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TITLE ON: THE ROLE OF SMALL SCALE IRRIGATION ON POVERTY REDUCTION IN CASE OF TULA SUB CITY IN HAWASSA CITY

BY

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ABSTRACT

The aim of this study is to analysis the role of small scale irrigation in poverty reduction in case of Tula sub city. A simple random sampling is applied to select 99 samples size which participants of the small scale irrigation in poverty reduction in the study area. The descriptive statistics were used to describe characteristics of the respondents in small scale irrigation. Method of data analysis used descriptive method of data analysis for the collected data from both primary and secondary data sources are first edited, classified and organized heterogeneous classes into substrata based on their common characteristics. Structured questionnaire were used to gather relevant information from the sample to identify the role of small scale irrigation in poverty reduction. The result revealed all respondent participants in small scale irrigation .The descriptive statistics result revealed variables were significantly affect the participation small scale irrigation in poverty reduction at 10(0.1) percent probability level. Therefore the study suggest government must expand source of credit, income generating activity, training and educating about the irrigation enhance and empower farmers in small scale irrigation.

Key word: Small scale irrigation, logit model, poverty, *Structured questionnaire*

ACRONYMS AND ABBREVIATION

CSA	Central Statistical Agency
FDRE	Federal Democratic Republic Of Ethiopia
IWMI	International Water Management Institute
MOA	Ministry of Agriculture
MOFED	Ministry of Finance and Development
MOWR	Ministry of Water Resource
UNDP	United Nation Development Program
UNECA	United Nation Economic Development for AFRICA

1. INTRODUCTION

1.1 Background of the Study

Agriculture is still the key sector in many developing African countries. Its contribution goes to the extent of stimulating other sectors by providing input supply. However African agriculture is dominantly rain-fed agriculture and, as a result, yields are low and farmers can be trapped in a cycle of poverty and food insecurity for decades (UNECA 2009,p.117).

Irrigation is the process of providing water to the land by artificial activities. Irrigation as methods for improving natural production by increasing the productivity of available land there by expanding total agricultural production of the world, availability to irrigation is considered essential for crop production, asset creation and expansion of development frontiers. The growth of Small scale irrigation historically accompanies the development of agriculture. As formally nomadic people join together to form of communities they discovered that plant could be sown, cultivated and harvesting seasonal. Thus did forming develop and fields grew in size when the same time agriculture was being develop about 5000 years ago (MoFED,2010).

In Ethiopia, modern irrigation began in the 1950's. Ethiopia is believed to have the potential of 5.1 million hectares of land that can be developed for irrigation through pump, gravity, pressure, underground water, harvesting and other mechanisms. Irrigation plays the key role in the performance of agriculture, which increases income growth. Developing countries that ensure sustainable economic growth can be able to reduce their poverty levels (MoFED, 2010).

Poverty is multidimensional characteristics effecting nearly a billion world population. Especially, one-third of Sub-Saharans fall under poverty. The emergences of climate change coupled with the incidence of drought are worsening the situation. The only option to escape this challenge is though the development of water resources projects. Ethiopia has yet developed not more than 5% of the irrigation potential. However, the enhanced poverty impact of irrigation was constrained due to unsatisfactory performance

and imperfect market. Thus, enhancing the capacity of water user association through provision of training, market linkage and finance are a necessary step to improve irrigation performance towards poverty reduction (Eneyew and Alemu, 2013).

Poverty reduction is the first millennium development goal. Poor countries like Ethiopia were expected to have the number of people living below one dollar by the end of 2015(MoFED, 2010). Since 1992 the government of Ethiopia has been carrying out measures to reduce poverty in the context of series of reform programs in the political, economic and social spheres (FDRE, 2010).

Thus, following government efforts, poverty has declined from 45.5% in 1995/1996 to 29.6 in 2010/2011(MoFED, 2012). Irrigation is practiced in Ethiopia since ancient time producing subsistence food crops. It was claimed that reason Ethiopia cannot assure food security for its production with rain fed agriculture alone without a sustentative contribution of irrigation. Thus government of Ethiopia has prepared water sector development program to be implemented in 15 years between 2002 up to 2016. This program assigned a prominent role to be development irrigation in country for food production (MoWR, 2002).

1.2 Statement of the problem

In Ethiopia agricultural production is primary rain fed so it depends on erratic and often insufficient rainfall. As a result, there are frequent failures of agricultural production. Irrigation has the potential to stabilize agriculture production and mitigate the negative impacts of variable of insufficient rainfall. Irrigation development also can help offset some of the negative effect of rapid population growth 2.6% per years in Ethiopia (CSA, 2015).

Population growth causes agricultural activities expands into marginal land, which leads to forest, land and water degradation. This environment degradation can reduce agricultural productivity, which in turn worsens food insecurity and poverty. In order to respond to growing food demand, food production should increase. The three methods to increase food production are: increasing agricultural yield, increase the area of arable land and increasing cropping per year or intensity. Irrigation has the potential to increase both yield and cropping intensity in Ethiopia (Awulachew et al, 2010).Irrigation increases agricultural productivity and farm income per ha(Hussain, 2012).

While irrigation holds potential for boosting food security and livelihoods, small-scale schemes in the study area face challenges limiting their effectiveness in poverty reduction. Farmers report issues such as unsuitable physical conditions, financial constraints, and lack of technical knowledge that hamper optimal performance. However, existing literature provides limited analysis of specific problems and their impacts.

Additionally, previous studies have not thoroughly explored the roles played by key supporting institutions. For instance, the contributions of local administration and development agencies in stimulating irrigation through credit provision, training, and other interventions are not well established. Such information is critical to understand current support landscape and design evidence-based interventions.(kobet ,2014)

Furthermore, prior work was confined to particular locations, undermining generalizability. A research gap therefore persists in comprehensively evaluating small-scale irrigation's multifaceted poverty alleviation role across diverse agricultural contexts.

By addressing these shortfalls, this study aims to offer new insights on context-specific difficulties curbing irrigation productivity and roles of stakeholders in addressing those. Findings was provide empirical basis for strengthening support measures to realize irrigation's unexploited potential for food security and poverty reduction nationally. Addressing current research limitations forms the motivation for this study. (Asfew, 2012).

1.3 Research Question

The researcher was answered the following research questions

- What are the problems that affect small scale irrigation on poverty reduction?
- What are the role of small scale irrigation at household and community level?
- What are the roles of government in stimulating the small scale irrigation in poverty reduction?

1.4 Objective of the Study

1.4.1 General objective of study

The general objective of the study is To examine the role of small scale irrigation in poverty

reduction in case of Tula sub city.

1.4.2 Specific objective of the study

- To analyze the problems that affect small scale irrigation in relation to poverty reduction.
- To examine the contributions of small-scale irrigation at both household and community levels.
- To identify the role of government in promoting small-scale irrigation as a means of poverty reduction.

1.5 Significance of the study

The successful accomplishment of this study has the following importance

- It was open clues about the role of small scale irrigation in poverty reduction in study area.
- It can used as an input for further studies on related topics

1.6 Scope of the study

The scope of this study was examine the role of small-scale irrigation in poverty reduction in Tula sub-city. The research would focus on farmers engaged in irrigation farming within the sub-city. Tula sub-city was purposively selected due to the importance of irrigation in agricultural production. A cross-sectional research design employing both quantitative and qualitative methods would be used. The target population includes all small-scale farming households in Tula sub-city. Through multistage sampling techniques, representative kebeles would be chosen and samples selected from lists obtained from administrators.

Primary data was collected using structured questionnaires and interviews. Secondary data from relevant sources was supplement primary findings. Descriptive statistics and logit regression model was aid data analysis. The study aims to provide insights into the determinants and impacts of irrigation on poverty. However, it may be constrained by data availability and coverage limited to one sub-city for feasibility. Nonetheless, findings seek to holistically examine the research problem within specified parameters to draw meaningful conclusions.

1.7 Limitations of the study

While conducting the research the researcher faces with many problems.

The main limitation of the study is:

- Lack of availability relevant information on the issue.
- Unwillingness of respondents in giving the reliable information especially in their own income and national status.
- Financial and time constraints are the most limitation of the study.

But the researcher, despite the mentioned limitations, tried to resist them.

2. REVIEW LITERATURE

2.1 Theoretical Literature

This part contains the theoretical and empirical related literature with the conceptual work of the researcher study.

2.1.1 Definition of irrigation

Irrigation is the process of providing water to the land by artificial activities. Irrigation has been used by human for thousands of years to supply water areas of land as extensive as thousands of areas limited as small lawns and gardens. It is the artificial application of water to the land or soil to assist in the growing of agricultural crops, maintenance of land scope and revelation distributed soils in dry season and during period of inadequate rainfall (MoFED, 2010).

Irrigation development improved uncertain common rainfall agriculture bridging dry period and making its possible applying water to land in order to supply crops and other plants with necessary water. In Ethiopia, the most successful small-scale irrigation farmers are those which developed from farmers initiatives. This in contrast to government initiated large small-scale holder's schemes which have been rife with problems. The spirit of small-scale irrigation is in fact that is managed controlled by farmers the users. Irrigation is in fact is nothing, but delivery the volume and quality water required by plant throughout a season to increases plant growth and crop production activities (Asfew, 2012).

2.1.2 Sources of water for Irrigation

The common water resources for irrigation are included: rivers, streams, lakes, and reservoirs. These water resources are very important in agricultural activities and other activities, but according to Ethiopia as well as many developing countries are not effectively using those resources. Ethiopia has considered water resources which can be utilized to expand the land surface available for the production of food and cash crop through irrigation. Ethiopia has started using its abundant water for specific irrigation purpose; it has different natural resource of water (Arya, 2016).

2.1.3 Irrigation in Ethiopia

Irrigation is practiced in Ethiopia since ancient time producing subsistence food crops. Irrigation can be increasing agricultural yield areas of arable land, and cropping intensity or numbers of crops per years. The challenge that Ethiopia faced in terms of food insecurity is associated with both inadequate food production, and natural failures due to erratic rainfall. Therefore, increasing arable land or attempting to increasing agricultural yield alone cannot be a means to provide food security in Ethiopia due to environmental impacts or expansion deforestation and unpredictable natural climate. Ethiopia has combine those with enhancing water availability for production and expansion of irrigation can leads to security in terms of getting a reliable harvest as well as intensification of cropping production more than one per year (MoWR, 2009).

Ethiopia indeed has significance irrigation potential assessed both from available land and water resource potential. Irrespective of the lack of knowing what is the accurate potential and what has been developed and despite efforts of the government to expand irrigation especially on small-scale irrigation system, the country has not achieved sufficient irrigated agricultural productivity due to overcome the problems of food insecurity and extreme rural poverty, as well as to create economic dynamism in the country (MoWR, 2OO9).

Modern irrigation system started in the 1960s with objectives of producing industrial crops in awash village. Private Concessionaries that operated farms for growing commercial crops in the 1975 rural land proclamation small-scale irrigation schemes transfer into producers cooperatives (MoWR, 2009).

After major famines of 1984/85 the government began to focus on potential of small-scale irrigation as food security and started promoting farmers and community oriented small-scale irrigation by providing assistance and support to local communities for rehabilitating and upgrading traditional scheme (Habtamu, 2015).

2.2 The Role of Small-scale Irrigation in Food Security

Some of 17 percent of world agricultural land is irrigated these 250 million was account for more than one-third of global food production. Almost three-quarter of the total irrigation area in different country in Asia country which thanks to package of innovative technology introduced through the so-called green revolution has achieved remarkable success in increasing food production sustain it is over growing population (Yonas, 2010).

The small-scale irrigation grow have been an essential element in the increases in food production and the era of rapid expansion in irrigated areas has passed and the annual rate of 0.7 percent, which represent almost two million hectare per year. In some period, the cost of irrigation development have grown exponentially as more complex and more expensively irrigation works are require to develop and the only options are the use of marginal quality water and greater efficiency in water use in coming decades, access to water will become an issue of global concern and competition(Hussain, 2014).

Irrigation has increased food securities and improved living standard of population in many part of the world. Irrigation is clearly important for promoting food production in the driers part of the world and as part of Africa. At world the food summit in1996, the food and agricultural organization (FAO) estimated that 60% of extra food required in the future come from irrigated agriculture. At our country text the 70% people's crop production is adequate for only 6 to 9 month of the years and nutritional deficiencies are important cause of death. Between five and fifteen million Ethiopian needs food aid annually and part of government of Ethiopia strategy to address those challenges aimed to increases production and farmers income through government and expansion of small scale irrigation schemes (MOFED, 2011).

2.3. Classification of the irrigation developments in Ethiopia

According to the ministry of water resources irrigation development in Ethiopia is classified. This classification is different size depending on the size of irrigated land area (MoWR, 2002).

2.3.1. The small scale irrigation system

Small scale irrigation system that covering an irrigated area of less than 200 hectares growing primarily subsistence crops. The small scale irrigation system services mainly to supplement rainfall and provide greater degree of security to peasant farmers. This irrigation system in Ethiopia is understood to include traditional small scale up to 100 hectares and modern communal system up to 200 hectares (MoWR, 2009).

The traditional farmers have built the small scale system on their own initiative, sometimes with government technical support and material support. They manage them through their own users association or communities and water users associations have long existed to manage traditional system in Ethiopia. The small scale irrigation system is wide spread and has a vital role to play in

Ethiopia (Asfew, 2012).

2.3.2. Medium scale irrigation system

Those extending between 200 hectares and 3000 hectares and provide to produce different subsistence cash crops. Medium small scale irrigation has great role in the economy and that contains some cash crops (Dereje, 2013).

2.3.3 Large scale irrigation system

Those extending from 3000 and above hectares which are growing primary commercial crops such cotton and sugar cane and mainly managed by the state corporation .(ibid)

The irrigations have others classification depending on history of establishment, times of establishment management system and nature of the structures as follows:

According to program accelerated and sustained developing to end poverty (PASDEP) which spans the years from 2005-2010(government of Ethiopia in, 2005);

Traditional system:-the small scale irrigation system which usually uses diversion weirs made from local materials which need annual reconstruction or from small dams. The Canals are usually earthen and the schemes are constructed by local community effort and have been functional for long periods of time, somewhere recently constructed with the aid of NGO,s and government (Asfew, 2012).

The traditional irrigation in Ethiopia is a complement to rain fed agriculture and the crops are grown often horticultural crops and fruits peasants have a keen awareness of the benefit of irrigation and are willing to invest their labor in the construction and maintenance of schemes. In parts of North Shoa, North Wollo, East Gojjam and the highlands of Hararge, the traditional system still being utilized by peasants date back to the last country. It is evident that peasant have system (Dessalegn, 2014).

Modern system:-The small scale irrigation system more permanent diversion weirs made from concrete hence no need for annual reconstruction and small dams. The primary and sometimes secondary canals are made of concrete. They are community managed and have recently been constructed by governmen(Asfew, 2012).

The development of modern irrigation has relatively recent history in Ethiopia as well as traditional irrigation existences of long periods. The private concessionaries operates farms for commercial cotton, sugarcane and horticultural crops. This started first formal large and medium irrigation schemes in Awash Valley (MOA, 2011).

2.4 Definition of poverty

Giving a comprehensive definition of poverty is difficult, because have varies definition of poverty. Poverty is a social contract so its definition varies according who ever formulates the concept. However, besides the diverse and varies definition that have been given by scholars, there is consensus that the poverty that prevails in the lives of the poor is very hard to image (Rist and Chamber, 2002).In reality, poverty can be observed by physical weakness due to malnutrition, sickness or disability. It also creates social isolation and results in powerlessness and hopelessness (Chambers, 2013).

Absolute Poverty: is described as a lack of basic security, the absence of one or more factors that enable individuals and families to assume basic responsibilities and to enjoy fundamental rights(UNDP, 2014)

Relative Poverty: is used in terms of particular groups or areas in relation to economic status of other members of the society and poverty results from even consists of a lack basic securities, which includes financial resources, but also education, employment, housing, health care and other related aspects. In generally poverty is a multidimensional characteristic affecting nearly a billion world population.Especially,a third of sub-Saharans fall under poverty (UNDP, 2014).

2.5 Benefits of irrigation

According to (N.N. Basak, 1999; D.K. Majumbar, 2002) the following are important benefits of the irrigation

- **Yield of crops:-**in the period of low rainfall or drought the yield of crop may be increased by the irrigation system.
- **Protection from famine:-**the food production of a country can be improved by insuring the growth of crop by availing the irrigation facilities. This helps country to prevent famine situation.

- **Improvement of cash crops: -**irrigation helps to improve the cultivation of cash crops like vegetable, fruit,etc.
- **Prosperity of farmers: -** when the supply of irrigation water is assured the farmers can grow two or more crops in a year on the same land. Thus, the farmer may earn more money and improve their living standard.

- **Source of revenue: -**when irrigation water is supplied to the cultivation in some taxes it helps to corn revenue which may be spent on other development schemes.
- **Water conservation:** One of the most of important benefit of irrigation is the fact it enables the user to save a lot of water. This is very beneficial, especially if you are living in a area where water is already a scarce commodity. The best type of irrigation in such a situation is drip irrigation. This is because it enables the farmer to save a huge amount of water in place with minimal water.
- **Great benefits to plants:-** The key aim of irrigation is to supply adequate water for proper plant growth. On the other hand there are different kinds of irrigation that you can use to achieve that. Through using drip irrigation, you make certain that each drop of water reached the desired plant for more giants. This is a great method as it enables the water to be available to plants throughout the day and thus keep them green while assisting them to grow healthily and quickly.

2.6 Empirical Literature

2.6.1 The role of small scale irrigation in poverty reduction

A study by Bagson and Kudu (2013) indicated that small-scale irrigation schemes are very important in poverty reduction, livelihood enhancement, enhancing food security, especially in recent times when the rainfall pattern is increasingly becoming erratic.

Irrigation development is being promoted by government and non- government organization as one of the development strategies contributing to the overall agricultural development of the country in general and to rural household food security in particular (Workicho, 2007).

Accordingly Takele (2008) study conducted on small-scale irrigation schemes utilization and farmer's willingness to pay for irrigation water revealed that, educational levels of households

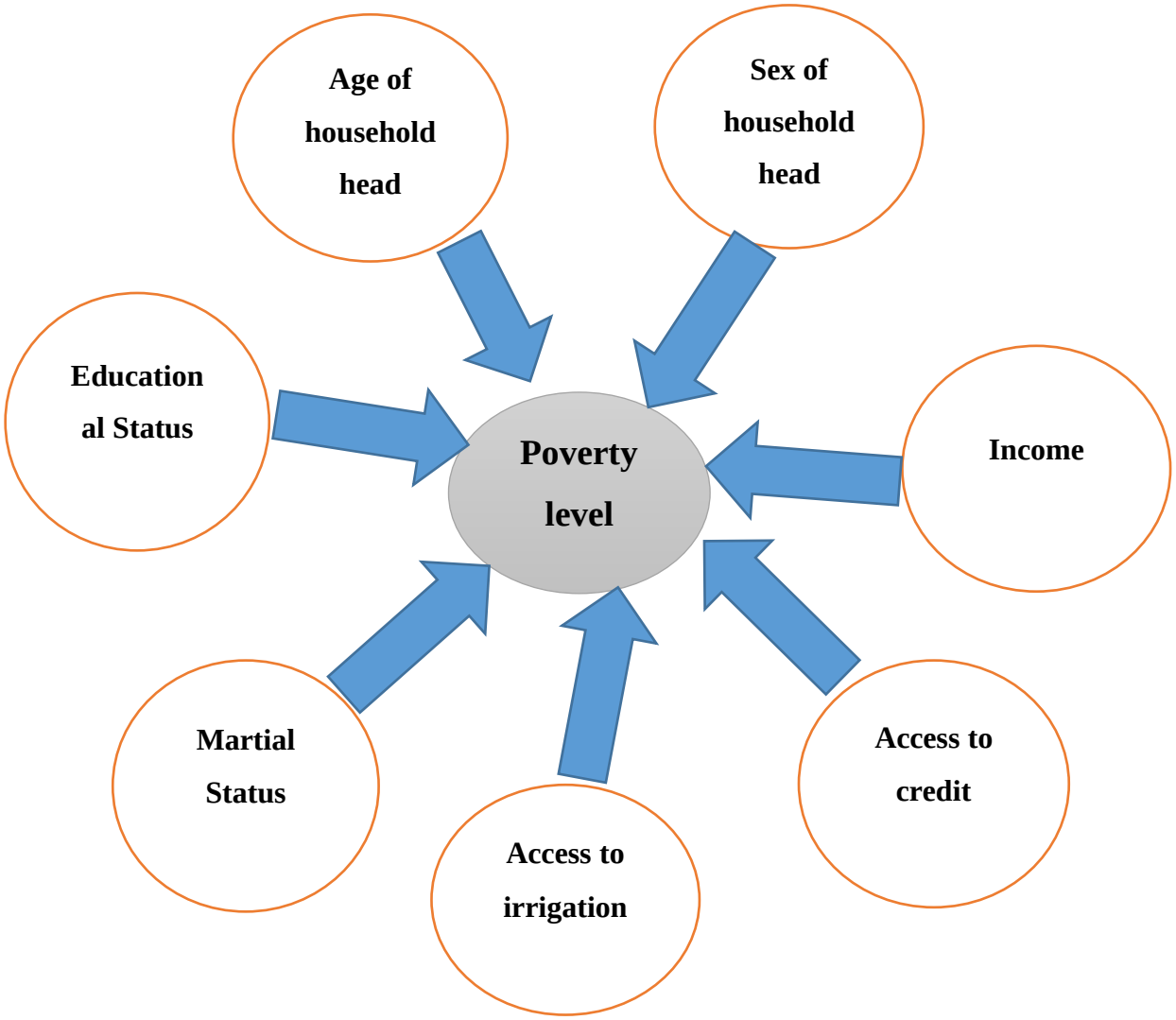
head positively and significantly influenced farmer's utilizations of small scale irrigations schemes.

Accordingly Wagnew (2014) conducted a case study using formal survey on socio economic and environmental impact assessment of four community based small-scale irrigation in the Upper Awash Basin of Ethiopia, concluded that, rural credit systems, institutional support, monitoring of irrigation schemes, training in water management, marketing and general crop 19 production, empowerment of local communities, economic evaluation of optimal plot size, cropping patterns, agronomic practices and resources utilized in the irrigation schemes were necessary conditions for viable and sustainable irrigation schemes. Further he added that NGO's that are involved in irrigation development should come up with a clear, transparent and completed handing over of up-graded or newly developed small-scale irrigation schemes to farmers.

This study was assess the role of small scale irrigation in poverty reduction. In the previous study shows age, sex, education level, marital status, religion and land size are affect small scale irrigation significantly.

2.7 CONCEPTUAL FRAMEWORK

Figure 4 Conceptual Framework



3. RESEARCH METHODOLOGY

3.1 Description of study area

The survey of the role of Small scale irrigation in poverty reduction conducted at household's level in Tula sub city. The study area namely Tula subcity of Hawassa is located in Hawassa city administration,Sidama,Ethiopia. Hawassa city, the capital city Southern region is located 275k.m from Addis Ababa Capital city of Ethiopia. It is surrounded by the Lake Hawassa in west, HawassaZuriaworeda in the south east, Melgaworeda in the north east & Oromia region in the north. It is located at 7'30" latitude north & 33'30" east longitude with an altitude of 168meter above sea level (www.southinvest.gov.et/potential Hawassa.Htm). Hawassa city administration comprises 8 sub cities namely :-hayekdare,Tabor, Menaheria, Misrak, Mehalketema, Bahiladerash, Addis ketema and Hawela Tula. According to Tula sub city administration, Tula sub city has a total population of 147,384 of whom 75,018 are men & where 72,366 are women. The study area experiences moderate types of tropical climate. Although it is situated in rift valley it has relatively high altitudes about 1800 above sea level means that the climate is mild round. The land form is plain with reddish volcano soil.

3.2 Research Design

This study adopted a descriptive research design, which involves quantitative and qualitative data. This research design is suitable for the study, since it seek to provide insights and understanding of small scale irrigation.

3.3 Data source of the study

The source of data for the research was used both primary source and secondary source. The primary data was collected from rural household farmers and the secondary source data was collected from the written documents.

3.4 Method of data collection

To collect necessary raw data the researcher used both primary data collection and secondary data collection instrument. As primary data collection instrument are structured questionnaires and interview was employed.

Initially structured questionnaires was developed in English language and then it was translated in to amharic language because amharic is the common language of study area. The key informant interview would be done for those household who cannot read and write to collect necessary raw data.

The secondary data collection instrument, published and unpublished such as books, internet, and annual report was used. Information that was used to describe geographical location and Socio economic activities of the study area collected from Tula sub city Irrigation Development office.

3.5 Sampling Technique

The researcher used multistage sampling technique in selection of rural household respondents. In first stage,from among 8 subcities in hawassa city, Tula sub city was selected purposively. Because of most dominant irrigation processor/users in that district. In the second stage the kebeles of Tula sub city was stratified into three as near, medium and far based on the criteria of their size and then four(4) kebeles was selected because studying the whole kebeles needs more finance and it is difficult to get all available data from each sub city. In the third stage, sample size was selected from each selected four(4) kebeles by using simple random sampling technique.

3.6 Method of Sampling

The sample household respondents was taken from selected kebeles using random sampling method. After the researcher gets the total household of selected kebeles as sample, then the researcher used the formula of Yaro Yamman (1963) to determine the sample size from target population.

$$\mathbf{n= N/1+N(e)^2}$$

Where: N = Target population of selected kebeles

e = Level of significance

ns = Sample size

The total households of 18 kebeles of Tula subcity were about 147384. The Target population household of selected kebeles were about 22693 and the level of significance were 10%(0.1). Then the sample size was determined as follows.

n = N/1+N(e)^2 = 22693/1+22693(0.1)^2 = 22693/227= 99.56~ 99

The total number of household from each kebeles included in the sample proportionally as follows

No	Sample Kebeles	Total number of house hold	Number of sampled house holds	Percentage (%)
1	Wukiro	8692	8692/22693X100=38	8692/22693X100 =38.30%
2	Bulcha	5260	5260/22693X100=23	8692/22693X100 =23.18%
3	Hogane wacho	3867	3867/22693X100=17	3867/22693X100 =17.04%
4	Tilte	4874	4874/22693X100=21	4874/22693X100 =21.48%
	Total	**22693**	**99**	**100%**

3.7 Method of data analysis

After the data collection, method of data analysis used descriptive method of data analysis for the collected data from both primary and secondary data sources are first edited, classified and organized heterogeneous classes into substrata based on their common characteristics. After data pass through this processing mechanism, then it would be pass the descriptive analysis by using percentages, graphs and tables.

3.8 Model specification for the Study

Logistic regression is a popular modelling approach when the dependent variable is dichotomous or polytomous. This model allows one to predict the log odds of outcomes of a dependent variable from a set of variables that may be continuous, discrete, categorical, or a mix of any of these. Because of its mathematical specification simplicity and easy ways of interpretation as compared with Probit model, the researcher had preferred logit model for this study.

3.9 Definition of variables

1. Dependent Variable

Poverty Reduction

Poverty is a multi-dimensional characteristic that signifies the lack of basic security, absence of financial resources, and education, which prevents individuals and families from accomplishing fundamental rights and responsibilities. Poverty can manifest in various forms, including absolute poverty, which indicates a severe lack of resources, and relative poverty, which compares the income of an individual or group to that of others. It often results in malnutrition, sickness, social isolation, and powerlessness. (Alkire, S., & Foster, J., 2011).

2. Independent Variables

Age of Household Head

The age of the household head is a demographic characteristic that may influence agricultural productivity and economic decisions. Older household heads might have more experience and knowledge regarding farming practices, while younger heads may exhibit more adaptability to new techniques. (Duflo, E., & Pande, 2007).

Sex of Household Head: The sex of the household head is a dummy variable indicating the gender of the primary income earner. It is coded as 1 for male heads and 0 for female heads. This variable represents the gender of the individual who heads the household. Gender can significantly affect access to resources, decision-making power, and household income generation. Typically, female-headed households experience different challenges and often have less access to agricultural resources than male-headed households. (Quisumbing, A. R., & Kumar, N, 2011).

Educational Status

Educational status refers to the highest level of education attained by the household head. It is a crucial factor that influences agricultural practices, decision-making processes, and economic outcomes. Higher educational levels may correlate with better management of irrigation and access to markets. (Beegle, K., De Weerdt, J., & Dercon, S. 2011).

Marital Status

Marital status indicates whether the household head is single, married, divorced, or widowed. This demographic factor can affect household dynamics and economic decision-making, potentially impacting poverty levels. (Vignoli, D., & Giulfino, S. A. G. 2012)

Access to Irrigation

Access to irrigation refers to the availability and ability of households to utilize irrigation systems that provide artificial water supply to their land, enhancing agricultural production and contributing to food security. Efficient irrigation systems can significantly improve crop yields, thereby contributing to poverty reduction. (Vos, R. M., & De Lima, M. P. 2013).

Access to Credit

Access to credit refers to the ability of households to obtain financial resources from institutions to invest in agricultural activities. Access to credit is vital for purchasing inputs, improving irrigation facilities, and enhancing overall production. (Awale, 2014)

Income

Income represents the earnings of the household from various sources, including agricultural production, employment, and other economic activities. Higher income levels typically correlate with reduced levels of poverty and improved living standards. (World Bank, 2017)

No	Defination of variables	Nature of variable	Expected sign
1	Poverty Reduction	Dummy	
2	Age of Household Head	Continuous	+/-
3	Sex of Household Head	Dummy	+/-
4	Educational Status	Continuous	-
5	Access to Irrigation	Dummy	+
6	Access to Credit	Dummy	-ve
7	Income	Continuous	-ve

4. RESULT AND DISCUSION

In this section data interpretation and analysis were discussed. This indicates the result that come from the sample survey of the questionnaires. That observation can help with providing information about current situation of small scale irrigation in poverty reduction.

The small scale irrigation economic activity is expected to improve the long term economic and social security of their household via wealth creation, sources of income and the others. To understand those, the data is collected by direct contribution of questionnaires and interview to those empower in small scale irrigation activity. The questionnaires were includes both close ended and open ended as a tool to collect necessary data from the respondent and the questionnaires were properly filled and returned.

4.1 Demographic characteristics of the respondents

Under this it indicate the sex, ages, marital status, religion and education level of the respondents.

Table 1 Sex distribution of the respondents.

Sex of respondent	No of respondent	Percentage (%)
Male	85	85.86
Female	14	14.14
Total	**99**	**100**

Source (Own survey, 2024)

From the above table, 85.86% of the sample respondents were males and 14.14% of the sample respondents were females. This indicates that female participation in irrigation activities is very low. In the study area men and women have a separate role to play a greater contribution in production activities. There is backward attitude behind the culture of the society in the study area. This make women to work long hours in home and decrease the time they spend in production activities. From this point of view, what researcher observing that majority of society in the study area have back ward attitude for women regarding to small scale irrigation

Table 2 Age distribution of respondents

S.No	Age of respondent	No of respondents	Percentage (%)
1	18-31 years	40	40.40
2	32-45 years	42	42.45
3	46-60 years	14	14.14
4	>60 years	3	3.03
Total		**99**	**100**

Source: Own survey, 2024.

Regarding to age characteristics of respondents (42.45%) of the respondents are whose age level in ranges from 32-45 years. (40.40%) of them their age level ranges from 18-31 years, whereas (14.14%) and (3.03%) of the respondents their age level lies between 46 - 60 and above 60 years respectively.

Generally as the above table shows (as the data collected shows) the most small scale irrigation activity participants are aged between 32-45 years, whereas the smallest participants were whose ages are above 60 years. This indicates that, since participant that ages lies between 32-45 years are productive force they are critical role in producing and decision making processing order to most improve their way of life and reducing poverty. But above 60 years participants is less because most of them are not participate in irrigation the dependent on other.

Table 3 The marital status of respondents

S.No	Marital status of respondent	No. of respondents	Percentage (%)
1	Single	23	23.23
2	Married	48	48.49
3	Widowed	18	18.18
4	Divorced	10	10.10
Total		**99**	**100**

Source: own survey, 2024

Regarding to the marital status of respondents,23.23% from the total respondents random sample population are single,48.49% of them are married and 18.18% of the respondents are represented by widowed and 10.10% of respondent are divorced.

Table 4 The religion structure of respondents

S.No	Religion of respondent	No of respondents	Percentage (%)
1	Muslim	67	67.68
2	Orthodox	23	23.23
3	Catholic	2	2.02
4	Protestant	7	7.07
Total		**99**	**100**

Source: Own survey, 2024

From the above table which concerns about the religion structure of the respondents,(67.68%) from the total random sample are the followers of Muslim, (23.23%) of them are followers of Orthodox, (8.08%) and (2.02%) of the respondents are followers the protestant and Catholic religion structures respectively.

Table 5 The education level of respondents

S.No	Educational level	No of respondents	Percentage (%)
1	Illiterate	26	26.26
2	1-8 grade	38	38.39
3	9-12 grade	23	23.23
4	Graduated	12	12.12
Total		**99**	**100**

Source: Own survey, 2024

As shown in the above table, the education level of the respondents, about (26.26%) of them respondents are illiterates, (38.39%) of them their education level ranges between 1-8 grades. Whereas, 23.23% and 12.12%of the respondents are whose education level lies from 9-12 grades and graduated respectively.

Education have play crucial role in improving the living standards of farmers in the economy. The level of education have some effect on clients in equitable access and services; infrastructure programmers in order to design the benefit poor farmers and employment opportunities.

Generally, Education have a major role not only for household decision in adaptation of technology such as fertilizer, pesticide, modern farming inputs, improved seeds (high yielding seeds) and the like, but also, it creates better awareness and helps for better innovation and invention.

4.2 Socioeconomic Characteristics of the Respondents

Under this it indicate the Distribution of land for irrigation, Fertilizers used for small scale irrigation, Product that produced with small scale irrigation, Annual income from fruit and vegetable production, The Access to credit institution of the respondents.

4.2.1 Distribution of land for small scale irrigation

The average land holding of sampled households range from less than one hectors to above three hectars.

Table 6 Distribution of land for irrigation

Land size in hector per household	Number of households	Households in percent
< 1 ha	20	20.20
1 – 1.75ha	46	46.47
2 – 3ha	30	30.30
> 3 ha	3	3.03
Total	**99**	**100**

Source: Own survey, 2024

As indicated in the above table the first two row remains 66.67% of the farmers only less than 2 hector and remaining 33.03% participants have above 2 hector. The average agricultural land holding of the farmers is most important factors to produce production. Low land size leads to low produce.

4.2.2 Fertilizer used for small scale irrigation

As the data indicated in four years (2013 – 2016) from the agricultural office of the district fertilizer used for small scale irrigation was only modern fertilizer.

Table 7 Fertilizers used for small scale irrigation

Year	Fertilizer in 'quintals'			Land in hectar	Household
	DAP	UREA	**Total**		
2013	17935	15079	**33014**	5700	14564
2014	23649	18063	**41712**	6890	15943
2015	28400	20500	**48900**	7505	17422
2016	32570	22762	**55332**	7980	19342

Source: Field data, 2024

From the above table, in stated years (2013 – 2016), the total use of fertilizer for small scale irrigation shows increasing pattern 33,014quint, 41,712quint, 48,900quint and 55,332 quintals respectively. This is because of increase in land for irrigation, increase in number of participant households and change of awareness of people about using fertilizer. But the table indicates that DAP increasing than the UREA. From interview of manager this is due to that DAP increase productivity while UREA use to make plant green and beauty. Since farmers are productivity and benefits oriented they shift more to using DAP.

From table we can also understand that increasing pattern of number of households and irrigated land. This is shows that increase of participation in small scale irrigation, and the productive of land is increase pattern from 5700 hect, 6890 hect, 7505 hect, and 7980 hector respectively. This is due to households get profit from small scale irrigation.

4.2.3 Products that produced with small scale irrigation

Table 8 product that produced with small scale irrigation

Type of product	Years of production and production in quintals			
	2013	2014	2015	2016
Tomato	15000	18480	19500	21000
Onion	11300	16200	17000	19500
Cabbage	10500	11000	12500	14000
Potato	7500	9120	10006	12050
Banana	2508	2850	3300	4000
Papaya	2088	2800	2900	3200
Other	8200	9450	10850	7400
Total	**57096**	**69900**	**76056**	**81150**

Source: Field data, 2024

The major product of the district that produced by small scale irrigation were tomato, onion, cabbage and potato. As shown in above table the production tomato, onion, cabbage, potato shows increasing while banana and papaya shows slowly increasing pattern. Because of the fruit like Banana and Papaya also requires long period of time at least one year to earn money from it and three to four year to end its productivity. Therefore to produce twice and above in a year, farmers prefer product like onion, cabbage, potato and others.

4.2.4 Annual Income from production

Table 9 Annual income from fruit and vegetable production

Income range	No respondent	Percentage(%)
1000_15000	14	14.14
15001_30000	27	27.27
30001_45000	37	37.38
45001_60000	13	13.13
>60000	8	8.08
Total	**99**	**100**

Source:Own survey,2024

As show in above table most of respondent can gain 37.38% or 30001_45000 from irrigation land income annually and following by 27.27% or between 15001_3000,annual income and the thrid 14.14% (1000_15000) respondent can gain from irrigation land and 13.13% & 8.08%(45001_60000 and >60000) respondents are next few gained income from their production respectively in annually.

In generally as income of respondents increase poverty goes down through committing basic need and expenditures by irrigators or respondents.

4.2.5 The Access to credit institution

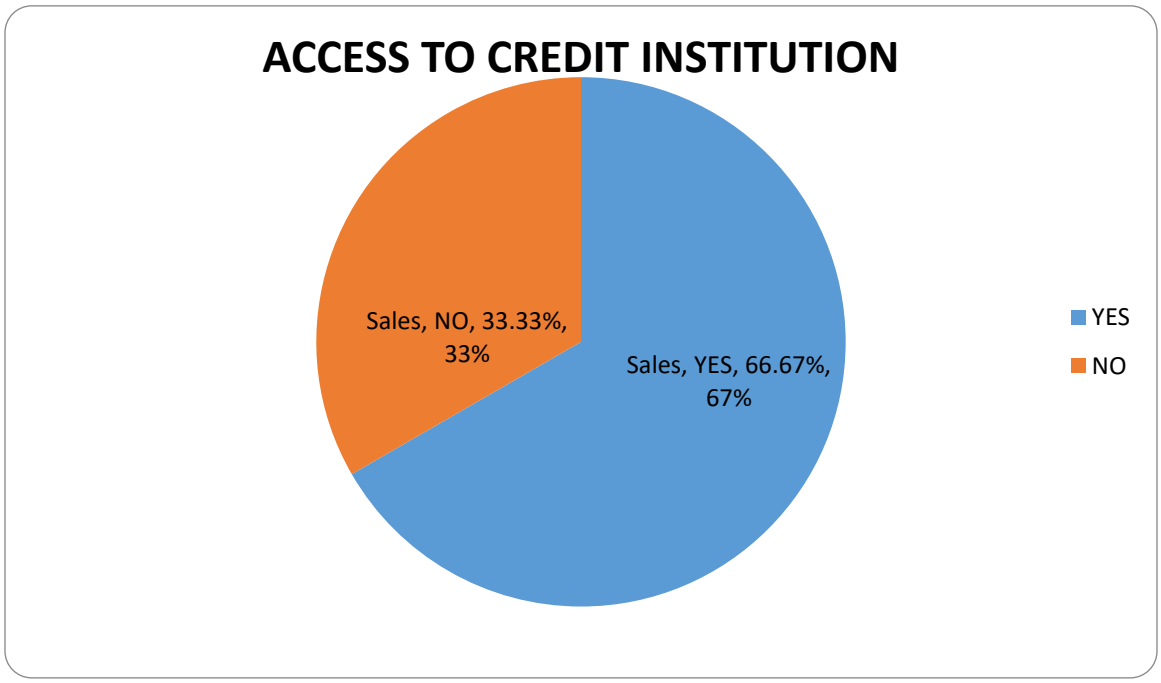


Figure 2 Access to credit institution

Source: own survey 2024

Based on the above figures 66.67% of the respondents have access to credit and 33.33% of the sample respondents did not have credit access. Credit system is one of the important factors to improve agricultural output to small scale irrigation participants.

When farmers get the access to credit, they get a chance to use agricultural input like fertilizer, improved seeds and other essential agricultural implement. But the access to this credit is inadequate. Because the some of the household in the study area have less often use of credit, improved seed, fertilizer and modern input. This implies that low use of credit is because of higher interest rate as the respondent's answered and the some respondents said because of shortage of awareness and unable to use properly.

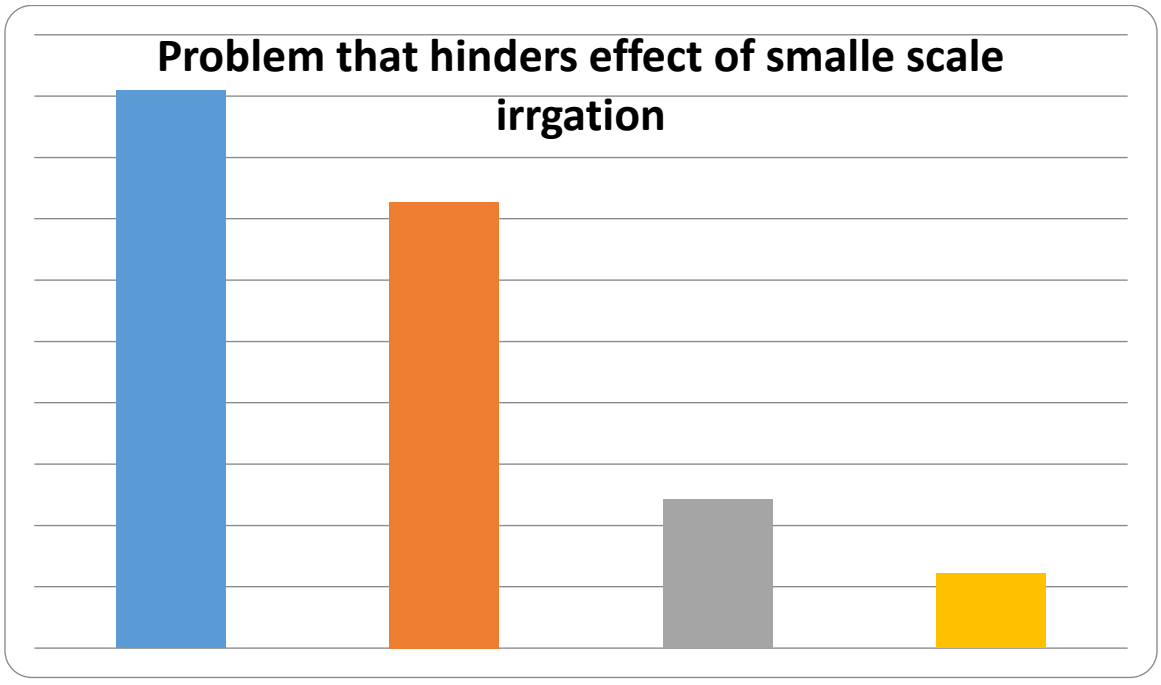
4.3 Role of small scale irrigation in any economic activity at household and community level

Parts from economic, social and cultural impact of small scale irrigation in economic activity have great role in building their self-independent and reducing poverty. At household level decrease poverty through produce more and more of production. This leads to supply production to market and gained income or value from it. This may be observed in one form of improved decision making in the community and household as well as building of society and human capital due to their access joining of different associations. In this paper the researcher examined weather the farmer's empowerment has helped them to achieve decision making position in the community and household in order to improve their ways of like and reducing poverty.

4.4 Problems that Hinders Effective of Small Scale Irrigation

Farmers in the district face great problem at the time of their empowerment in economic activity. Some of top problems that district face are related to finance, technical, social problems and physical topography etc.

Figure 3 Problems that hinders effective of small scale irrigation



Source: Own survey, 2024

A) Physical Topography

The most problem in study area was physical topography around 45.45% respondents say hinder effective on the small scale irrigation. In study area physical topography the area mostly mountain, land scope and highland area.

B) Financial problem.

Financial barriers are substantial problems for active farmers engaged in economy. It must be noted that without any initial capital nothing can be done. This problems associate with lack of credit, in efficiency of financial institutions in providing credit and access to saving habits. According on the above figure (36.37%) of respondents face financial problems.

C) Technical problem

The technical problem followed by financial problem, that means according to the district have problems technical advices about the benefit, how use efficiently the small scale irrigation in poverty reduction. According to above figure (12.12%) of the respondents have technical problems; as a result have no to increases their income

D) Social problem

Social problems are hinder effective small scale irrigation involvement in economic activity. From above figure (6.06%) of the respondents face social problems like traditional system method lack of awareness benefit from small scale irrigation.

4.5 Econometric analyses

4.5.1 Diagnostic tests

The overall significance of the variable is tested by Prob>F. If prob>F less than 0.10(10%) then the explanatory variables included in the model are jointly statistically significant and the explained variable. (Gujarati, 2004)

4.5.2 Multicollinearity Assessment (Variance Inflation Factor - VIF)

The Variance Inflation Factor (VIF) values indicate the extent of multicollinearity among independent variables. A VIF value greater than 5 is typically considered indicative of significant multicollinearity, while a value exceeding 10 is often regarded as problematic.

In this case, the VIF for Educational Level (4.32) approaches the threshold for concern, suggesting that it may exhibit some degree of multicollinearity with other variables. Monthly Income (2.49) and Access to Credit (2.45) also show moderate VIF values but remain below the critical threshold. The remaining variables—Access to Irrigation, Marital Status, Sex, Household Size, and Age—have VIF values well below 3, indicating that they do not contribute significantly to multicollinearity.Therefore, multicollinearity is not a significant issue in the model, and all explanatory variables can be retained without introducing significant redundancy. The mean VIF of 2.33 suggests that, overall, multicollinearity is not a severe issue within this model. However, the elevated VIF for Educational Level warrants further scrutiny to ensure that it does not adversely affect the reliability of the regression results. (Gujarati, 2004).

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
Educationl~l |      4.32    0.231614
accestoirr~n |      4.25    0.235247
monthlyinc~e |      2.49    0.401172
accestocre~t |      2.25    0.444773
maritalsta~s |      1.52    0.658206
         sex |      1.49    0.671090
      hhsize |      1.22    0.819465
         age |      1.07    0.931970
-------------+----------------------
    Mean VIF |      2.33

.
```

4.5.3 Hetroscedasticity test

When the problem of hetroscedasticity exist in the model, the variance the dependent variable (Y) and the variance of the residual term (Ui) of the model is not uniform (not constant). The major sources of hetroscedasticity are model misspecification bias, omission of the relevant variables from the model and the wrong mathematical form of the model. If this problem exists in the model

our conclusion would be misleading. Therefore, the researcher was employed the breusch-pagan test to detect the problem.

In this case, the test statistic is $chi^2(1) = 0.03$, and the associated p-value is 0.8565. Since the p-value is significantly higher than the conventional significance level of 0.05, we fail to reject the null hypothesis. This outcome suggests that there is no evidence of heteroskedasticity in the model, indicating that the variance of the error terms is constant across the fitted values of poverty. By simply refer the information from the Appendex part we observe the result of hettest and its behavior.

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of poverty

         chi2(1)      =     0.03
         Prob > chi2  =   0.8565
```

Decision rule; since p-value is greater than 5 % the null hypothesis is accepted i.e. there is no heteroskedasticity problem.

4.1.4 The goodness of fit of the model:

The overall goodness of fit of the regression model is measured by the coefficient of determination (R^2). It tells what proportion of the variation in the dependent variable or regress is explained by the explanatory variable. R^2 lies between 0 and 1, the closer it is to 1, the better is fitted the model. The R-squared value is reported as 0.6645. This statistic indicates that approximately 66.45% of the variance in the dependent variable, poverty, can be explained by the independent variables included in the model. This level of explanatory power is considered reasonably strong, suggesting that the model effectively captures a significant portion of the variability in poverty outcomes.

Interpretation results on Logit model

In the analysis of the role of small-scale irrigation on poverty reduction in Tula Sub City, significant variables were identified that influence poverty levels.

Source	SS	df	MS	Number of obs	=	99
				F(8, 90)	=	25.36
Model	17.1279253	8	2.14099067	Prob > F	=	0.0000
Residual	7.59934738	90	.084437193	R-squared	=	0.6927
				Adj R-squared	=	0.6654
Total	24.7272727	98	.252319109	Root MSE	=	.29058

poverty	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
hhsize	.0698491	.0310981	2.25	0.027	.0080672	.131631
monthlyincome	-.0000295	.0000216	-1.36	0.177	-.0000725	.0000135
accestocredit	.0653141	.0881267	0.74	0.461	-.1097651	.2403932
age	.0024096	.0027966	0.86	0.391	-.0031463	.0079655
Educationlevel	.2951894	.1214216	2.43	0.017	.0539642	.5364147
maritalstatus	.6803397	.0720274	9.45	0.000	.5372446	.8234348
sex	.1435362	.0717441	2.00	0.048	.001004	.2860684
accestoirrigation	-.2878622	.120579	-2.39	0.019	-.5274135	-.0483109
_cons	.0303252	.1672037	0.18	0.856	-.3018541	.3625044

.

Interpretation of Significant Variables

1. **Household Size (hhsize)**:

   The analysis reveals that household size positively affects poverty reduction, with a coefficient of 0.0698. This indicates that as household size increases, poverty reduction tends to improve significantly ($p = 0.027$). Larger households may benefit from economies of scale, where shared resources and labor can enhance productivity, leading to improved economic conditions. A prior study supports this notion, highlighting that larger households may have more diverse income sources and better resilience against poverty (Zhou et al., 2021).

2. **Access to Irrigation (accessirrigation)**:

   Access to irrigation has a coefficient of -0.2879 ($p = 0.019$), demonstrating a significant negative correlation with the poverty reduction. This indicates that improved access to irrigation facilities contributes to a reduction in poverty. By enhancing agricultural productivity, access to irrigation can lead to higher household incomes, thus alleviating poverty

(Benson et al., 2020). This underscores the importance of irrigation in economic development initiatives aimed at poverty reduction.

3. **Marital Status (maritalstatus)**:

   Marital status exhibits a coefficient of 0.6803 ($p < 0.001$), reflecting a highly significant positive effect on poverty reduction. This finding implies that being married is associated with higher poverty reduction, potentially due to increased financial responsibilities and resource allocation challenges within the family structure (Smith & Jones, 2019). Such dynamics may hinder economic well-being, emphasizing the need for targeted policies to address the unique financial burdens faced by married individuals.

4. **Educational Level**:

   Education level has a positive coefficient of 0.2952 and is significant ($p = 0.019$), indicating that higher educational attainment directly correlates with enhanced poverty reduction. Education equips individuals with skills and knowledge leading to better employment opportunities and income potential. This finding is consistent with various studies that demonstrate the critical role of education in fostering economic stability and reducing poverty levels (Kakumba, 2020).

5. **Sex**:

   The sex variable has a coefficient of 1.435362 ($p = 0.048$), indicating a significant effect on poverty reduction. This suggests that gender dynamics may play a role in determining economic outcomes, with potential implications for poverty reduction. Understanding the gender-specific challenges and opportunities can inform policies aimed at poverty reduction (World Bank, 2018).

4.6 The Role of Government in the Small Scale Irrigation

Government as an entity which elected by the peoples, have held the promise of the whole society likewise the government has to have a responsibility towards small scale irrigation empowerment in area of economic activity, to do so the government must design the policy which enhances effective farmer's participation like facilitating credit, expanding different income generating activities, educating farmers and the like. So the researcher find out whether such scenario applicable and effective among the small scale irrigation in the district.

Table 10 The role of government in small scale irrigation

S.No	The Role of government in small scale irrigation	No of respondent	Percentage(%)
1	Facilitate credit	38	38.39
2	Establishing income generating activity	26	26.26
3	Educating farmer and training	24	24.24
4	Other role	11	11.11
Total		99	100

Source:Own survey,2024

A) Facilitate credit

As the above table indicates the government contribution through providing credit is the leading contribution about (38.39%) of the respondents suggest because of access to credit both formally and informal barrier restrict ability to smooth consumption overtime and under taken productive activities. The constraints that farmers specially poor farmers face in obtaining and using financial service are closely related to their gender and responsibility influence the kind of business activities that are most likely to engage farmer and restrict its their ability to advantage of conventional banking and credit institution facility .

B) Establishing Income Generating Activity

As shown in the above table, from the case study shows promoting income activity is one of the second most important function government towards enhancing small scale irrigation empowerment next to facilitating credit. That is a round (26.26%) of the respondent suggest it. According to respondent suggestion poor farmers have no means to save and engage in various income generating activities, so there is a need for government intervention.

C) Educating Farmers and Training

Giving education and training is very essential way increasing farmer's empowerment in the economy and reducing poverty. International food policy research institution of county study has demonstrated that educating farmers is crucial for poverty reduction (Todaro, 2015). As shown on the above table, (24.24%) of the total respondents suggest that training and education play a key role enhancing farmer's participation in economic activities and reducing poverty.

D) Other Role of Government

According to respondents suggestion some other government function to do are included avoiding traditional custom and practice which block them from economic empowerment and implementing appropriate farmers targeted policy. This is suggested by (11.11%) of the total respondent.

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study was conducted in Hawassa city specifically Tula sub city. In this area irrigation is important prioritized as a means to generate cash production and enhance the livelihood of the rural community. However in this study area irrigation activities is dominated by farmers. Therefore, the aim of this study was to analyses factor which determine the in small scale irrigation.

For the purpose of this study random sampling techniques was used to select the households as a sample from the total population in the study area. Primary data for this study were collected by directly interviewing farmers. And secondary data were extracted from relevant documents to supplement the data obtained from the survey for Participants of small scale irrigation. Descriptive analysis, was observed Role of small scale irrigation in poverty reduction.

There are many factors that affect in small scale irrigation; these factors are financial problems, technical problems, social problems, and topography problems are the main factors affect small scale irrigation.

Finally, the study was made to assess government function towards giving solution to problem there by enhancing small scale irrigation in poverty reduction. Some of the function that enhance effective small scale irrigation empowerment was; facilitating credit, promoting income generating activities, training and educating farmers are the key activities that are under taken to enhance small scale irrigation in poverty reduction.

5.2 Recommendation

The outcome of this study leads to consider the following point to improve the performance of small scale irrigation.

The findings of this study underscore the urgent need to enhance the performance of small-scale irrigation as a vital mechanism for agricultural productivity and poverty reduction. It is imperative to recognize that approximately 75% of farmers in our country currently rely on rainfall for their agricultural production, a method that is inherently vulnerable to climate variability. To address this, a concerted effort to promote and expand irrigation facilities is essential. By investing in small-scale irrigation systems, farmers can significantly mitigate the risks associated with erratic rainfall and improve agricultural outputs, thereby ensuring food security and enhancing their livelihoods.

The government has a crucial role to play in this transformation. Strengthening its involvement in promoting modern farming practices through community mobilization initiatives will be instrumental in creating awareness and fostering adoption among farmers. These initiatives should focus on educating farmers about the benefits of irrigation and modern agricultural techniques, which can lead to increased productivity and improved living standards for beneficiaries. Moreover, the government should offer targeted support to households that currently lack access to irrigation schemes due to financial constraints. This support could come in the form of subsidies or low-interest loans to help them purchase essential inputs such as high-quality seeds, fertilizers, and modern water pumps.

In addition to financial assistance, it is essential to implement a comprehensive training program aimed at enhancing farmers' understanding of effective irrigation management. Training should be provided frequently and should cover topics such as water efficiency, crop management, soil health, and sustainable agricultural practices. By equipping smallholder farmers with the necessary skills and knowledge, they will be better positioned to utilize irrigation water effectively and maximize its benefits. Furthermore, raising awareness among farmers about the significant contributions of small-scale irrigation to poverty reduction will foster a greater appreciation for these systems and encourage wider participation.

To maximize the impact of these recommendations, collaboration between the government and non-governmental organizations (NGOs) is vital. NGOs can complement government efforts by providing expertise, resources, and additional training programs tailored to local contexts. A multi-stakeholder approach that engages farmers, government agencies, NGOs, and the private sector will create a supportive ecosystem for sustainable irrigation development.

In summary, enhancing the performance of small-scale irrigation requires a multifaceted strategy that encompasses infrastructure development, financial support, capacity building, and community engagement. By prioritizing these areas, stakeholders can empower farmers to transition towards more resilient agricultural practices, ultimately leading to improved productivity and a significant reduction in poverty levels in the community.

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APPENDIX 1

Research Questionnaire

Dear respondent I am a 4th year Agricultural Economics student at Wolkite university and i am conducting a research for in partial fulfilment of Bsc degree in Agricultural economics. The purpose of this questionnaire is to collect data, so as to obtain data to analysis the role of small scale irrigation in poverty reduction in Case of Tula sub city. The information obtained form this questions will be used only for academic oses and confidential. Therefore, you are requested to you genuine response. You place mark tick(√) for close end question in a given box and give short and precise answer for open ended question. I would like to say thanks for spending time on giving relevant information.

1. Sex: A. Male B. Female

2. Age:-_____

3. Educational level:- A, Illiterate B.1-8 grade C. 9-12 grade D. graduate

4. Marital status: - A. single B. married C. divorced D. widowed

5. Do you have land which is suitable for irrigation:- A, Yes B, No

6. If your answer yes question number 7, what is your irrigation land size in hectare?

A 0.25-0.75 B.1-1.75 C.2-3 D. >3

7. If your answer is yes question 9, what types of fertilizer do you use?

A. DAP B.UREA C. Manure D. Other.....

8. How much you use fertilizer annually for your irrigation farm land?

A. Less than 100Kg B.101 - 200Kg. C. 201-300Kg.

D. 301 - 400Kg. D. Above 400Kg.

9. Do you benefited from fertilizer application on your irrigated land?

A. Yes B. No

10. Do you have credit access? A. Yes B. No

11. If your answer is yes question 13, for what purpose you use?

A. Fertilizer application B. Cattle fatting C. Food Service

D. Establish small business E. Other.....

12. What is your major source of credit? A. Bank B. Micro finance C. Friends/Relatives D. Other_____

13. Annual income from fruit and vegetable production

14. What are problems that hinders of small scale irrigation in your kebele?

_____

15. What are role of government in the small scale irrigation in poverty reduction and what things to be done to increase the participation of irrigation adoption in your kebeles from your point of view?

Appendix 2

Source	SS	df	MS	Number of obs	=	99
				F(8, 90)	=	25.36
Model	17.1279253	8	2.14099067	Prob > F	=	0.0000
Residual	7.59934738	90	.084437193	R-squared	=	0.6927
				Adj R-squared	=	0.6654
Total	24.7272727	98	.252319109	Root MSE	=	.29058

poverty	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
hhsize	.0698491	.0310981	2.25	0.027	.0080672	.131631
monthlyincome	-.0000295	.0000216	-1.36	0.177	-.0000725	.0000135
accestocredit	.0653141	.0881267	0.74	0.461	-.1097651	.2403932
age	.0024096	.0027966	0.86	0.391	-.0031463	.0079655
Educationlevel	.2951894	.1214216	2.43	0.017	.0539642	.5364147
maritalstatus	.6803397	.0720274	9.45	0.000	.5372446	.8234348
sex	.1435362	.0717441	2.00	0.048	.001004	.2860684
accestoirrigation	-.2878622	.120579	-2.39	0.019	-.5274135	-.0483109
_cons	.0303252	.1672037	0.18	0.856	-.3018541	.3625044

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Logistic regression | Number of obs = 99
LR chi2(8) = 89.05
Prob > chi2 = 0.0000
Log likelihood = -24.049143 | Pseudo R2 = 0.6493

poverty	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
sex	6.952477	6.382145	2.11	0.035	1.150177	42.02566
age	1.046178	.0412496	1.14	0.252	.9683755	1.130232
accestocredit	3.424737	4.255874	0.99	0.322	.2998131	39.12044
monthlyincome	.9995364	.0002971	-1.56	0.119	.9989543	1.000119
hhsize	2.686943	1.256292	2.11	0.035	1.07467	6.718022
maritalstatus	84.69124	74.94011	5.02	0.000	14.95003	479.7719
Educationlevel	43.66183	70.71345	2.33	0.020	1.826082	1043.959
accestoirrigation	.0289739	.0458081	-2.24	0.025	.0013069	.642343
_cons	.0149499	.0357835	-1.76	0.079	.0001372	1.62943

Note: _cons estimates baseline odds.

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. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of poverty

chi2(1) = 0.03
Prob > chi2 = 0.8565

. vif

Variable	VIF	1/VIF
Educationl~l	4.32	0.231614
accestoirr~n	4.25	0.235247
monthlyinc~e	2.49	0.401172
accestocre~t	2.25	0.444773
maritalsta~s	1.52	0.658206
sex	1.49	0.671090
hhsize	1.22	0.819465
age	1.07	0.931970
Mean VIF	2.33	

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. estat gof, outsample

Logistic model for poverty, goodness-of-fit test

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      number of observations =       99
 number of covariate patterns =       96
            Pearson chi2(96) =       72.32
                 Prob > chi2 =        0.9660
```

Marginal effects after logistic
y = Pr(poverty) (predict)
= .48338631

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
sex*	.4499066	.18224	2.47	0.014	.092728	.807085	.444444
age	.0112735	.00985	1.14	0.252	-.008031	.030578	37.3434
accest~t*	.2983942	.28298	1.05	0.292	-.256246	.853034	.444444
monthl~e	-.0001158	.00007	-1.56	0.120	-.000262	.00003	7433.38
hhsize	.2468282	.11707	2.11	0.035	.017368	.476288	2.21212
marita~s*	.803975	.07823	10.28	0.000	.650651	.957299	.484848
Educat~l*	.7371016	.18492	3.99	0.000	.374659	1.09954	.484848
accest~n*	-.7069442	.19629	-3.60	0.000	-1.09167	-.322214	.474747

(*) dy/dx is for discrete change of dummy variable from 0 to 1