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DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

THE ROLE OF SMALL SCALE IRRIGATION ON SMALL HOLDER FARMER'S INCOME IN OROMIA REGIONAL STATE OF DUGDA WEREDA IN THE CASE OF BEKELE GIRISA KEBELE.

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SENIOR ESSAY APROVAL

We are here certify that we are agreed and evaluated this essay entitled "Role of small scale irrigation on small holder farmers income in Oromia region of Dugda Wereda in the case of Bekele Girisa Kebele " Prepared by Mikiyas Alemayehu . ID.NO. SSR/0879/12. Agerie Atalay. ID.NO.SSR/0116/12, and Halima Hussien. ID.NO. SSR/0629/12. We recommended that it is submitted as fulfilling the requirement for the award of B.A degree in Geography and Environmental Studies**.**

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As an examiner of the B.A. senior essay open defense examination, we have certified that we have read and evaluated the senior essay by Mikiyas Alemayehu, Agerie Atalay, and Halima Hussien. We are recommended the senior essay to be accepted as fulfilling the requirements for the award of B.A. Degree in Geography and Environmental Studies.

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Final approval and acceptance of the senior essay is contingent up on the submission of its final copy to Wolkite University Department of Geography and Environmental Studies through the candidates.

DECLARATION

This is confirming that, this senior essay entitled "The Role of small scale irrigation on small holder farmers income in Oromia region of Dugda wereda in the case of Bekele Girisa Kebele" Submitted in partial fulfillment of the requirement for the award of B.A Degree in Geography and Environmental Studies at Wolkite University Department of Geography and Environmental Studies is our original work done under the Guidance of Mr. BAHAILU GETU. (M.A). We are, the candidates, whose name, ID. No. and Signature is depicted below confirm that the matter embodied in this senior essay has not been submitted earlier for an award of any degree. We also assure that all relevant sources of information used in this senior essay have been duly acknowledged.

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List of Acronyms

(ADLI) Agricultural Development led industrialization.

(ATA) Advanced technology attachment.

(CIDA) Construction Industry development agency.

(CSA) Central statistical agency.

(ETB) Ethiopian birr.

(EU) European union.

(FAO) Food and Agricultural Organization.

(FHI) Food and Healthy institution.

(GDP) Gross domestic product.

(IDP) International development program.

(IDP) Irrigation development plan.

(JICA) Japan international corporation agency.

(MOA) Ministry of Agriculture.

(MOWE) Ministry of water energy.

(MOWR) Ministry of water resource.

(NGO) Non-governmental organization.

(OSHO) Occupational safety and healthy ordinance.

(REST) Rapid emergency shelter taskforce.

(SICA) Service item control activity.

(SIDA) Swedish International development agency.

(UNDP) United nations development program.

(UNICEF) United nations international children's fund.

(US) United states.

(WAO) World agricultural organization.

(WSDP) Water sector development program.

ABSTRACT

Critical studies on irrigation systems and developments in Dugda District have been conducted by some researchers from the historical point of view up to the present time. This review discusses on the role and significance of small scale irrigation in improving household income in Dugda District based on the current conditions of development and its contributions in improving the standard of living of household and its challenges. It is believed that irrigation practices are a good strategy in improving the standard of living of users in comparison to non-users. Irrigation users have higher living standard than that of non-use. On the other hand, evidence from many studies show that irrigation plays a significant role in the enhancement of food security and economic development of Ethiopia. Concerning the development of small scale irrigation in the country, Ethiopia has high potential of irrigable land and water resources. However, the exploitation of an irrigable land is only about 5 to 6 percent. This means, irrigation as a good strategy of improving standard of house hold living is not given attention by the public authority. As a result, its contribution to the national economy is not significant when compared to rain-fed agriculture. Therefore, public authorities, non-government bodies and researchers should participate for encouraging and motivating households to take part in small scale irrigation.

Keywords: Irrigation, Income, Living Standard Of Households.

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CHAPTER ONE

1 Background of the Study

1.1. INTRODUCTION

In Ethiopia, agriculture remains among the most important economic sectors. It produces about one-third of GDP and employs 70 percent of the workforce, accounting for 80 percent of the country's merchandise exports (EATA, 2014). Agriculture is the leading sector of Ethiopian economy as well the overall economic growth of the country largely depends on the agricultural sector. However, Ethiopian agriculture remains characterized by small-scale subsistence production systems where crop and livestock yields are very low (Desta and Almaz, 2015).Although agricultural productivity is very much affected due to variability of rainfall and drought(Sensen, 2013).

From the total production of Ethiopia's, about 97% food crops are produced by rain-fed agriculture, whereas only 3% is from irrigated agriculture (FAO, 2015). Because of high dependency on rain-fed agriculture, other topographic and low adaptive capacity along with other related factors, Ethiopia ranks the ninth most susceptible country in the world to natural disasters and weather related shocks (Tongul and Hobson, 2013). On the other hand, Ethiopia has abundant water resources, its agricultural system does not yet fully benefit from the technologies of water management and irrigation(Seleshi et al., 2010).

According to Nahusenay and Madhu(2015),one of the aspects given attention by the government is to improve food and agricultural production through the strengthening small scale irrigation. The net farm income is the most watched indicator of farm sector well-being, as it captures and reflects the entirety of economic activity across the range of production processes, input expenses, and marketing conditions that have persisted during a specific time period. There are different mechanisms by which irrigated agriculture can improve household income and food security, through: increasing farm production and productivity that helps very poor households meet the basic needs, protecting against risks of crop loss due to erratic, insufficient rainwater supplies, promoting greater use of yield enhancing farm inputs and creation of additional employment (Agidew, 2017).

According to the Oromia Regional State Ministry of agricultural and natural resource office report of 2016, there are about 1.1 million hectare of irrigable land and among this only 37,470 hectares of land have been irrigated. According to this report, Oromia Region is endowed with good potential of land which can lift the regions out of poverty but it could not yet utilize this opportunity of resource.

However Bekele Girisa Kebele has a huge potential in terms of surface and ground water availability and land which are in most cases suitable for irrigation, its role in this sector is not as much as needed to reduce the problem of income. This underdevelopment of small scale irrigation and low level of income in the sector needs investigation.

1.2 Statement of the Problem

According to Sargoi (2012), the development of small-scale irrigation is one of the major intervention strategies to boost agricultural production in the rural areas of the country. This helps poor farmers to overcome rainfall and water constraint by providing a sustainable supply of water for cultivation and livestock farming, strengthen the base for sustainable agriculture, provide of increased food security to poor communities through irrigated agriculture and contributing to the improvement of human nutrition.

But small scale irrigation is not only for the providing of a sustainable supply of water and increased food security. Therefore, this research would be conducted to improve the income of the household and standard of living by using small scale irrigation properly. Small scale irrigation is a key to increase farmers‟ income, household employment and defending livelihoods against economic vulnerability by producing higher value crops for sale in markets and to harvest more than once per year.

The Dugda district endowed with lakes and rivers water resource, on the rivers and lakes government, NGOs and farmer established small-scale motorized irrigation system. Under those system farmers grow field and horticultural crops. Small-scale irrigation largely designed to horticultural crop production. Because of The production of horticulture is more effective for improving the income of households than field crops. So The purpose of this study is to improve their income in the study area.

1.3. Objective of the study

1.3.1.General objective

The general objective of the study is to examine the role of small scale irrigation on small holder farmer's income in Dugda woreda in the case of Bekele Girisa Kebele.

1.3.2Specific objective

The study has the following specific objective

1, To identify the factors determining small scale irrigation in the study area.

2, To distinguish potential challenges and opportunities of the small scale irrigation in study area.

3, To explain the role of small scale irrigation in Improving the Standard of Living of household in study area.

1.4Resarch question

Based on the objective the following main research questions are rise in the study.

1) What are the factors determining small scale irrigation in the study area ?

2) What are the potential challenge and opportunity of the small scale irrigation in the study area?

3) how small scale irrigation can improve the standard of living of household in study area ?

1.5 Significance of the Study

The significance of finding from this study about role of small scale irrigation would be useful for stake holders and the regional and local decision makers to implement the developments program to address the constrains that affects the developments of small-scale irrigation. Generally, this study would be served to create awareness about the role of small scale irrigation in improving the income of the household rather than using rainfall developments on agriculture. This research enables households of Bekele Girisa Kebele to improve the income and the household start using small-scale irrigation in line with rain fed developments on agriculture. As a result, the study is would be helped local and developments agents to formulate appropriate intervention mechanisms.

1.6. Scope of the Study

The study is to assess the role of small scale irrigation practice on the income of the household in Dugda wereda of Bekele Girisa Kebele. In addition, in this Kebele, the researchers are going to assess the role of small-scale irrigation related to how productivity and income benefits come in to being.

1.7. Limitation of the Study

When the study had conducted the encountered some difficult the most common problem was the presence of involuntary and unwillingness of some respondents to give the answer questionnaires and lack of to get the required information at the target area. These were shortage of time to collect sufficient information for study and lack of finance to by necessary material for research work.

1.8. Organization of the Study

This study was organized in such a way that chapter one includes introduction, statement of the problem, research question, objective of the study, specific objectives, and scope of study, significance of the study and limitation of the study. Chapter two presents review of the related literature. Chapter three deal with the description of the study area. In addition, research design, research approach, sample size and sample techniques, data collection and data analysis and presentation are included in chapter three. Chapter four deals with result and discussion and chapter five includes conclusion and recommendation.

CHAPTR TWO

2. REVIEW OF RELATED LITERATURE

2.1.Defination and concepts of irrigation

Irrigation is the addition of water to the soil to produce near optimal moisture condition for crop production in report of water scarcity. Irrigation is the practice of supplying needed water to crop land and to produce plant growth. It may be used to combated occasional drought or to make and land productive. More elaborate concepts of the term are employed for irrigation .irrigation is very complex activity where climate ,water, soil ,plant and finally man in their socio-economic environment are intervening to delicate in related system of dependences. irrigation is the provision of water from river, lake, or underground source artificially to enable an area of land to be cultivate .(Awlachew Seleshi B, Merrey D .Van Koppon 2016).

In general terms, irrigation can be defined as the artificial supply of water to supplement natural precipitation or substitute for it for the purpose of agricultural production(Mohamed, 2006). According to Indhumathi et al., (2017) Water is most powerful natural resource as it has great influences in health and wealth of the people and production of food. Thus, water has great role in survival and comfortable life of living things. We are depending on the water resources for development of agriculture. Besides various other uses of water, the largest use of water in the world is for irrigating land. The same report by MoWE(2013), indicated that water is a basic need for human beings and animals. It is essential for their metabolic processes. It is used to build healthy workforce, ensuring food security, provision of clean energy for agriculture and industry.

2.2. Impacts of Small-scale Irrigation on farmer's income in Ethiopia

Access to such small scale irrigation can significantly improve income level and food security status of beneficiary households(Eshetu and Young-Bohk, 2017). According to Lipton *et al.* (2003), irrigation increases productivity by reducing crop losses that were due to limited water supply, enabling cultivation during the lean season, and making crop production possible on lands where rain fed agriculture is infeasible. The other study shows that farm productivity is positively correlated with the availability of farm power coupled with efficient farm implements and their sustainable utilization. On the other hand, the report of (MoA, 2015) shows that

Agricultural mechanization not only enables efficient utilization of various inputs such as seeds, fertilizers, plant protection chemicals and water for irrigation but also it helps in poverty alleviation by making farming an attractive enterprise. In Ethiopia, nearly all small farmers are still using traditional hand tools and oxen plow, which greatly is restricting crop productivity and production.

Irrigated agriculture plays a central and dynamic role in the improvement of rural livelihoods, but is often subject to criticisms of inefficiency in water use, high capital and recurrent costs and lack of sustainability associated with inequity in the distribution of both land and water(Reinders, 2011). Although irrigation leads to increased agricultural income and production diversity, and this leads to improved diets and access to irrigation has the potential to improve both household income and the diversity of crops that farmers produce. Increasing household income, in turn, leads to higher dietary diversity, while increases in production diversity do not contribute to increases in dietary diversity over and above the effect of income (Passarelli *et al.*, 2018).

According to Garbero and Songsermsawas (2018), Small-scale farmers in the developing world face multiple challenges that limit their opportunities to achieve higher agricultural productivity and improve their living conditions. One promising channel to help farmers attain more desirable agricultural outcomes is to increase their access to water, an important input for agricultural activities. Several studies have noted the positive and significant benefits of irrigation infrastructure on agriculture.The main income sources of Ethiopian rural households were cropping, livestock and off-farm activities and the irrigating households have significantly larger mean annual income than non-irrigating households. Although the poverty analysis indicated that a much higher proportion of poor are non-irrigating than irrigating households, different studies revealed that there is positive significant impact on the income of participant household income as a result of participation in small-scale irrigation(Getaneh, 2011;Temesgen *et al.*, 2018).

According to Awulachew (2010), with high potential, if it is successfully operated, irrigation in Ethiopia could play a significant role in the agricultural transformation of the country, contributing up to ETB 140 billion to the economy. Furthermore, another study done by Tsegazeab (2015) micro irrigation is one of the most useful irrigation systems designed to increase production and productivity; and reduces risk, related with rainfall variability and increases income of rural farm households and not surprisingly, planners, researchers,

development practitioners, and donors emphasize the importance of micro irrigation in their policy recommendations and actual measures.

According to Aam (2013), small-scale irrigation has immense potential to improve agricultural productivity and incomes of poor rural households. Irrigation in fact is nothing but is a continuous and reliable water supply to different crops in accordance with their water requirement. According to Seleshi *et al.*(2005), agricultural production in Ethiopia has affected by increasing population, deforestation and land distribution. This reflected in a decrease in household production and grazing land. Hence, it has become a common phenomenon to ask for emergency food assistance for acutely food insecure people in Ethiopia. The adoption of new technology (e.g. irrigation) is the major powerful for agricultural growth and poverty reduction(Norton *et al.*, 2010). This indicates that investment in irrigation can increase farmer's independence on rainfall, it increases irrigated farmland, it generates employment, it promotes farmers to produce two or three times in a year and use more of chemical inputs. Small scale irrigation in developing countries was considered as a means of increasing production, reducing the dependence on rainfall and provides jobs to the poor(Chazovachii, 2012).

Although small-scale irrigation is believed in helping to address irregular rainfall pattern problem there by reducing rural poverty, food insecurity as well as improving the overall contribution of agriculture to the national economy(Tizita, 2017), it increases land productivity, crop yields, adoption of mineral fertilizers and enables to diversify into non-conventional and market-oriented products (Eshetu *et al.*, 2010). It also improves farm households‟ diet, incomes, health and food security(Torell and Ward, 2010). Hence irrigated agriculture is accepted as essential in increasing land productivity, enhancing food security, earning higher and more stable incomes and increasing for multiple cropping and crop diversification(Smith, 2004).

In general irrigation in Ethiopia is considered as a basic strategy to alleviate poverty and increase income of the household. It is useful to transform the rain-fed agricultural system which depends on rainfall into the combined rain-fed and irrigation agricultural system. This is believed to be the most prominent way of sustainable development in the country. However, the development of irrigation practices in Ethiopia has to be investigated so as to seriously know the history of irrigation emergence and its subsequent developments (Gebremedhin, 2015).

2.3. Use of Irrigation Water in Ethiopia

Water is mankind's most vital and versatile natural resource (Nata et al., 2008) and has always played an essential role in Ethiopian society as it is an input to almost all production systems (MoWR, 2006). Water is also considered as an essential resource for irrigation. Irrigation can be defined as an artificial application of water to soil for the purpose of supplying the moisture essential in the plant root-zone to prevent stress that may cause reduced yield and/or poor quality of harvest of crops (Reddy, 2010). This is an intentional action made by human to apply water for growing crops, especially during dry seasons where there is a shortage of rainfall. Water applications to crop fields are of various types. The most commonly used and most ancient type is surface irrigation methods (FAO, 2002) through using gravity forces. This was used especially across river sides and it doesn't depend on mechanized equipments. Nowadays, modernized irrigation systems are mostly used which works based on the pressurized energy system (FAO, 2001). The sprinkler and drip irrigation systems are of this type of water application systems.

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Nata et al., (2007); Abraham et al., (2011) listed out the benefits of irrigation that includes; increase food production in arid and semi-arid regions, enhances food production, promotes economic growth and sustainable development, create employment opportunities, and improve living conditions of small-scale farmers. As a result, irrigation contributes to poverty reduction and protects the environment from degradation and pollution. Furthermore, it increases subsurface water levels and recharges groundwater. As a result, small, medium and large scale irrigation infrastructure needs to be developed in the country. This helps to produce export commodities that would earn foreign exchanges and provide.

raw materials to the local industries. Since, most of the irrigation development in Ethiopia is expressed through an expansion of small-scale irrigations. Medium and large scale irrigation developments are needed to be taken into consideration.

2.4. History of Irrigation in Ethiopia

Sulas et al., (2009) in the study conducted to investigate whether irrigation was a key factor in state formation and urban development in the ancient civilization of Axum, Northern Ethiopia, found non-sufficient information regardless of water managements of rain-fed agriculture. However, In Ethiopia, traditional irrigation was practiced before centuries (Bekele et al., 2012). Moreover, in the highlands of Ethiopia, irrigation practices have long been in use since ancient times for producing subsistence food crops (Awulachew et al., 2007; Bacha et al., 2011; MoA, 2011a). Different authors; Awlachew et al., (2007); Makombe et al., (2007); Hagos et al., (2009); Bacha et al., (2011) stressed that supplementary irrigation has been practiced by smallholder farmers of Ethiopia for centuries to solve their livelihood challenges.

Spate irrigation has also been used traditionally in Ethiopia (Mehari at al., 2011) particularly in Southern Tigray and in some semi-arid areas in Oromia region (MoA, 2011a). This irrigation system has been used for water harvesting from flush floods flooded from larger catchments at upper streams. These traditional irrigation systems were developed and managed through forming a water user's association for functions of construction, water allocation, operation and maintenance and were headed by individuals (Belay and Bewket, 2013). This association comprises up to 200 users grouped in to 20 to 30 groups of farmers who share a common main canal or its branches (MoA, 2011a). From the above discussions, the exact date when irrigation was started in Ethiopia remains uninvestigated regardless of routinely saying "irrigation was started in Ethiopia during ancient times" Awlachew et al ., (2007); Makombe et al ., (2007) ; Hagos et al ., (2009) ; Bacha et al ., (2011).

Modern irrigation, however, was started in the early 1950's by the bilateral agreement between the government of Ethiopia and the Dutch company jointly known as HVA-Ethiopia sugar cane plantation (MoA, 2011a; Bekele et al., 2012). Most of the traditional irrigated lands in Ethiopia are dominantly supplied by surface water sources, while ground water uses has just been started on a pilot basis in the East Amhara region (MoA, 2011a). According to MoA, (2011a) pressurized sprinkler irrigation system was once practiced in Fincha State Farm, Eastern Amhara, Southern Tigray and on some private farms in the Rift Valley. The Rift Valley is a place where modern irrigation in Ethiopia starts especially in the Awash River Basin at which adoption of pump-irrigation commences. Surface irrigation methods predominantly furrow irrigation and basin irrigation methods were practiced for cotton and wheat productions and for

commercial fruits such as bananas respectively. Meanwhile, similar reports such as Awulachew et al., (2007) explained that irrigated agriculture was started in Ethiopia in the upper Awash Valley with the objective of producing industrial crops as sugarcane, cotton and horticultural crops on a large-scale basis, explained in a remarkable emergence of irrigation development and establishment of agro industrial centers. This was due to taking an advantage of the construction of Koka dam aimed as a reservoir irrigation water supply, flood control and hydropower generation. During the middle 1970s, windmills and hand pumps were introduced to lift water from groundwater for drinking water supply, domestic and gardening purposes (MoA, 2011a).

According to the Ministry of Agriculture, in Ethiopia, there were modern water storage and water management systems for irrigation purposes. This includes water diversion schemes, water storage dams, micro irrigation systems, rainwater harvesting and shallow groundwater harvesting techniques. These systems make use of different water drawing irrigation technologies for lifting, conveying and applying irrigation water for irrigation uses. Night water storage facilities, Treadle pumps for lifting water, smallholder drip systems and micro- sprinklers for irrigation application are used among others (MoA, 2011a).

2.5. ways of Irrigation development and participation condition in Ethiopia

Ethiopia has a long history of traditional irrigation systems. Simple river diversion still is the dominant irrigation system in Ethiopia. According to Seleshi *et al.* (2010), estimates the irrigation potential of Ethiopia may be as large as 4.3 million hectares. Traditional irrigation schemes cover more than 138,000 hectares whereas modern small-scale irrigation covers about 48,000 hectares. The total current irrigation covers only about 6% of the estimated potential land area.

According to Gebremedhin and Asfaw(2015), irrigation was practiced during ancient times in Ethiopia even if its exact date of emergence is unknown. Ancient use of irrigation water was through use of surface irrigation methods and spate irrigation types. Modern irrigation was started at the Awash River basin with bilateral cooperation of Ethiopia and Dutch company. Ethiopia is a rich country in water resource and most of the time it is termed as a water tower of east Africa because of its abundant water resource availability(Adugna , 2014). Although Ethiopia has a huge potential of water resource which accounts 122 billion meter cube annual surface runoff and 2.9 billion meter cube groundwater, it is characterized by uneven spatial and

temporal distributions(Tesfa, 2015). But, Ethiopia is using a very little of its abundant water resource potential for irrigated agriculture(ATA, 2016). The study taken by Gebremedhin (2015), indicated that the policies and strategies of Ethiopia strongly supports the irrigation developments especially the small scale irrigation through the Water Sector Development Programs (WSDP) and Ethiopian Irrigation Development Plan (IDP). This irrigation development is mainly expressed in the development of small-scale irrigation schemes by governments, donors and NGOs. Irrigation is believed as a key for food security and poverty reduction in Ethiopia. As a result, developments in the Ethiopian irrigation system have shown great advancements so as to assure Ethiopian livelihoods especially in the rural areas. However, the contribution of irrigation to the national economy as compared to its potentials is insignificant(Woldegebrial *et al.*, 2017).

2.6. Irrigation Developments in Ethiopia

Irrigation development is vital to the sustainable and reliable agricultural developments in Ethiopia. Subsistence dominated smallholder farmers' economy can be improved through the use of irrigation in the Ethiopian agriculture (MoA, 2011b). Similarly, make use of irrigation agriculture is going to be a means for increased agricultural production to meet the growing food demands of rapid population growth. Irrigation development in Ethiopia can be considered as a cornerstone of food security and poverty reduction tool as it has a power to stimulate economic growth and rural developments (Hagos et al., 2009). As a result, irrigation infrastructures are increasing year after year, which show country wide positive development implications and experiences in small and large scale irrigation schemes. In Ethiopia, farm size per household is 0.5ha and the irrigated land per households' ranges from 0.25 ha - 0.5 ha in the Ethiopian context (MoA, 2011a). As a result, individual land holdings per households are too small to feed the household. With this limited landholdings, increasing food demands of the population depends on either one or a combination of increasing agricultural yield, increasing the area of arable land, and increasing cropping intensity by growing two or three crops per year using irrigation (MoA, 2011a).

On the other way, Irrigation development in Ethiopia is in its infancy stage (MoA, 2011a). The Ethiopian government is therefore pursuing plans and programs to develop irrigation in an effort to substantially reduce poverty and create an atmosphere for social change. As a result, the

Ethiopian average rate of irrigation development for the last 12 years was about 1,090 - 1,150 ha/year (Nata et al., 2008; Bekele et al., 2012). In Ethiopia, only 10% of the estimated potential irrigable land is actually irrigated (Gebremedhin and Pedon, 2002) and 2% of cultivated lands are irrigated (MoWR, 2001). Similarly, irrigated agriculture comprises only 3% of the total national food production (Bacha et al., 2011). That is why; irrigated agriculture is far from satisfactory despite of considerable investment, public interest, and strategic support of the government.

Belay and Bewket, (2013) explained that irrigation water is critical to poverty alleviation through increased production in rural areas so as to improve food security and rural livelihoods. Smallholder irrigation has recently received significant focus from local governments to enable farmers to cultivate crops twice or more per year. Bacha et al. (2011) in the study of the impact of small-scale irrigation on household poverty in central Ethiopia, reported that land productivity, asset ownership, credit utilization, extension support, resilience to poverty, mean off-farm income, and mean food consumption and expenditure on food and non-food assets were significantly higher for irrigators than non-irrigators.

Irrigation development is taking place through the use of government budgets, donor programs and NGOs. However, As compared to its potential and rain-fed farming, contribution of irrigation to the national economy is quite limited which contributes about 2.5% of the overall GDP (Hagos et al., 2009; MoA, 2011a). Moreover, the existing irrigation development in Ethiopia, as compared to the irrigation potential the country has, is not significant (MoA, 2011b). Thus, irrigation has to play significant contribution in mitigating food insecurity and hence poverty reduction.

2.7. Drivers of Irrigation Development in Ethiopia

Small scale households are the main units for development in Ethiopia. All the irrigation development partners work for the betterment of these households. The Ethiopian Agricultural Development Led Industrialization (ADLI) policies and its driven strategies make use of favourable conditions for the irrigation development. Most of the irrigation partners are from international communities up to localities that have significant contributions towards food security and poverty reductions at households and national levels. According to the Ministry of Agriculture (MoA, 2011a); World Bank, CIDA, EU, US Government, Japan, UNDP, UNICEF, World

Vision, Plan International, Menchen fur Menchen, Care Ethiopia, Concern Ethiopia, Water Action, Water Aid

Ethiopia, Oxfam, Lutheran World Federation, FHI/E, IFAD, JICA, SIDA, Irish Aid,

CIDA are among the international partners towards irrigation developments in Ethiopia. Meanwhile, Ethiopian Orthodox church, Ethiopian Evangelical Church, OSHO, ORDA, REST etcetera are mentioned as local NGOs participating in the sector.

2.8. Challenges and Opportunities of Irrigation Development in Ethiopia

There are different challenges that hinder the irrigation development by small holder households in Ethiopia. According to Temesgen (2017), out of the challenges pointed out by farmers, lack of market at the time of harvest holds the first rank, distance of farm land from irrigation water source, lack of knowledge on the efficient use of irrigation by the farmers, lack of market and linkage, lack of awareness on the sustainable use of water and lack of linkage between micro finance institutions and smallholder horticultural crop producers are some constraints. Although the major small-scale irrigation problems identified by different studies throughout the country indicated that, financial constraints especially for the purchase of motor pumps, shortage of agricultural inputs specially improved seed and pesticides, high cost of irrigation, shortage of water pump technologies, spare parts and gabions, technical problems such as maintenance of motor pumps, insufficient market information and market networks, shortage of ponds and diversion, infrastructure specially road and storage, theft of fruits, diseases and pests such as rust, root ruts, ball worm, blights, powdery mildew, gummosis and water borne diseases are among the problems (Nahusenay and Madhu, 2015).

Another study taken by Gebremedhin and Asfaw (2015), identified the challenges for Ethiopian irrigation development are: Inadequate awareness of irrigation water management as in irrigation scheduling techniques, water saving irrigation technologies, water measurement techniques, operation and maintenance of irrigation facilities, inadequate knowledge on improved and diversified irrigation agronomic practices, shortage of basic technical knowledge on irrigation pumps, drip irrigation system, sprinkler irrigations, surface and spate irrigation methods, inadequate baseline data and information on the development of water resources, lack of experience in design, construction and supervision of quality irrigation projects, low productivity of existing irrigation schemes, inadequate community involvement and consultation in scheme

planning, construction and implementation of irrigation development and poor economic background of users for irrigation, infrastructure development are some challenges. Another study taken by Tizita(2017) shows that lack of suitable land that can be used for irrigation (irrigable farm land) was the major constraints for irrigation non-user households.

On the other hand, there are many opportunities that enhance irrigation development in Ethiopia. From these opportunities the policies and strategies of Ethiopia strongly supports the irrigation developments(Tadesse and Baihilu, 2017). Another study taken by Amede(2014), identified the following future opportunities: high water potential, high commitment of the Ethiopia government, donors and NGOs to support irrigation management and development activity. There is also availability of favorable climate condition and ground water in Ethiopia. It can be used as an opportunity to produce more than once a year if the farmers could be able to access the ground water by means of using different types small-scale irrigation (Temesgen, 2017).

2.9. Future Irrigation Programs in Ethiopia

The Ethiopian Irrigation Development Plan (IDP) emphasizes the development of small-scale irrigation systems through giving highest priority for capacity-building in the study, design, and implementation of irrigation projects. Increasing emphasis will also be given to the development of large and medium-scale irrigation schemes. Ethiopia has designed a Water Sector Development Programme (MoWR, 2002). Accordingly, new irrigation works will be undertaken to develop a total of 274,612 ha of farmland under the irrigation development plan by the federal government and regional governments for large and medium scale irrigation developments. By the end of the water sector development program (WSDP), the total area under irrigation will be 5.1Million ha (MoWR, 2002). However, due considerations should be given during expansion of irrigation infrastructures. Irrigation can have adverse effects on environment and public health, if it is not properly managed (Abraham et al., 2011)

CHAPTER THREE

3.1. Research Methodology

The methodology aims at outlining all methods, materials and procedures would be used in the study. Firstly, it presents the general description of the study area. Secondly, it details the types and sources of data, sampling procedures and method of data analysis.

3.1.1. Description of the Study Area

This section captures the physical and natural features of Dugda Woreda. It also elaborates the topographic and natural features land use and ecological features.

3.1.2. Location, Population and Physical Features

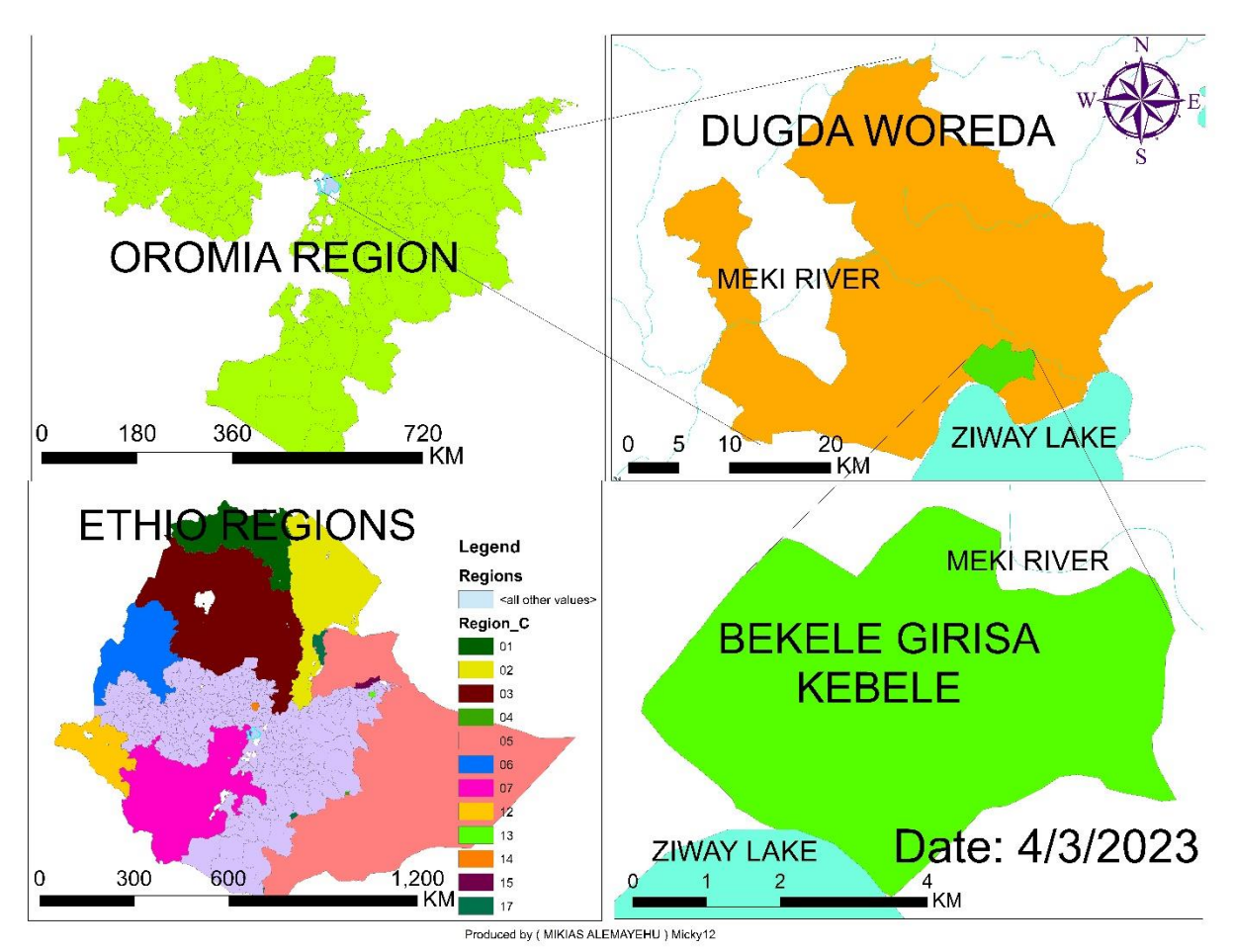
East Shoa zone has thirteen Woredas with a population of less than a million and Ziway Dugda Woreda is one of and predominantly well known for its Small Scale irrigation (CSA, 2015). The Woreda would be selected purposively for the reason that small scale irrigation activities are mostly practice.

3.1.3. Astronomical location of Dugda wereda

Dugda Woreda is located in East Shewa Zone of Oromia Regional State. Geographically the Woreda is located between $8^0$01'N to $8^0$10'North latitude and $38^0$31'E to $38^0$57'E longitude. The total area of the Woreda is 959.45 km^2. The Woreda has 36 rural Kebele Administrations and four urban kebeles. Meki, the main capital of the Woreda, is located 134 km to the South East of Addis Ababa on the main asphalt road to Ziway town. Meki town has three urban Kebeles, namely; 01, 02 and 03.

3.1.4. The Relative Location of Dugda wereda

The boundaries of the Woreda are Bora Woreda in the North and North West, Arsi zone in the East, Adami Tulu Jido Kombolcha Woreda in the South and Gurage zone of SNNPRS in the West (WAO, 2014).



3.1.5. Map of Study Area (figure 1.1)

3.1.6. Demographic Feature

According to the National Housing and Population Census, population projection of the year 2015, the population of the woreda was 185, 534 of whom 95,095 (51.3%) are men and 90,439 (48.7%) are women. of its population from wereda Bekele Girisa Kebele has 10,590 populations, while 5457 are males 5133 the population are females (CSA, 2015). The age distribution of kebele were around 27% were from 20-30 year's old people, about 48.95% were about 30-40 years old and about 23.95% were greater than >40 years old. And the income distribution of kebele were around 16.8% of the farmers can earned less than <10,000 birr. About 21.9% of the farmers were earned from 15000-30,000 birr, about 27.1% of the farmers were earned from 30,000-45000 birr and about 34.39% of the farmers were earned greater than >45000 birr annual income. (field Survey, 2023)

The 2015 National Housing and Population Census indicated that there were 27,613 migrant people living in the Woreda that came from different parts of the country. Of the total migrants, 51% were male and 49% female. About 62% of the migrants live in rural areas while 38% live in urban areas engaged in different activities (CSA, 2015).

3.1.7. Altitude

The altitude of the Woreda varies from 1600 meters to 2020 meters above sea level. The highest part of the Woreda lies towards the West along the border of Gurage zone. Mount Bora is the highest peak of the Woreda which is about 2020 meters above sea level. The physical feature of the Woreda is 97.14% flat land while the remaining 2.86% is mountainous. The agro-ecology of the Woreda is 55% Kolla (Wet Desert) and 45% Weyna Dega (Moderate Highland Dry) (WAO, 2014).

3.1.8. Soil Type

The two major types of soil in the Woreda are Sandy Loam (59%) and Clay Loam (41%). These soil types have light texture making them vulnerable to both wind and soil erosions. In addition, these soil types are saline and alkaline contents, though the degree of salinity is very low (ibid).

3.1.9. Climate and Water Resources

3.1.9.1. Rainfall Pattern and Temperature

Agriculture in Dugda Woreda is mainly rain fed. The major rainy months are June to August. Farm farmers cultivate their land during this season using rain. However, there are irregularities of rainfall in the Woreda. The average annual rainfall in the Woreda was 671.8mm in the past twenty years. The minimum rainfall recorded were 282.7mm in 1990, 418.3mm in 1991 and 458.6mm in year 2009. As a result, there were food shortages during these years in the Woreda due to low crop production. Between years 1994-1996 as well as years 1998-2001 and years 2003-2008 the rainfall pattern improved, though with some irregularities such as late set-ins and early set-offs particularly during flowering period. The maximum rainfall recorded was 915.4 mm in 2003 (International Development Enterprise, 2011).

3.1.9.2. Temperature

In the past two decades the average maximum temperature of the Woreda was 24.8^0C and the average minimum temperature was 11.4^0C. On average, this trend in temperature could be taken as suitable for crop production, animal husbandry and human habitation (ibid).

3.2. Research design

For this study the researchers have been used descriptive research design. The reason for choosing this design is because it enables to describe the role of small scale irrigation practice for improving the income of household in detail.

3.3. Research Approach

The researchers have been employed both qualitative and quantitative approach. Qualitative approaches applied to describe the existing condition of small-scale irrigation and quantitative approach applied to statistical or numerical data.

3.4 Type and Source of Data

To get necessary information the researchers have been collected data from both primary and secondary sources.

3.4.1. Primary source of data

The primary data sources are the first hand information that is directly have been collected from the respondents and data have been collected from Bekele Girisa kebele administrator, experts and households in Bekele Girisa kebele.

3.4.2. Secondary source of data

In this study the researchers have been used secondary data source to support the finding of the study which including books, published and unpublished materials, magazines, documents, internet sources and written report of small-scale irrigation of the kebele are use.

3.5. Data collection Tools

In order to obtain adequate information, the researchers have been collected from respondent who are living in the study area and the documents, which are finding in agriculture office of Bekele Girisa Kebele through the various mechanisms like questionnaires, interviews and field observations.

3.5.1. Questionnaires

The researchers have been used developing questionnaire for respondents, the developed questionnaires properly have been selected and arranged reflecting investigates the true information. Both close ended and open ended questionnaire, is using for data collection.

3.5.2. Interviews

This data has been used interview communication between researchers and interviewee in order to obtain credible data. However, majority of household in the study area cannot write and read. Therefore the households should take agriculture related courses for in order to develop their knowledge on agricultural productivity that helps households to improve income. Through the help of professional man or supported by (Development agent) DA.

3.5.3. Field Observations

First hand data on the field have been collected by direct observation on the selected area for this study. The researchers have been observing the necessary visual information with the help of camera from the existence of small-scale irrigation.

3.6. Sampling

3.6.1. Sample size and sampling techniques

3.6.1.1. Sample size

Dugda woreda has 33 kebele from this kebele the researchers have been selected Bekele Girisa kebele, because this kebele is mostly practice small scale irrigation. According to Dugda Woreda Ministry of Agricultural and Natural resourse office report of 2016, Dugda woreda has185, 534 total populations. while populations, 95,095 (51.3%) are men and 90,439 (48.7%) are women. of its population from wereda Bekele Girisa Kebele has 10,590 populations, while 5457 are males 5133 the population are females from these 2316 households are practice small scale irrigation from these households 96 respondents selected by using. (Yamane law of 1967) sample size determination formula.

3.6.1.2. Sampling techniques

To assure the outcome of the research a small and more manageable number of respondents are chosen Hence, the researchers have been guided by sampling technique depending on the area of the research. Therefore, the researchers would be used simple random sampling technique are

adopted because the rationale for using this sampling is that it enhances the representativeness of the sample.

According to (Yamane law1967) sample size determination formula

$$n=N/1+N (e) 2$$

Whereas n= Sample of the house hold

N=Total number of the research

e=Error of the research

$$n=2316/1+2316(0.1)2$$

$$n=2316/1+2316(0.01)$$

$$n=2316/1+23.16$$

$$n=2316/24.16$$

$$n=96$$

3.7. Method of data analysis and presentation

The researchers have been used both qualitative and quantitative data analysis techniques. The collected data from the sample respondent is organized and analysis based on different data obtained through open ended questionnaires and structured interview is analyze. Quantitatively using percentage, ratio and tables while data obtained interview open question and observation is analyzed qualitative using narration and description. Data analysis using percentage and data presentation are using table.

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

4.1. Background Information of the Respondents

In this study, some demographic features which are expected to have significant implication on the finding would be presented. These are age, sex, marital status, language, education level, religion, and family size.

4.2.Demographic Characteristics of Respondents

4.2.1. Age Composition of Respondents

Many studies indicate age is continuous variable and measured. In Ethiopia household head is the decision maker for farm activities. Age is one of the factors that determine decision making of a person.

Table 4.1 Age Composition of Respondents

No	Age	Frequency	Percentage (%)
1	20-30 years	26	27%
2	30-40 years	47	48.95%
3	>40 years	23	23.95%
	Total	96	100%

(Source; Field Survey, 2023)

As indicated on table 4.2, 27% of respondents were about 20-30 years old while remaining 48.95% and 23.95% of the respondents 30-40 and greater than 40 years old respectively. This indicates that most of the farmers use small scale irrigation in the Kebele was between 30- 40 age ranges.

4.2.2. Sex of Household Head Composition of Respondents

Sex is one of the demographic variables used to describe the back ground of the respondents.

Table 4.2 Sex of household head composition of respondents

No	Sex of household head	Frequency	Percentage (%)
1	Male	62	64.6%
2	Female	34	35.4%
	Total	96	100%

(Source; Field Survey, 2023)

Table 4.2 indicates, 64.6% of the respondents were male whereas 35.4% of the respondents were females. This indicates that the majority of the males practice small scale irrigation.

4.2.3. Marital Status of the Respondents

Marital status was important to get relevant information for the respondents.

Table 4.3 marital status of the respondents

No	Marital Status	Frequency	Percentage (%)
1	Single	26	27%
2	Married	54	56.3%
3	Widowed	16	16.7%
	Total	96	100%

(Source; Field Survey, 2023)

Table 4.3 indicates, 27% of the respondents were single. Whereas 56.3% of the respondents are married and 16.7% of the respondents were widowed. Most of the respondents who practice small scale irrigation were married.

4.2.4. Language of the Respondents

Table 4.4 Language of the respondents

No	Language	Frequency	Percentage (%)
1	Amharic	9	9.37%
2	Tigrigna	-	-
3	Oromigna	87	90.63%
	Total	96	100%

(Source; Field Survey, 2023)

According to table 4.4 indicates, 90.63% of the respondents speak Oromigna language and 9.37% are speak Amharic language. Most of the respondents who are practice in small scale irrigation were speech Oromigna language.

4.2.5. Education Status of the Respondents

The education level of respondents is explained as follows. This includes illiterate, elementary, high school and above grade level.

Table 4.5 Education status of the respondents

No	Education status	Frequency	Percentage (%)
1	Illiterate	23	23.96%
2	Elementary	37	38.54%
3	High School	25	26%
4	Above	11	11.45%
	Total	96	100%

(Source;Field Survey, 2023)

Table 4.5 indicates, 23.96% of the respondents are illiterate. The remaining 38.54% of the respondents, 26% of respondents and 11.45% of the respondents were elementary, high school and above grade level respectively.

4.3. Small Scale Irrigation

4.3.1. Land Ownership

This part indicates whether a household has own land or not.

Table 4.6 land ownership

No	own land	Frequency	Percentage (%)
1	Yes	81	84.4%
2	No	15	15.6%
	Total	96	100%

(Source; Field Survey, 2023)

Table 4.6 indicates, 84.4% of the respondents have their own lands. The remaining 15.6% of the respondents have no own land. Most of the respondents were land owners.

4.3.2.Actual Land Size under Small Scale Irrigation

Table 4.7Actual land size under small scale irrigation

No	Amount of land per hectare	Frequency	Percentage (%)
1	<1 hectare	19	19.8%
2	1-3 hectares	62	64.58%
3	>4 hectares	15	15.62%
	Total	96	100%

(Source; Field Survey, 2023)

According to the table 4.7, 19.8% of the respondents irrigate a land below 1 hectare. 64.58% of the respondents cultivate, 1-3 hectare and 15.62% of the respondents have cultivate above 4 hectare of land by irrigation respectively. The majority of farmers have 1-3 hectare land own.

4.3.3 Type of crops cultivate on irrigated land

Table 4.8 Type of crops cultivate on irrigated land

No	Type of Crops	Frequency	Percentage (%)
1	Food crops	23	23.95%
2	Cash crops	54	56.25%
3	Both food and cash crops	19	19.8%
	Total	96	100%

(Source; Field Survey, 2023)

Table 4.8 indicates, 23.95% of the respondents are cultivate food crops, 56.25% are produce cash crops and the remaining 19.8% are cultivated both food and cash crops. Of the cultivated crops cash crops are cultivated in a large amount in the kebele.

4.3.4. Frequency of production per year

Table 4.9 Frequency of production per year

No	Period of time	Frequency	Percentage (%)
1	One time	10	10.4%
2	Two times	70	72.9%
3	Three times	16	16.7%
4	Above three times	-	-
	Total	96	100%

(Source; Field Survey, 2023)

According to table 4.9 out of respondents, the majority 72.9% of the respondents produce two times per year. 16.7% of respondent produce three time per year. 10.4% of the respondents produce one time. Therefore, the majority of respondent were produce two times per year in the study area.

4.3.5. Surplus Production

Tables 4.10 Surplus production

No	Produce surplus	Frequency	Percentage (%)
1	Yes	96	100%
2	No	-	-
	Total	96	100%

(Source; Field Survey, 2023)

Table 4.10 indicates 100% of the respondents responded that they produce surplus. This results the entire farmers produce surplus

4.3.6. Purpose of Surplus Production

Table 4.11 Purpose of Surplus Production

No	Purpose of surplus products	Frequency	Percentage (%)
1	Sale	80	83.33%
2	Store	9	9.37%
3	Other	7	7.3%
	Total	96	100%

(Source; Field Survey, 2023)

Table 4.11 indicates, 83.33% of respondents use the surplus product for sale. The remaining 9.37% of the respondents use the surplus product for store and the rest 7.3% of the respondent is use other purpose than sale and store.

4.3.7. Economic Benefit of Small Scale Irrigation

Table 4.12Economic Benefit of Small Scale Irrigation

No	Economic benefit	Frequency	Percentage (%)
1	Yes	87	90.6%
2	No	9	9.4%
	Total	96	100%

(Source; Field Survey, 2023)

According to the table4.12, 90.6% of the respondents responded that small scale irrigation has an economic benefit. Small scale irrigation leads to economic growth, increase productivity, better living standard and gradual change from small scale to the largest one. It enables to get enough money, sufficient food, fulfillment of basic needs and control of poverty. The remaining 9.4% of the respondent did not believe in economic advantage of small scale irrigation because of the size of irrigated land owned by them

4.3.8. Support for Small Scale Irrigation Practice

Table 4.13 support for small scale irrigation practice

No	Supporters	Frequency	Percentage (%)
1	Government	53	58.33%
2	NGO	8	8.33%
3	No support	32	33.34%
	Total	96	100%

(Source; Field Survey, 2023)

Table 4.13shows that the 55.2% of the respondents the small scale irrigation practice supported by government. 33.34% of respondents said that the small scale irrigation is never been supported any organization and 8.33% of the respondents said that small scale irrigation supported by NGO. An impact that the small scale irrigation practice is highly supported by government because small scale irrigation practice is important to increase community income.

4.3.9. Support Type from Government for Irrigation

Table 4.14 Support type from government for irrigation

No	Support type	Frequency	Percentage (%)
1	Money	-	-
2	Fertilizer and improved seeds	54	56.25%
3	Education support	28	29.2%
4	Provide pesticides	14	14.55%
	Total	96	100%

(Source; Field Survey, 2023)

As indicated in table 4.14, the majority of the resident accenting for 56.25% of respondent get provide fertilizer and improved seeds by the government and about 29.2% of the respondent provide educational support and 14.55% of the respondent were gets pest seed on small scale irrigation in the study area. This support is strengthening farmers on small scale irrigation and enabling them to get sufficient food for their families. Generally, government is support small scale irrigation at the Kebele level, but not only in the study area at all of the country. Because of small scale irrigation is the back bone of sustained socio- economic development at the whole of the world.

4.4.1. Annual Crop Yield per Farmer

Table4.15 Annual Crop Yield per Farmer

No	Crop yield production for quintal/per plot of land in (hectar)	Frequency	Percentage (%)
1	< 5 quintal(1/8hec)	12	12.5%
2	5-10 quintal(1/4hec)	42	43.75%
3	10-15 quintal(1/2hec)	24	25%
4	>15 quintal(1hec)	18	18.75%
	Total	96	100%

(Source; Field Survey, 2023)

Table 4.15 indicates, 43.75% of the respondents have gotten 5-10 quintal of products from 1/4hec per plot of lands. 25%, 18.75% and 12.5% of respondents have gotten10-15 quintal from 1/2hec, above 15 quintal 1hec and less than 5quintal of products from 1/8hec respectively. The majority 43.75% of the respondents have gotten 5-10 quintal from 1/4hec of crop production per farmer.

4.4.2. Major Problem of Irrigation Practices

There are different problems that hinder irrigation practices from being successful.

Table 4.16Major Problem of Irrigation Practices

No	Problem of irrigation practices	Frequency	Percentage (%)
1	Lack of fertilizer	19	19.79%
2	Market problem	16	16.7%
3	Shortage of water	48	50%
4	Shortage of skilled man power	13	13.5%
	Total	96	100%

(Source; Field Survey, 2023)

Table 4.16 indicates, 50% of the respondents confirmed that shortage of water is the main problem. 19.79% of the respondents responded lack of fertilizer during small scale irrigation. The remaining 16.7% and 13.5% of the respondent believed that market problem and Shortage of skilled man power are the hindrances of small scale irrigation respectively. Majority problems are shortage of water for small scale irrigation because drought reduces amount of rain fall year to year.

4.4.3.Yearly Income of The Respondent

Table 4.17, Yearly income of the respondents

No	Yearly income in (birr)	Frequency	Percentage (%)
1	<10,000 birr	16	16.8%
2	15000-30,000 birr	21	21.9%
3	35000-45000 birr	26	27.1%
4	>45000 birr	33	34.39%
5	Total	96	100%

Table 4.17 Income of the respondents

Source field survey, 2023

Based on the table 4.17, majority of the respondent were annual income greater than 45000 which accounts 35000_45000%,15000_30,000, <10,000which accounts 34.39%, 27.1%, 21.9%, 16.8%respectively.due to this reason, people's ability to earn income and have positive attitude and perception about the benefit of small scale irrigation and they were used for improving their productivity that led to increase in income.

4.4.4. Annual Income before Starting and After Starting Small Scale Irrigation

All respondents respond that the annual income before small scale irrigation practice was low because of the amount of production was depending on rain fall. So, the amount of income was low per year. The annual income of the household was increased year to year after using small scale irrigation. As shown in the (Table 4.17) So that the respondents that increases incomes after using small scale irrigation practice.

4.4.5.The Trend of Small Scale Irrigation Activities

In the study area the trend of small scale irrigation in Bekele Girisa Kebele is increased from time to time. Because as we compare and contrast the time of beginning and the current time, the availability of input materials is good relative to the past. the reason for this increment is the developed awareness of societies about the advantage of small scale irrigation is slightly increases the present time. This are explained in the table 4.15 it shows the increment in annual

crop yield per farmers from year to year and table 4.17 it shows the increment in yearly income of the respondents

4.4.6. The Potential Economic Advantage of Small Scale Irrigation Activities

All respondents respond that the economics of small scale irrigation activities to create annual productivity of crops twice and more without searching of rain. It also used to good result of economic change, improve society's income and it raises the production of higher value crops and improve their living standards. It leads market availability and children to learn. In the irrigation system higher value products are the most important societies to improve their income, machineries and for improving their income by using irrigation to produce two or three times per year. so their economy and saving practice increase.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The role of small scale irrigation practices in Bekele Girisa Kebele enables societies to improve their income by producing higher value crops and wide spreading of cash crops for markets. Most of annual income were earned from the production that produced by irrigation as they responding the respondents. The trend of small scale irrigation activities from the beginning to the present time is slightly increased. Because the recognition of societies who lives around that area about the advantage of small scale irrigation is also increased. The potential economic advantage of small scale irrigation activities in the study area the people teaches their own children, improve their housing, living standard and soon. But still now there is the challenges which hinder societies to do this economic activity efficiently and effectively such as the availability of fertilizer, new crop types, new machines and the others are not fulfill. There are many problems that hinder to the development of irrigation practices. Among those lack of institution and well trained professions to distribution incidents, herbicides, pesticides and other immediately when the energy is occurred, inadequate fertilizer supply, market problem, lack of awareness of the society.

5.2. Recommendation

Based on the finding, some recommendations are forwarded to minimize the problem observed in the area.

- The government should provide adequate education to the community about the important of irrigation.
- Expanding the capacity of small scale irrigation agriculture and creating additional access through integrated water investment is important to increase agricultural product and leads to increase the income of households.
- Organize the capacity building activity to advance the farmers participation in small scale irrigation to upgrade their existing indigenous way of management system.
- Create awareness and responsibility about handling storage and disposalof irrigation practices that means every farmer participate through irrigation practice in everywhere.

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Appendix

COLLEGE OF SOCIAL SCIENCE AND HUMANITIES

DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

Dear respondent!

The main purpose of this questionnaire is to collect data as part of under graduate research work. On the title "the role of small scale irrigation practices for improving the income of households in Bekele Girisa Kebele." This questionnaire is designed for research purposes hence the researchers kindly request you to give your frank response. Your cooperation in responding the questionnaire would be significant and contribute a lot for the success of this study.

Thank you for your cooperation

Note:

- ✓ No need to write your name.
- ✓ Please circle your answer on the provided choice for close ended quaternaries
- ✓ Writes your answer on the blank space far open ended quaternaries.

Part one: Back ground of the information

1. Age: A. 20-30 years B. 30-40 years C. above 40 years
2. Sex of house hold head: A. Male B. female
3. Martial statues: A. Single B. Married C. Divorced D. widowed
4. Language: A. Amharic B. Tigrigna C. Oromigna D. Other
5. Educational status: A. Illiterate B. Elementary C. high school D. above
6. Religion: A. orthodox B. Muslim C. Protestant D. other
7. Family size: A. 1-4 member B. 5-10 members C. above 10

Part two: small scale irrigation.

1. Do you have land of your own?

   A. Yes B. No

2. If your answer is yes how many your area size of land in hector?

   A. <1 hector B.1-3 hector C. above 4

3. Do you practice irrigation?

   A. yes B. No

4. If no why? _____

5. What type of crop you cultivate on irrigated land?

   A. food crops B. cash crops C. others_____

6. How many times you produce from your irrigation farm per year?

   A. One time B. twice C. three times D. above three

7. Have you ever produce surplus?

   A. yes B. no

8. If "yes" for what purpose you use the surplus?

   A. sale B. store C. others_____

9. Do you believe that small scale irrigation benefited you economically?

   A. yes B. no

10. If yes_____

11. Are there any organizations that help you in irrigation?

    A.yes B .No

12. If your answer is "yes" which organization?

    A Government B.NGO C. other

13. What they support you? A. money B. fertilizer and improved Seeds

    C. educational support D. provides pesticide

14. How much the annual crop yield per farmer in your Kebele?

A. < 5 quintal B 5-10 quintal C 10-15 quintal D >15 quintal

15. What are the major problems that hinder to irrigation practice?

    A. lack of fertilizer B. market problem C. shortage of water D. shortage of skilled man power

Part three: open ended questionnaire related to small-scale irrigation

1. When you compare a yield before and after you started irrigated agriculture which one do you think is best economically? _____
2. What specific changes occurred in your economic life after started irrigated agriculture? _____
3. How the trend of small-scale irrigation activities in the study area? _____
4. What is potential economic advantage of small-scale irrigation activities in the study area_____
5. What are the major problems that hinder to irrigation practice in the study area? _____