A THESIS

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BY: Debella Ebissa

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INDIRA GANDHI NATIONAL OPEN UNIVERSITY

SIGNIFICANCE OF SMALL SCALE IRRIGATION IN IMPROVING LIVELIHOOD OF HOUSEHOLDS: A CASE STUDY AT ARSI NEGELE DISTRICT, WEST ARSI ZONE, OROMIA, ETHIOPIA

BY: ***Debella Ebissa***

May, 2014

ADDIS ABABA

ETHIOPIA

DECLARATION

I **Debella Ebisso**, hereby declare that the Dissertation entitled *Significance of Small Scale Irrigation in Improving Livelihood of Households: A Case Study At Arsi Negele District, West Arsi Zone, Oromia, Ethiopia* submitted by me for the partial fulfillment of the M.A. in Rural Development to Indira Gandhi National Open University, (IGNOU) New Delhi is my own original work and has not been submitted earlier either to IGNOU or to any other institution for the fulfillment of the requirement for any course of study. I also declare that no chapter of this manuscript in whole or in part is lifted and incorporated in this report from any earlier work done by me or others.

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CERTIFICATION

This is to certify that Mr./Miss/Mrs **Debella Ebisso** student of M.A. (RD) from Indira Gandhi National Open University, New Delhi was working under my supervision and guidance for his/her Project Work for the Course MRDP-001.

His/Her Project Work entitled *Significance of Small Scale Irrigation in Improving Livelihood of Households: A Case Study At Arsi Negele District, West Arsi Zone, Oromia, Ethiopia* which he/she is submitting, is his/her genuine and original work.

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ACRONYMS

ADLI - Agricultural Development Led Industrialization

AFDB - African Development Bank

DA - Development Agents

EGS - Employment Generation Schemes

EPRDF - Ethiopia People Republic Democratic Front

ESRDF - Ethiopian Social Rehabilitation Development Fund.

EVDSA - Ethiopian Valley Development Studies Authority

FAO - Food and agricultural Organization (of UN)

FDRE - Federal Democratic Republic of Ethiopia

HH - Households.

IDD - Irrigation Development Department (of the former MOA)

IFAD - International Fund for Agricultural Development.

LWF - Lutheran World Federation.

masl - Meter above sea level.

MEDaC - Ministry of Economic Development and Cooperation.

MOA - Ministry of Agriculture

MWR - Ministry of water resources

NGO - Non-Governmental Organization.

PA - Peasant Association

ONCCP - Office of the National Committee for Central Planning

SAER - Sustainable Agricultural and Environmental Rehabilitation

SCF- UK Save the Children Fund- United Kingdom.

WoA - Woreda Office of Agriculture

WUA - Water Users Association

ABSTRACT

This purpose of this study was to examine the significance of small-scale irrigation in improving the livelihoods of the beneficiary households by ensuring food security in Arsi Negelle Woreda of West Arsi Zone, Oromia region. Its specific objective was to assess the impact of irrigation on household food security, paying particular attention to its contribution towards increasing agricultural production, household income and the potential to reduce dependency on food assistance.

A total of 170 household heads, who adequately represented Arsi Negelle woreda as homogenous community, were selected via simple random sampling technique. To serve these objectives, household survey, focus group discussion and key informant interview were used to collect data at household and individual level. Annual household production, income generated, asset owned and other socio-economic data were collected using structured questionnaire with the help of local DAs after a brief highlight was given. Background information of the study area, irrigation potential, beneficiaries, market survey, etc. data were collected from concerned government line departments in the woreda.

The study revealed that the irrigation scheme enhanced household food security and their wellbeing during the off-farming (dry) season, and in addition it has helped to sustain, diversify and increased agricultural production. The Irrigation had enabled farmers to generate more income and maintain productive assets. The study had also revealed that irrigation promotes the use of agricultural inputs through supply of water during the dry season and when the amount and distribution of the main rain is found to be inadequate. Such opportunity of irrigation improves food availability and the food security situation of households.

The result of this study also shows that households with access to irrigation have been able to double their annual income through the production of high value horticultural crops. Irrigation is providing gainful self-employment for participants and improving household access to marketable food. Moreover, households could diversify their diet composition and be in a better nutrition status due to diversified food sources produced through the use of irrigation.

CHAPTER ONE: **INTRODUCTION**

1.1. Background of the study

Agriculture, as in many other developing countries, is the mainstay of Ethiopia's economy, with the livelihood of nearly 85 percent of the population, over 50 percent of gross domestic product and about 90 percent of foreign exchange earnings directly depending on it. Many would concur that the overall performance of Ethiopia's economy for the future depends on the development in this sector.

Even though, agriculture plays a decisive role in the economy of Ethiopia, its potential is largely unexploited. Less than 40 percent of the arable land is currently cultivated (IWMI, 2005). Ethiopia's irrigated land is fewer than 200,000 hectares of farmland, although a total of 3.7 million hectares had been classified as potentially irrigable (MoWR, 2002).

In spite of the dominant role agricultural sector plays in Ethiopia, its performance has been disappointing as the problem of food security is still very serious. Food production has lagged behind population growth and the natural resources base on which agriculture fundamentally depends up on has eroded at alarming rate, further depressing the sector productivity. The poor performance of the sector and the problem of food security has worsened by the rapid population growth and hence of a rapidly increasing demand for food. It is estimated that Ethiopia must double its cereal production by 2025 to meet the food needs of its rapidly growing population (IWMI, 2005).

Ethiopian agriculture sector is largely small-scale, subsistence oriented and heavily dependent on rainfall, which is highly variable spatially and temporally. The farming system is mainly based on plough and animal draught power,

which has created complementarities between crop and livestock production for centuries. With the advent of high population growth in recent years, recurrent drought has been threatening the farming system. The growing population pressure has resulted in ever declining household crop production, diminishing grazing land, feed shortage, scarcity of manure and deforestation. Consequently, food insecurity often turns into famine with the slightest adverse climatic incident. The challenge for the country is how to meet this increasing food demand with the existing but diminishing natural resources and worsening climatic condition. Hence, a sustainable increase in food production to achieve food self-sufficiency and improve the well-being of the citizen depends, at least in part, on how Ethiopia addresses its dependence on erratic rainfall and the weak link between its agriculture and water resources.

In line with the experiences of the green revolution in Asia, the dominant public interventions to promote the performance of the agricultural sector in Ethiopia have been promotion of improved production technologies mainly improved seed and fertilizer. In recent years, the promotion of different forms of irrigation both in drought prone and potential areas of the country has been considerable.

World Bank (2007a) indicated that, if Ethiopia stays on a business-as-usual growth path, poverty will increase by another 10 million people, and food security will be compromised even further. The same source indicated that the largest impact on poverty and food insecurity can be achieved through a focus on growth in the production of staple crops, which today account for 65 percent of agricultural value added as well as most smallholders' employment. The simulated growth in staple food production could be achieved through a doubling of the irrigation area by the year 2015.

According to FAO (2000), small-scale irrigation development has shown improvement throughout the developing world that it can be used as a key

drought mitigation measures and a vehicle for long term agricultural development of the country. The development of small-scale irrigation is one of the major intervention areas to boost agricultural production in the rural area of Ethiopia (IWMI, 2005). Small-scale irrigation schemes enable to increase agricultural production more than that could be achieved with rain fed agriculture. It helps farmers to overcome rainfall and water constraints by providing a sustainable supply of water for cultivation and livestock; strengthen the base for sustainable agriculture; provide increased food security to the community through increasing agricultural production, contribute to the improvement of poor nutrition level of the farmer and provide source of household income (Abonesh, 2006).

The government of Ethiopia has recognized the importance of water and increased its focus on water resource development and utilization to achieve such broad objectives: economic growth, rural and agricultural development, food security and protection against adverse drought condition -all expected to reduce poverty (MoWR, 2000). Its water policy stresses on the need for increased use of small-scale irrigation system through rivers diversion and building small dams.

The central role of irrigated agriculture is well understood in Oromia National Regional State. In the region, extreme poverty and hunger push people into marginal lands and more fragile ecosystems, characterized by drought stress and low soil fertility. Therefore, irrigated agriculture is important in stimulating sustainable economic growth and is the cornerstone for food security and poverty reduction. The regional government has established institutions at different levels that are responsible for studying, design and implementation of irrigation schemes. These institutions are giving extension service and training for better utilization of water resource throughout the region. The Regional

government has prepared short term, medium term and long term small scale irrigation development program (2002-2016) (MoWR, 2002).

Irrigation is assumed to reduce poverty. However, it is not well known to what extent farm households using irrigation are better- off than those who depend on rainfall and whether there exists variability in poverty status among farmers, under the current situation in the region. The study aimed at filling the information gap on the role of small-scale irrigation infrastructure in poverty reduction.

1.2. Statement of the Problem

The Ethiopian economy is dominated by smallholder subsistence agriculture, which accounts for 46% of the GDP, 85% of export commodities and 85% of the employment opportunity (Makombe et al., 2007). The majority of the sector depends on rainfall. Irrigation and improved agricultural water management provide opportunities to cope with the impact of climatic variability and to enhance productivity per unit of land and to increase the production volume.

One of the interventions in PASDEP to accelerate growth in the agricultural sector is promotion of irrigated agriculture mainly by expanding of irrigated area through development of multi-purpose dams including wise utilization of surface and ground water (MoFED, 2006). Current agricultural development strategy and policy of the government promotes irrigated agriculture in all potential river basins.

In Ethiopia, increasing food demand can be met in one or a combination of three ways: increasing the area of arable land, increasing agricultural yield and increasing cropping intensity (number of crops per year). Expansion of the area under cultivation is a finite option, especially in view of the marginal and

vulnerable characteristic of large parts of the country's land. Increasing agricultural yields and cropping intensity in both rain fed and irrigated agriculture are the most viable options for achieving food security in Ethiopia. Hence, the problem is failure of production as a result of natural causes, such as dry-spells and droughts, agricultural production can be stabilized and increased by providing irrigation and retaining more rainwater for in situ utilization by plants (IWMI, 2005).

Irrigated agriculture is one of the critical components of world food production, which has contributed significantly to maintain world food security and to the reduction of rural poverty.

In Ethiopia, the irrigated area has increased rapidly: In 1995 it was 75,000 ha and in 2003 it was 200,000 ha, in 2009/10 it had increased to 853,000 ha and at the end of the Ethiopian 5 years transformation plan (2014/15) will reach 1,850,000 ha (Diao and Nin Pratt, 2007; GTP, 2010).

The increased competition for water in the Central Rift Valley puts a great pressure on the local hydrology and ecosystem. The sustainability of irrigated agriculture is being questioned, both economically and environmentally (Jansen et al., 2007). The majority of existing irrigation schemes are small, serving usually not more than 200 to 300 households (Tahal Consulting Engineers, 1988). Many of these schemes are based on stream and river diversions and ground water wells, while some depend on small dams and perennial springs. Most of the schemes were designed and developed without the consent of the local communities. As a result, many of the small-scale irrigation projects have been operating below expected returns. The sustainability of small-scale irrigation projects depends on (operational) management. Many studies in Ethiopia focus on technical aspects of irrigation schemes, and very little is known of the socio-economic implications of irrigation development (Van Den Burg and Ruben, 2006).

Hence, there is a need for better understanding of the socio-economic functioning of smallholder irrigation schemes in the Central Rift Valley, which could contribute to improvements in their performance. The aim of this research is to the assess the significance of small scale irrigation in improving livelihood of households in Arsi Negele woreda, to identify operational constraints, and to identify options to improve their performance in their future sustainability.

1.3. Objectives of the Study

The overall objective of the study will be to assess the significance of small-scale irrigation in improving the livelihood of households. The specific objectives of the study are:

The Specific Objectives are:

1. To assess the livelihood strategies among the users and non-users of small-scale irrigation;
2. To assess determining factors to the livelihood status of the households;
3. To investigate factors affecting the effectiveness of irrigation development;
4. To investigate the opportunities available for small scale producers of the district;
5. To suggest possible intervention areas in order to bring better socio economic benefits to the small scale irrigation user, horticulture farmers.

1.4. Research Questions

1. Is there a significant difference in livelihood strategies among the users and non-users of small scale irrigation in Arsi Negelle district?
2. What are the determining factors affecting the livelihood asset building of the households in the area?

3. Are there any other factors, which could negatively affect irrigation development in the study areas? If so, what is the magnitude of the problem?
4. What are the opportunities for small scale irrigated crop produces?
5. What are the possible intervention areas in order to bring better socio-economic benefits to the small scale irrigation users in the district?

1.5. Scope of the study

The study focused on the assessment of the impact of small-scale irrigation with household livelihoods. This study is limited to only one district, Arsi Negelle which is located in West Arsi administrative zone, because of the limited time and resources. Even though it would have been better to assess other districts found in the zone, the district was purposely selected because of its accessibility and good practices in small-scale irrigation.

1.6. Significance of the study

Irrigated agriculture is a priority in the agricultural transformation and food security strategy of the Ethiopian government. Increased availability of irrigation and less dependency on rain-fed agriculture is taken as means to increase food production and self-sufficiency of the rapidly increasing population of the country.

Under the fifteen-year Water Sector Development Program (WSDP), irrigation development sub-program, a total of 1606 small-scale irrigation schemes are planned to be implemented nationally mainly for the provision of food requirements (MOWR, 2002). Foreign governments, multi-lateral agencies and

Non-government organizations (NGOs) are expected to collaborate with government of Ethiopia to foster this program.

In line with the development policy of the country, Oromia National Regional State and NGOs are promoting irrigation development to increase and stabilize food production in the region. Large number of small-scale irrigation schemes has been built in the region. In Oromiya region, irrigation schemes have been promoted for long, yet few research activities of the impact of irrigation schemes have been conducted.

The attainment of the objectives mentioned above is important because gaining a clear understanding of the impact of past investments in small-scale irrigation is an essential prerequisite for improving and modification of future interventions. The result of the study is expected to contribute to design small-scale irrigation development strategies of the country in general and the region in particular. Besides, it will fill the information gap on the significance profile of small-scale irrigation in improving the household livelihoods in Arsi Negelle district of West Arsi Zone.

1.7. RESEARCH METHODOLOGY

1.7.1 Selection of Sample Irrigation Schemes

Among the woredas in the West Arsi Zones, Arsi Negelle has better surface water potential for irrigation development. Most of the areas of the *Woredas* comprise the lower plain. The perennial streams that flow from the highlands could be a potential source of irrigation water to the vast irrigable plain during the dry season and when the amount and distribution of the main rain is found to be inadequate for the production of crops.

Currently, modern (formal) irrigation development in West Arsi Zone is concentrated on river irrigation which for the purpose of this study, 10

peasant associations irrigation schemes were purposely selected from the existing schemes. The selection of study PAs was based on type of schemes (traditional and formal), performance level and location accessibility of irrigation schemes. Moreover, to compare irrigation households with their non-irrigation counterparts, an equal sample size of non-irrigation households were drawn from the same *kebele* where irrigation schemes are found. Thus, the difference between sample irrigators and non-irrigation households is limited to those areas having access to irrigation water.

1.7.2. Sampling Method

Sample population was classified into two groups: irrigators and non-irrigation households. Sample households from each irrigation schemes and kebeles were identified using systematic random sampling technique from the Kebele list of households. The overall sample size was 170 households, 85 from irrigation and 85 households from non-irrigation group. In the PAs taken as a sample *kebele,* out of the total 1200 irrigation and 1840 non-irrigation HHs, 170 HHs each were selected randomly using systematic random sampling technique.

Therefore, the sample size is believed to be representative and can generate reliable information since each group of households are homogeneous in their socioeconomic settings.

1.7.3. Methods of Data Collection

In this study, both quantitative and qualitative data were collected from primary and secondary sources. Thus, the following data collection methods in combination were employed during the data collection process of this study:

a) Household sample survey

The conventional household survey was the main method used to collect quantitative information. A carefully designed questionnaire consisting of interrelated questions was employed and administered by oriented enumerators. Sample household heads were the unit of analysis from whom quantitative information was collected.

The fieldwork was completed over a six-week period from the whole month January to February 2014. Ten DAs and four woreda experts were trained as enumerators to conduct the survey under the close supervision of the researcher. Therefore, the enumerators were development agents in each irrigation scheme at kebele and woreda level. Prior to launching of the survey, enumerators were briefed about the survey and familiarized with the questionnaire.

Qualitative Data Collection Methods

The qualitative assessment was included because it is useful in understanding issues that could not be obtained from questionnaire method. Qualitative data collection methods were used to obtain insights, thoughts and attitudes of peasants concerning irrigation development in the study area. In a more practical sense, information gathered using these methods include past experiences and role of the community in irrigation development, the role of irrigation in preventing adverse effect of drought in the past decades, problems and constraints of irrigation development in general and the significance of irrigation towards improving the livelihoods of the households in particular.

***b)* Focus Group Discussion**

Focus group discussion with peasants was one of qualitative data collection method in this study. Each focus group comprised of 10 to 15 individuals who were found in the same village in the study area.

c) Key Informant Interview

Individuals who were considered knowledgeable and rich in experiences about irrigation activities and socio-economic condition of the community in the study area were identified and interviewed individually. The key informants interviewed were including elderly people, local religious leaders, water committee members, development agents, *Woreda* and *Kebele* officials and zonal experts. In addition to the formal interview, I also benefited from the informal discussion with experts and colleagues at *Woreda* and zonal level. Moreover, the researcher's personal observation of the site helped to understand the over-all process of irrigation development and crosscheck data gathered through household survey and key informant interview.

d) Secondary Data

In addition to primary data, secondary data were also used in this study. Secondary data from reports were obtained mainly from West Arsi Zone Department of Agriculture, Arsi Negelle Woreda Agriculture Office, and Woreda Finance and Economic Development. Literatures related to irrigation development and food security issues from libraries and other institutions have also been reviewed.

1.7.4. Methods of Data Analysis and Presentation

Qualitative data were analyzed through systematically organizing the information and giving attention to local situations opinions, perceptions and

preferences of households at the study areas. Quantitative data analyses were carried out using simple and relevant statistical methods such as average, percentage and frequency distribution. In order to see the socio-economic impact of irrigation schemes, comparative analyses were made between irrigation and non-irrigation households.

1.8. Scope and Limitation of the Paper

This research was made to assess the socio-economic impact of small-scale irrigation and its contribution to household food security in Arsi Negelle *Woreda* of West Arsi. However, the study has many limitations. Household survey by itself is complex and to get reliable data especially on household land holding, volume of production, income, number of livestock as well as other variables which have close economic and social implications are not always free from error. Peasants can only recall the most recent information and it was not possible to get time series data. From their past experiences, people in the study area expect other land distribution practice and have responded in a different way. Moreover; peasants of the area also used to see and understand everything in light of relief assistance. As a result, they were reluctant to give information on their socio-economic status and they have often under-reported what they have actually owned. However, different methods such as focus group discussion and informal interviews were used to crosscheck the data gathered through questionnaire interview.

Another problem faced during the data gathering was unavailability of the household heads in their home during most of the daytime since they were busy cultivating and sowing their irrigation land. The only way of reaching the farmers was to visit them on their farm and they were not willing to spend required times on the interview.

Irrigation is capital intensive development intervention. However, due to lack of data on the cost of the development, it was not possible to undertake cost-benefit analysis of irrigation projects in this study. Due to financial and time constraints, the researcher had a relatively short stay in the study area. As a result, not all aspects of the household in the area were dealt with. Moreover, transport facility and other necessary research inputs were major constraints in this research.

1.9. Organization of the Paper

The paper is organized as follows. Chapter one is an introduction of the study, which contains background of the study, statement of the problem, research objective, scope of the study, significance of the study, methods of data collection and scope and limitation of the paper. Chapter two gives an overview of the literature on irrigation development and food security. Chapter three deals with general background information about the study area and with description of sample irrigation schemes. Chapter four presents major findings and discussion of the survey on small-scale irrigation and household food security. Moreover, in chapter five a summary and conclusion is made by addressing the main issues, problems and findings of the study.

CHAPTER TWO: **LITERATURE REVIEW**

2.1 Significance of Irrigation

Ethiopia is one of the poorest countries in the world and the second in population in Africa. Population is growing rapidly at a rate of more than expected close to 3 percent per annum having tremendous social, economic and political problems. In addition, natural hazards like climatic change and destructions of natural resources are the bottleneck to improving the wellbeing of the population. The government had undertaken and is taking different improving activities to the betterment of the population. Irrigation development (whether it is small-scale, medium or large) is the one in improving the livelihood of the farming community.

2.2 Theoretical Conception

2.2.1 Concept of Livelihoods

There are many different definitions of livelihoods. According to Chambers and Carney, (1998, as cited in Adunya, 2008) a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

According to Mulu, 2008 (as cited in Zewudu, 2010) a livelihood means all the different elements that contribute to, or affect, their ability to ensure a living for themselves and their household. These include: the assets that the household owns or is able to gain access to – human, natural, social, financial and physical; the activities that allow the household to use those assets to satisfy

basic needs; the different factors that the household itself may not be able to control directly, like the seasons, natural disasters or economic trends, that affect its vulnerability; and policies, institutions and processes that may help them, or make it more difficult for them, to achieve an adequate livelihood.

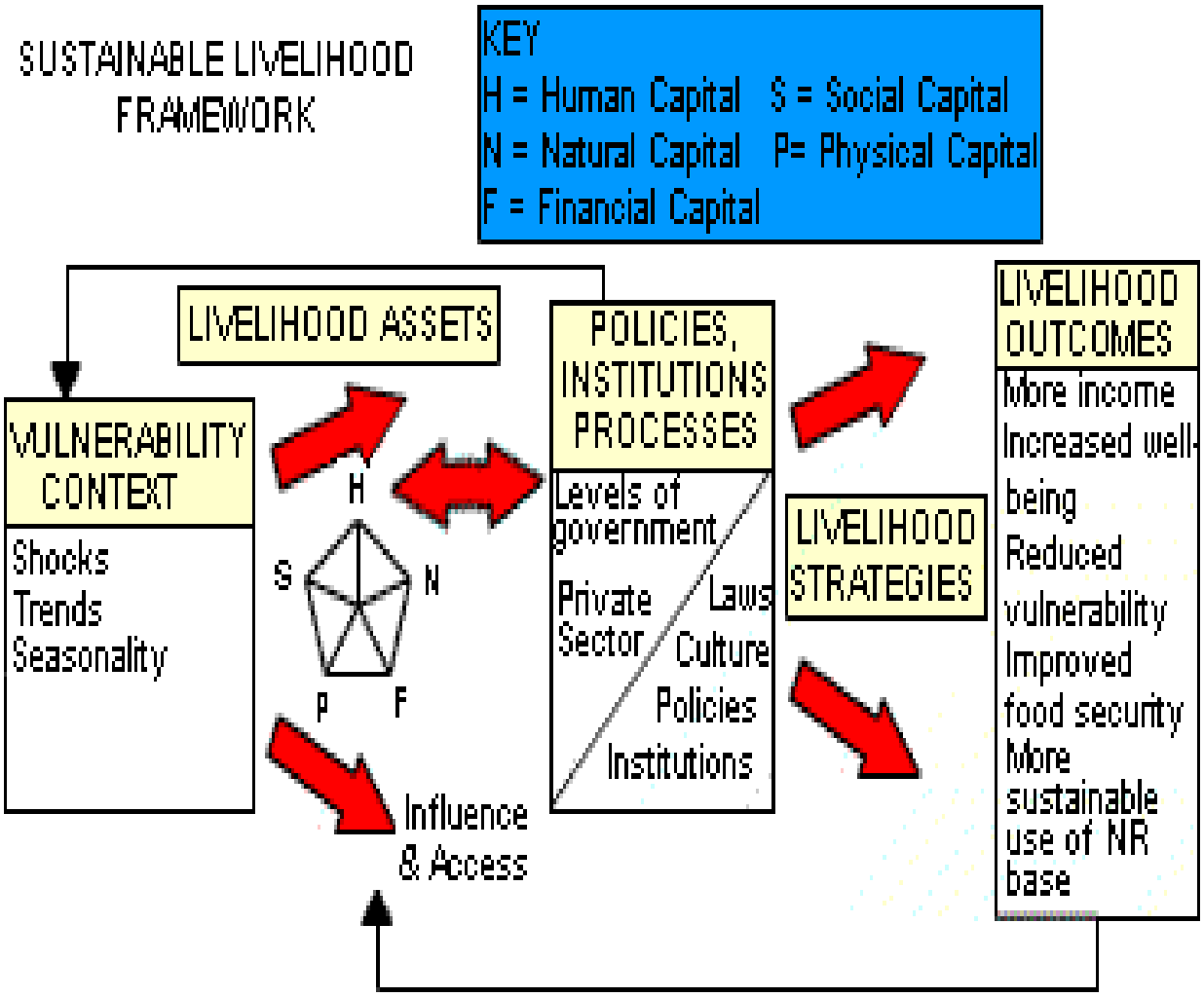
From livelihood definition, the term capability refers to the ability of individuals to realize their potential as human beings, in the sense of both of being (to be adequately nourished, free off illness) and doing (to exercise choice, develop skills, and participate socially). Strictly, capabilities refer to the set of alternative beings and doings that a person can achieve within or her economic, social, and personal characteristics (Ellis, 2000).

Similarly, Ayalneh (2002) indicated that rural livelihood systems comprise complex and diverse economic, social and physical strategies; where these strategies are realized through the activities, assets and entitlements by which individuals make a living.

2.2.2 Sustainable Livelihood Framework

The sustainable livelihoods approach has often been linked to a participatory style of development in a variety of different ways (for example, through decentralization of decision making, devolution of fiscal responsibilities and local institution building). Whilst most donors and many governments have enshrined participation in the rhetoric of official policies and project designs, the extent to which this has been translated into robust and replicable development practice has been limited (Soussan *et al.*, 2000).

A Sustainable Livelihood Framework



Source: DFID (1999)

The sustainable livelihood framework presents the main factors that affect people's livelihoods, and typical relationships between these. It can be used in both planning new development activities and assessing the contribution to livelihood sustainability made by existing activities (DFID, 1999). The framework, according to the same source, is centered on people that does not work in a liner manner and does not try to present a model of reality. Its aim is

to help stakeholders with different perspectives to engage in structured and coherent debate about the many factors that affect livelihoods, their relative importance and the way in which they interact. This, in turn, would help in the identification of appropriate entry points for support of livelihoods.

2.2.3 Vulnerability Context

Vulnerability context is the external environment in which people exist. People's livelihoods and the wider availability of assets are fundamentally affected by critical trends as well as by shocks and seasonality – over which they have limited or no control (DFID, 1999). It is the trends of change and variability in those factors that affect livelihoods, and in particular describes structural processes, that can materially disrupt different aspects of livelihood processes (Soussan *et al.*, 2000).

In general, vulnerability context refers to seasonality, trends, and shocks that affect people's livelihoods. The key attribute of these factors is that they are not susceptible to control by local people themselves, at least in the short and medium term (DFID, 1999). Shocks destroy assets directly. For example, crops standing in the field are affected in the case of drought. They also result in the erosion of assets indirectly, as a consequence of enforced sales and disposals made in order to smoothen consumption during the sequence of responses that occur at times of disaster (Ellis, 2000b). Hence, the means of resistance are the assets and entitlements that individuals, households and communities can mobilize and manage in the face of hardship (Mosser and Norton, 2001).

As most poor people around the world are likely to be found in vulnerable areas (Ayalne, 2002), shortfalls in household agricultural resources and performance are important sources of household vulnerability (Yared, 2002). Vulnerability to

shocks is therefore closely linked to asset ownership. The more economic assets people have the less vulnerable they are, and the greater the erosion of people's assets, the greater their insecurity (Mosser and Norton, 2001).

2.2.4 Sustainable Livelihood Assets

Assets are the building blocks of a sustainable livelihood. By building assets, individuals and households develop their capacity to cope with the challenges they encounter and to meet their needs on a sustained basis. The framework draws attention to the variety of assets that contribute to making a sustainable livelihood and to ways in which they are interdependent. Within the five broad categories of assets it presents, it suggests a wide range of subcategories (DFID, 1999).

Assets may be described as stocks of capital that can be utilized directly, or indirectly to generate the means of survival of the household or to sustain its material well-being at different level above survival (Ellis, 2000b). Thus, assets are the basic building blocks upon which households are able to undertake production, engage in labor markets, and participate in reciprocal of exchanges with other households.

According to Ian Scoones (1998), Messer and Townsley (2003 cited in Mulu, 2008) and DFID (2000), livelihood assets are categorized into five capitals:

Human capital (H): The skills, knowledge, ability to labor and good health important to the ability to pursue different livelihood strategies;

Physical capital (P): The basic infrastructure (transport, shelter, water, energy and communications) and the production equipment and means that enable people to pursue livelihoods;

Social capital: The social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods;

These are developed through: networks and connectedness**,** either vertical or horizontal (between individuals with shared interests) that increase people's trust and ability to work together and expand their access to wider institutions, such as political or civic bodies, membership of more formalized groups which often entails adherence to mutually-agreed or commonly accepted rules, norms and sanctions; and relationships of trust, reciprocity and exchanges that facilitate co-operation reduce transaction costs and may provide the basis for informal safety nets amongst the poor (DFID 1999).

Financial capital (F): The financial resources which are available to people (whether savings, supplies of credit or regular remittances or pensions) and which provide them with different livelihood options; and

Natural capital (N): The natural resource stocks from which resource flows useful for livelihoods are derived (e.g. land, water, wildlife, biodiversity, environmental resources).

2.2.5 Diversification

Diversification has been defined by Ellis as 'the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living' (Ellis, 2000). Barrett *et al.,* (2001) suggest that diversification patterns reflect individuals' voluntary exchange of assets and their allocation of assets across various activities so as to achieve an optimal balance between expected returns and risk exposure conditional on the constraints they face. If appropriate interventions are to be effective in reducing rural poverty, and vulnerability to poverty, it is important

to have an understanding of households' preferred livelihood diversification strategies and the extent to which these strategies are feasible.

Livelihood diversification therefore refers to attempts by individuals and households to find new ways to raise incomes and reduce environmental risk, which differ sharply by the degree of freedom of choice (to diversify or not), and the reversibility of the outcome. Livelihood diversification includes both on- and off-farm activities which are undertaken to generate income additional to that from the main household agricultural activities, via the production of other agricultural and non-agricultural goods and services, the sale of waged labor, or self-employment in small firms, and other strategies undertaken to spread risk.

2.2.6 Livelihood strategies

According to DFID (1999) the term livelihood strategies are defined as the range and combination of activities and choices that people make in order to achieve their livelihood goals, including productive activities, investment strategies, reproductive choices, etc. The purpose of understanding livelihood strategies is to shed light on how and when individuals, households, and groups negotiate among themselves, with their communities, markets and society to improve their well being or reduce food insecurity by appropriating the benefits from their assets, activities, and investments.

These choices are reflected in the way that people use their assets and as such are an important part of household behavior, while determining well-being. Livelihood strategies include: how people combine their income generating activities; the way in which they use their assets; which assets they chose to invest in; and how they manage to preserve existing assets and income (DFID 2001). Livelihood strategies are generally understood as the strategies that people normally use in peaceful and stable times to allow them to meet basic

needs and contribute to future well-being (Ellis, 2000). They are more than a response to contextual factors and the assets available; however they are also the result of men's and women's objectives and choices.

2.2.7 Transforming Structures and Process (Institutions)

Transforming Structures and Processes are the institutions, organizations, policies and legislation that shape livelihoods (DFID, 1999). According to North (1990), institutions are "formal rules, conventions, and informal codes of behavior that comprises constraints on human interaction." Examples of institutions are laws (e.g. criminal law), land tenure arrangements (property rights), and the way markets work in practice ('the market' as an institution). Institutions have been also described as 'regularized patterns of behavior structured by rules that have widespread use in society (Leach *et al.*, 1999). The role of institutions is to reduce uncertainty by establishing a stable structure to human interaction (North, 1990).

Social relations, institution and organizations are critical mediating factors for livelihoods because they encompass the agencies that inhibit or facilitate the exercise of capabilities and choices by individuals and households (Ellis, 2000).

2.2.8 Livelihood Outcomes

Livelihood outcomes are the achievements of livelihood strategies, such as more income (e.g. cash), increased well-being (e.g. non material goods, like self-esteem, health status, access to services, sense of inclusion), and reduced vulnerability (e.g. better resilience through increase in asset status), improved food security (e.g. increase in financial capital in order to buy food) and a more sustainable use of natural resources (e.g. appropriate property rights) (Scoones,

1998). Livelihood Outcomes directly influence the assets and change dynamically their level 'the form of the pentagon', offering a new starting point for other strategies and outcomes (DFID, 1999; 2000).

2.2.9 Concept and Definition of Irrigation

a). Definition of Irrigation

Irrigation is the supply of water to agricultural crops by artificial means, designed to permit farming in arid regions and to offset the effect of drought in semi-arid regions. 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).

b). Definition of Small Scale Irrigation

The first question in any discussion of irrigation, as stated by Turner (1994) is the definition. Certainly, the application of water to plants is irrigation. There could be great differences between countries and agencies over what is meant by "small". In fact, small according to the Indian definition is regarded as large in Africa. Turner (1994) points out that irrigation system can be classified according to size, source of water, management style, and degree of water control, source of innovation, landscape niche or type of technology. However, most authors agree on the concepts of local management and simple technology should be combined with size. The best working definition seems to be that used by the UK Working group on Small Scale Irrigation (SSI): small scale irrigation is 'Irrigation, usually on small plots, in which farmers have the major controlling influence and using a level of technology which the farmers can effectively operate and maintain'. There is also a case for using the term 'farmer-managed irrigation systems' (FMIS), as used by the International

Irrigation Management Institute (IIMI), which removes the confusion with authority-managed small-scale irrigation.

According to Jorge (1993), irrigation system fall into two broad categories: Those in which the principal management responsibility is exercised by government agencies with the farmers playing a subsidiary role, and those in which most management activities are carried out and decision made by the farmers themselves with the government providing periodic technical or logistical support. The latter category in which farmers assume the dominant role is referred to as Farmer-Managed Irrigation Systems (FMIS). In general, an important characteristic of FMIS is that the farmers also control and manage the water abstraction from its source.

Governments often classify these systems as "small-scale irrigation system" or "minor irrigation systems," although examples of FMIS may be found with command areas of hectares. FMIS are also known as traditional, indigenous, communal or people's systems. The precise set of activities and functions that the farmers and their organizations perform varies from country to country.

Irrigation projects in Ethiopia are identified as large-scale irrigation if the command area is greater than 3,000 ha, medium-scale if it falls in the range of 200 to 3,000 ha, and small-scale if it covers less than 200 ha. The categorization is based on the size of land area irrigated. In addition to the above classification according to (Dessalegn, 1999; MOWR, 2002; Dejene and Yilma (2003), there is new classification based on the dimensions of time and management. This system distinguishes between four different types of irrigation schemes in Ethiopia: traditional, modern communal, modern private and public.

A reliable and suitable irrigation water supply can result in major improvement in agricultural production and ensure the economic vitality of the country.

Many civilizations have been dependent on irrigated agriculture to provide the basis of their society and enhance the security of their people. Some have estimated that as little as 15-20 percent of the worldwide total cultivated area is irrigated. Judging from irrigated and non-irrigated yields in some areas, this relatively small fraction of agriculture may be contributing as much as 30 to 40 percent of gross agricultural output (FAO, 1989).

Many countries depend on surface irrigation to grow food crops. Without surface irrigation, their agricultural production would be drastically decline and problems of unreliable food supply, insufficient rural income and unemployment would be widespread. Although precise data are lacking, estimation of surface irrigation accounts for some 80 to 90 percent of the total 7260 million hectares of irrigated land worldwide, mainly in developing countries in the tropics and sub-tropics, where hundreds of millions of farmers depend on surface irrigation to grow their crops (Jurriens et al. 2001).

The method, frequency and duration of irrigation have significant effects on crop yield and farm productivity. For instance, annual crops may not germinate when the surface is inundated causing a crust over the seedbed. After emergence, inadequate soil moisture can often reduce yields, particularly if the stress occurs during critical periods. 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 field, or only to the drainage pathways. 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, 1989).

FAO (1989) outlined the problems irrigated agriculture may face in the future. One of the major concerns is the generally poor efficiency with which water resources have been used for irrigation. A relatively safe estimate is that 40 percent or more of the water diverted for irrigation is wasted at the farm level through either deep percolation or surface run off. Irrigation in arid areas of the world provides two essential agricultural requirements: (1) a moisture supply for plant growth, which also transports essential nutrients; and (2) a flow of water to leach or dilute salts in the soil. Irrigation also benefits croplands through cooling the soil and the atmosphere to create a more favorable environment for plant growth (FAO, 1989).

c). Water Resources and Irrigation Development in Ethiopia

The 12 river basins of Ethiopia have an annual runoff volume of 122 billion m^3 of water. There is also an estimated 2.6 billion m^3 of ground water potential (MoWR, 2002). This amounts to an estimated 2,620 m^3 of water per person per year in 1990 for a population of 47 million. By 2005, this has reduced to 1707m^3 due to population growth to about 73 million and the per capita availability continues to fall. Ethiopia will become physically water scarce country by the year 2020 if this trend continues unchecked (IWMI, 2005).

Traditional irrigation in Ethiopia is a complement to rain fed agriculture and the crops grown are often horticultural crops and fruit trees. Peasants have a keen awareness of the benefits of irrigation and are willing to invest their labor in the construction and maintenance of the schemes. In parts of North Shoa, North Wollo, East Gojjam and the highlands of Harrarge, the traditional systems still being utilized by peasants date back to the last century. Elected elders known as “water fathers or water judges” manage many of these schemes and this traditional management system has proved effective in many instances. In some cases, peasant associations manage the irrigation schemes (Dessalegn, 1999).

According to Dessalegn (1999), modern irrigation schemes development is a relatively new phenomenon in the country. The Imperial government took the first initiative in irrigation development in the second half of the 1950s. Large-scale irrigation schemes were constructed from the end of the 1950s, and were concentrated in the Awash Valley as part of the agro-industrial enterprises that were expanding in the area at the time. They subsequently spread to the Rift Valley and the Wabe Shebelle Basin. Essentially, the government's interest at the time centred almost entirely on large-scale irrigation schemes.

In the pre-revolution period, the purpose of irrigation was to provide industrial crops to the growing agro-industries in the country, and to boost export earnings. The main crops grown were sugar cane, cotton, sesame, fruit and vegetables. In the Rift Valley areas, some irrigation schemes were used to grow food crops. There was a shift of emphasis in the post-revolution period though the earlier objectives were not abandoned. Initially, irrigation was seen as part of the modernisation and socialisation of the country's agricultural economy. Moreover, irrigation was considered an important investment for improving rural income through increased agricultural production, and for reducing the growing pressure on the land by bringing unused land under cultivation. Later, with the recurrence and continued threat of drought and environmental hazards, the justification for water management schemes expanded to include relieving drought and recurrent food shortages, and growing more food for the internal market to improve food security and the nutritional status of the population (Dessalegn, 1999). For much of the lifetime of the *Dergue*, very little attention was given to small-scale and traditional irrigation schemes constructed and managed by peasant farmers. It was only in the second half of the 1980s, because of the devastating famine of 1984/85, that the Dergue began to show interest in small-scale irrigation schemes (MoA 1986; Tahal 1988).

The establishment of the Irrigation Development Department (IDD) within MoA at the end of 1984, a body entrusted with the development of small-scale irrigation projects for the benefit of peasant farmers, signalled a new approach to water development by the military government. Although, progress was slow, from the mid-1980s to the fall of the Dergue in 1991, IDD was able to construct some 35 small schemes (MOA, 1993), of which nearly one-third were formerly traditional schemes used by peasants.

The Ministry of Water Resources (MoWR) is responsible for the overall planning, development, management, utilization, and protection of the country's water resources, as well as supervising all water development activities carried out by other institutions. Large-scale water supply is also handled by the ministry through its Water Supply and Sewerage Department.

The regional/sub-national institutions involved in the water sector are the Bureaus of Water, Mines and Energy (BoWME) and/or Bureaus of Water Resources Development (BoWRD) which exist in regions and are responsible for small-scale irrigation and rural water supply as well as small-scale hydropower development. Oromiya Irrigation Development Authorities (OIDA) which undertake operational activities in line with its mandates (study, design, and construction of small-scale irrigation schemes). The Bureaus of Agriculture and Rural Development (BoARD) have similar functions at the regional level as the MoARD. Several NGOs are involved in the water sector, particularly in small-scale irrigation and rural water supply projects.

d). Water management

Medium and large-scale irrigation schemes are managed by government enterprises. The water management of small-scale irrigation schemes is the responsibility of the farmers themselves, mainly through informal/traditional community groups. Some formal Irrigation Users Cooperatives (IUCs) have been established. Apart from the provision of extension and training services to

the IUCs on the part of the MoARD/BoARD, no institution is directly involved in water management in smallholder-irrigated agriculture. Once the construction of irrigation schemes is completed, they are handed over to the beneficiaries but maintenance remains within the responsibility of the regional governments. The absence of any appropriate local-level organs to cater for small-scale irrigation has resulted in a lack of guidance in irrigation operation and maintenance at a community level. With an increase in irrigated areas and more users, irrigation water management and rules for water allocation are becoming more complex and problematic. Disputes are already common, especially between upstream and downstream users. A decentralization process is under way with regional and lower level administrative organs which are becoming more autonomous in aspects related to irrigation development and water management. The strategy is to establish IUC before projects are implemented and to strengthen them through both training and involvement in the process so that they can take over the responsibility of operation and water management when construction is completed (WWDSE, 2001).

A Water Resources Development Fund (WRDF) has been established recently within the MoWR to serve as a public financial intermediary dedicated to financing the water supply and sanitation services and irrigation development through the provision of a long-term loan to groups meeting established criteria and based on the principles of cost recovery. The WRDF, which finds funds from donors, is a nucleus for the development of a financially autonomous institution for water resources development through a cost recovery system (MoWR, 2002).

e). Water policies and legislation

A comprehensive and integrated Water Resources Management Policy, prepared by the MoWR, was adopted in 2000. Some of the guiding principles are: i) recognition of water as a scarce and vital socio-economic resource to be

managed and planned strategically; ii) recognition of water as an economic good; iii) stakeholders to be involved in water resources management. Relevant proclamations are Proclamation No. 197/2000, Proclamation No. 4/1995, Proclamation No. 41/1993 and Proclamation No. 197/1992.

Proclamation No. 197/2000, stating that all of the country's water resources are the common property of the Ethiopian people and the state and giving the MoWR the necessary power to allocate and apportion water to all regional states regardless of the source and location of the resource (MoWR, 2000). Proclamation No. 4/1995, stating that the MoWR has the power and duty to determine the conditions and methods required for the optimum allocation and utilization of the water that flows across or between more than one regional government among various users. Proclamation No. 41/1993 is granting the regions the mandate for certain aspects of water resources, including small-scale hydropower activities. Proclamation No. 197/1992, dealing with the water resources management regulations describing development areas that require a license, procedures for obtaining licenses, the allocation of water for various uses and the need to protect water resources from pollution. It considers that water is an economic good and that it has to be valued and deserves protection.

Water Resource Sector Strategies have been developed and short-, medium-, and long-term Sector Development Programs prepared for the period 2002-2016. These strategies include the financing of water resources management and development; the creation of an enabling environment; trans-boundary rivers management; stakeholder participation and gender mainstreaming; disaster-prevention and public safety, and environmental health standards (MoWR, 2000).

f). Irrigation Development in Oromia National Regional State

The farmers in Oromia region have a long history of practicing irrigation to supplement rain fed agriculture. Local people's initiatives include surface irrigation through river diversions widely used in the region to irrigate plots.

The regional government believes irrigation intervention to be a drought-proofing strategy. To this end, different NGOs had been constructing small scale irrigation schemes. The regional government with collaboration with NGOs planned to increase construction of small scale irrigation schemes.

2.2.9.7 Significance of Irrigation to Livelihood Improvement

Smith (2004) indicated that there are four major inter-related mechanisms through which irrigated agriculture can reduce poverty: (1) Improvements in the levels and security of productivity, employment and incomes for irrigating farm households and farm labor; (2) Linkages in the rural economy; (3) Increased opportunities for rural livelihood diversification; and (4) Multiple uses of water supplied by irrigation infrastructure. First and most directly, irrigation can raise the incomes of those farmers with access to irrigated land. Water control in agriculture may boost productivity and incomes by: ensuring adequate water throughout the growing season, contributing to higher yields and quality (higher farm-gate prices) by eliminating water deficits and providing at least a measure of drought protection; securing a crop where rainfall is inadequate or too variable; allowing a second or even a third crop by making water available in the dry season; allowing new crops or varieties for which market opportunities exist; improving timeliness and/or crop duration, allowing area expansion and/or increased cropping intensities; enabling farmers to adapt timing of production to market demand and higher prices, to take advantage of good weather conditions, or to avoid adverse weather

extremes; and raising farm household and hired labor productivity through all of these effects.

A further benefit arising for landowners may be appreciation of the value of land that has access to irrigation, often enhancing access to credit, and social standing and influence within the community.

2.3 Empirical Evidences of Irrigation Schemes for Poverty Alleviation

Bhattarai *et al.* (2002) conducted a research in India on impact of irrigation on agricultural growth and poverty alleviation at macro level. The study results clearly demonstrate the role of irrigation in reducing rural poverty. The study suggests that poverty level in India has explicitly decreased during the time period of 1970-1993 when irrigation development was high. This is also supported with consumption expenditure, which shows the increasing rate of per capita consumption of rural population. Among all the variables selected for analyzing the poverty measures in this study, irrigation has the strongest influence in explaining the reduction in poverty. Irrigation has even a larger marginal impact on reducing poverty than the impact of rural literacy. Likewise, increased high yield variety seeds adoption and fertilizers use have also played a favorable role in reducing poverty in India, but their influence on poverty reduction is lower than the marginal incremental impact of irrigation and rural literacy.

Hussain *et al.* (2003) examine the linkage between agriculture water and rural poverty, using the 'with' and 'without' approach. Comparison was made between three categories (1) with improved irrigation infrastructure (2) unimproved irrigation infrastructure (3) without any irrigation infrastructure. The study was under-taken in Pakistan and Sri Lank based on household

survey conducted during 200/001. The study revealed that households' income and expenditure level were higher in areas with access to irrigation infrastructure than those areas having no such option. Households' expenditure was 24 percent higher in areas with irrigation than in areas having no access to irrigation in Sri Lanka. Similarly, in Pakistan the study indicated that access to irrigation infrastructure reduced the incidence of chronic poverty.

Roberts (2003) studied the role of micro-irrigation for income generation in Asia. The study revealed that micro-irrigation had a widespread impact on rural poverty, helping smallholder families to increase their net income by an average USD 100.00 per year.

According to Hussain, I. (2004), irrigation has a strong augmenting impact: the value of per hectares crop production under irrigating is about twice that of rain fed land. Numerical results of the study show that household income and consumption are much higher in irrigated settings than rain-fed settings and a 50 percent point gap is common. Poverty incidence is 20 to 30 percent higher in rain fed settings. The same study suggests that irrigation significantly contribute to reducing the worst kinds of poverty i.e. chronic poverty. Indirect impact of irrigation on income and poverty are much larger than direct impact. Even at local level, direct productivity related anti poverty impacts of irrigation are one- third of total in the area, and the impacts are much higher when economy wide multiplier impacts are also accounted for. This study concludes that in the areas where community and households depend on agriculture for their livelihood, access to irrigation is a necessary but not sufficient condition for poverty alleviation.

A study conducted to assess the impacts of small irrigation on agricultural production and poverty alleviation in marginal area Punjab, Pakistan showed that poverty estimates in irrigated agriculture was lower as compare to over all

estimates of the country. The poverty head count index was 29.14 percent and 37.3 percent in irrigated land and rain fed categories of the farmers, respectively (Hussain, 2004).

The study carried out on 26 selected irrigation schemes in India, Pakistan, Bangladesh, China, Indonesia and Vietnam indicated that irrigation significantly reduce poverty. Poverty incidence in irrigation system estimated at 33.5 percent but in rain fed farming system it was much higher (almost twice) (Hussain and Wijerathna, 2004).

The study under taken in Tanzania confirmed that despite current operational and technical problems facing irrigation schemes, the schemes has significantly contributed to both food security and cash income. In villages where the irrigation practice was dominant, the villages were able to produce a four months' food surplus and a cash income of approximately Tanzanian shilling (Tshs) 133,078 per cropping season per household. This scenario shows that, irrigation, if well advocated, has the potential to alleviate poverty and ensure year round food security (Abiud and Baker, 2004).

According to the study under-taken on three irrigation schemes in Tigray, Ethiopia, annual income of irrigation users has increased at about 31-61 percent. The improvement has resulted mainly from sales of cash crops produced using irrigation. In addition, the study shows that the development of the irrigation schemes has helped the farmers in reducing the risk of drought by fostering livestock and crop production and diversifying income sources (Mintesnot *et al*. 2004).

Desta (2004) studied impacts of community managed irrigation on farm production efficiency and household income in Weliso and Wenchi district of Oromia region. The study result revealed that access to irrigation was found to significantly improve the technical efficiency of household. The study also

showed that access to irrigation was found to be one of the determinant factors of household income.

The development of irrigation has direct and indirect net benefits on poverty alleviation. Evidence from comparisons of poverty across irrigated and non-irrigated settings shows that, on average, poverty incidence is over 21 per cent less in irrigated as compared to non-irrigated settings (Hussain, 2005).

Abonesh (2006) analyzed the impact of small scale irrigation schemes on household food security. The result of the study indicated that access to irrigation improves the food security of households.

CHAPTER THREE: **GENERAL BACKGROUND OF THE STUDY AREA**

3.1 Description of The Study area

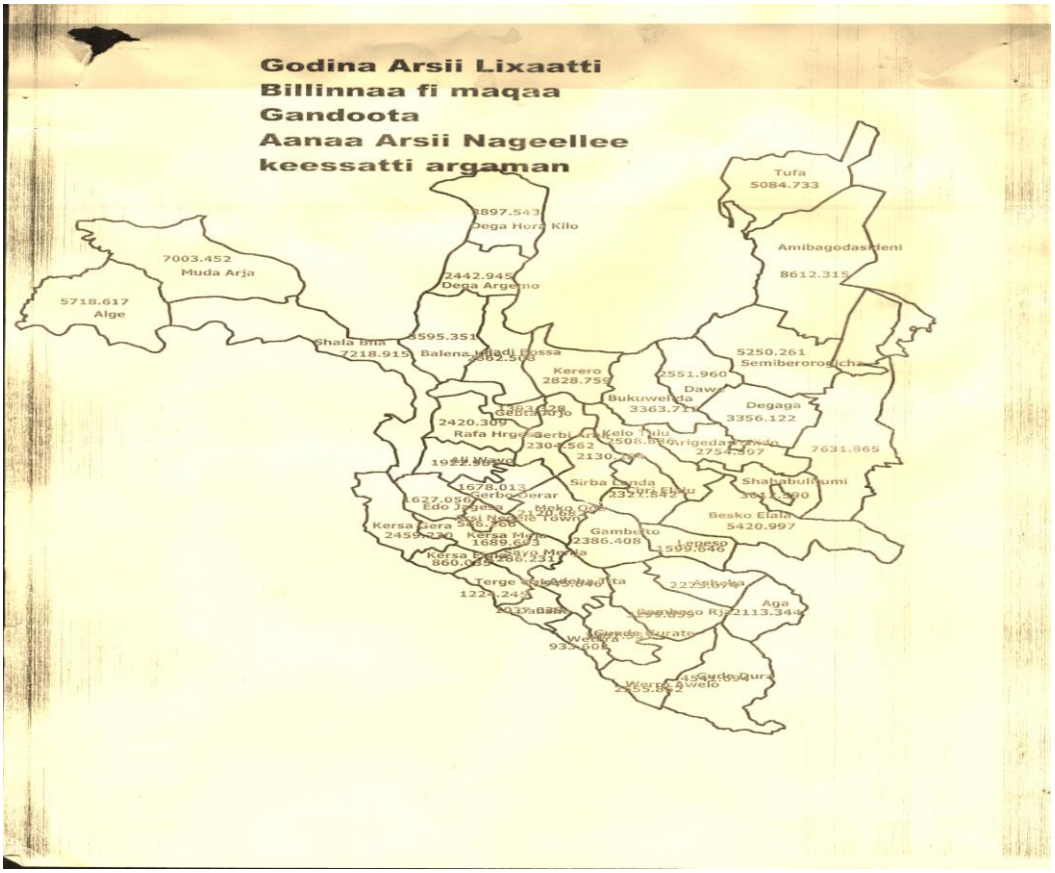
The study was be undertaken in Arsi Negele district of West Arsi zone Oromia Regional National State. The capital center of the district is Negele town which is situated at 226 km from Addis Ababa to the South on the main asphalt road that takes to Hawassa.

The district is located in the central part of the zone having the total area of 420 km^2. It has common boundary line with Adami Tulu Jido Kombolcha in the North, Shashamanne in the South, Kofele in the West, and Kersa district in the Eastern direction.

The district is divided into 43 distinct geographical areas with different proportion of latitudes, namely, highland (5 %) which is very small part of the district, midland (58%) and the lowland (37%%).

Map of Oromia National Regional State

Woreda Geographical Map



Source: Woreda Socioeconomic Survey, January - March, 2014

3.1.1. Population

According to the 2007 population and housing census, the population of the district was estimated to reach 304,928, of which 49.6 % are male and 50.4 % are females (CSA, 2007). Among the population, 20% are urban dwellers while 80% are rural community. Administratively, the district is categorized into 43 rural kebeles and two urban centers, namely, Negele and Goljota towns with four sub-administrative kebeles. From among the kebeles, 26 of them were practicing small-scale irrigation.

In the district, the number of kindergartens were **5**, first cycle (grades1-4) were **45**, grades 1-8th **15** and secondary (grades 9-10) **2**, preparatory **2** and **1** vocational

school. The district also has 4 government health centers, 6 clinics , 38 health posts and 45 private drug vendors(Source Woreda Socioeconomic Survey, January - MArch,2014).

3.1.2. Topography & Nature of Rural Settlement

Topographically, the district is mostly characterized and dominated by plain surface. The relief of the district ranges between 1500 and 2100 meters above sea level(masl). The soil type of the district falls under sandy major soil types, which are conducive for annual crop production and has high potential for agricultural activity.

3.1.3. Climate and Rainfall Distribution

The total annual rainfall of the district usually ranges between 600 - 1000mm. The highest temperature was recorded during the dry season, that is, in the months of January, February and March that rises up to between 21^{o}c and 27^{o}c, whereas the lowest temperature occurs in the months of October, November and December.

3.1.4 Land Use Pattern and Agriculture

The total area of the woreda is about 420 km^{2}, of which, 62% is arable, 3% water bodies, 5% forest and 18% grazing and others. Arsi-Negele is characterized by crop-livestock based farming systems. It is rich in both crop production and livestock rearing. Maize and wheat are the most important cereal crops grown in the district. Annual crops accounted for 95% of all crop lands in Arsi Negele (source of information?).

Major crops Cultivated in the Woreda

With regards to crop production, the administrative woreda is dependent on both the *Belg* and *Meher* seasons. According to the available data from the

Department of Agriculture, the major crops cultivated during the short rain (Belg*)* season, in order of importance are maize, *Teff, Sorghum, and cash crops such as potatoes, Onion and cabbages*, while during the main rain (*Meher)* season the most important cultivated crops are sorghum, *teff*, maize, wheat, barley , peas, beans and lentils. The woreda has also benefited from irrigated crop production, although the total area is small as compared with the rain-fed fields. maize, sugarcane, *teff, and cash crops, such as potatoes, tomatoes, onion,* and others cover the largest portion of cultivated land under irrigation.

3.2. Food Security Situation in the woreda

Arsi Negele woreda is one of the food insecure areas of West Arsi Zone. The food insecurity situation in the Zone is caused by many interrelated and complex manmade and natural factors. Among other things, crop cultivation is becoming unreliable and production is decreasing due to the changing pattern of climate, particularly erratic rainfall. The progressive decline of the inherent fertility and organic content of the soil and erosion induced land degradation have coming to critical point in the woreda. Moreover, the low income of the farmers is due to lack of off-farm employment opportunities(source: West Arsi Zonal Basic Data profile).

Many of the households in the woreda do not produce enough food to feed themselves for the whole year. Some do not own sufficient plot of land to produce even the minimum for subsistence. Some households are obliged to share half of their harvest for the use of oxen, which belong to others. The Department of Agriculture of the Zone estimates that with an average farm size of about one hectare, the grain production for a farming family could be 5 quintals of cereals.

Understanding farm households perceptions of food security, food security status, its causes and coping strategies across wealth level and agro-ecology

are prerequisites to improve food security and coping ability. Indicators of wealth status considerably vary across Kebeles. Overall, households and community representatives felt residents are getting poorer and food insecure overtime. Even though the difference was observed in the conceptualization of food security across Kebeles, many informants relate food security to sufficiency of own produce. Unlike the past years, the impact of drought and variable rainfall were complemented by price escalation to worsen food security situation. To minimize risks and overcome food shortage, households employed a wide range of strategies (at a time and sequentially). However, households in different wealth categories employed different strategies(Source: West Arsi Zonal Basic Data profile).

3.3. Small-Scale Irrigation Development in Arsi Negele Woreda

3.3.1. Traditional Small-Scale Irrigation

Irrigation is generally defined as the application of water to the land for the purpose of supplying moisture essential to plant growth. It is an age-old art which was practiced for thousands of years in the Nile Valley. Egypt claims to have the world's oldest dam built about 5000 years ago to supply drinking water and for irrigation. Traditional small-scale irrigation refers to schemes that involve temporary and unstable structures, established by the community members themselves and often destroyed by the water flow during the rainy seasons. Farmers of the area do practice irrigation to alleviate moisture stress problems for crop growth. However, the practice is of primitive type, consisting of flash floods, temporary diversion structures across the beds of rivers and earth canal following the contours of rugged terrain. According to the information from the Department of Agriculture, the use of existing springs and streams for irrigation purpose has increased through time in response to increasing food shortage and drought situation in the area (Turner,1994).

Farmers presently irrigate cereals, vegetables and some perennials that have a good market in the vicinity. The methods of irrigation practiced by most of the farmers are distributed to the scheme beneficiaries on a rotation basis. The water distribution system of traditional structure is inefficient to deliver the required amount of water. The needs to irrigate at night so as to irrigate more land are the common experiences of the traditional irrigation beneficiaries. The Department of Agriculture has reported that from cereals Maize, and from vegetable onion, potatoes and Tomato and from perennials sugar cane and citrus fruits are commonly produced and preferred by farmers in most traditional irrigation schemes of the woreda (Turner,1994).

3.3.2. Formal Irrigation Development

Formal Irrigation and Livelihoods: Smallholder irrigation schemes play a vital role in the local economy and the livelihood strategies of the farmers. "Formal Irrigation Schemes" refers to irrigation schemes with permanent structures (diversion weir and canals) and with a capacity for irrigation throughout the year. These schemes have normally been planned, designed and constructed through public investment and in some cases by NGOs. According to the data obtained from the Zone Department of Agriculture, there are about 56 streams (rivers) in Arsi Negelle woreda, which have the potential to irrigate an estimated area of 13,000 hectares(Mesfin, 2013).

The formation of Irrigation Development Department (IDD) in 1983 within the then Ministry of Agriculture was mainly to undertake development activities of small-scale irrigation schemes. It has also been indicated that due to the onset of another phase of severe drought in the 1980s, renewed commitment was made by the government and international community towards the development of small-scale irrigation as a means of improving food security.

The main focus of the IDD was to improve the existing traditional irrigation systems and increasing irrigable areas through construction of permanent diversion structures and partly lined canals.

Since 1991, Ethiopia has adopted a new federal administrative structure and semi-autonomous national regional states are established to undertake socio-economic development and administrative activities. Accordingly, the responsibility of rural development in general and small and medium-scale irrigation in particular is transferred to the regional states. Thus, the roles of former IDD in the Ministry of Agriculture have been taken over by the new institutions of each regional state.

Concerning with the Oromia National Regional State, Oromia Water & Irrigation Development Bureau has been established in 1995 with some fundamental undertakings such as: study, design and construction of small and medium-scale irrigation and micro dams and rural development studies with the belief that crop yield and livestock production can be increased to a significant level with greater and more efficient use of the available water resources through the development of small and medium-scale irrigation schemes(Zonal Basic Data profile).

The main development objectives of smallholders' irrigation were: -

a) Provision of adequate and sustainable irrigation water through the development of irrigation;

b) Achieve secured food production through improved cropping systems, supply and utilization of agricultural inputs and up-grade agriculture skill of the farmers;

c) Improve cash income level and standard of living of the beneficiaries.

3.3.3. Institutional Framework for Small-scale Irrigation Development

Irrigation means the management of water for the enhancement of agricultural production (FAO 1987: 54). Investment in irrigation construction is heavy and complex in which implementation of different phases are required in order to be operational and effective.

This Small-Scale Irrigation Capacity development is in line with the priority development agenda of the country. Traditional small-scale irrigation development in Ethiopia has a history of antiquity; while "modern" irrigation development was started only in the 1950s' by the commercial irrigated farms established in the Awash Valley through the joint venture of the then Government of Ethiopia and a foreign company. However, the irrigation sub-sector has not yet well developed and, thus, is not contributing its share to the overall economic development of the country as required (IFAD 1985).

After the constructions of the scheme infrastructures are completed, the Department of Agriculture and its sub-offices at the Woreda level take the responsibility to assist in the management and operation of the schemes. The assistance from department of agriculture is provided through the Development Agents (DA) in the form of advice on irrigation agronomy and to some extent on the operation and maintenance of the scheme.

It is known that some forms of farmers' organization at the scheme level are essential for the smooth operation of the scheme itself. At present, water committees are established at each scheme. However, it has been indicated that water committees have no legal status to officially handover the scheme infrastructure. Therefore, beneficiary farmers should be organized into a form of legally recognized and registered Water Users Association in order to be the proper owner of the schemes(Mesfin 2013).

3.4. Description of Sample Irrigation Schemes

Evolution of Irrigation and its Development

Irrigation in Ethiopia dates back several centuries, if not millennia, while "modern" irrigation was started by the commercial irrigated sugar estate established in the early 1950s by the Imperial Government of Ethiopia and the Dutch company in Ethiopia. The actually irrigated area has not been estimated but field assessments in small-scale irrigation projects indicate that some irrigation schemes are not operating to their full potential and some are not functional at all due to factors related to shortage of water, damaged structures and poor water management. On the other hand, farmers are extending canal networks in some modern irrigation projects and can therefore irrigate more land than is reportedly equipped for irrigation(Mesfin, 2013).

During the imperial regimes local resources (human, land, water and other natural) were “owned” by a few powerful individual state agents, landlords, army officials, or local tax collectors who used to work on behalf of the central kingdom. These individuals had full privileges to control and decide on any of the resources and hence on the irrigation schemes. In fact the schemes were owned or established by these individuals. Ownership of the scheme was similar to the land holding systems(Mesfin, 2013).

In the socialist Derg regime, the dominant motto was empowering the socially disfavored peasants in the imperial regime through organizing and making them “owners” of the resources. It was time that traditional agrarian institutions showed major changes (Crewett et al., 2008). The schemes were then transferred to peasant cooperative unions.

In principle, the cooperatives availed many political and social positive implications. In practice, the final result turned out to be similar in some ways to the previous regime. Local kebele administrators exploited the peasants by

using their position in the hierarchies of the authorities as a tool - replacing the former landlords. Government supporters and cadres used to impose their political agenda on the people and used to bribe farmers' labours for their own personal benefits (Adam, F. 2001.

There has been no major change in core property (land) policies between the Derg and the current government; hence changes with respect to irrigation schemes were not as radical as that between the imperial and the Derg regime. Ownership of the scheme is maintained to be communal while the management system has been changed in many respects.

3.5 Development of Small Scale Irrigation in the Woreda

3.5.1. **Yeka Lalesa Irrigation Scheme**

Yeka Lalesa is one of the two irrigation schemes in the kebele of *Kararo* which is the first kebele with irrigation scheme along the gravel road. The scheme is situated a few kilometers north of the road. It is divided into two parts: Yeka and Lalesa, which are found on the left and right bank of the river Huluka. Both branches obtain water from the same diversion weir but on either side of the same. The total command area is 80ha. Expansion has mainly been done in Lalesa. Though the total area in Lalesa is larger than in Yeka, the volume of water being diverted to Yeka main canal - favoured by the topography of the area - is relatively larger.

Irrigation Management

At present the scheme is managed by water user association (WUA) that was established in 2000. The main crops grown at present include: sugarcane, tomato, onions, potato, and other vegetables and tree fruits such as mango. Technically there are two groups with different command areas; however, the

exact area of each of the blocks is not updated in the present state by the local state agencies. Water is distributed per block according to a program posted on the notice board of the WUA office. Chemicals such as fertilizers, pesticides and other inputs are also distributed in this office. The distribution of water is based on the land area, the crop type being grown, and the soil type in the sub-block. Each irrigator used to have three days to apply irrigation water to his farm. Nowadays, the flow of water in river Huluka is so low that individual turns have eventually been reduced to two days.

3.5.2. **Lebu Leephis Irrigation Scheme**

Lebu Leephis is the second scheme along the gravel road. It was established in 2007 with financial support obtained from the African Development Bank (AFDB). During the rainy season, some amount of irrigation water is needed for seedbed preparation and planting, in addition to cleaning of the canal in this period.

Irrigation Management

Lebu Leephis irrigation scheme is formally divided into two main blocks: 'kekure betach' and 'kekure belay', meaning, *above the pond and below the pond, respectively.* The storage was provided to increase the command area. The total command area above the pond was estimated to be 45 ha and below was 105 ha, together making 150 ha. The area below the pond was again divided into two sub - blocks: 'kemakefafeya belay' and kemakefafeya batch', *above and below the division box, respectively*. It should be noted that this layout is only an approximate locations of the main structure to help visualize the scheme.

The irrigation scheduling was twice a week for each block: above pond, above division and below the division. The program, though, was flexible within the

limits of water availability. Accordingly, the incoming water to the pond was likely to be delayed by few hours. The bottom line here is that in this arrangement the basic turn (that both blocks have two days per week) shall not be affected.

3.5.3. **Melka Kola Traditional Furrow**

On the river Leephis three traditional furrow irrigations were available in the area of Gorbi Arba and Ke'llo Tullu that are located on the upstream part of Lebu Leephis. Another traditional irrigation system was developed in Sogido located on the upstream part of Ke'llo Tullu, and the "modern" irrigation scheme Lebu Lephis. There is no access road either for a vehicle or motor bikes. One needs to walk up and down to reach the traditional diversion site.

The irrigation experience of the people in the area can be evidenced with furrows like Melka Kolla. Big boulders have been placed in series across the river Leephis to create a diversion.

Irrigation management

Maintenance of the headwork, the main canal and water allocation was managed by furrow members. They did not a have written WUA guideline like the one in the modern irrigation scheme. They used to irrigate the whole week in earlier times. The utilization of water has become a source of disagreement lately with the establishment of Lebu Leephis in the downstream catchment and other traditional irrigation schemes on the upstream side.

3.5.4. **Melka Jelisie Traditional Furrow**

This is also a traditional furrow located upstream of Melka Kolla furrow. The construction of the diversion and the size of the main canal were quite similar to that of Melka Kolla. The furrow near the diversion was stabilized by a stone

ridge and cemented with earth. Age wise it is the oldest of such schemes on the river Leephis in the kebele. It was established during the imperial regime.

A few years later, under the current government, the youth association ceased the business and Ke'llo Tulu primary school took over the land. Since then the school has been renting the land out to private contractors to avoid getting involved in the processes of managing the farm business.

3.5.5. **Melka Godo furrow**

This is the third furrow in Ke'llo Tulu kebele and has been functional since 1992. Its unique name is not usually mentioned but conventionally it was referred to by the community as 'the middle one.' This is because it is located between Melka Kolla and Melka Jelisie. The irrigated land is found on the opposite of Melka Jelisie and Melka Kolla, or on the eastern bank. The command area is relatively small when compared with Melka Jelisie. In the earlier times the scheme was operated by diverting water from the main furrow of Melka Kolla. They used a half block of wood to allow the water flow to the other side. Since the volume of water that pass across the river was limited by using such a method, the area irrigated was small.

3.5.6. **Pump irrigation**

Another interesting case in the same kebele is the emergence of pump irrigation, which was introduced by the Woreda Agricultural office(WoA). The WAB made an advertisement about the technology, the uses and sizes of the pumps that were supplied by the bureau itself. An arrangement was made to help farmers pay the price in such a way that they would pay half of it first and the rest one year after. Lebu Leephis irrigators have been complaining that the

water being used by these pumps is too much to the extent that it has further aggravated the water shortage problem in the dry season. They mention that the pump owners close the gate of the weir to get enough water for their pumps at the downstream end. However, the state agencies have ignored the complaints on the premise that as long as the pump owners do not pump water at or above the weir, they do not affect the flow in Lebu Leephis. The pump irrigation business has been observed to be profitable for pump owners who were - within the local context of living standards - rich farmers and can afford the price and risks associated with new methods and/or new technologies in their farm businesses.

3.5.7. **Gadamso Irrigation Scheme**

Gadamso is a village in Boku Wolda kebele located at a distance of 30 km from the Woreda capital Arsi Negele. Gadamso irrigation scheme is the fifth irrigation scheme that has been constructed along the course of the gravel road in the direction of Assella. It became functional since 1994 with funds obtained from IFAD. Farmers were involved in the construction phase by contributing their labour and they obtained payment in return. Though the project was established in 1985 (during the Derg regime), it was delayed for several reasons. Due to famine in some parts of the country then the project was interrupted for a while. In 1986, however, the government had reached an agreement with the community for cooperation in the construction phase of the scheme.

Irrigation Management

The WUA, established in 2002, had taken the role of the irrigation management. It is responsible for water allocation and distribution, and management and maintenance of the system. Just like the rest of the irrigation

schemes in the region the committee members of the WUA were elected by the users themselves. Some users were not members of the WUA. This is because joining or dropping out from the WUA was not obligatory. But it is mandatory to participate in maintenance and cleaning operations, as well as, obeying the rules and regulations of the WUA.

3.5.8. **Argeda Irrigation Scheme**

Argeda is the seventh small scale irrigation on the chain of irrigation system along the gravel road on the way to Assella (from the West to the East). Argeda irrigation scheme was established at a distance of 36 km from Arsi Negele in a kebele called Argeda Shaldo. Only a few lengths of the main canal were constructed along a furrow that used to be a traditional water diversion system serving two water mills during the imperial regime (in the mid of 1970s). The two initiators of the furrow, who used to live in the kebele came with the idea of establishing water mill plants to mitigate the problem associated with processing of agricultural products in the area. While having separate water mill plants one after the other, the two individuals constructed the furrow together.

Irrigation management

There were three sub - blocks each getting water twice a week: “Argeda I” 18 ha, “Argeda II” 32 ha and “Argeda III” 40 ha. At the head of Argeda II, a division box was provided to divide the flow into two secondary canals: one taking water to Argeda II and another to Argeda III. Even though there was water shortage in the main canal, there was no night shift irrigation; but in the dry season some farmers irrigate during the night at their own volition. In times of water shortage, the two secondary canals operate rotationally, otherwise simultaneously. Water is not distributed fairly across all the blocks. Argeda I

get its water directly from the main canal so the users were placed on the side having the minimum risk. The arrangement has also encouraged them to be opportunistic; some of them do not close after they have irrigated in their allocated time. Since they are located at a considerable distance from the rest, it was not that easy to inspect what they were doing every time.

The WUA seems to be fairly well organized with respect to requesting the necessary support from NGOs, such as, credit services, trainings, seeds and fertilizer supplies.

3.5.9. **Kurtata Irrigation Scheme**

Kurtata is the last irrigation scheme along the gravel road to be discussed in this study. It is a traditional scheme of which only the headwork has been upgraded; while the rest of the scheme is still in its traditional state. The scheme is located at 43 km from Arsi Negele. The topography near the diversion was very rugged, and as a result a wide area of cultivated land cannot not be favoured by the benefit of irrigation water. The total command area was estimated to be 26 ha., with good quality potable water available in the kebele, according to the Woreda agricultural office.

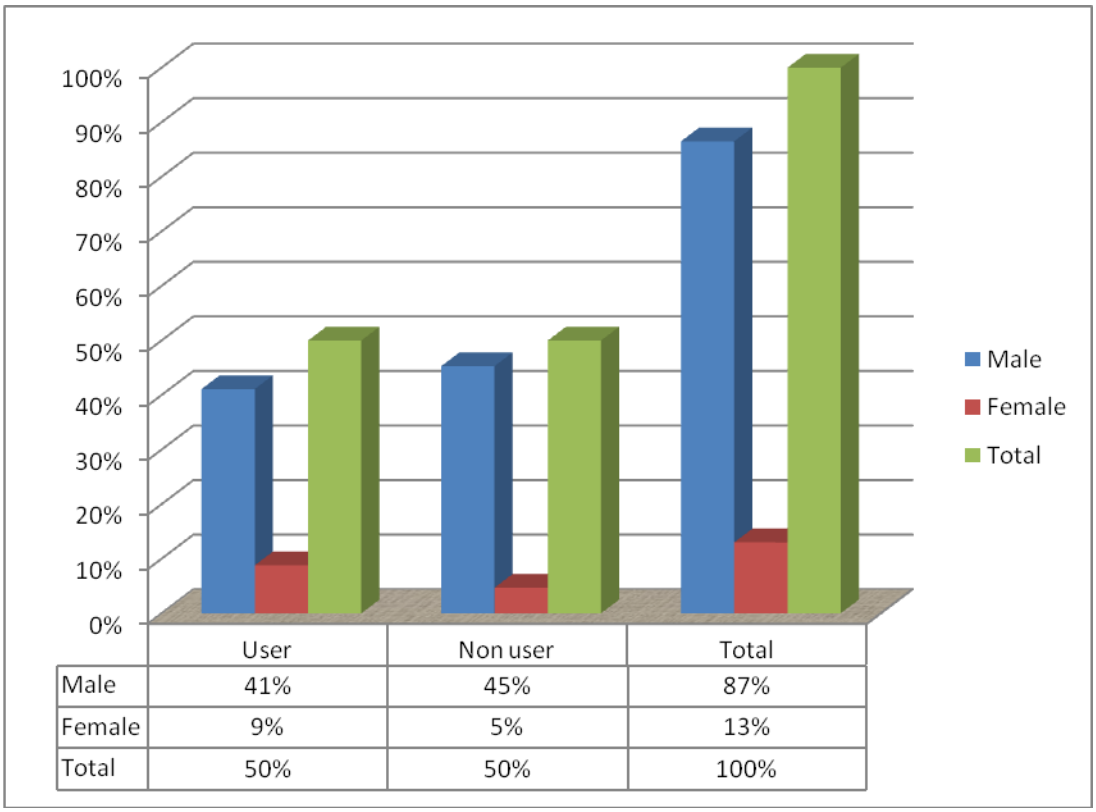
Irrigation management

Kurtata scheme management is now managed by the WUA which was established at the beginning of 2012. Currently, it has a total membership of 64 (59 male and 5 female) household heads. The WUA makes irrigation scheduling based on the area of land and crop types. Just like the rest of the schemes in the Woreda, the scheduling does not follow straight and rigid rules.

CHAPTER FOUR: **SURVEY FINDINGS AND DISCUSSIONS**

4.1. Household characteristics/Demographic Characteristics

Out of the sample PAs of irrigation users, 70 of the households (41.1%) were male-headed and 15 (8.8%) of them were female-headed. While from non-irrigation users, 77 households (45.3%) were male-headed and 8(4.7%) of them were female-headed households. This indicates that, out of a total of 170 respondents, 147(86.5%) were male-headed households and 23(13.5%) were female-headed households (Fig.1; Table 1). There is a significant difference between male and female users, which indicating that irrigation user households were significantly male-headed. When the scheme was established men-headed households were given preference over women-headed households with the assumption that women could not cope with the demands of the scheme. It could also be that only few female-headed households were present in the area in relation to male-headed households. Usually, women provide labour, especially during harvesting and in other off-farm activities to supplement household income.



	User	Non user	Total
Male	41%	45%	87%
Female	9%	5%	13%
Total	50%	50%	100%

Fig. 1 Gender Characteristics of the Household heads

Source: Household Survey Results, January - March 2014

Table 1:- List of PAs & number of sample households per PA

Modern irrigation	**Respondents**								
	Users			**Non users**			**Total**		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Argada	7	2	9	8	1	9	15	3	18
A/G/Sade	7	1	8	8	1	9	15	2	17
B/Reejii	7	2	9	7	1	8	14	3	17
Dagaga	7	1	8	8	1	9	15	2	17
Dawwee	8	1	9	7	1	8	15	2	17
I/Jigeessa	7	1	8	8	1	9	15	2	17
Q/Gara	7	2	9	8	1	9	15	3	18
Q/Uluu	6	2	8	8	1	9	14	3	17
S/rogicha	8	1	9	7		7	15	1	16
S/Rogicha	6	2	8	8		8	14	2	16
Total	70	15	85	77	8	85	147	25	170

Source: Household Survey Results, January - March 2014

Age (in years) of Household-Heads

The age range of households was classified into three groups: 18-35, 36-64 and greater than or equal to 65 years of age. Among the respondents from the irrigation users, 34% of respondents fall in the age range of 18-35 years, 62.4% of respondents were in the age group of 36-64 and 3.5% were 65 or above years old. Whereas, among the respondents of non-irrigation users, 48.2% were in the age group of 18-35 years, 48.2% of respondents were 36-64 years, while 3.5% were 65 or above years old (Fig. 2).

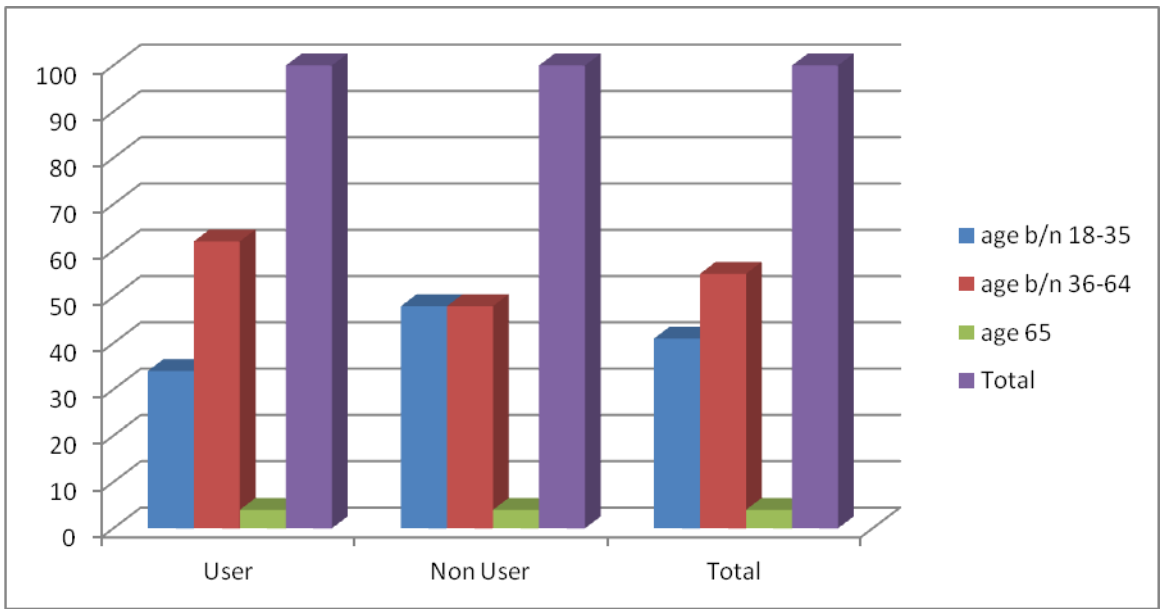


Fig. 2 Graphical Representation of Ages of Respondents

Source: Household Survey Results, January - March 2014

Education: Basic Education, Formal schooling (grade), Illiterate

Education is a very important factor in the development of any country's economy. It determines the skill level of farmers, the ability to read and write and the understanding capacity. Roger and Shoemaker (1971) informed and (Obibuaku 1983) stated that education is not only an important determinant of adoption of innovation but also a tool for successful implementation of innovation. There is a relationship between educational level and irrigation farming.

As far as their educational status is concerned, the statistical summary provided in Fig. 3 below shows that, greater proportion of sample households had gained formal education (schooling). Significant number of the households had acquired basic education which helped them to read and write their names and some simple business related matters. The data analyzed had revealed that, categorically, 71.8% were formally educated (both users & non users),

18.2% had gained basic education, and 10% of the respondents were illiterate. Since significant number of respondents has received basic & formal education, most of the household heads can, at least, read and write important documents during commercialization and on other matters. This had created great opportunity for the households to utilize the technologies and easily adopt the new innovations (Fig. 3).

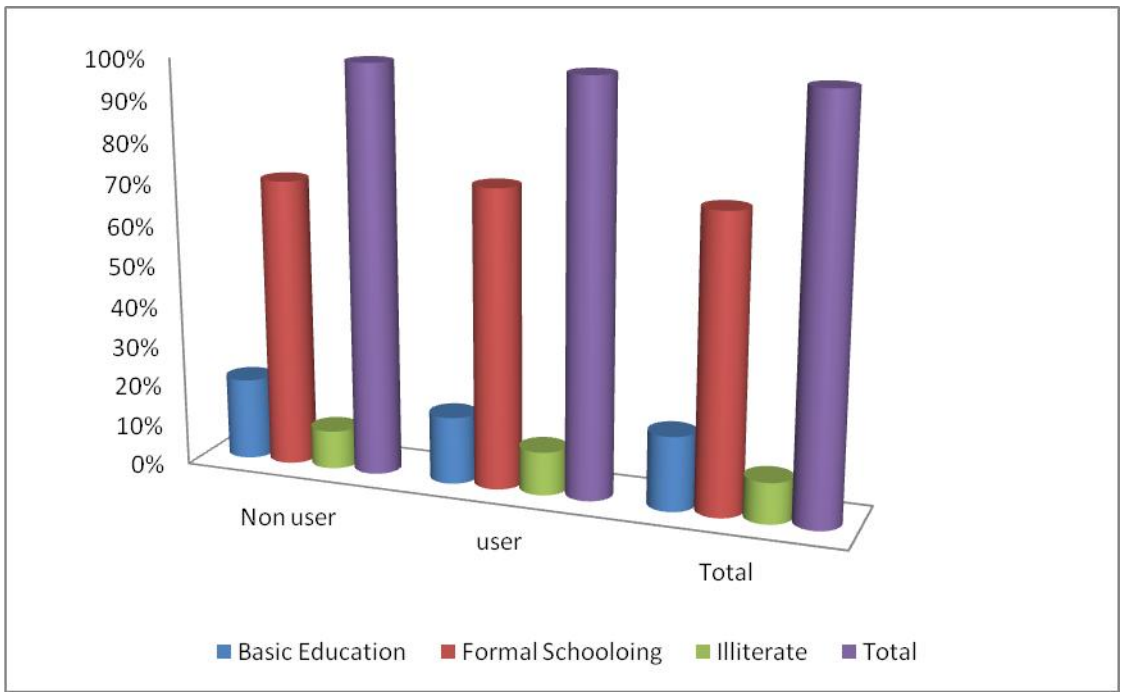


Fig. 3 Educational Status of Respondents

Source: Household Survey Results, January - March 2014

Marital Status

Marital status of respondents may become an important factor in agricultural production, especially when farm labour is in short supply. Married couple with large family size may have large supply of labour to work on the farm and this may increase the size of farm land cultivated. Among the respondents, 91% of them were married (Table 2).

Among the remaining, 0.5% were single, 2.9% were divorced and 5.3% were widowed, which means that the scheme also had created opportunities to the vulnerable groups in society (Table 2; Fig. 4).

Table 2: Marital Status of the Respondents

Marital status	Irrigation users		Non Irrigation users		Total	
	Frequency	%	Frequency	%	Frequency	%
Single	0	0	1	1.2	1	0.5
Married	76	89.4	79	92.9	155	91.1
Divorced	4	4.7	1	1.2	5	2.9
Widowed	5	5.9	4	4.7	9	5.3
Total	85	100	85	100	170	100

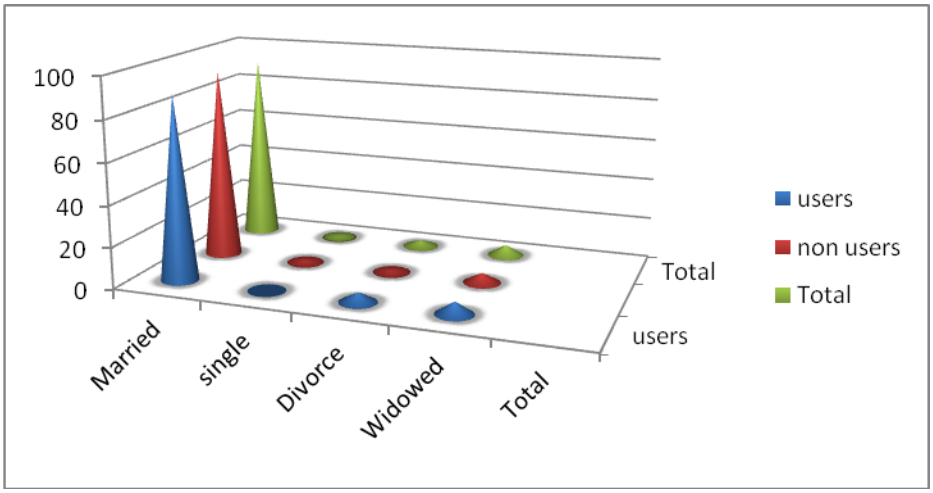


Fig. 4 Marital Status of Respondents

Source: Household Survey Results, January - March 2014

Religious background

The results of the study had indicated that 86.5% of respondents were Muslims, 7.7% were protestants, Catholic 0.6% and 5.3% were Adventist Christians (Table 3; Fig. 5).

Table 3: Religious background of the Respondents

Religion	Irrigation users		Non Irrigation users		Total	
	Frequency	%	Frequency	%	Frequency	%
Muslim	67	39.4	80	47.1	147	86.5
Orthodox Christians	0	0	0	0	0	0
Protestants	11	6.5	2	1.2	13	7.7
Catholics	0	0	1	0.6	1	0.6
Others(Adventist)	7	4.1	2	1.2	9	5.3

Source: Household Survey Results, January - March 2014

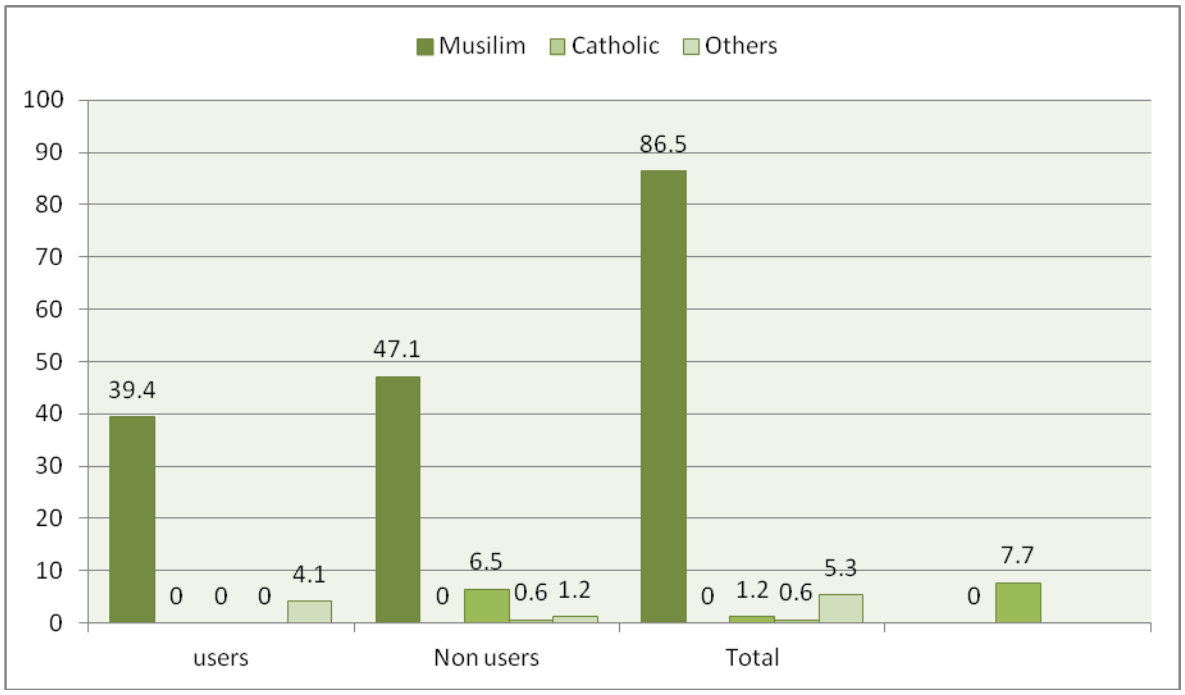


Fig. 5 Graphical Representation of religion of Respondents

Source: Household Survey Results, January - March 2014

4.1.1 Family size and Labor Availability

Family size is a continuous variable measured in adult equivalent which indicates the availability of active labor force in the household. Since production is the function of labor, availability of labor assumed to have positive relation with volume of supply. However, family size is expected to have positive impact on volume of income of the households, but larger family requires larger amount of consumables which has a tendency to reduce marketable supply.

But studies conducted at different times indicate both positive and negative relationship. For example, a study conducted by Wolday (1994; as cited by Rehima, 2007) identified that family size has significant positive effect on quantity of crop marketed. From this context, family size is expected to have positive or negative impact on volume of sale.

Average family size at the national level in Ethiopia was 4.7 (CSA 2007). In the study area, the average family size was 5.6 with a minimum one and maximum of twelve (12). There was no significant difference in family size between the irrigating and non-irrigating households.

The study revealed that, out of 170 sample population, 57.7 per cent were children below 15 years old, for both irrigation users and non-users. Those considered inactive, below 15 years, constitute 62.4% for users and 52.9% for non-users. The economically active people, within the age range of 16-64, were 37.7 % of the total population. However, the retired group who were 65 and above had a share of 4.7% of the respondents.

Family size has a strong relation with household resource endowments. For example, family size has direct relation to land holding and income of the family, though this is not always true. Family labour in traditional agriculture

is the most important factor of production both for increasing income and hence for food security. In rural economy, child labor is mostly used for cattle rearing, and in some areas, children within the same age group participate in agricultural activities, especially in weeding and threshing.

Table 4: Mean Family size, and family labor size of households

Characteristics	Irrigating households (N=85)	Non-Irrigating households(85)	Total (N=170)
Family size, persons	5.8	5.6	5.7
Family size (family labor)	4.6	4.0	4.3

Source: Household Survey Results, January - March 2014

Table 5: Demographic Characteristics of Sample Households.

Description	Irrigation		Non-irrigation		Total	
Total population by age	85	100%	85	100%	170	100%
≤15	53	31.2%	45	26.5%	98	57.7%
16-64	29	17.1%	35	20.6%	64	37.5%
≥65	3	1.8%	5	2.9%	8	4.8%
Average family size	5.8		5.6		5.7	

Source: Household Survey Results, January - March 2014

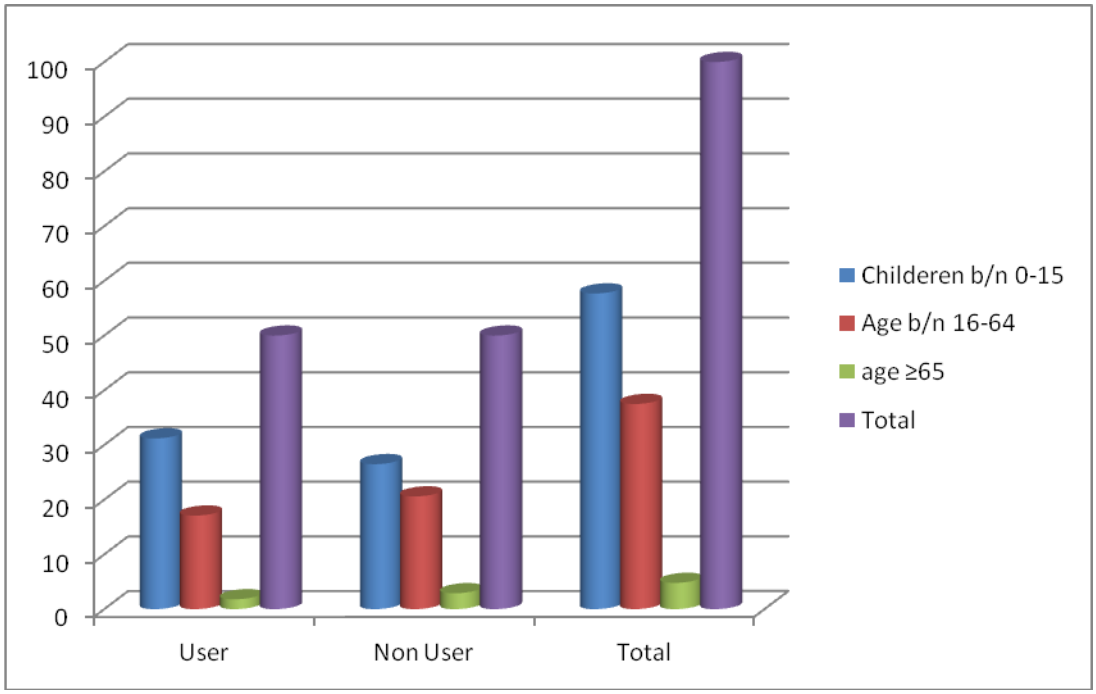


Fig. 6 Demographic Characteristics of Respondents

Source: Household Survey Results, January - March 2014

4.1.2 Land Distribution.

At national level, the major distribution of land was carried out in 1975, following the overthrowing of the Imperial regime. It was done through a legislation issued by the *Dreg* government, which succeeded the Imperial regime. Thereafter, no land distribution was carried out. According to the information obtained from key informants and the quantitative data obtained, all were cultivating the land under their possession. However, land acquisition varies from household to household, as some of them had legally acquired land from government and others had inherited from families and relatives.

Regarding the distribution of irrigation land in the study area, it was also varied, but did not exceed 0.5ha. However, in this study, it was known that some of them had owned more than 1 ha. As the information gathered during

the survey indicates, irrigation land was distributed to a maximum possible number of households, which resulted in very small plot size per household.

Any holder of rural land shall be given land holding certificate which indicates size, land use and cover, fertility level, obligations and rights of the holder. Irrigable lands may be distributed in order to use the land equitably in accordance with the provisions of the proclamation. A holder of rural land shall be obliged to use and protect his/her land and when the land improperly used the user shall lose his user rights (Zonal Agriculture Office, 2012).

Irrigated agriculture requires intensive management as compared with rain-fed agriculture and the land holding size per household has significant impact on effective management of the land in a more productive manner.

According to the data collected, 47.6% of the respondents own land size ≤ 1 hectare , 20% of the respondents had obtained a land size b/n 1-2 ha and 32.4% of the respondents possessed a land size ≥2 hectares. However, from the discussion made with key informants and group discussants, it was revealed that the opportunity for having land greater than 2 ha. was through renting. Regarding the land holding rights, 85.3% of the respondents had their land use certificate, whereas, 14.7% did not acquire certificate as they had inherited the land from their relatives (Fig. 7 & 8).

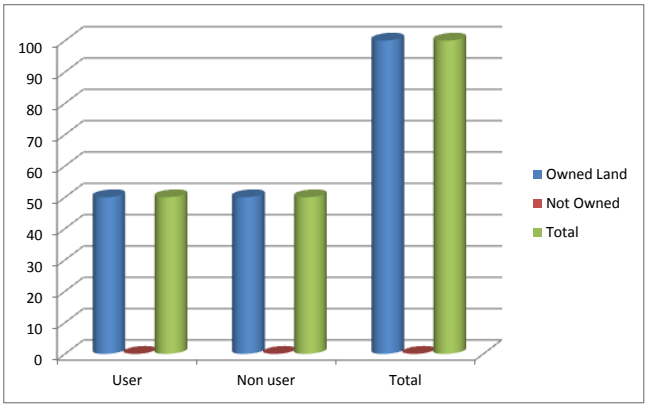


Fig. 7 Land Holding Status of Respondents

Source: Household Survey Results, January - March 2014

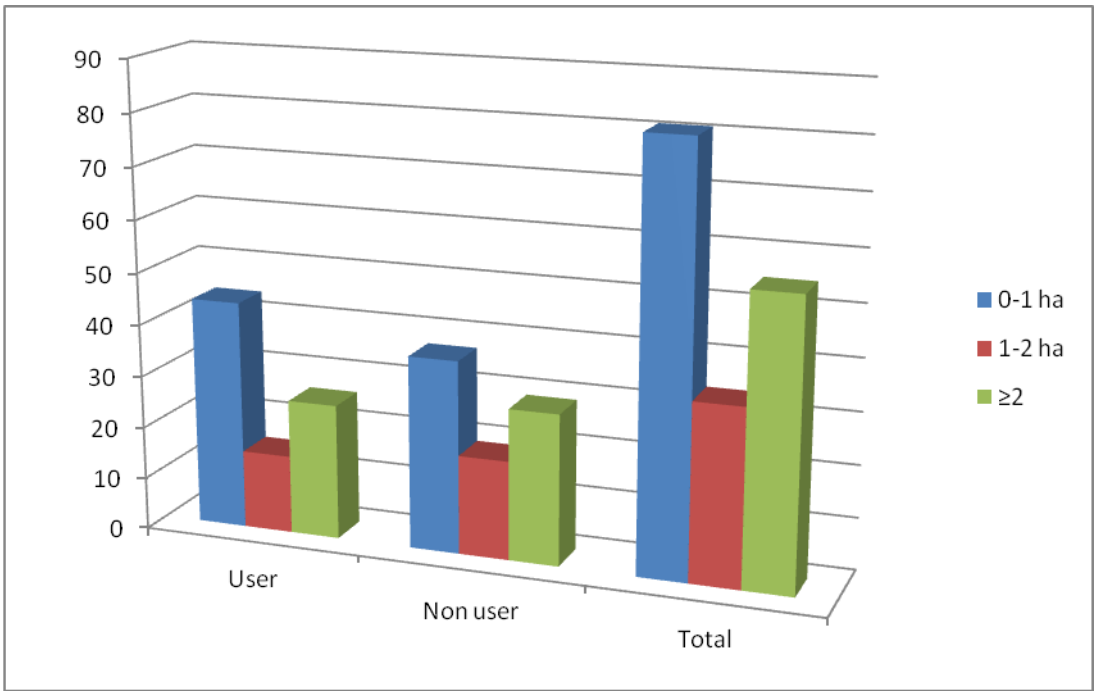


Fig. 8 Land holding size of Respondents

Source: Household Survey Results, January - March 2014

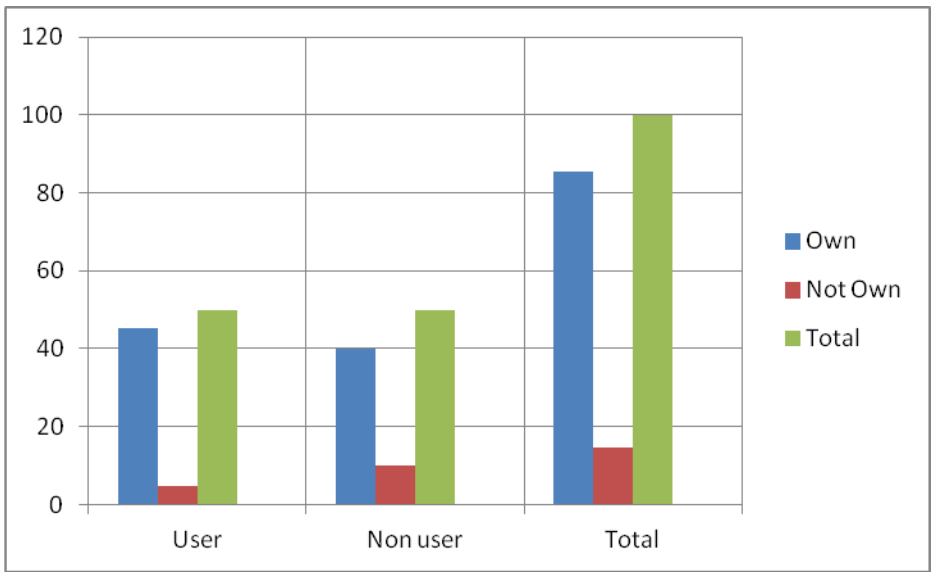


Fig. 9 Land Holding Certificate

Source: Household Survey Results, January - March 2014

4.1.3 The Nature of the Land Owned by the farmer

The woreda covers an area of 42,000 ha and includes a diversity of environment. However, *Woyinadega* and *Kola* areas, with low and variable rainfall, predominate. In addition, small-scale irrigated areas, which cover around 626 ha of the land area were used for different agricultural activities. Crops are grown during the rainy season, while irrigated areas were cultivated year round. The main rain-fed crops were wheat, barley, maize, *Teff*, and vegetables such as tomato, potato, onion and cabbages. Livestock, mainly cattle (cows & oxen), donkeys sheep and goats, were important feature of many farming systems and provide key linkages between and within the different systems (Woreda report from office of Irrigation, 2012).

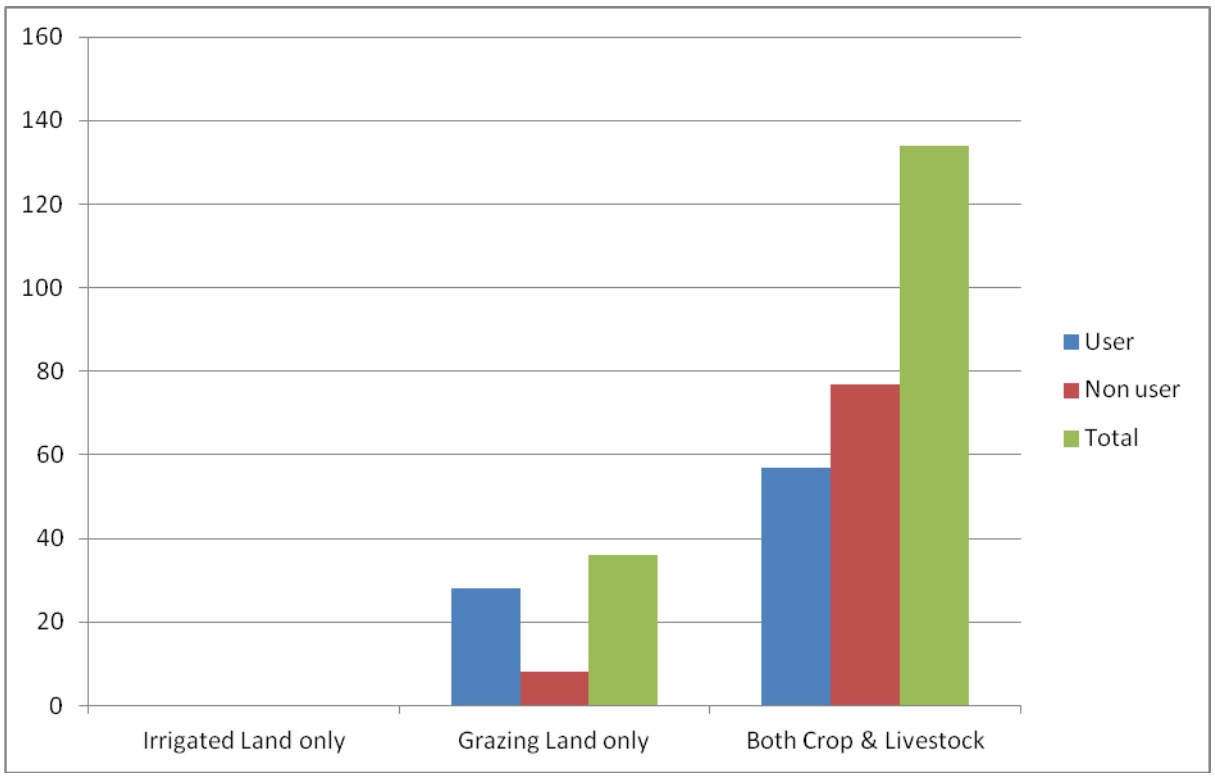


Fig. 10 Nature of Land Owned by Respondents

Source: Household Survey Results, January - March 2014

Out of the irrigated land possessed by irrigation users, 96.5% of the respondents had cultivated their land where only 3.5% remained uncultivated. Since the non-irrigation users did not have irrigable land they were not engaged in irrigation farming. When it comes to the frequency of cultivation of their land, the result varies from kebele to kebele and between users and non-users. All irrigation users cultivate their land twice in a year even though the extent of farm size varies across the kebeles. However, 76.5% of respondents from non-users cultivate their land once in a year and only 23.5% of respondents had cultivated twice per year using both the Mehar and Belg seasons.

Regarding the possibilities of renting - in and renting- out of land by irrigation users, 21% of the respondents had rented-in land and 79% of the respondents

were not. According to responds from the majority of users, the size of land they rented-in was less than one hectare.

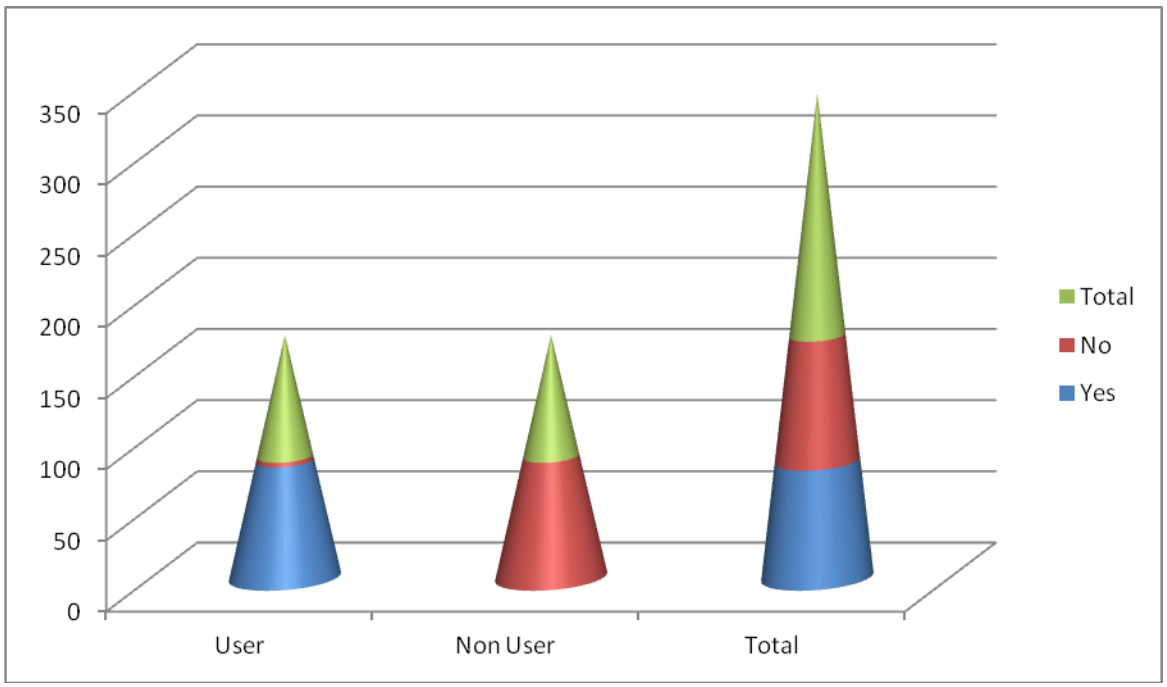


Fig. 11 Land renting opportunities by respondents

Source: Household Survey Results, January - March 2014

Based upon the survey result, the opportunity for land rental was low. Out of the many factors considered during the survey, 88.2% had indicated that the opportunity for land availability was insignificant. The other reason for low land rental is the high cost of the rent of the plot (Table 5).

Table 6: Opportunity for Irrigable Land rental

Factors	**% of Respondents**				
	High	Medium	Low	Easy	Difficult
Supply of Land Rental	11.8%(10)	31.8(27)	56.4%(48)		
Cost	47.1%(40)	44.7(38)	8.2%(7)		
Legal Administrative				78.8%(67)	21.2%(18)

Source: Household Survey Results, January - March 2014

4.1.4 Types of Farming

Subsistence agriculture has long been the major part of non-market household production. It accounts to 85% of the country's economy, mainly, crop and livestock production. Farmers practice agriculture based on their own options and suitability of their land. Almost all farmers preferred to use mixed farming rather than crops & livestock production separately (Fig. 12).

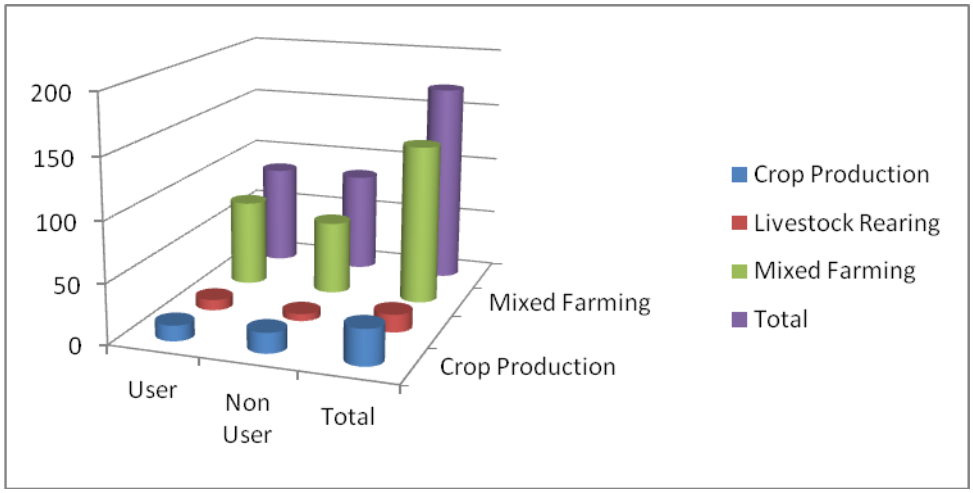


Fig. 12 Preferences of Production by Respondents

Source: Household Survey Results, January - March 2014

The primary and secondary activities for the HHs income are mainly based on mixed farming (crop production and livestock production), and off-farm employment and non-farm activities (Table 6).

Table 7: The primary and Secondary sources for the HH income

Cultivation Activities	**Users**	**Non users**	**Total**
	Primary	Primary	
Crop production	13	17	30
Livestock	9	6	15
Mixed farming (1+2)	73	62	135
Off-farm employment	6	12	18
Non-farm activities (self-employment such as trade)	10	11	21

Source: Household Survey Results, January - March 2014

a). Small-scale Irrigation and Crop Production.

Crop production is the major activity in the *Woreda* together with livestock production. In the past, farmers used to produce during short rainy season *(Belg*) and the main rainy (*Meher*) season. Food crop production is largely practiced during the main rainy season, and during *Belg* season, production was mainly supplemented with irrigation. Different types of food crops were produced in the ten study Pas, both during the rainy and Belg seasons and by using irrigation water (Table 7).

Table 8:- The Principal food crops cultivated in the study area

Kebele where study took place	**Food grain cultivated**	
	Main Rain	**Irrigation**
Argada	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato	Maize, Tomato, Onion, Potato, Sugar Cane
A/G/Sade	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato	Maize, Tomato, Onion, Potato, Sugar Cane
B/Reejii	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato	Maize, Tomato, Onion, Potato, Sugar Cane
Dagaga	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato	Maize, Tomato, Onion, Potato, Sugar Cane
Dawwee	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato, Sugar Cane	Maize, Tomato, Onion, Potato, Sugar Cane
I/Jigeessa	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato	Maize, Tomato, Onion, Potato, Sugar Cane
Q/Gara	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato, Sugar Cane	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato, Sugar cane
Q/Uluu	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato, Sugar Cane	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato, Sugar Cane
S/rogicha	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato, Sugar Cane	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato, Sugar Cane
S/Rogicha	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato, Sugar Cane	Teff, Barely, Wheat, Maize, Sorghum, Onion, Potato, Sugar Cane

Source: Household Survey Results, January - March 2014

Almost all (96.5%) irrigated land were cultivated to increase their household income.

Farmers produce crops to generate cash income, and for consumption. Sources of income were from sale of irrigated crops, rain-fed crops, livestock, off-farm and non-farm services, remittance, rental of land, and from self-employment (Table 9).

Table 9:- Reasons for Cultivation of Food Grain & Cash Crops

Grain/Cash crops Produced	% of Respondents cultivating crops	Reasons for Production			
		Food Consumption	IGA	High prod.	High Market Demand
Potato	41.1	√	√	√	√
Maize,	67.1	√	√	√	
Tomato	44.7	√	√		√
Onion	35.3	√	√		√
Cabbage	2.4	√	√		
Sorghum	1.1	√	√		
Sugar Cane	2.4	√	√		√

Source: Household Survey Results, January - March 2014

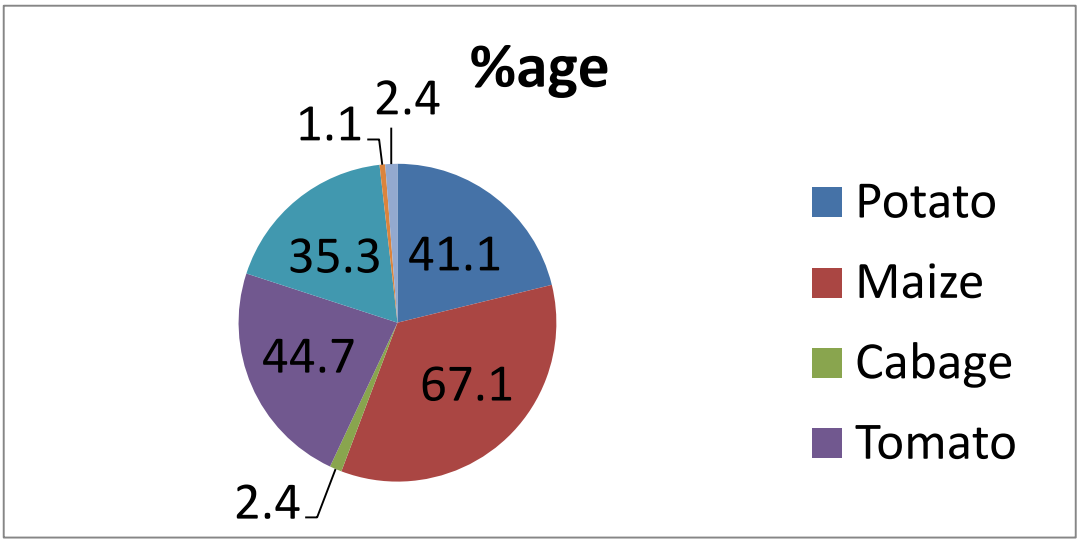


Fig. 13 Graphical Representation of percentage of Respondents

Source: Household Survey Results, January - March 2014

According to informants, focus group discussion and quantitative data results, production from the rain-fed fields has not been sustainable mainly due to

unreliability and poor distribution of rainfall, especially in recent years. Under such situation, irrigation households have produced two times a year by applying irrigation water during the dry season, and through supplementary irrigation during the years of unsatisfactory wet season. Through such intensive and sustainable production system, irrigation households would be able to meet their consumption needs from their own produce better than their non-irrigation counterparts. By using intensive irrigation systems, the productivity of irrigation land was almost double of what could be harvested from the main rain, if it is cultivated by using improved seeds and chemical fertilizers. This was attributed to the fact that in rain- fed agriculture water is a limiting factor and there has been better farm management practice in irrigation farming. As indicated from the survey, 88.2% of the respondents from irrigation users ensured that they produced crops partially for consumption and partially for the market. However, only 7.1% of the harvests were sold in the market and 4.7% were used for own consumption (Fig. 14).

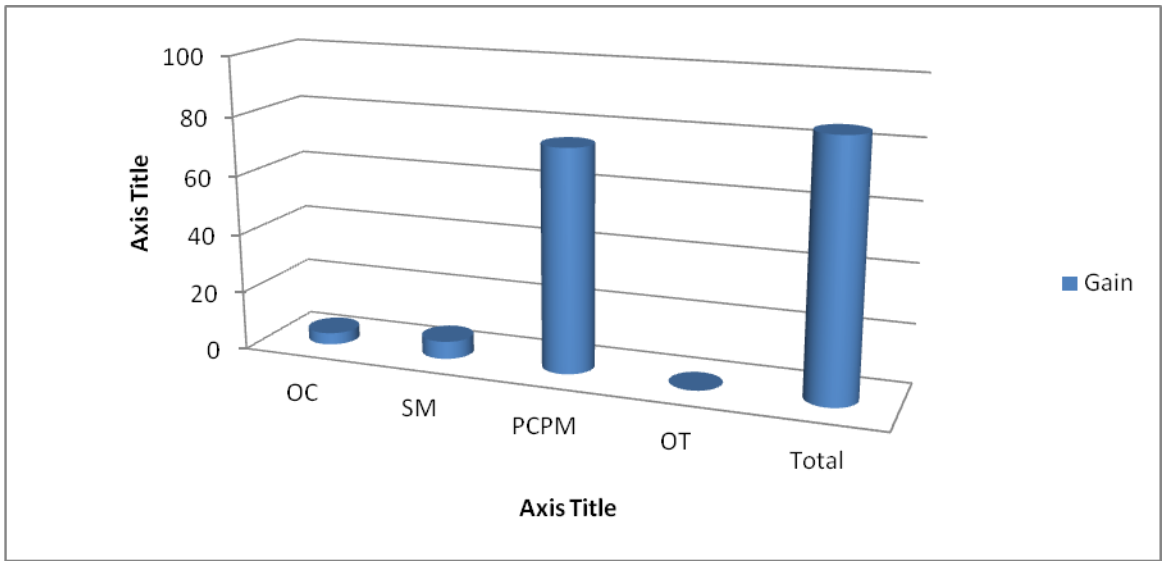


Fig. 14 Respondents view on Purposes of crop production

Source: Household Survey Results, January - March 2014

OC- Own consumption, SM- Selling for the market

PCPM- Partial for consumption & partial for Market, OT- other

b). Cash Crops Production and Marketing

One of the major advantages of irrigation is the possibility of adopting high value crops (vegetables and fruits) which need year round water supply and are reliable source of household income. Cash crops in this context refer to crops produced through irrigation, decidedly for the sole purpose of sale in order to generate household cash income. This does not indicate that other crops are never sold. In the study area, it has been found that most households had sold wheat, maize and vegetables, such as, potatoes, tomatoes and onion.

According to the available information, cash crops grown in the schemes include vegetables (onion, potato, sugar cane, tomato, pepper, cabbage, etc) and perennial crops (citrus fruits, coffee, banana, papaya, etc). The size of cash crops cultivated in each scheme depends upon farmers experience on management and technical skills to grow such crops, market situation, seed availability and farmers preference to grow either cash crop or cereals. It has also been identified that irrigation extension service is needed to provide technical assistance and information on cash crop production and marketing (Mesfin, 2013).

c). Market Supply of Cash Crops

When irrigation is used for cash crops, markets for sale of produce at a reasonable price have been important to irrigation success. Due to lack of storage and transport facilities, perishable horticultural crops are highly sensitive to marketing situation. Vegetables and fruits produced were either sold at local market or transported to other markets by merchants. Negelle town is an important local market for vegetables produced in the sample schemes. Other distant markets for sugar cane, onion, potatoes and tomatoes were Shashamane and Kuyera (Table 10).

Table 10: Price of Some major Vegetables at Local Market (2012/13).

Vegetables	Unit of count	Prices in Birr	
		Lower	Higher
Sugar Cane	Stalk	2	3
Potato	Quintal	150	200
Tomato	Box	150	200
Onion	Quintal	400	500
Cabbage	Quintal	30	50

Source: Household Survey Results, January - March 2014

Farmers have indicated that low and fluctuating price of vegetables has been the major problem of irrigation farming. The terms of trade were always in favor of the buyers, and farmers lack the bargaining power. Since the demand for vegetables is limited in urban areas and as there are many vegetable producer schemes in the surrounding *Woredas*, there is a high competition for vegetable market. According to respondents, potatoes and Onions are suffering most from lack of market.

4.1.4. Farm Input and Technology Used

According to the survey result, 83.3 per cent of sample irrigation households have used chemical fertilizers both for field crops and vegetable cultivation, which had enabled them to get the maximum possible amount of produce from a small plot of land. The scope of increasing the area under crop in the study area is almost non-existent because of high cost, & low supply. Most land, which are suitable for crop production, have already been used. It has been believed, therefore, that increasing the use of fertilizer remains the sole means of maintaining soil fertility as well as increasing agricultural production. The use of modern agricultural inputs (fertilizer and improved seeds) has been

introduced to the study area since the last 3 decades through the agricultural extension program of the government. According to information obtained from the *Woreda* agricultural office, almost all farmers used fertilizers (both DAP and Urea) which has been utilized for both rain-fed and irrigation farming.

Irrigation promotes the use of other inputs through supply of moisture at time of unreliable rainfall. Accordingly, the survey result revealed that 91.7 % and 83.3% of irrigation and non-irrigation households used fertilizer during 2012/13 cropping year, respectively. This was due to the fact that the productivity of vegetables that were grown under irrigation relies heavily on fertilizer. Besides, 62.4% and 67.1% of irrigation users & non-users, respectively, used improved seeds for better income. Moreover, income from cash crops and increased production enables irrigation farmers to afford the high price of inputs (Table 11).

Table 11: Farmers Response on the prices of input utilized

Factors	**% of Respondents**					
	DAP		**UREA**		**Improved Seed**	
	Users	Non Users	Users	Non Users	Users	Non Users
Cost High	65%	76.5%	54%	41%	81%	52.6%
Cost Medium	30%	18.8%	38%	47%	15%	47.4%
Cost Low	5%	4.7%	8%	12%	4%	0.0%
Accessible	77.7%	62.4%	82.9%	72.9%	67.9%	35.1%
Not Accessible	22.3%	37.6%	17.1%	17.1%	32.1%	64.9%
Own saving	87%	49.4%	79%	61%	83%	70%
Credit	10.6%	37.7%	18.4%	39%	17%	305
Safety Net	2.4%	9.4%	2.6%	0.0%	0.0%	0.0%
Remittance	0.0%	3.5%	0.0%	0.0%	0.0%	0.0%

Source: Household Survey Results, January - March 2014

4.1.5. Household Income and Its Sources

In favourable years, the main sources of income for rural households are sale of grain, sale of smaller animals, seasonal employment and performing diverse income generating activities. Major source of income at the time of harvest (October-December) is from sale of crops relatively at a low market price. After the food stock from main rain production is exhausted (usually around May and June) the main source of household income was from sale of animals and animal products and from off-farm activities. This has been the usual pattern of rural household income source in the study area. However, irrigation households have additional income source from the sale of cash crops. For the purpose of this study, the total household income has been divided into four groups depending on the source of income generated. These include income from cash crop production, income from food crop production, income from

sale of livestock and income from other sources. Only irrigation households generate income from cash crops production (Table 12).

Table 12: Average Yearly Income of Sample Irrigation Households (2012/2013)

Irrigation users in sample PAs	**Income of Households**				**Total**
	Cash crop	Food grain	Livestock	other	
Argada	8,500	4,535	1,235	320	14,590
A/G/Sade	6,225	5,435	1,035	500	13,195
B/Reejii	3,500	2,450	1,265	865	8080
Dagaga	5,500	2,845	3,235	980	12,560
Dawwee	4,560	6,453	935	657	12,605
I/Jigeessa	3,450	3,435	832	1350	9,067
Q/Gara	2,980	7,535	650	978	12,143
Q/Uluu	6,543	4,520	895	1,025	12,983
S/rogicha	2,360	3,680	235	720	6,995
S/Rogicha	5,640	2,890	1,200	550	10,280
Mean	4,926	4,378	1,152	795	11,249
%age	44	39	10	7	100

Source: Household Survey Results, January - March 2014

The average income of irrigation households was Birr 11,249.00, which is the sum of average income from cash crops, food grain, livestock sale and income from other sources (Table 12).

When comparing the share of different sources of income, cash crop production alone accounts for 44 per cent of the total household income. This shows how cash cropping are important to the irrigation communities. Food grain

production was the other major source of income for irrigation group, which accounts for about 39 per cent of the average income of all households, where livestock and other means account for 10 percent and 7 percent, respectively (Table 12).

Table 13:- Average Yearly Income of Sample non-Irrigation Households (2012/2013)

Non Irrigation users in sample PAs	**Income of Households**				**Total**
	Cash crop	Food grain	Livestock	other	
Argada	2,550	2,721	741	192	6,204
A/G/Sade	1,868	3,261	621	300	6,050
B/Reejii	1,050	1,470	759	519	3,798
Dagaga	1,650	1,707	1,941	588	5,886
Dawwee	1,368	3,872	561	394.2	6,195
I/Jigeessa	1,035	2,061	499	810	4,405
Q/Gara	894	4,521	390	586.8	6,392
Q/Uluu	1,963	2,712	537	615	5,827
S/rogicha	708	2,208	141	432	3,489
S/Rogicha	1,692	1,734	720	330	4,476
Mean	1,477.74	2,626.68	691.02	476.70	5,272.14
%age	28	50	13	9	100

Source: Household Survey Results, January - March 2014

The average total income of non-irrigation households was Birr 5,272.14, which is the sum of average income from food grain, livestock production and other off-farm sources. The major share of the total household income in this case comes from food grain production (Table 13). The share of food grain income accounts to 50 per cent of the total income, whereas, cash crop share

was only 28 per cent and livestock and other off-farm activities account for 13 per cent and 9 percent, respectively. This shows that non-irrigation households are highly vulnerable to drought and rain shortfall as about 50 percent of their subsistence comes from rainfall dependent crop production. According to the survey result, the second major source of income for non-irrigation households' comes from cash crops which were harvested from rain-fed agriculture. On the other hand, the contribution of livestock production to non-irrigation household income is the least of the four major sources. This may be the result of selling most of their livestock to withstand the frequent drought and food shortage situation in the area. Lack of grazing land and shortage of animal feed has been the major problems of animal rearing in the study area.

There is a significant difference between mean income of irrigation and non-irrigation households. This significant difference in income generated by the two groups of households is mainly due to high income of irrigators from increased cereals production and sale of cash crops.

4.1.9. Participation of Households in Off- farm Activities

Rural household income can be supplemented by some other income generating activities in addition to crop production and animal husbandry. During group discussion, farmers have identified that rich households in the community were those who own two oxen and rent (share cropping) the land of other poor families, participate in petty trade and who had received remittance. This shows that how off- farm activities contribute to the livelihood of farmers in areas of low agricultural income and drought prone areas. Moreover, the survey result shows that about 46.6 per cent and 78.3 percent of sample households from irrigation and non-irrigation groups, respectively, have been engaged in off-farm activities.

4.1.10. Livestock Holding

Livestock and crop production have not been separated from agrarian based economy. Livestock production is the single most important productive asset for households in the study area both as working tools (for plowing and transporting) and as an asset to protect against periods of food shortage. The loss of livestock, especially ox, is critical as it is not only ruins the asset base, but also impoverishes the general productive capacity of the households. Thus, the ownership of livestock is often used as an indicator for wealth. Small animals like sheep and goats play a major role for rural households. Mostly, they are sold to settle various household expenditures such as tax, social obligations, etc, and also to purchase food items in time of food shortage. Donkeys are the most important types of domestic animals in the study area in that petty trade were made possible due to ownership of this animal. They are the only means of rural transport system, and as a result, 73.5 per cent of the sample households in both groups had maintained donkeys.

As indicated in the previous discussion, shortage of grazing land and animal feed is a critical problem as all available lands are converted into croplands. As a result, the number of livestock resources each household own were very few, mainly oxen and milking cows. The few animals left were grazing on marginal land and fed crop residues piled at farmers homestead after harvesting. Irrigation households have maintained large number of oxen and cows than their non-irrigation counterparts. Since irrigation is a year round farming activity, having at least one ox is an essential input of farming activities. Some of the irrigation households had also been involved in ox fattening business. On the other hand, non-irrigation households had maintained larger number of sheep and goats. These animals are totally dependent on grazing and browsing for their feed.

4.1.11. Problems of Small-Scale Irrigation Development.

Irrigation is a special component of agricultural development in which the technology intervenes to provide soil moisture and reduce water stress on crops. Therefore, irrigation development helps to sustain and increase agricultural production, especially in areas where rainfall is unreliable and fail to come. However, the performance and effectiveness of both traditional and formal small-scale irrigation schemes are constrained by multidimensional problems ranging from individual farmers' attitude to institutional arrangements. Some of the major identified problems were:

• Small size of irrigation plots: especially traditional scheme is reported to be the major bottleneck of irrigators to maximize their benefit from irrigation. Additionally, variation in plot holding size among farmers was also reported to be the cause of poor operation and management in the study area.

• Poor coordination between institutions dealing with irrigation development: For example, there were no clear-cut duties and responsibilities between the Department of Agriculture & Department of Service Cooperative and Promotion. Moreover, the Department of Agriculture was poorly equipped with resources and had to cover both rain-fed and irrigated areas. The department was often in short of specialist expertise in irrigated agriculture. Therefore, this divided pattern of organization has had unsatisfactory result.

• Inadequate farmers' knowledge and experience in irrigated agriculture: This had resulted in poor performance of formal irrigation scheme. In addition to this, there was no adequate support structure in agricultural extension for irrigated agriculture from the agriculture office.

• Double or multiple cropping: The assumption of change to double or multiple cropping due to availability of water was not frequently met in reality. According to the information obtained from the extension workers, in some few schemes, some farmers were unwilling to undertake more intensive cultivation.

• Lack of necessary inputs: vegetable seeds, fruit seedlings, and chemical fertilizers, and in some cases, credit services were not available when needed. Problems related to fertilizer were not only lack of supply, but also inadequate quantity of provisions.

• Lack of market and marketing facilities: marketing has been proven to be a problem for small holder irrigators in the study schemes. Lack of storage facility and absence of proper functioning farmers' organization all had contributed to low farmers bargaining power especially on marketing of potatoes, onions and tomatoes.

CHPTER FIVE: **CONCLUSION AND ECOMMENDATIONS**

This study had paid significant emphasis on overall socio-economic impact of small -scale irrigation and its contribution to the livelihoods and household food security situation in Arsi Negelle woreda of west Arsi Zone. In this study attention was given to the role of irrigation in increasing agricultural production, income and asset possession of households in the study area.
Despite the low productivity and recurrent drought in the study area, it is believed that crop production can be sustainable through development of small-scale irrigation schemes in areas endowed with perennial water sources.

Since the 1980's the Ethiopian government has given attention to small-scale irrigation development as means of combating drought situation and improving household food security. Accordingly, 9 small-scale irrigation schemes with a total irrigation area of 626 hectare of land have been developed in Arsi Negelle. Performance level of irrigation schemes is viewed from the point of effectiveness of management and operation of the scheme, cropping intensity and adoption of high value cash crops. Factors, which determine the performance of irrigation schemes, are identified as farmers' group cohesion, strength of the water committee, location proximity of the schemes to people's home, past experience of farmers in irrigation agriculture and farmers commitment to undertake intensive agriculture.

In an effort to tackle the chronic problem of food insecurity in the country, the Ethiopian government is implementing a new agricultural extension package program targeted to achieve growth and transformation plan in crop production which could play a vital role in the course of action towards securing the food need and welfare of the populations. However, the adoption and effectiveness of the new agricultural technologies have been constrained by moisture stress, unreliable and poor distribution of the rain. The finding of this study shows

that the use of small-scale irrigation can reverse this tendency of drought prevalence. Generally, all-in-all irrigation schemes studied have positive impact on the living standard and food security status of irrigators.

• Irrigation households have been able to produce two times a year using the irrigation water. In areas of small plot size per household and unreliable rainfall situation irrigation helps farmers to increase and sustain their agricultural production and food availability at household level. More importantly, irrigation harvest reaches at a very critical period of June, when the food stock from main rain production is exhausted and the price of food grain is very high at the market. Moreover, the production of high value cash crops by the irrigation schemes means that farmers are now effectively participating in the mainstream economy of the region.

• The study also revealed that irrigation household has been able to make twice as much annual income as their non-irrigation counterparts. This high income was mainly due to cropping pattern being practiced by incorporating high value horticultural crops. Therefore, small-scale irrigation is providing gainful self-employment for participants and enabled them to be income secured and better access to food.

• Asset base plays a crucial role with regard to productive capacity and agricultural performance of rural households. Cash income generated from irrigation farming has been an important source of investment on productive assets of rural households. According to the result of the survey, 83.3% of irrigation households could maintain one or more oxen. All these assets are good indicators of wealth and the improvement of the living standard of irrigators in the study area. Thus, we could conclude that, if successfully performed and cash crops are adopted, small-scale irrigation development is a viable intervention to break through the vicious circle of rural poverty and food insecurity. Finally, based on the findings of the study, the following issues are

identified for future consideration for the effective performance of irrigation schemes in the long run.

- Coordination of all relevant institutions involved in small-scale irrigation development is important during the planning, implementation and operation of schemes.
- Training of irrigators in water management, maintenance of infrastructure, general crop production and marketing are also necessary for good performance of schemes.
- Beneficiary farmers should participate through the project planning and implementation processes.
- Demonstration works such as irrigation methods, irrigation scheduling on different crops, cropping intensity and input utilization rates should be carried out in each of the irrigation schemes.
- Provision of inputs and credit service, as some form of incentive for model farmers and disincentives for farmers who are not cultivating their irrigation plots are also important to increase the effectiveness of irrigation schemes.

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Appendix A: Questionnaire for household survey

Questionnaire no._____

Enumerator Name_____

Name of respondent_____

Date of interview_____

Start time _____ Finish time_____

Relationship of respondent with household head_____

(father, mother, husband, wife, household head)

I. Household characteristics/Demographic Characteristics

1. Sex (0=Male, 1=Female_____

2. Age (in years) _____

3. Education (in years of schooling)

   Basic Education_____

   Formal schooling(grade)_____

   Illiterate_____

4. Marital Status

   1= Married (if Married No. of Wives_____)

   2= Single

   3= Divorced

   4= Widowed

5. No. of children from all wife/wives _____

6. No. of Dependents

a. children aged b/n 0 - 15 _____

b. Productive aged b/n 16 - 64 _____

c. Retired aged ≥65 _____

3. **Religious background**

1= Muslim

2= Tewahido Orthodox

3= Protestant

4= Catholic 5= other_____

II. SOCIO-ECONOMIC CHARACTERISTICS

1. Agricultural Farm Characteristics

1. Do you have your own land?

1. Yes (0) 2. No (1)

a. If your answer is "Yes", what is your land holding size in ha--------

b. have you acquired land use right certificate from the government?

1. Yes (0) 2. No (1)

c. If your answer to Q#1 is "No", how did you acquire the land you have cultivated in the last twelve months?

1. via rent

2. via crop sharing agreement

3. From relatives

4. Other; specify _____.

2. How do you describe the nature of the land you own?

1. Cultivated land(both irrigated & non irrigated)-------

2. Grazing land.....

3. Irrigated Land.....

2. Types of Production

3. What are the primary and secondary activities of the Household Head for household income?

1. Primary Activity

2. Secondary Activity

Codes

1=Crop production 2=Livestock rearing

3= Mixed farming (1+2) 4=Off-farm employment

5= Non-farm activities (self-employment such as trade)

6=Domestic activities 7= other

4. If the activity you are primarily engaged in is crop cultivation or mixed farming, then which of the following crops have you cultivated for the specified crop production 2 - 3 years?

Type of Prices crop produced	1=Yes 2=No	Primary reason for production	Land devoted (in ha)	Crop Harvested (in qtl)	Crops sold in the year (in qtl)	Prices	
Teff						unit	Total
Barley							
Wheat							
Maize							
Sorghum							
Tomato							
Onion							
Potato							

*Primary reason for production

1= Own consumption 2= Selling to the market

3= Partial for consumption and partially for market 4= Other

5. Out of irrigated land you have, are you cultivating all? 1. yes(0) 2. No(1)

a. if your answer is yes, what main crops you have practiced regularly? Why?

Crops 1. _____2. _____ 3. _____

4. _____5. _____6._____

Reasons_____

_____

b. For what purpose do you use the production of these crops

reason for production

1= Own consumption 2= Selling to the market

3= Partial for consumption and partially for market 4= Other

c. What is the significant contribution of these crops to your livelihoods? _____

_____

_____

d. What is the average income from irrigated land in birr

6. How often do you cultivate your land in a given year?

1=Once in a year 2= Twice in a year

3= More than twice in a year

7. Have you rented-in additional farm land from other smallholder farmers?

1= Yes 2= No

8. If your answer to Q#7 is "yes", how large is the rented-in land in ha? _____.

9. How do you rate the possibilities of renting-in land in your locality in terms of the following factors?

9.1 Supply of land rental - 1= High 2= Medium 3= Low

9.2 Cost - 1= High 2= Medium 3= Low

9.3 Legal and Administrative procedures - 1= Easy 2= Difficult

10. Have you rented-out land to other smallholder farmers?

1= Yes 2= No

11. If your answer to Q#10 is "yes", how large is the rented-out land in ha?. ---. Why you rented out_____
_____
_____

12. How do you rate the possibilities of renting-out land in your locality in terms of the following factors?

12.1 Demand for land rental - 1= High 2= Medium 3= Low

12.2 Revenue generated/return - 1= High 2= Medium 3= Low

12.3 Legal and Administrative procedures -1= Easy 2= Difficult

3. Farm Input and Technology Used

13. Which of the following farm inputs have you purchased and applied as of the production year?

S/N	Description		1. Yes 2. No	Qty in kg	Cost	Accessibility	Source of financing
1	Fertilizers	DAP					
		UREA					
		OTHERS					
2	Improved Seed						

Codes

1. Cost - 1=Very high 2=High 3=Medium 4=Low 5=Very Low

2. Accessibility - 1= Accessible 2= Not Accessible

3. Source of financing - 1= Own Savings 2= Credit 3= Safety net 4= remittance 5= Other ----------

14. If you are not applying any one of the above mentioned inputs, what are the possible reasons? _____

15. Have you been applying irrigation?

1=Yes 2=No

16. If your answer to Q#15 is "Yes", what kind of irrigation do you use?

1=Stream/river diversion

2=Small scale irrigation Dam

3= Other specify _____

17. Do you pay money for the use of irrigation?

1=Yes 2=No

18. If your answer to Q#17 is "yes", how do you rate its affordability? 1=Expensive 2=Affordable 3=Cheap

19. How often do you cultivate using irrigation?

1=Once 2=Twice 3=Thrice 4=More than thrice

20. Did you take out credit/loan? 1= Yes 2= No

21. If your answer to Q#25 is "No", what was the main reason?

1= Lack of Access 2= High interest 3= Collateral requirement

4= Availability of other alternatives

5= other (please specify) _____

22. What did you do with the borrowed money?

S.N	Target Activity	1= Yes 2= No	Rank According to degree of expenditure (1= high 2= middle 3= low)
1	Purchased Inputs such as fertilizer, improved seeds, etc		
2	Purchased Livestock		
3	Rented-in land		
4	Hired farm laborer		
5	5 Other (please specify)		

23. Have you been able to settle all or part of your loan?

1=Yes, paid out all 2=Yes, paid out partially

3= No, not paid at all

24. How do you assess the cost of getting credit (interest and other charges)?
1=Expensive 2= Affordable 3= Cheap

25. What did the labor composition of your farm look like in the last production year?

S.N	Participation in Farm activity	Number of persons
1	HH head	
2	Spouse	
3	Young Adult b/n 6-15 age	
4	Adult b/n 16 – 64	
5	Old age >=65	

4. Live stock Resources

26. How many of the following livestock do you own?

Assets owned		**Quantity in units**
Livestock	Cows	
	Oxen	
	Calves	
	Donkey	
	Goats	
	Sheep	
	Chicken	
	Bee (in # of hives)	
	Mulls or Horses	
Total Herds		

5 Social Capital

27. Are you a member of any local organization or association?

1=Yes 2=No

28. If your answer for Q#26 is "yes", which association do you belong to?

1. Farmer's Cooperative 1= Yes 2= No

2. Savings and Credit Institution 1= Yes 2= No

3. Women's Association 1= Yes 2= No

4. Other (please specify): _____

29. If your answer for Q#26 is "yes", how does your membership benefit you?

S/N	Membership benefits	1= Yes 2= No
1	1.1 Fast Input Delivery	
	1.2 Affordable Input price	
2	2.1 Fair farm gate output price	
	2.2 strong bargaining power	
	2.3 reliable storage facility	
3	3.1 Easy access to credit	
	3.2 Low cost credit	
	3.3 Increased Savings Habit	

30. Are you a member of an ***Iqub*** (informal rotating group savings technique)?

1= Yes 2= No

31. If your answer for Q#29 is "yes", is there a culture of giving priorities to members during their emergency periods?

1= Yes 2= No

6. Access to public Goods/Services

32. Are you a member of the agricultural extension package of your *Wereda/District/*?
1= Yes 2= No

33. If your answer for Q#31 is "yes", which of the following services have you received so far?

S/N	Type of Good or Service Received	Yes	No
1	Technical advice		
2	Market Information (input or/and output)		
3	Credit		
4	Farm equipment		
5	Improved seeds		
6	Fertilizer		
7	Capacity building training		
8	Weather related/Metrological		

7. Infrastructure and Market Information

34. Who is the **major** buyer of your farm outputs?

1= rural consumers 2= cooperatives

3= middlemen from towns 4= urban consumers

5= others (please specify): _____.

35. What is the nearest output market where you mainly sale your products? ----------
---

36. Do you have road access to the nearest town/city?

1= Yes 2= No

37. If your answer for Q#43 is "yes", what is the nearest town/city where you sale your products? _____.

38. Do you have transport access to the nearest town/city if you intend to sale products there? 1= Yes 2= No

39. How do you get to the nearest output markets most often?

1= on foot 2= by pack animals 3= by car

40. How do you acquire market information pertaining output prices most often?

S/N	Means of Accessing Information	using as a means		Degree of dependence	Frequency of use
		Yes	No		
1	Radio				
2	Government/Extension agents				
3	Television				
4	Mobile				
5	Traders/Middlemen				
6	Neighbors				
7	Other (specify				

Codes

1.Degree of dependence 1= High 2= Medium 3= Low

2. Frequency of use 1= High 2= Medium 3= Low

8. Household Income

41. How many mealtimes does your household consume basic food on average in a day?

1= one time in a day 2= two times in a day

3= three times in a day 4= more than three times in a day

42. Estimation of household incomes from farm, off-farm and non-farm activities for the last twelve months

Item	Quantity sold in the year	Total Value earned from sales (in birr)
Livestock		
Crop		
Vegetables		

43. Did you participate in non-farm activities/off-employment?

1= Yes 2= No

44. If your answer to Q#42 is "Yes", how much did you receive as income from your participation?

S/N	Type of Activity	Self employment	Off-farm employment	Total income earned in the year
1				
2				
3				
4				
5				

Appendixe B: Key Informant Interview

Key Informant Interview (With Agriculture and Rural development experts)

A. Personal background

1. What is your job responsibility?

2. How long have you served in this woreda?

B. Production, Marketing, and Farm Characteristics

1. What is the primary means of livelihoods for the people in this woreda?

2. What are the main food and cash crops grown in this district and why?

3. What services and assistance do the farmers get from your office?

4. What efforts are done to integrate the smallholder farmers with the market?

5. What are the challenges and opportunities at their disposal?

6. What are the major non-farm activities farmers do in this woreda?

7. What is the trends in using small scale irrigation for Agricultural production?

8. What practical experiences/observation do you have in identifying the irrigation users and non users?

a. Food gap in month

b. level of income

c. living standards

d. withstand shocks

Appendix C: Focus Group Discussion Questions

1. Is there a significance difference in livelihood strategies among the users and non-users of small scale irrigation?

2. What are the determinant factors affecting the livelihood asset building of the households in the area?

3. Are there any other factors, which could negatively affect irrigation development in the study areas? If so, what is the magnitude of the problem?

4. What are the opportunities for small scale irrigated crop produces?

5. What are the possible intervention areas in order to bring better socio economic benefits to the small scale irrigation users in the district?