Qt	Type of grain use		
					Home consumption	Hoard for seed	Sold out (qt)
	Kiremti						
	Belg						
	Irrigated						
	Kiremti						
	Belg						
	Irrigated						
	Kiremti						
	Belg						
	Irrigated						

Crop type 1 = barley 2= wheat 3 maize 4 teff 5 millet 6 sorghum 7 chick pea

8 bean 9 flax seed 10 vinegar 1 field seed 12 sesame 13 onion 14 tomato 15 potato 16 lentil 17 lettuce 18 cabbage 19 carrot 20 garlic 21 banana 22 guava 23 papaya 25 orange 26 other (specify) \_\_\_\_\_

2.7 For how many months of the year do you feed from your own production?

\_\_\_\_\_

2.8 If you didn't feed last year by your own production how many months did you face food shortage \_\_\_\_\_ and mention the name of these months

\_\_\_\_\_

2.9 Have you ever faced food shortage in the past 10 years?

Yes \_\_\_\_\_ No \_\_\_\_\_

2.10 if your answer to Q 2.9 is yes for how many months did you face food shortage during a normal year? Mention the months

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2.11 for how many months did you face food shortage during a drought / hunger year? Mention the months

---



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2.12 If your answer to Q2.11 is yes how you did cope up? Put the following coping mechanisms that you adopted in their order of importance

Borrow money from other sources	
Others (specify)	
Coping mechanism	Rank (1= most important 2= important 3= less important )
Reduce food consumption	
Eat wild edible plants /fruit /famine food	
Request help from relatives	
Purchase low cost foods	
Look for assistance from the government	
Obtain food /cash through food / cash for work	
Sale of trees and wood	
Sale of animals	
Search for other employment within the woreda	
Migration to anywhere in Ethiopia for labour	
Borrow money from relatives	

### Section 3: Water Management

3.1 For how long have you used irrigation? Since \_\_\_\_\_ (year)

3.2 What is the approximate distance of your irrigation field from your residence? (km or meter)

3.3 What is the water conveyance method from the source to the field?

1. Concrete canal \_\_\_\_\_
2. Earthen canal \_\_\_\_\_
3. High density pvc \_\_\_\_\_
4. Other (specify) \_\_\_\_\_

3.4 What type of water application method do you use ?

1. Flooding \_\_\_\_\_
2. Furrow application \_\_\_\_\_
3. Sinker irrigation \_\_\_\_\_
4. Drip irrigation \_\_\_\_\_
5. Other (specify) \_\_\_\_\_

3.5 Did you get enough water for your irrigation last year?

No \_\_\_\_\_ Yes \_\_\_\_\_

3.6 If your answer for Q 3.5 is no mention the months that you faced water shortage \_\_\_\_\_

3.7 If you had shortage of irrigation water last year what did you do?

1. Used only part of the irrigation area \_\_\_\_\_
2. Planted crops that required less water \_\_\_\_\_
3. Stopped producing \_\_\_\_\_

3.8 How do you evaluate the strength of your water users' committee/cooperative?

1. Very strong \_\_\_\_\_
2. Strong \_\_\_\_\_
3. Weak \_\_\_\_\_
4. Very weak \_\_\_\_\_

3.9 If the association is weak or very weak what are the main problems? Please describe \_\_\_\_\_ them

3.10 Do you use the irrigation water as a supplement for seasonal crops when rain comes late/stops early?

1. No \_\_\_\_\_ Yes \_\_\_\_\_

3.11 If your answer for Q3.10 is no what is the reason for not using it?  
\_\_\_\_\_

### **Issues related to irrigation practices**

3.12 How many times do you produce per year?

1. Once \_\_\_\_\_ 2. Twice \_\_\_\_\_ 3. Three times \_\_\_\_\_

3.13. How many types of crops do you produce in your irrigable plot of land per season?

1. One type, please explain \_\_\_\_\_

2. Two types, please explain \_\_\_\_\_ and \_\_\_\_\_

3. Three types, please explain \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_  
\_\_\_\_\_

3.14 Have you ever received training on irrigation management or other issues?



3.15 If your answer for Q3.14 is yes when and for how long

Type of training	Year of the training	For how many days
Water management		
Organization and management /cooperative		
Input use		
Crop harvest		
Post		
Management		

3.16 How many months of the year are you engaged in the irrigation activities?

\_\_\_\_\_

3.17 Do you have labour shortage in the operation your irrigation farm?

Yes \_\_\_\_\_

No \_\_\_\_\_

3.18 If your answer to question 3.17 is yes then what do you do?

1. I sharecrop all the land \_\_\_\_\_ 2. I sharecrop part of the land \_\_\_\_\_

3. I rent all land \_\_\_\_\_ 4. I rent part of the land \_\_\_\_\_

5. I use hired labour \_\_\_\_\_

3.19 If you used hired labour how much labour did you hire last year?

\_\_\_\_\_

3.20 If you use hired labor did the payment for the labor increase because of irrigation? Yes \_\_\_\_\_ No \_\_\_\_\_

3.21 If you rent what is the renting rate per plot per year in Birr? \_\_\_\_\_

3.22 What constraints affect you in using your irrigation plot efficiently?

(Put in their order of importance) 1-5

Constraint (factors)	Rank 1, 2, 3, 4, 5
Lack of input financing	
Lack of input availability	
Lack of rural access to road and transportation	
Conflict in water utilization with users	
Lack of markets for produce	
Shortage of land	
Absence of government support	
Lack of skill	
Shortage of labour	
Other (specify)	

3.23 Do you increase your family labour utilization as a result of using irrigation?

Yes \_\_\_\_\_

No \_\_\_\_\_

**Section 4: Market Credit and Extension Services**

4.1 What is your most important source of price information for your agricultural products?

- 1. Radio \_\_\_\_\_
- 2. Newspapers \_\_\_\_\_
- 3. Traders at the market \_\_\_\_\_
- 4. Traders who come to the farmland \_\_\_\_\_
- 5. Fellow farmers \_\_\_\_\_

4.2 Where do you get most of your inputs?

- 1. Do not use \_\_\_\_\_
- 2. Trader at farmstead \_\_\_\_\_
- 3. Agricultural service cooperatives \_\_\_\_\_

4.3 How many kilograms of fertilizer and chemicals did you use last year?

- 1. Fertilizer, please explain in kilograms \_\_\_\_\_
- 2. Chemicals (herbicide and pesticide)  
herbicides \_\_\_\_\_, pesticides \_\_\_\_\_ kilograms

4.4 Is the price of the input fair? 1. Fair \_\_\_\_\_ 2. Expensive \_\_\_\_\_

4.5 Where do you sell your agricultural produce?

- 1. Take the produce to the market. Where? \_\_\_\_\_
- 2. Traders buy from field. Where do they come from?  
\_\_\_\_\_
- 3. Contract with an institution. Where do they sell?  
\_\_\_\_\_
- 4. other (specify) \_\_\_\_\_

4.6 How do you sell your produce?

1. as an individual \_\_\_\_\_
2. as a member of an information group \_\_\_\_\_
3. as member of a cooperative \_\_\_\_\_
4. other (specify) \_\_\_\_\_

4.7 Do you face any problem in selling your produce?

1. Yes \_\_\_\_\_ No \_\_\_\_\_

4.8 If your answer to Q 4.7 is yes what type of problem?

---

4.9 Do you get sufficient credit services?

Yes \_\_\_\_\_ No \_\_\_\_\_

4.10 If your answer to Q4.9 is yes from where did you get the credit?

---

4.11 If you have received credit can you tell the amount?

1. in cash \_\_\_\_\_
2. in kind \_\_\_\_\_

4.12 For what purpose did you use the credit you got?

- |                       |                                |
|-----------------------|--------------------------------|
| 1. To buy fertilizer  | 6. To buy irrigation equipment |
| 2. To buy seed        | 7. For loan repayment          |
| 3. To buy oxen        | 8. To buy food                 |
| 4. To buy animals     | 9. To start up petty trade     |
| 5. To buy animal feed | 10. Other (specify)            |

4.13 If you don't use credit what is the reason?

1. not interested
2. the credit organization is too far
3. interest rate is very high
4. other (please specify)

4.14 What kind of collateral /security was required for getting credit?

1. nothing
2. livestock
3. group guarantee
4. land certificate

**Extension services**

4.15 Were you visited by an extension agent last year?

1. No \_\_\_\_\_ Yes \_\_\_\_\_

4.16 If your answer to question 5.1 is yes, during which operation and how many times?

Period of visit	Time of visit and support given
Land preparation	
Planning /training	
Weeding	
Applying agro chemical	
Watering	
Harvesting	

4.17 Do you get advice from extension agents on the time and types of crop to be planted for better income?

1. Yes \_\_\_\_\_ 2. No \_\_\_\_\_

4.18 If the answer to question 4.16 is no, what could be the possible reason?

1. There are not enough extension agents in the area \_\_\_\_\_
2. They do not come to the area frequently. \_\_\_\_\_
3. They lack required skill to help farmers

**Other income and yearly household expenditure**

4.19 **Annual income from livestock (from Sep. 2008 – Aug 2009)**

Item	Number sold /rented in the year			Total income from sale /rent in Birr		
	Sold	Rented	Total	From sale	From rent	Total
Oxen						
Cows						
Bulls						
Heifers						
Goats						
Donkeys						
Camels						
Horses						
Honey						
Total						

#### 4.19 Non – agricultural sources of income

Description	Amount
Wage labour	
Petty trade	
Weaving	
Sale of local beverage	
Other	
Total	

4.20 Did you or any member of your family receive food aid last year

1. Yes \_\_\_\_\_ 2. No \_\_\_\_\_

4.21 did any member of your family participate last year in food for work/PSNP?

1. No \_\_\_\_\_ 2. Yes \_\_\_\_\_

**4.22 Household expenditure /month for most of the items listed below**

Commodity	Quantity consumed			Expenditure		
	Own production	Purchased or any other source	Total	Unit	Per	Purchase value expressed in Birr
Teff						
Wheat						
Barley						
Millet						
Maize						
Sorghum						
Bean						
Tomato						
Garlic						
Livestock						
Purchased livestock production						
Meat						
Milk						
Egg						
Sugar						
Coffee						
Salt						
Soap						
Gas						
Clothing						
Shoes						
Medical expenses						
School expenses						
Other						
Total						

## APPENDIX THREE

### Checklist for focus group to the *woreda* agriculture and rural developmental cooperative office experts, and *woreda* administration

Date \_\_\_\_\_ offices experts and *woreda* administration  
*Woreda* \_\_\_\_\_

Name of the *woreda* scheme \_\_\_\_\_

1. Who initiated irrigation development in your area? \_\_\_\_\_
2. Were the beneficiaries consulted before construction? \_\_\_\_\_
3. Did the community participate in the construction ? \_\_\_\_\_  
What was their contribution ? \_\_\_\_\_
4. How strong is the cooperative /users association? \_\_\_\_\_
5. How is the irrigation land distributed? \_\_\_\_\_
6. What technical obstacle do you observe in the scheme? \_\_\_\_\_
  - How do you solve it? \_\_\_\_\_
  - What is beyond your capacity? \_\_\_\_\_
  - What is your suggestion to solve the problem? \_\_\_\_\_
7. Are there practical changes in crop as a result of the irrigation water?  
\_\_\_\_\_
8. What livelihood improvements are registered at household level so far?  
\_\_\_\_\_
  - How is it explained?

**Interview Questions to the Development Agent**

Date .....

Name of irrigation scheme .....

Name of the Interviewee ..... Sex .....

1. Whom does the irrigation structure belong to?
2. How do you help the irrigation users?
3. Have there been any conflicts pertaining to irrigation in the scheme?
  - If yes, how did you solve them?
  - What are the outstanding issues so far?
4. Do you make decisions pertaining to irrigation at your discretion or have to wait for guidelines to come down from *woreda* office?
5. What can be grown using irrigation?
6. How do you evaluate the contribution of the scheme to household income generation?
  - Do you think workers of land in the scheme are utilizing water to the maximum in the dry season?
  - Are all the users able to support themselves year round from their own production?
  - If not, what is the reason and what should be done?
7. How strong is the cooperative or association?
  - Do they have their own binding and enforcing by-laws?

8. Do you believe that you have enough skill and are making maximum effort to help the farmers?
- If not, what are the gaps you want to fill?
  - Are the beneficiaries achieving what can be achieved from their irrigation plots?
  - What are the indicators?
9. What differences do you observe between the irrigation users and non-users related to production practices and productivity?

**Checklists for the cooperative committees, *Tabia* administration and informant beneficiary farmers**

Date .....

Name of irrigation scheme .....

Group Members	Sex	Position
1. ....	.....	.....
2. ....	.....	.....
3. ....	.....	.....
4. ....	.....	.....
5. ....	.....	.....
6. ....	.....	.....
7. ....	.....	.....

1. How old is the irrigation scheme?

2. Do you have a water users association or cooperative?

1. Yes                      2. No

3. If your answer to Q.2 is yes, who established the association or cooperative?


1. Bureau of agriculture
2. *Woreda/ Tabia* administration
3. Irrigation users by their own initiative
4. Others Specify .....



## Declaration

I, the undersigned, declare that the thesis is my original work, has not been presented for a degree in any other university and that all sources of material used for the thesis have been duly acknowledged.

**Declared by:**

 \_\_\_\_\_

Gebrehiwot Belay

Candidate

**Confirmed by:**

 \_\_\_\_\_

Ali Hoase

Advisor

