

**IMPACT OF IRRIGATION FARMING ON INCOME OF SMALLHOLDER  
FARMERS IN KILOSA DISTRICT, TANZANIA**



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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE  
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AGRICULTURAL ECONOMICS OF SOKOINE UNIVERSITY OF  
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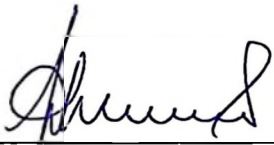
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## ABSTRACT

This study was carried out in Kilosa District in the 2011/12 crop season. The main objective was to determine the impact of irrigation on household income of smallholder farmers engaged in paddy cultivation. The specific objectives were to evaluate profit margins between irrigators and non irrigators in the study area, to identify factors influencing profitability of smallholder farmers in the area, and to assess shares from different sources of income to the total household income of smallholder farmers in the study area. The study adopted a cross sectional research design. The findings indicate that the average gross margin per hectare of irrigated paddy was approximately 50% higher than that of rain fed paddy, this has a significant impact on the household income. It was also found that farmers' plot size, seed types used, plot location (distance) with respect to water source and number of family labour engaged in off-farm activities determined the irrigators' level of profit. This study found that irrigated paddy production itself shares about 44% of the entire income of farmers in Kilosa District. From the findings of this study it can be concluded that there is a significant difference in profitability on paddy farming between irrigators and non irrigators. Irrigated paddy mean income was higher than other sources of household income and become the largest income share to the entire household income. Non irrigator's off-farm income share to household income was higher than that of non irrigators. From these findings, it is recommended that the government of Tanzania should invest more in irrigation projects and improve the already established irrigation schemes in Kilosa District to promote paddy farming and this will increase food production, farmers' income and reduce food insecurity rather than depending on rain-fed farming.

**DECLARATION**

I, **Paul Alphonse**, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.



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**Paul Alphonse****MSc. Candidate**08.09.2014**Date**

The above confirmation above confirmed;



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**Dr. R. M. J Kadigi****(Supervisor)**08.09.2014**Date**

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**DEDICATION**

To my late parents, Mr. Alphonse Clemence and Mrs. Mary Alphonse who sent me to school on time regardless of their poor financial position.

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### LIST OF ABBREVIATIONS AND SYMBOLS

ACT	Agriculture Council of Tanzania
ANOVA	Analysis of Variance
AQUASTAT	FAO's Information System on Water and Agriculture
DFID	Department for International Development
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GIS	Global Inference System
HBS	Household Budget Survey
IFAD	International Fund for Agricultural Development
JICA	Japanese International Corporation Agency
MAFC	Minister for Agriculture, Food and Cooperatives
MT	Metric Tones
NGOs	Non Governmental Organization
NIMP	National Irrigation Master Plan
SARO	Semi -Aromatic
SNAL	Sokoine National Agricultural Library
SSR	Seed Sufficiency Ratio
Tshs	Tanzanian Shillings
URT	United Republic of Tanzania
USAID	United States
USD	United States Dollar
USDA	United States Department of Agriculture

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background

Tanzania is a country of approximately 40 million inhabitants (URT, 2009). In 2005, around 75% of the population lived-in rural areas, deriving their livelihoods mainly from agriculture and other related activities. The agricultural sector account for 24.6% of the country's GDP and accommodates 82% of the labour force (URT, 2007). In Tanzania, food production mostly depends on rain-fed agriculture (URT, 2001). However, food production fluctuates due to unreliable rainfall. Over-reliance on rain-fed agriculture for food production contributes to food insecurity and therefore leads to income poverty (URT, 2002). Irrigated land is far more productive than rain-fed land (FAO, 2007), and the expansion of irrigation acreage over the past 30 years has contributed to gains in food production (Mwakalila and Noe, 2004). According to available data Tanzania has a potential irrigation area of about 29.4 million ha (URT, 2009).

Lack of rainfall is often catastrophic to smallholder farmers whose agricultural systems have no control over the weather conditions and therefore when there is prolonged drought they experience crop failure. This is not only depriving farmers of their anticipated income from the sale of surplus produce but also results into food insecurity if there is no food stock to sustain their families (IFAD, 2000). Tanzania Development Vision 2025 through its Poverty Reduction Strategic Paper considers irrigation as priority area for poverty reduction in the country due to its important role in national economy (Nagu and Howlett, 1997). The strategy for economic growth and poverty reduction in Tanzania (Makakati wa Kukuza Uchumi na Kuondoa Umasikini Tanzania) MKUKUTA has highlighted the importance of promoting agriculture as it states that: Reduction of

poverty requires sustained high growth rate of GDP of at least 6-8% per annum over the next decade. Toward this, focus will be on scaling our investments towards modernising small, medium and large scale agriculture for increased productivity and profitability, promoting off-farm activities including small and medium size enterprises with particular emphasis on agro-processing. The strategy also gives particular attention to trade, services and marketing infrastructure and creating conducive environment to attract private investment (ACT, 2007).

Tanzania is currently implementing its home grown initiative popularly known as Kilimo Kwanza that aim at bringing about green revolution with special emphasis on increasing productivity through irrigation and mechanized Agriculture (URT, 2006). It also intends to create a more conducive enabling environment through improved access to markets, extension services, value addition and institutional support to agriculture and related services (Daniel and Faith, 2012).

For the period starting from 2000/2001 to 2004/2005, seventy five (75) irrigation schemes of an area of 27 470 hectares and six (6) dams commanding 860 hectares were implemented. The cumulative area developed under irrigation by 2001/2002 was 191 900 hectares, which apart from other crops produced, paddy production reached 767 600 tons; in 2002/2003 the area reached 200 895 hectares producing 803 580 tons of paddy; in 2003/2004 area developed reached 227 486 hectares with the production of 909 944 tons of paddy. In 2004/2005 it was expected to achieve a cumulative developed area of 254 610 hectares, with 1 018 440 tons of paddy; however the achievement was only 249 992 hectares (URT, 2009).

Rice is by far the predominantly irrigated crop in Tanzania, but sugar-cane, tea and coffee have importance as industrial crops. The bulk of rice produced is locally consumed although considerable amounts are exported to neighbouring countries. Typical rice yield have increased from an average of 1.8 to 2.0 tons per hectares to as high as 4.0 to 5.0 tons per hectares on improved traditional and new smallholder irrigation schemes, whereas on the previously parastatal owned farms, yields reached as high as 8 tons per hectares. However, parastatal farms have been privatized due to high insupportable operational costs (URT, 2007).

## **1.2 Problem Statement and Justification**

Kilosa District has several developed irrigation schemes, among them is Mvumi farmers managed irrigation scheme which has been developed by various stockholders including the Government of Tanzania since 2003 (URT, 2003). Despite the efforts made by stakeholders to develop irrigation project in the study area, there is prevailing income poverty among farmers practicing irrigation in the area.

Researchers have assessed the economic performance of irrigation schemes to smallholder farmers in other parts of Tanzania, for example, Chemka (1996) carried out a study at Kapunga irrigation project, on the comparison of the performance between irrigation schemes managed by farmers and those managed by the government and Mkojera (2008) conducted a similar study for Mombo, Kivulini and Lekitatu irrigation schemes on economic analysis of the farmer managed irrigation schemes. Mnyenyelwa (2008) studied on traditional irrigation systems and livelihood of smallholder farmers. However, little is known on the impact of irrigation farming on household income of paddy farmers in the study area. This study therefore aims at providing insight on the impacts of irrigation activities on the income of smallholder farmers by evaluating the

profit margin between irrigators and non irrigators, identifying the factors that influence profitability of smallholder irrigation scheme in the study area, and assessing the share of income from irrigated and rain fed paddy to total household income. The study will help policy makers and other stakeholders to promote rice production by implementing sustainable future plans for developing irrigation projects.

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

#### **1.3.1 The overall objective**

To determine impact of irrigation farming on household income of smallholder farmers in Mvumi irrigation scheme in order to promote rice production in Kilosa District.

#### **1.3.2 Specific objectives**

- i) To evaluate paddy farming profitability between irrigators and non irrigators in the study area,
- ii) To identify factors influencing profitability of smallholder irrigation scheme in the study area, and
- iii) To assess the share of income from irrigated and rain fed paddy to total household income.

### **1.4 Hypotheses**

- i) The difference between profit margins accrued by paddy irrigators and non irrigators are statistically significant.
- ii) There are socio-economic factors that can influence the income accrued by paddy irrigators.
- iii) The irrigators and non irrigators percentage share of paddy income to total household income has significant statistical difference.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Key Concepts

##### 2.1.1 Income

Case and Fair (2006), defined income as the consumption and savings opportunity gained by an entity within a specified time frame, which is generally expressed in monetary terms. For firms, income generally refers to net-profit: what revenue remains after expenses have been subtracted. However, for the case of this study, "income is the sum of all the wages, salaries, profits, interests' payments, rents and other forms of earnings received by a farmer in a given period of time.

##### 2.1.2 Smallholder farmers

Smallholder farmers are farmers own a plot of up to 5 ha for irrigation of crops within an irrigation scheme, Agriculture in Tanzania is dominated by smallholder farmers (peasants) cultivating an average farm sizes of between 0.9 and 3.0 hectares (URT, 2009).

##### 2.1.3 Household

John (1997) defines household as the basic residential unit in which economic production, consumption, inheritance, child rearing, and shelter are organized and carried out; it is the basic unit of analysis in many social, microeconomic and government models. Campbell and Stanley (1990) argued that, most economic models do not address whether the members of a household are family in the traditional sense. Government and policy discussions often treat the terms household and family as synonymous, especially in western societies where the nuclear family has become the most common family structure.

#### **2.1.4 Household income**

In this study, household is a person or a group of people living in the same residence in which economic production, consumption, inheritance, child rearing, and shelter are organized and carried out, and household income refers to the average total income per household from all economic activities carried out by a person or group of people living in a particular residence.

#### **2.1.5 Household source of income**

Access to productive resources such as capital, land and family labour determines household income. The household budget survey, classified that the sources of income into two main groups; income from grain production (rain fed and irrigated agriculture) and income from non-farm sources (HBS, 2004).

#### **2.2.6 Current status of irrigation in Tanzania**

In Tanzania many small rivers and springs have been harnessed for irrigation farming schemes. Due to farmers limited resources these schemes usually cover relatively small area and also score very low on water management and farmers' organization operation. It is the common phenomenon to maintain intake structures frequently during flood, because of water loss before reaching the plots which have poor water flow. Tanzania national committee for irrigation and drainage urge that, traditional irrigation, goes back hundreds of years in the country (URT, 2007) and that those schemes have become inadequate due to increase in population, tear and catchment degradation among other reasons. According to Mzava and Makota (1994), irrigation development in Tanzania has gone through three stages: first, there was an imposed smallholder irrigation practice. The second was large scale government managed irrigation practice, in which only the government was involved in irrigation development. The third stage was the farmer

managed irrigation system. In the first two stages there was no farmers' involvement in planning, designing and constructing scheme, also farmer's responsibility in operating and maintaining schemes were not clearly defined. All the stages still exist in the country but at different magnitude.

URT (2007) estimated that by the year 2002 irrigation potentials was 2.1 million ha in mainland Tanzania , while for Zanzibar was estimated to be 8521 hectare. The study further revealed that most of the irrigated areas are under surface irrigation, mostly used by smallholders and water distribution is usually by lined and unlined canals where furrows and basins are widely used.

Various development partners, inter alia, International Fund for Agricultural Development (IFAD), the World Bank and Danish International Development Assistance have been supporting irrigation development in the country. The amount of US\$193 million loans for 12 projects was launched in the country since 1978. IFAD has developed two country strategic opportunity papers for the United Republic of Tanzania, the first in 1998 and the second in 2003. In terms of investments, the fund has been for operations in the irrigation sub sector, five of these 12 projects and programmers were ongoing in 2005 (IFAD, 2005).

### **2.3 Paddy Cultivation and Associated Activities**

Traditional production yields are household-based and small. Paddy cultivation is labour intensive, but typically the peak demands of labour, for transplanting and harvesting, are extreme, short and synchronized. Rain fed farming is vulnerable to weather irregularities (Cantrell *et al.*, 2004). In some places, the yield is low but the quality can be high.

Irrigated paddy cultivation is and will remain the predominant off-stream water use (Thi *et al.*, 2010).

### **2.3.1 National paddy production**

Paddy is the second most important food and commercial crop in Tanzania after maize; it is among the major sources of employment, income and food security for Tanzania farming households. Tanzania is the second largest producer of rice in Southern Africa after Madagascar with production level of 818 000 tones (USDA, 2007). Based on the 1998/99 – 2004/05 data, Tanzania produces an average of 893 000 MT of paddy per annum. Paddy output is more correlated with rainfall than maize; the standard deviation for the period is around 400 000 MT or 45% of the annual average. Production peaked in 2001/02 when about 1.5mil MT of paddy was produced as against 307 000 MT recorded a year earlier which makes an increase of 293% (USDA, 2007).

### **2.3.2 National trends of rice production and consumption**

In Tanzania, the leading regions in rice production are Shinyanga, Tabora, Mwanza, Mbeya, Rukwa and Morogoro. Others include Kilimanjaro, Arusha, Manyara, Iringa, Mara, Tanga and Kigoma. Total area under rice cultivation in 2005 was 702 000 hectares of which 90% is under small scale farmers and the rest under large scale. Rice is grown under three major ecosystems namely rain-fed lowland, upland rice and irrigated.

From Table 1 shows the trends in acreage, production and consumption of milled rice in Tanzania for the past ten years, the area increased from 490 000 hectares in 1998 to 665 000 hectares in 2007 representing an increase of 36%. Likewise, production did increase by 54% from 530 000 tons (equivalent to 803 030 tons of paddy rice) to 818 000 tons which is equivalent to 1 258 462 tons of paddy rice during the same period.

Productivity of milled rice for the same period did not change much and varied from 1.0 to 1.2 tons of milled rice per ha which is equivalent to 1.6 to 1.8 tons of paddy per hectares. The low yield is mainly caused by the use of genetically low yielding varieties, drought, and low soil fertility, weed infestations, prevalence of insect pests, diseases and birds among others.

Consumption of rice is gradually increasing and per capita consumption in 2007 was 25.4 kg, and Seed Sufficiency Ratio (SSR) was 84.5 %. According to USAID the recommended level of SSR for ensuring a country's sustainable food availability should be above 120% (USDA, 2009).

**Table 1: Annual Paddy Production Trend in Tanzania from (1998-2007)**

Year	Area Harvested ha	Production 1000t	yield (t / ha)
1998	209	530	1.08
1999	475	511	1.80
2000	500	511	1.02
2001	530	569	1.07
2002	500	465	1.29
2003	570	720	1.26
2004	620	556	0.86
2005	688	573	0.83
2006	650	785	1.21
2007	665	818	1.21

Source: URT (2009)

### 2.3.3 National paddy yield

National standard paddy yield at 1534 Kg/ha. Trend wise, annual productivity fluctuates significantly with rainfall showing positive growth. Yield growth has averaged at 8% per annum. Kilimanjaro leads in productivity with a 5204 Kg/ha yield in 2004/05 followed by Arusha at 4051 Kg/ha, Kigoma at 2195 Kg/ha and Mbeya at 2 170 Kg/ha. Current evidence suggests that there can be significant gain by farmers through increased productivity (ACT, 2007).

#### **2.3.4 Consumer preferences and demand projection for rice**

Rice consumers in Tanzania are very keen on the grain size, colour, taste/flavour and cooking attributes of rice. The majority of the consumers prefer aromatic to non-aromatic rice. Example of aromatic rice is Super Kilombero and (Semi-Aromatic) SARO 5 (TXD 306) and non aromatic is (Iringa variety) IR64. Consumers also prefer sticky white long grain rice to white broken and colour long grain rice. The common grade standards of rice available in the local markets are premium grade one and standard. Premium prices are usually given to aromatic rice type for example Kyela brand and rice brand of premium or grade one in attractive package. Grade one is 25% broken, while standard is not more than 50 percent broken grains. A high yielding variety (SARO 5) TXD 306 has been improved to grain quality and aroma, It is highly preferred by consumers and farmers followed by non-aromatic high yielding varieties such as TXD 85 and TXD 88 (MAFC, 2009).

#### **2.4 Major Challenges of Paddy Cultivation and Marketing in Tanzania**

A number of challenges facing paddy sub-sector have been documented in Tanzania. Inefficient use of water and difficult in accessing irrigation water by all farmers irrespective of their differences in socio-economic status, age groups, and gender is sometimes a problem. Pests and diseases attacks common in rain-fed lowland ecosystem are also recorded in this ecosystem. Fertilizers, pesticides and herbicides are heavily used in some irrigation schemes. Floods and water logging incidences are common in areas served by broken down irrigation schemes. Infrastructure for communication and transportation is relatively poorly developed.

Rice farming is prone to floods during heavy rains; drought which leads to severe moisture stress; attacks by weeds such as striga and nut grass; pests including stem borers

and African rice gall midge; and diseases including rice yellow mottle virus, rice blast and bacterial leaf blight. Soils are not very fertile and phosphorous -deficiency cases are frequently reported. Infrastructure for communication and transportation is not well developed. In addition rice competes with other food crops such as maize, sorghum and cassava for land and labour (URT, 2009).

Rice farming faces numerous marketing challenges. Of the most important challenge is the issue of poor access to markets emanating from a variety of physical and structural market-related constraints. These include tariff and non tariff barriers, poor roads infrastructure, high transaction costs, inadequate financial services and dishonest brokers. Further, there exists a huge problem of unreliable measuring equipments that are used by some unscrupulous traders to exploit farmers. In some cases these traders use *lebe* (a local measure which is equivalent to about 15 kgs) instead of using standardized measures such as weighing scales. In addition there is the use of other exploitative measures popularly known as "*lumbesa*" (*bags* which weighs approximately 120 kg – 130 kg). The aim of using such non-standardized measure includes exploiting farmers as well as reducing levies, transportation, handling and storage charges. Furthermore, many undifferentiated rice varieties were sold at different prices (ACT, 2007).

#### **2.4.1 Opportunities for paddy cultivation**

Irrigated lowland ecosystem has a low to medium fragile natural resources base. It is the most productive ecosystem and most of improved rice varieties are adapted such as IR64 and SARO 5(TXD 306). Yields range from 2.5 to 4.0 tons of paddy per hectare. Intensification of rice production is possible and the areas under this ecosystem can be expanded as more irrigation schemes are rehabilitated and constructed. The National

Irrigation Master Plan (URT-2002) provides detailed information on the irrigation potential in Tanzania.

Rain-fed lowland ecosystems have the following opportunities: Availability of water during floods and relatively fertile soils compared to upland ecosystem. Varieties commonly grown are Supa series and landraces. Yields range from 1.5 to 2.0 tons of paddy per hectare. Fragility of the natural resources base is low. Intensification of rice production is possible given available resources such as fertile soils and flood water. Also crop diversification can be practiced and expansion of the rice production areas is possible (URT, 2007).

#### **2.4.2 Review of government policy on irrigation**

Irrigation development in Tanzania is critically important in ensuring that the nation attains a reliable and sustainable crop production and productivity as a move towards food security and poverty reduction. The Government has decided to formulate the National Irrigation Policy which will ensure the direction for the implementation of irrigation interventions to ensure optimal availability of land and water resources for agricultural production and productivity to contribute effectively towards food security and poverty reduction as stipulated in the MKUKUTA (URT, 2009).

Tanzania's Poverty Reduction Strategy Paper (PRSP) sets out the medium term strategy for poverty reduction and indicators for measuring progress. It defines the objectives for poverty eradication by 2010, Vision 2025; this entails integrated planning, development and river basin management in support of food security and poverty reduction as well as environmental safeguards. Sustainable irrigation management, therefore, is one of the most important agents to enable Tanzania to achieve its development vision objectives

(both social and economic), such as eradicating poverty, attaining water and food security (Mwakalila and Noe, 2004).

The objective of the National Water Policy for Water Resources Management is to develop a comprehensive framework for promoting the optimal, sustainable and equitable development and use of water resources for the benefit of all Tanzanians, based on a clear set of guiding principles. Therefore, good irrigation management is needed such that each water user gets the amounts of water desired at the right time and ensures that water is available throughout the year, or at least when needed. Through this kind of management, irrigated agriculture can improve household income and hence poverty alleviation (URT, 2002).

## **2.5 Tools used in Analysing Gross Margin**

### **2.5.1 Gross margin analysis**

Gross margin is the difference between the value of an enterprise's gross output and the marginal cost of that production (Johnson, 2003). It is the analytical tool that has been widely used in finding the profit in farm activities. Gross margin of a farm activity is the difference between gross earned and variable costs incurred. Most often new technologies in agriculture are aimed at increasing the farm production by the fact that income is one of the immediate objectives of the farmers (Mutayoba, 2005). Gabagambi (1998) used the model to study profitability and returns per resource invested in paddy and cotton production for smallholder farmer's production systems.

### **2.5.2 Regression analysis**

Regression analysis is a statistical model that can describe and evaluate relationship between a dependent variable and one or more independent variables. The mathematical model of their relationship is the regression equation which contains estimates of one or

more regression parameters. These estimates are constructed using data for the variables such as from the sample. The estimate measures the relationship between the dependent variable and each of the independent variables. They also allow the estimating of the dependent variable for given value of each respective independent variable. Also regression analysis can be used to predict outcome of a given dependent variable based 'on the interaction of other related explanatory variables (Manage, 2007).

### **2.5.3 Empirical studies underpinning factors influencing profitability among smallholder farmers**

Masuku (2011) when studying the determinants of the profitability of sugarcane growers in the Swaziland sugar supply chain employed the backward stepwise regression method to determine the independent variables that affect the farmers' performance/profitability. The results of this study provide considerable insights regarding the factors affecting the performance of smallholder farmers in the sugar industry. Profitability of the sugarcane farmers is affected by the yield per ha, the farmer's experience, sucrose content on the sugarcane, the change in the production quota of the farmers and the distance between the farm and the mill.

Mumba *et al.* (2012) used multiple linear regressions to identify socio-economic factors affecting the profitability of smallholder dairy farming in Zambia. The findings of the multiple regression analysis indicated that level of education, dairy cow herd size and distance to the market significantly affected the profitability of smallholder dairy farming in Zambia. An increase in level of education and dairy cow herd size, with a unit decrease in distance to the market, led to an increase in profitability of smallholder dairy enterprise.

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Altahat *et al.* (2012) used multiple linear regression to investigate factors included price of purchased pullet, feed price, cost of labour, cost of veterinary service and medicine, building and machinery depreciation, repairs and maintenance and miscellaneous costs, length of production cycle, feed conversion ratio, mortality rate, egg sale price and laying percentage.

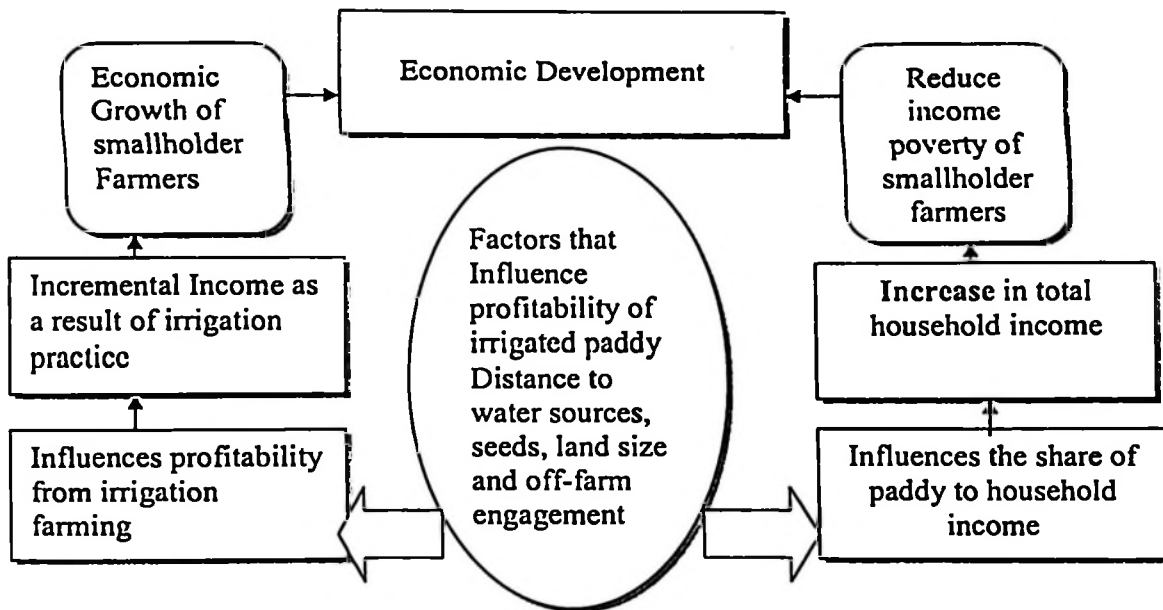
The results that emanated from the analysis concluded that higher prices of purchased or breeding pullet, higher feed price, higher cost of labour, higher cost of veterinary service and medicine, higher other costs including building and machinery depreciation, repairs and maintenance and miscellaneous costs. Also, higher feed quantity to be converted to eggs and higher mortality rate are associated with lower profitability of laying hen enterprises, while higher length of production cycle, higher egg sale price and higher laying percentage are associated with higher profitability. Critical limits indicated for various cost components should be used as a guideline to adjust budget in commercial egg operation thereby, ensuring higher net profit per bird. In the study which aimed at analyzing factors affecting Profit of Broiler Industry in Faisalabad, Mustafa and Ahfaq (2012) employed a profit function regression model was used as a decision support tool in commercial broiler production. Price of purchase chicks, cost of feed, cost of labour, mortality rate (%), feed conversion rate-FCR and cost of building and machinery depreciation, electricity, heating and cooling charges and rent on the profit of the broiler producer were investigated. The results of the study shown that each of these factors has a specific effect on producer's profit, Amongst the independent variables entered in the model, only the statistical association of "labour costs" with the dependent variable was not found to be significant at, and it was therefore dropped from the model. The rest had a strong statistical association with profit per kg live weight.

Other studies which used multiple linear regression include that conducted by Nchinda and Mendi (2008), Otieno *et al.* (2009), Chagunda *et al.* (2006) and Ceveger and Yalcin (2003) that have demonstrated the impact of age, gender, marital status, education level, household size and distance on relative profitability of smallholder enterprise by use of multiple regression models.

## 2.6 Conceptual Framework

Conceptual framework presented in Fig. 1 shows irrigation interventions that can transform the lives of farmers and their communities. To note this irrigators and non irrigators' income difference can be noted and scientific test is conducted to find out whether its difference is statically significant. However, farmers 'total Income is from different sources and income from paddy was tested to found out its significance to total household income. Nevertheless, socio-economic factors that influenced positively farmers' profitability such as land distance to water source, land size, type of seed used and number of family labourers used in off- farm activities influenced an increment in farmers' income as result of irrigation practices, this influences led to the growth of smallholder farmers' economy, eventually it leads to economic development of Kilosa District in general and Mvumi Village in particular.

On the other hand these factors have influenced farmers' income from paddy that contributes to the entire individual household income. This shows the extent to which farmers' income is changed by irrigation interventions and this leads to the success in irrigation farming through increment in the farmers' income. This income increment to smallholder farmers leads to the reduction of farmers' income poverty. Ultimately, this leads to economic development in the study area and the entire nation's economy.



**Figure 1: Conceptual Framework of the Impact of Irrigation on Income of Smallholder Farmers**

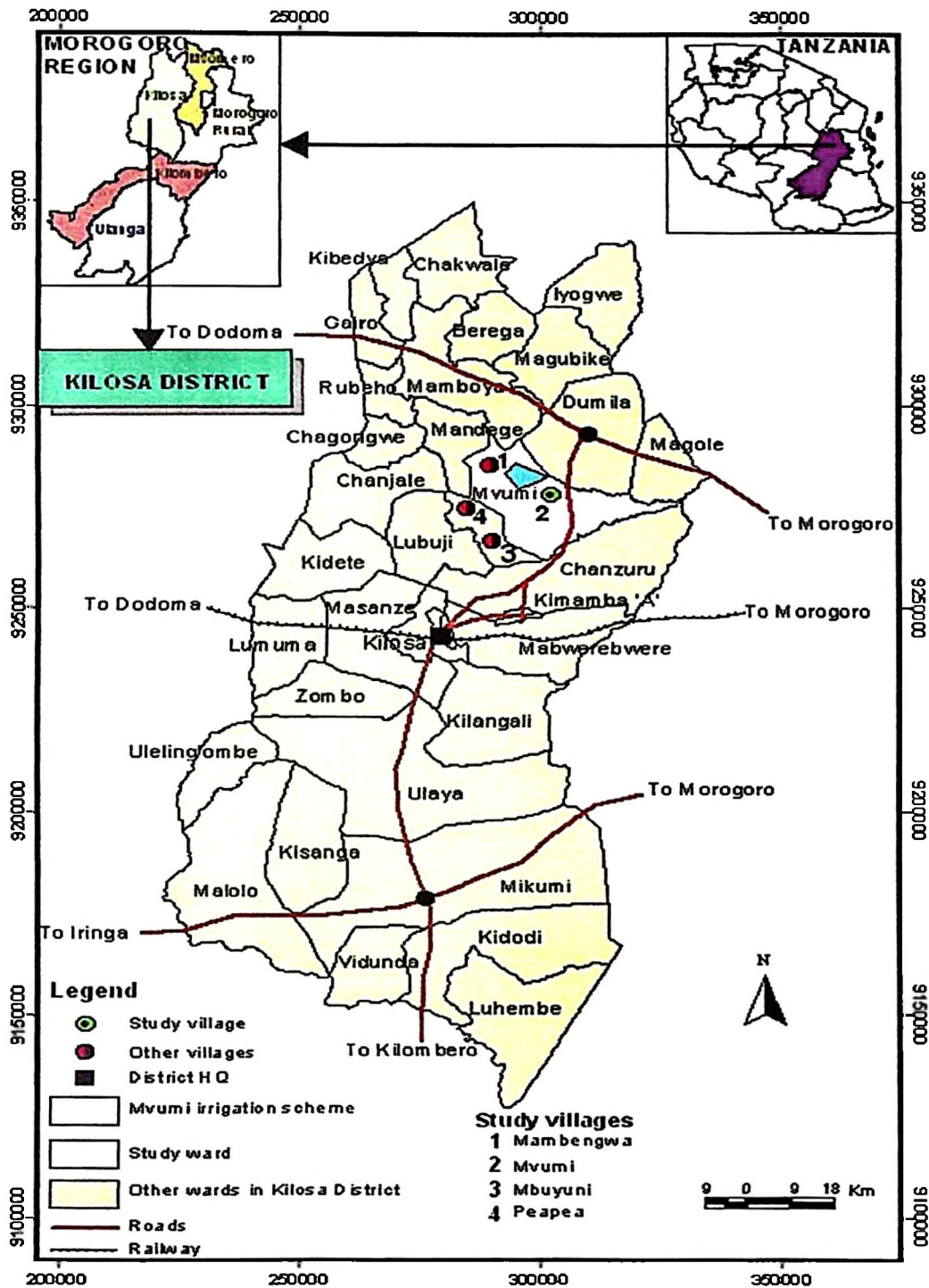
## CHAPTER THREE

### 3.0 RESEARCH METHODOLOGY

#### 3.1 Description of the Study Area

Kilosa is one of the six administrative districts in Morogoro Region in Tanzania. Others include Mvomero, Ulanga, Kilombero, Morogoro Urban and Morogoro. It is among the famous paddy producing districts in the region. The area is comprised of 1 426 540 hectares with potential land of about 536 590 hectares where 26 000 hectares are suitable for irrigation (URT, 2003). Currently, only 9410 ha are under irrigation and that is only 36.25% of the irrigable land (URT, 2007). According to the 2002 National Population Census, the population of the Kilosa District in the year 2011 was projected to be 600 428 of which 300 073 were males and 300 355 females.

The study was conducted at Mvumi and Mambengwa villages of Msowero Ward. Mvumi Irrigation Scheme was identified as a potential area for irrigation development in 2003. The project is located in Msowero Ward, Magole Division, Kilosa District about 45 kms from Kilosa Town. Mvumi irrigation scheme has 240 households farming under irrigation. There are 373ha (293 hectare of paddy and 80 hectares of vegetable) under irrigation, and 720 ha potential for irrigation. Mvumi irrigation scheme was funded by Aid Counterpart Fund under the assistance of Japanese government in October 2001(URT, 2003)



**Figure 2: A map of Kilosa District Showing Villages Around Mvumi Irrigation Scheme.**

Source: (SUA Remote Sensing and GIS Laboratory, 2012)

### 3.1.1 The physical environment

Kilosa District is located in the North part of Morogoro Region. It borders Kilindi District in the North, Mvomero District in the East, Morogoro District in the Southeast, Kilombero District in the South, Iringa Region in the Northwest and Dodoma Region in the West. It lies between latitude  $5^{\circ} 55''$  and  $7^{\circ} 53''$  North and Longitude  $36^{\circ} 30''$  and  $37^{\circ} 30''$  East. Mvumi Irrigation Project is located in Mvumi village, Msowero ward, in Kilosa District about 45 kms from Kilosa Town. The project is at an altitude of 430m above mean sea level at latitudes  $6^{\circ} 35' 30''$  S and longitude  $37^{\circ} 12' 30''$  E.

### 3.1.2 Climatic condition in Kilosa District

Kilosa District has an area of 14 918 km<sup>2</sup> and covers 20.5% of the total land area of Morogoro Region. The climate of Kilosa District as described in detail by (Kimaro 1989) is characterized by a dry tropical climate of the semi-arid type. The mean annual temperature of the district is 25° C. Annual rainfall ranges from 800 mm in low-lying areas to about 1300 mm in high altitude areas. The vegetation of Kilosa District is characterised by miombo woodland in the hilly areas and grassland occurs in the alluvial plains. Much of the vegetation however, is under pressure for firewood and grazing land.

The District is divided into three agro-ecological zones (Gilland-Byers, 1984). In the high altitudes, cultivation of temperate crops such as wheat is possible in only small pockets of agricultural land which is available. The Plateau is another zone and is characterized by plains and dissected hills with moderately fertile and well-drained soils. The other zone is the flood plains which comprises both flat and undulating plains extending to the foothills in the west.

### **3.1.3 Soils**

Kilosa is situated at the foot of the Eastern Arc system that runs through the district in a north–south direction. These mountains can reach an altitude of 2200m. The escarpment and the uplifted terrain in the west create rain shadow and dry climate in the area by the foot of the escarpment. With the fault formation during the creation of the Great Rift Valley the area of the district got fragmented. The red soil that was uplifted became eroded and the new soil that developed is more yellow in colour and is not as deeply weathered. The eroded soil from these parts was deposited lower down in the valleys and that has resulted in a very fertile soil. The fertility is due to the nutrient rich material that was washed down from the mountains and also because of high water content.

### **3.2 Study Design**

This study adopted a cross sectional single visit survey. This design allows the collection of data at one point in time. It was employed because the resources available in terms of time and money would not be adequate for the collection of data more than once. The target populations were smallholder farmers under irrigation from Mvumi village and those who were under rain fed farming from Mambengwa village in Msowero ward.

### **3.3 Sampling Approach**

Among the farmers where paddy is grown, purposive sampling was used to sample farmers engaging in paddy production. The proportionate sampling was used to separate the selected population of paddy farmers into two homogeneous groups (strata) i.e. farmers irrigators and non irrigators. The sample representations were 25% of the population, and then random sampling was used to obtain 60 farmers from irrigators and 60 from non irrigators, making a total sample size of 120 farmers. These samples were selected from homogeneous groups of irrigators and non irrigators from Mvumi and

Mambengwa villages respectively. Mvumi irrigation scheme had 240 households under irrigation while Mambengwa village had 242 households who practiced rain-fed farming.

### **3.4 Data Collection Methods**

#### **3.4.1 Primary data**

A structured questionnaire was used to collect both quantitative and qualitative data. The household heads were interviewed to get information such as the socio-economic characteristics, paddy production practices, output per unit area, and income per unit area and input availability. Visits were made to the respective fields so as to observe the physical condition of the field.

#### **3.4.2 Secondary data**

Secondary data such as acreage, source of funds, climate and scheme development were obtained from district Council offices, irrigators organizations, Ministry of Agriculture Food Security and Cooperatives, Kilosa District Council, Morogoro Zonal Irrigation Unit, Non- Governmental Organizations, Sokoine National Agricultural Library (SNAL) and Electronic sources.

### **3.5 Data Analysis Methods**

The collected data were analyzed using Statistical Package for Social Sciences and Microsoft Excel. Descriptive analysis of various socioeconomic characteristics of the respondents was done. In addition, an ordinary linear regression technique was used and independent samples t-tests were used to test hypotheses.

#### **3.5.1 Income that accrue under irrigated and rain fed farming**

This was found by using the farm management tool of Gross margin which is popularly used to estimate the profitability of farm business. In this study, the tool was employed to

estimate profit in two study groups of irrigators and non irrigators. The analytical model was:

$$TR - AVC \dots\dots\dots (1)$$

Where;

GM = Gross margin (in Tshs/ha)

TR = Total revenue (quantities of 80kg bags per ha x unit price in Tshs/ha)

AVC = Average variable costs (quantities x unit cost in Tshs/ha)

Kabiri (2009) highlighted a number of limitations associated with Gross Margin analysis. Firstly, he concludes that the Gross Margin cannot be treated as a profit figure because fixed costs have to be covered by Gross Margin in order to derive the profit figure. In his Second conclusion he observed that Gross Margin can vary widely from one year to the next due to the fluctuation in market prices and efficiency. Lastly, he concluded that Gross Margin analysis is static and therefore, has no consideration for variation in money value over time.

Costs incurred per hectare were deducted from the revenue per hectare obtained from the sampled household heads. The difference was the net income per hectare, the net income from irrigators and non irrigators were then identified. The test was carried out by using an independent samples t-test to find out whether their difference was statistically significant.

### **3.5.2 Factors that influence profits under irrigated agriculture**

In order to establish the relationship between profitability and specified factors that were assumed priory to influence the profitability of paddy enterprise for smallholder farmers particularly those farming in irrigation scheme, the study used multiple linear regression model which is expressed as:

$$\text{Net Income per ha} = \beta_0 + \beta_1 \text{ AGE} + \beta_2 \text{ EXP} + \beta_3 \text{ EDUC} + \beta_4 \text{ PS} + \beta_5 \text{ DIST} + \beta_6 \text{ OFF} + \beta_7 \text{ SEED} \dots \dots \dots (2)$$

AGE Ages of Household Head (in years)

EDUC Education attained by household head (in years)

EXP Household heads crop farming experience (in years)

PS Household heads plot size used for paddy farming (in hectares)

DIST Plot location (distance) with respect to irrigation water source (in metres)

OFF Number of Household labour spent in off - farm activities (no. of labour)

SEED Seeds type used SARO 5 (TXD 306) =1, SUPA =0

$\beta_1 - \beta_6$  Parameters to be estimated

$\beta_0$  Intercept, constant term

$\mu$  Disturbance term

### 3.5.3 Expected sign from variables coefficients

The variables listed above were expected to be significant with positive signs as they were run in the linear regression model.

AGE: Age of the household head is expected to influence the crop production because farmers with more than 60 year are retiring , in this case they had no energy to work than young farmers, therefore we expected household heads above sixty years to have negative influence on their income while those who were below sixty years to have positive influence.

EDUC: Education of household heads: Education was expected to affect farmers' income positively because of the expected understanding ability to adopt techniques easier than the illiterate farmers. This category was comprised of years spent in school, this meant

that those whose schooling were above seven years influenced positively to the income of smallholder farmers.

**EXP: Experienced household heads:** It was anticipated that farming productivity increases as farmer's experience increases. Hence, this study expected experienced household heads in farming particularly irrigated farming to be more productive compared to less experience household heads. Thus, those who had been farming at least ten years in irrigation farming were considered experienced. Therefore, this variable was expected to influence positively to the experienced household heads.

**PS: Plot size:** Plot size was expected to influence income positively such that, the larger the size, the higher the yield and income to farmers with an assumption of other factors remaining constant. In this case those farmers with less than 0.9hectares were considered to be small size plots while those above that can experience economies of scale. Therefore, this large plots variable was expected to be significant and carry a positive sign. However, Agriculture in Tanzania is dominated by smallholder farmers (peasants) cultivating an average farm size of between 0.9 and 3.0 hectares each.

**DIST: Location of plot with respect to water source:** since there is inadequate water supply, far located plots are expected to receive little amount of water supply than those near plots. Thus incomes of near located plots are expected to be positively affected.

**OFF: Off-farm engagements:** Above 50 % of household labour that is been spent on off-farm engagement is expected to have a negative sign on the farmers income , the more number of household labour spent in an off-farm activities can reduce income of irrigators. This is referred to as household's numbers of labour been used in off-farm per

season. The reduced number of labour in irrigation farming can reduce concentration and hence less income.

SEED: Seed types used. Household Head used SARO 5(TXD 306) and SUPA which were characterized by higher yields and low yields respectively, both seeds are aromatic. SARO 5(TXD 306) was expected to carry a positive sign because of its higher yields while SUPA was expected to have negative sign because of its low yields that influences the farmers' income. However, supa variety had high demand than its counterpart.

#### **3.5.4 The percentage share of paddy enterprise to the household income**

This was investigated in order to determine the share of income accrued from various livelihood strategies undertaken by the respondents. In order to establish this, various off-farms and farm livelihood strategies were selected, including supplementary crops grown other than paddy crops and livestock among others. The total income was established by adding income from individual farmer income. The purpose of doing this interpretation was to find how irrigation farming is important due to its contribution to the household income. The share of income was computed by the use of:

$$\frac{\text{Income from source } i \times 100}{\text{Total household income}} = \text{income share} \dots \dots \dots (3)$$

Where,  $i = 1^{\text{st}}$  up to 12th source of income

The independent samples t-tests was conducted to find out the individual farmers percentage share to total household income, each group of farmers are compared to found its statistical differences, however, the mean percentage shares of 60 individual farmers of each group, mean standard deviation and mean standard deviation were computed.

### **3.6 Limitation of the Study**

The study was completed according to the requirements. Nevertheless, a number of limitations were principally noted. Due to lack of adequate record keeping, the collection of primary data largely depended on household heads' ability to recall past events. This was a limit on the part of respondents to give right account of household important information.

## CHAPTER FOUR

### 4.0 RESULTS AND DISCUSSION

#### 4.1 Socio-Economic Characteristics of household heads

##### 4.1.1 Ages of household heads

Age is an important demographic variable and is a primary basis of demographic classification in vital statistics, censuses and surveys (URT, 2005b). Basnayake and Gunaratne (2002) argued that the age of a person is usually a factor that can explain the level of production and efficiency. Table 2 shows that the majority of the respondents' age was between 23-33 and 34-43 for paddy irrigators and non irrigators respectively. Saries *et al.* (2006) reported that an active household labour is between 15 years but less than 65 years but subject to physical fitness and ability to take risks. Generally, most of the interviewed household heads were adults who were in a position to explain different matters pertaining to paddy production.

##### 4.1.2 Sex of household heads

Findings indicated that majority of the respondents were males who represented 63.3% and 66.7% of irrigators and non irrigator's household heads respectively. The proportions of female respondents were 36.7% and 33.3% for the two groups respectively. This means that, men are the decision makers in the family and control most resources of the family. In addition, in the study area large proportion of the farming activities were run by men. For Tanzania, in both smallholder and large farms men and women carry out different types of works; therefore men and women are rewarded unequally by the agricultural system, with women mostly realizing fewer returns when compared to their male counterparts (CARE, 2010). Nevertheless, the level of participation of women in Kilosa is relatively low due to traditional settings that women should carry out housekeeping while men engages mostly in farm works.

#### **4.1.3 Marital Status of household heads**

Table 2 indicates that 95.0 and 80.0 % of the irrigators and non irrigators were married and few irrigators were single and widow (1.7%). The marital status found in this study relates that findings of Chacha (2007) who reported that the married, single, divorced and widow were 91%, 3.1%, 3.5% and 2.4% respectively, this implied that there was early marriages, which increased labour power to the farming process instead of hiring them. This indicates that in order to guarantee for food availability for their expected families, most married take agriculture more seriously than those who are still single. This is evidenced by results which show that non married farmers account for at least 20% when counted together.

#### **4.1.4 Household heads' education level**

Education is always valued as the means of liberation from ignorance and enables one to perform the economic activities efficiently. Table 2 shows that 75% of the irrigators had primary school education while 10% had secondary education; 10% had no formal education and five percent had post secondary education. Furthermore, the findings show that about 78% of non irrigators had attained primary school education and 6.7% had secondary education while 10% had informal education and 5.0% had post secondary education. Mukwenda (2005) contends that education accounts for 50% variation in agriculture output in Tanzania. Thus the high education level of interviewed respondent can also be exploited to boost paddy productivity by more than 50%.

#### **4.1.5 Household size**

From Table 2 the size of a household can have a great impact on the family labour which is needed in the farm management. As seen from Table 2, most families of the irrigators 68.3% had the size ranging from 5-8 members. Many families had more than three

members. Family sizes ranging from 9-12 members were only 25.0% while those with 13-16 members were 6.7%. In addition, the results indicated that the proportion of non irrigators with 5-8 members were 70.0%; those with 9-12 members were 21.7% and those with 13-16 members were 8.3%.

From these findings, it could be argued that high income among the irrigators as compared to non irrigators was attributable to the size of households among the irrigators. More than 90% of the overall family size was 7-10 people for the combined two groups. Families were unable to hire labour because of small capital, which led them to depend much on family labour in performing farm operations. The families with only 5 people was found to have two or three children often depended much on hired labour in some farm operations. This was an added cost of producing paddy which also affected the farmers' ability to access farm inputs.

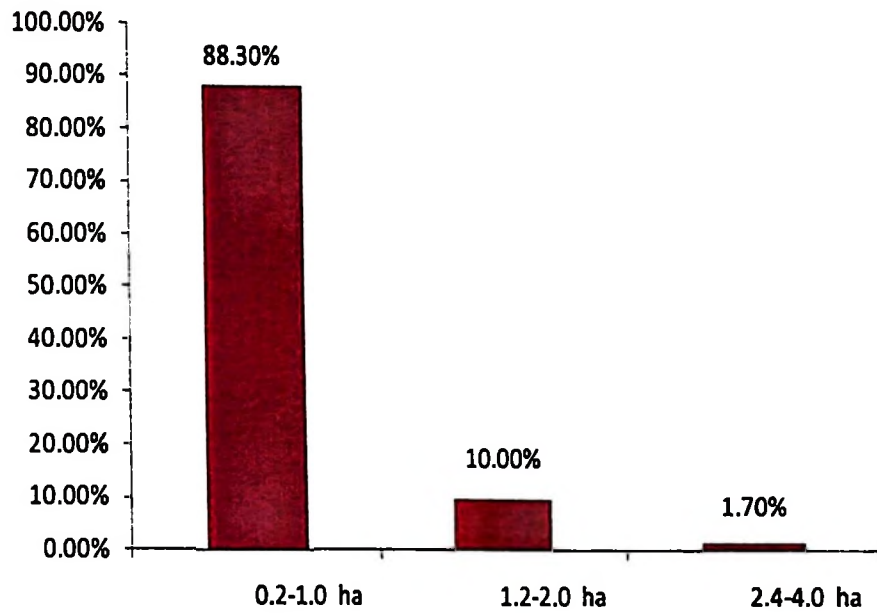
#### 4.1.6 Land size under paddy cultivation

The findings in Table 2 show that 88.3% and 71.7% of irrigators and non irrigators of paddy owned the land size ranging from 0.2 to 1.0 ha, followed by 10.0% and 21.7% who owned 1.2 to 2.0 ha respectively. In addition, 1.7% and 6.6% owned the land size ranging from 2.4 to 4.0 ha for both groups of farmers respectively. On average, every household owned the land size of 0.77 ha while non irrigators owned 0.96 ha. In Tanzania most of smallholder farmers owns about 0.3ha to 0.9 ha (URT, 2009). These findings are similar to those of Fischer (2006). This implies that there is limited potential land for irrigation than that of rain-fed land in the study area. However, the land size used was far below that 5 ha standard land size for smallholder farmers.

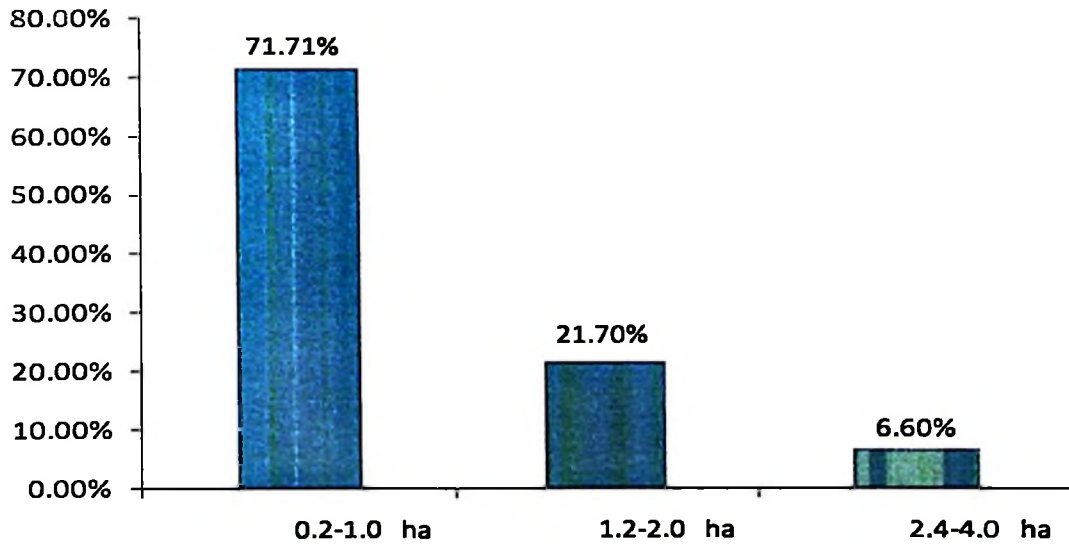
Land around Mvumi Irrigation Scheme is privately owned and thus, a farmer had a final decision on their plots. For example, they could rent or sell the plots because there were no by laws which restricted them from doing so. However, most of the farmers under rain fed agriculture in Msowero ward had inherited the land and no rules or regulations had been formulated to control land ownership.

**Table 2: Description of socio-economic characteristic of heads of households for irrigators and non irrigators at Msowero ward in Kilosa District**

	Irrigators n=60	No irrigators n=60
<b>Age</b>		
Mean	37.3	40.4
Maximum	22.0	23.0
Minimum	71.0	75.0
<b>Marital status</b>		
Single	3.3	13.4
Married	95.0	80.0
Widowed	1.7	6.6
<b>Education Level</b>		
Informal	10.0	10.0
Primary education	75.0	78.3
Secondary education	10.0	6.7
Higher education	5.0	5.0
<b>Household size</b>		
5.0-8.0	68.3	70.0
9.0-12.0	25.0	21.7
13.0-16.0	6.7	8.3
<b>Land size: ha</b>		
<0.2	-	-
0.2-1.0	88.3	71.7
1.2-2.0	10.0	21.7
2.4-4.0	1.7	6.6



**Figure 3: Distribution of land size per ha for paddy cultivation by irrigators' households at Mvumi irrigation scheme in Kilosa District**



**Figure 4: Distribution of land size per ha for paddy cultivation by non-irrigators' households at Mambengwa village in Kilosa District**

#### 4.2 Paddy Farming Profitability between Irrigators and Non Irrigators

Table 3 shows that irrigated paddy farming was more profitable than the paddy farming that depended on rainfall. This is evidenced that irrigation farming was found to have higher profit of 591 848.00 TShs/ha higher than rain-fed farming in the study area. The results also imply that the irrigating farmers had approximately 50% higher than non irrigating farmers. Revenue per hectare of irrigated paddy exceeded revenue accrued by non irrigated paddy by 70.31%. The large revenue of irrigators was due to high productivity per hectare. The average prices of irrigated paddy were higher by 36.68 % higher than that of rain fed paddy in the study area. The difference in prices between them was due to different varieties of seeds used by these groups. However the rain fed farming experienced varieties commonly grown are Supa series and landraces which had low yields. This variety has high quality /taste and fetches higher average price.

**Table 3: Irrigators and non irrigators' average revenue per hectare from paddy cultivation at Msowero ward in Kilosa District**

<b>Scheme</b>	<b>Production Kg/ha</b>	<b>Average Price Tshs/Kg</b>	<b>Revenue in Tshs/ha</b>
Irrigators	3 869.65	496.65	1 921 863.50
Non Irrigators	1 946.12	579.84	1 128 440.50

From Table 4, the variable cost for irrigator was larger than that of non irrigators because of higher cost of transplanting, water fees, fertilizer and other miscellaneous costs. However, non irrigators' transplanting cost was reduced by the use broadcasting techniques, little land rent fee and ploughing costs. Land rent fee was high to irrigators due to limited water for irrigation, although the potential irrigable land around Mvumi approximately 63.75% was not yet utilised (MAFC, 2003).

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**Table 4: Average gross margin per ha for irrigated and rain-fed paddy at Mvumi irrigation scheme in Kilosa District**

Item	Tshs Irrigators	Non Irrigators
Land clearing	47 816.00	47 816.00
Ploughing	53 275.00	53 275.00
Seedling	58 416.00	58 416.00
Weeding	54 700.00	54 700.00
Harvesting	107 683.00	107 683.00
Transporting	55 258.00	55 258.00
Water fees	25 000.00	-
Bird scaring	57 650.00	57 650.00
Fertilizers	101 900.00	39 747.00
Seeds	24 685.00	24 685.00
Hand hoe	4 550.00	4 550.00
Land rent	50 000.00	20 000.00
Other costs	11 900.00	-
Total variable cost	671 685.00	470 110.00
Revenue	1 921 863.50	1 128 440.50
Gross Margin in Tshs/ha	1 250 178.50	658 330.50

The Gross Margin for paddy farming was calculated in terms of mandays Table 5. For irrigated paddy the gross margin showed returns per Tshs mandays of Tshs 2 637.51 which was equivalent to USD 1.65. This shows that this return was above 1 USD while rain-fed farming gross margin showed return of 1371.52 per Tshs manday equivalent to USD 0.86 was still below US \$1(Tshs 1600) per day poverty threshold as suggested by the United Nations. This implies that irrigation had impact on farmers' earnings.

**Table 5: Costs and margins for irrigated and rain-fed paddy farming at Msowero ward in Kilosa District**

	Yields Kgs	Units	Price/units Tshs	Total value Tshs
<b>Irrigated Paddy</b>				
Revenue				
Yields/kg/ha	3 869.6		496.65	1 921 863.50
Total revenue				1 921 863.50
Total Costs Tshs/ ha				671 685.00
Gross Margin Tshs/ha				1250 178 .50
Average farm size ( ha)		0.77		
Family labour (Mandays ha)		474		
Gross Return to an Average farm Tshs				962 673.75
Returns per (Tshs/Manday )				2 637.51
Return per (US \$/Manday )				1.65
<b>Rain-fed Paddy</b>				
Revenue				
Yields/kg/ha	1 946.1		579.84	1 128 438.22
Total revenue				1 128 438.22
Total Costs Tsh/ ha				470 110.00
Gross Margin tshs/ha				658 330.50
Average farm size ( ha)		0.96		
Family labour (Mandays ha)		480		
Gross Return to an Average farm Tshs				631 997.28
Returns per (Tshs/Manday )				1371.52
Return per (US \$/Manday )				0.86

#### 4.3 Testing for paddy farming profits between irrigators non irrigators

Profit from paddy production was calculated to obtain its monetary value. The mean gross margin for Irrigators was nearly two times that of non irrigators, paddy gross margins differences for irrigators and non-irrigators were tested. The differences between the two groups were statistically tested by using independent samples t-test. From Table 7 the results found showed that the profits between the two groups differed and were statistically significant at  $p=0.01$ . Therefore, the null hypothesis was rejected in favour of the alternative hypothesis that the difference between the two groups was statistically significant. This implies that irrigation farming income is greater than rain fed farming.

**Table 6: Descriptive statistics for paddy irrigators and non irrigators at Msowero ward in Kilosa District**

Var.	Group of farmers	N	Mean	Std. Deviation	Std. Error Mean
	Irrigators	60	4 991 150	1.928 070	24 891.33116
	Non Irrigators	60	2 633 350	3 573 880	46 138.56409

**Table 7: The test of profit difference between paddy irrigators and non irrigators at Msowero ward in Kilosa District (n=120)**

Variable		Std error diff.	t – value	Df	Sig.	Mean diff.
Irrigators and non irrigators	Equal var.	52 565. 02	4.497	118	0.001	235 774
Gross Margin	Equal var. not assumed	52 565. 02	4.497	90.62	0.001	235 774

#### 4.4 Factors Influencing Profitability of Smallholder Farmers Under Irrigation

The results showed that farmer's social economic variable of farmers' experience, Schooling years of Household head, age of the household head, and were all statistically not significant while land size, distance from water source to the plots , numbers of family labour force engaged in off-farm activities, and seed type used were significant. Therefore, the results suggest that the experience of the households' head had no notable effect on farmers' income. Schooling years on the other hand indicated positive coefficient relationships with the dependent variables although their effects were not significant.

Positive relationship between the average plot size cultivated and the income earned can be attributed to the fact that average farmers in the schemes owned or cultivated relatively small plots of 0.77 ha per household. It was found that farmers with large plots above the mean value of 0.77 ha had the advantage of economies of scale of production than small plot, thus influencing the respondent's income. The plot location in relation to water flow or source influenced income significantly because the nature of water flows in the study area. The canal lining ends at secondary canal level, this restricts smooth water flow on

the earth to the plots by gravity. This leads to small amount of water available to the far located plots namely the tail, middle and head sections in the area.

Number of household labour used in off-farm activities was significant. It was found that households with more than half of its family labour in off-farm activities were reducing farming operations in irrigation, thus decreasing yields and hence less income. On the other hand, the presence of more than two times of non-irrigators engagement in off-farm activities implies that there was switching of this group from rain-fed agriculture to petty businesses due to unpredictable rainfall. The seed type SARO 5(TXD 306) used was significant in influencing profits among the farmers. Farmers who adopted this type of seeds had positive results than its counterpart Supa which has low yields. However, Supa had higher demands despite its low yields and farmers used this variety mostly for home consumption, SARO 5(TXD 306) was mainly for commercial purposes.

#### **4.5 Regression results and interpretation of the factors influencing profit of smallholder Irrigation scheme**

Regression analysis was carried out to test for the influence of socio-economic factors of individuals on profit levels in paddy farming. It was found that factors such as schooling years, land size cultivated, land distance to water source, numbers of hours used in off-farm activities, seed type would have a positive influence on the household profit. Table 9 shows that three factors were insignificant and their results showed that irrigators' income was increased by 0.030 units as a result of one year increase in farmers' experience in paddy farming. One year increase in farmers' age has influenced a decrease in farmers' income by 0.001 units. Also, farmers' one year increase in schooling has influenced an increase in farmers' profit by 0.044 units (holding all other independent variables constant).

Three independent variables were significant at  $p= 0.05$ . An increase in the use of SARO 5 (TXD) type of seed has increased irrigators' income by 0.313 unit than 'Supa' type of seed, over 50% additional family labour into off-farm activities reduces farmers' income by 0.136 unit, The increase farmer's land size by one unit (ha) has influenced an increase in farmers' income by 0.598 unit and this was significant at  $p= 0.01$ . One metre of land distance increase from irrigation water source has influenced a decrease in farmers' income by 0.299 units (Holding all other independent variables constant).

**Table 8: Descriptive statistics of smallholder irrigation scheme at Mvumi village in Kilosa District**

	Mean	Std. Deviation	N
Irrigators Gross Margins	499 000.00	192 807.422	60
Age of Household head	40.35	10.963	60
Schooling years of Household head	7.00	2.905	60
Experience of Household head in paddy farming (years)	13.8167	9.42138	60
Land distance from source water to the plots	5 133.300	204.35651	60
Type of seeds used	1.0333	.18102	60
Family labour used by irrigators in off- farm activities	4.7000	2.70780	60
Land size owned by irrigators	2.8167	2.04601	60

**Table 9: Regression analysis for the factors influencing profit of smallholder irrigation scheme at Mvumi village in Kilosa District**

Variable (Independent)	Std. Error	$\beta$ Coefficients	T	Sig.
Constant	92 554.015		0.418	0.677
Age of Household head	1 261.059	-0.001	0.014	0.989
Schooling years of Household head	4 164.964	0.049	0.775	0.442
Experience of Household heads in paddy farming	1 729.311	0.030	0.356	0.723
Land size owned by irrigators	31 132.171	0.598***	4.642	0.001
Location (distance) of plots to irrigation water source	112.367	-0.299**	-2.510	0.015
Type seeds of used	61 314.246	0.131**	2.284	0.026
Additional family labour into off- farm activities	4 440.002	-0.136**	-2.185	0.033

\*\*\*Significant at  $p < 0.01$ , \*\*Significant at  $p < 0.05$ , F- value 31.526

#### 4.6 Overall Evaluation of the Model

The multiple regression models used to identify factors influencing income of smallholder irrigating farmers had an F value of 31.526 indicating the presence of an overall goodness

of fit of the model used with the coefficient of determination ( $R^2$ ) value of 0.771 implying that more than 77% of the variation that was observed in the net profit realised by irrigating farmers was explained by the selected independent variables. Nevertheless, these findings imply that approximately 23% of the variations in dependent variable were not captured by the model.

The regression model was tested for the multi co linearity problem, the problem that describes the presence of linear or near linear relationship among explanatory variables. The test was to check if independent variables in the model had this problem so as to take corrective measure. From Table 10 the test of the model on multicollinearity was found through tolerance and Variance Inflation Factor (VIF) test. The higher the inter correlation of the independent variables, the more the tolerance approaches zero, when VIF is high there is high multicollinearity and instability of the coefficients. The VIF has a lower bound of 1 but no upper bound. Authorities differ on how high the VIF has to be to constitute a problem. I tend to get concerned when a VIF is greater than 2.50, which corresponds to an  $R^2$  of 60 with the other variables (Allison, 2012).

**Table 10: The test of multicollinearity for the factors influencing irrigators' profit of smallholder irrigation scheme in Kilosa District**

Variables (Independent Predictors)	Co linearity Statistics	
	Tolerance	VIF
Constant		
Age of the Household head	0.637	1.571
Schooling years of the Household head	0.812	1.232
Experience of Household heads in paddy farming	0.545	1.736
Land distance from source water source to the plots	0.739	1.354
Type seeds of used	0.986	1.014
Family labour used by irrigators in off- farm activities	0.843	1.187
Land size owned by irrigators	0.932	1.073

Therefore, multi collinearly which consists of variables with high VIFs indicated (dummy) variables that represent a categorical variable with three or more categories was

corrected by choosing reference category with a larger fraction of the cases, that may be desirable in order to avoid situations where none of the individual indicators is statistically significant even though the overall set of indicators were significant.

#### **4.7 Income Share from Irrigated and Rain Fed Paddy**

The major economic activities of the household heads in the study area were crop production such as paddy, maize and sun flower, livestock such as cattle, goats and chicken. Off- farm activities included formal employment, local brew, carpentry and petty business such as hair cutting saloon and small sundry shops. The average total income from irrigators' group of paddy farmers was higher than non irrigators group by 28.06%. This implies that irrigation farming has impact on total household income in the study area.

Table 11 shows that all the economic activities undertaken by farmers who practised irrigation, the share of paddy to total household income was 44.23%, followed by maize 15.09%, and sunflower was 14.11%. This category of crops shared 73.43% to total household income of irrigators. The results also showed that livestock sector had shown that cattle comprised of 3.67%, chicken 2.57% and goats 3.50%. In this category, the sector shared 9.74% to household income. This implies that paddy production has the greatest share to household income which is nearly half of the other sources combined under this category.

Regarding the off farm activities, income from petty businesses shared 6.00%, salaries shared 6.40%, followed by local brews 1.71%, carpentry production 1.49%, and other miscellaneous income 1.23%. In general, this category had a share of 16.83% to the overall income of the household.

**Table 11: Average income from irrigators' different sources to average total household income per season at Mvumi scheme in Kilosa District (n=60)**

Source of income	Average variable costs	Average revenue	Gross Margin (Tshs)	Average area ha	Average total income Tshs	share%
<b>Crops</b>						
Paddy	671 685.0	1 921 863.5	1 250 178.50	0.77	962 637.75	44.23
Maize	188 950.0	534 783.3	345 833.30	0.95	328 541.67	15.09
Sunflower	233 186.2	540 300.5	307 114.30	1.00	307 114.30	14.11
<b>Subtotal</b>					<b>1 568 293.72</b>	<b>73.43</b>
<b>Livestock</b>						
Cattle	170 000.0	350 000.00	80 000.00	1.00	80 000.00	3.67
Chicken	5 404.6	11 000.00	5595.38	10.00	55 953.80	2.57
Goats	13 600.0	52 000.00	38 400.00	2.00	76 800.00	3.50
<b>Subtotal</b>					<b>212 753.80</b>	<b>9.74</b>
<b>Off-farm</b>						
Salaries/wages			11 250.00	12	139 354.83	6.40
Petty business	6 757.10	4 130.00	10 887.10	12	130 645.16	6.00
Local brews	4 624.96	7 428.78	2 803.82	12	33 645.84	1.71
Carpentry	1818.20	4 520.38	2702.38	12	32 428.56	1.49
Others	5 328.36	7 560.00	2 231.64	12	30 215.98	1.23
<b>Subtotal</b>					<b>366 290.37</b>	<b>16.83</b>
<b>Total</b>					<b>2 176 413.37</b>	<b>100.00</b>

On the other hand Table 12 shows that rain fed paddy shared 36.56% to total household income, followed by maize 13.13%, and sun flower 8.65%. In general, income from crops counted for 58.13%. On the other hand, goat keeping shared 4.90%, cattle 8.20%, chicken 1.60%, in this category of livestock sector it was noted only 14.79%.

Also, petty business shared 12.18%, carpentry 5.90%, salaries 3.97%, local brews 3.91% and other miscellaneous income 1.10%. This category had a total share of 27.08% to the entire household income for non irrigators .A difference of 7.6% was found between irrigators and non irrigators' total income from paddy

For the non irrigators, petty business contributed 12.18%, carpentry 5.90%, salaries 3.97%, local brews 3.91% and other miscellaneous income 1.10%. This category had a total share of 27.08% to the entire household income for non irrigators .A difference of 7.6%was found between irrigators and non irrigators' total income from paddy.

In addition, 12.18% of non irrigators' income was realised from petty business while 6.00% of the irrigators' income share was from petty business. This shows that non irrigators' share from petty businesses was twice that of irrigators counterpart. This implies that more household labour was devoted in off-farm activities.

**Table 12: Average income from non irrigators' different sources to average total household income per season at Mambengwa village in Kilosa District (n=60)**

Source of Income	Average Variable Cost	Average Revenue	Gross Margin	Average area ha	Average Total Income	Share %
<b>Crops</b>						
Paddy	470 110.00	1 128 440.0	6 583.50	0.96	631 997.28	36.56
Maize	267 975.00	540 237.50	2 722.50	0.82	223 255.25	13.13
Sunflower	245 500.00	560 500.40	3 150.40	0.43	149 585.27	8.65
<b>Subtotal</b>					<b>1 004 838.30</b>	<b>58.13</b>
<b>Livestock</b>						
Cattle	180 000.00	250 000.00	70 000.0	2	140 000.00	8.20
Chicken	5 999.50	10 500.00	4 500.50	6	27 003.00	1.60
Goats	18 533.20	46 666.67	28 133.6	3	84 400.38	4.90
<b>Subtotal</b>					<b>251 403.38</b>	<b>14.79</b>
<b>Off-farm</b>						
Salaries wages			5 625.00	12	67 500.00	3.97
Petty business	42 200.71	59 448.58	17 247.7	12	206 974.48	12.18
Local brews	4 560.01	10 100.00	539.99	12	66 479.85	3.91
Carpentry	3 966.67	12 300.00	333.33	12	100 000.00	5.90
Others	2 150.00	1 965.63	184.36	12	2 212.43	1.10
<b>Sub total</b>					<b>443 166.76</b>	<b>27.08</b>
<b>Grand total</b>					<b>1 699 408.50</b>	<b>100.00</b>

#### 4.8 The Significance Test for the Share of Paddy to Total Household Income

The average income accrued from paddy was tested to know whether its share to total household income was significant. These shares from both irrigators and non irrigators are tested by using independent samples t- test to find out statistical differences. The individual farmers percentage share to total household income of each group of farmers are compared to find out its statistical differences, however, the mean percentage shares of 60 individual farmers of each group, mean standard deviation and mean standard deviation were computed.

From Table 13 the findings shows that the mean percentage of irrigators was higher by eighty percent whereas the mean deviations of non irrigators were approximately higher by two units over irrigators' side, and standard errors of the groups had differences of approximately 0.26 units. This implies that mean different of individual percentage shares of paddy to total household income between two groups were not high.

**Table 13: Independent samples t-Tests between irrigators and non irrigators' paddy share to total household income at Msowero ward in Kilosa District**

		N	Group statistics		
			Mean	Std. Deviation	Std. Error Mean
Group of Irrigators and Non Irrigators	Irrigators	60	44.292	19.53334	2.52174
% shares of paddy to total income	Non Irrigators	60	36.556	21.51646	2.77776

Table 14 shows different percentages of individual income shares from paddy production to total household income between irrigators and non irrigators were statistically tested. The result shows that the difference in shares between two groups to total household income was statistically significant 95% ( $p = 0.05$ ).

Therefore, the null hypothesis was rejected in favour of the alternative hypothesis that irrigators and non irrigators' percentage shares of paddy income to their respective total household incomes were statistically different. This implies that paddy share to total household income of irrigators was higher than that of non irrigators, and income share from irrigated paddy to smallholder farmer's income in the study area was significantly higher than that of rain fed farming.

**Table 14: Irrigators and non irrigators' independent samples t-tests**

Variable		t value	df	Sig.	Mean Difference	Std. Error Diff.	95% Confidence Interval	
							Lower	Upper
% of paddy share Irrigators and irrigators	Equal Variable Assumed	2.053	118	0.024	7.70388	.75169	0.2451	15.13324
	Equal Variable not Ass.	2.053	116.91	0.024	7.70388	3.75169	0.27380	15.13395

## CHAPTER FIVE

### 5.0 CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Conclusions

From the findings of this study it can be concluded that there is significant difference in profit between irrigators and non irrigators practicing paddy farming. Results from independent samples t-test indicated that the gross margin between the groups of smallholder farmers in Kilosa District differed significantly. However, returns to labour were high among irrigating farmers compared to non irrigating farmers implying that irrigation had an impact on farmers' income.

It can also be concluded that farmers' seed types used, plot location with respect to water source and number of households' human labour engaged in off-farm activities were factors that determined farmers' level of profit realized from irrigation farming. Findings from this study revealed that off-farm activities largely influences small holder farmers' income as irrigation farming requires large number of labour, It was found that when irrigators uses more than half of its household's labour in off-farm activities significantly reduced their income, this implies that modern farming inputs are required to reduce number of human labour used in irrigation farming. On the other hand, it was found that off-farm income share from non-irrigators was two times that of irrigators, this implies that there was switching of this group from rain-fed agriculture to petty businesses due unpredicted rainfall.

This study has also found out that far located plots from irrigation water source in the study area were receiving little or inadequate water supply than near plots, this implies that farmers' income for far located plots to irrigation water source was significantly little than of near located plots. This shows that irrigation infrastructure should be improved together with operation and maintenances in order to reduce water supply irregularity.

Irrigated paddy share to the entire household income was about 15.30% higher than rain-fed paddy. Non irrigators' off-farm income category was found to have larger share of 10.28% over irrigators' counterpart. However, Irrigators' petty business share to the entire household income was less than half of non irrigators' group. However, more than fifty percent of influence is explained by the above factors while factors like farmers' age, experience in paddy farming, land and farmers years in schooling need to be investigated further to establish how it influences paddy profitability.

Nevertheless, different percentages of farmers' income shares from paddy production to total household income between irrigators and non irrigators were statistically tested. The result has shown that the difference in shares between two groups to total household income was statistically significant. Therefore, the null hypothesis was rejected in favour of the alternative hypothesis that percentage shares of paddy income between irrigators and non irrigators' to their respective total household income differed significantly.

This implies that paddy share to total household income of irrigators was higher than that of non irrigators, and that share of irrigated paddy farming to smallholder farmer's income in the study area was significantly higher than that of rain fed paddy farming. However, the average variable cost of paddy production per hectare was relatively higher to the irrigators than non irrigators.

## 5.2 Recommendations

In view of the above conclusion, the study recommends as follows:

- i) The deliberate effort should be made to invest more in irrigation projects and improve the already established irrigation schemes in Kilosa District to promote paddy farming. This will increase food production, farmers' income and reduce food insecurity rather than depending on rain-fed farming.
- ii) The improved seeds should be highly promoted and subsidized to allow easy availability so that it can widely used by farmers.
- iii) The government of Tanzania policy of agricultural inputs subsidies should be fully implemented. It should also promote sustainable irrigation projects so as to increase financial capacity in order to use modern inputs.
- iv) The government policies of promoting modern agricultural inputs should be promoted to allow smooth practice of non-farm activities in order to reduce income poverty.
- v) The government of Tanzania and other stakeholders should allocate more funds in agriculture particularly in irrigation farming in order to achieve full operation capacity of these schemes.
- vi) It is recommended that policy actions should focus on factors which significantly affect paddy profitability, thus all development intervention should focus on engagement in off-farm activities, adequate water supply to the paddy plots and seed types to be used.
- vii) The government should facilitate the availability of soft loans and capacity building of farmers in Kilosa to develop irrigation activities.

### **5.3 Further Research**

From the finding of this study the recommendation for further researches is to be made on the impact of farming experience and off- farm activities on smallholder farmer's income in Kilosa District.

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## APPENDICES

**Appendix 1: Questionnaire for irrigators**

Questionnaire No.....

Date of Interview.....

**A. Socio-economic factors that influence production of smallholder-managed irrigation Scheme**

1. Name of respondent ..... Age .....

2. Sex of the respondent.....Male/Female

3. Marital status of the respondent.

a) Single ( )                      b) Married ( )

c) Divorced ( )                      d) Widowed ( )

4. What is your level of Education?

a) No formal Education ( )    b) Primary Education ( )

c) Secondary Education ( )    d) Post Secondary Education ( )

e) Higher education ( )

5. What other activities are you engaged in? (Excluding the main irrigation farming)

a) Livestock farming ( )    b) Small business ( )

c) Selling charcoal ( )    d) Carpentry ( )

e) Bricks making ( )    f) Lumbering ( )

g) Others specify ( )

6. Who in your household is primarily responsible for taking care of the farming activities in the scheme?

a) Husband ( )                      b) Wife ( )

c) Children ( )                      d) employees ( )

e) Relatives staying within ( )

7. Apart from irrigation farming, what is your main alternative source of income?

a) Government employment ( )    b) Self employment ( )

c) Private company employment ( )    d) others, specify ( )

8. What role do you (respondent) play in the scheme?

- a) A scheme leader ( ) b) A member of irrigation association ( )
- c) A block/area leader ( ) d) A farmer ( )
- e) Others (specify) ( )

9. The household size (number)

10. Number of family members who engage in irrigation activity ( )

11. Number of family members who engage in non irrigation farming activity ( )

12. Number of households members who engage in farming activities full time ( )

13. Number of household members who engage in farming activities part time ( )

**B. Land tenure/ownership in the scheme and farm production**

1. Size of land you own.....in acres

2. What is the total size of land/plot you own in the scheme ..... acres.

3. Of the above owned land how many acres you actually irrigate...acres

f) Can you access land from the irrigation scheme? 1=Yes 2=No ( )

g). If no, what hinder you from accessing land from the scheme?

- i. ....
- ii. ....

4. In the last cropping seasons what was the size of land under paddy cultivation in 2010/2011?

	Area in acres
Land under crop cultivation	
Land rented out	
Land rented in	
Land left uncultivated	
Total areas	

5. What was the farm size that you cultivated in the year 2010/2011 that received sufficient irrigation water.....in acres?



**D. Household's Income.** How much money do you earn from farming activities in 2011 crop season?

Sources of income	Amount of output sold (Bags, kgs)	Price per unit (Tsh.)	Total amount (Tsh.)
<b>Sales of crops</b>			
Paddy (under irrigation)			
Maize			
Beans			
Banana			
Sunflower/ Simsim			
Others			
<b>Sub- total income (crops)</b>			
<b>Livestock and livestock Product sales</b>			
Cattle			
Goat/ sheep			
Chickens			
Milk			
Eggs			
Skin			
Pigs			
Manure (Cow dung)			
Land rent out (If any)			
<b>Sub- total income</b>			
<b>Grand total</b>			

**E. Income from Off-Farm Activities**

Apart from crop farming activities, what other activities bring income into your

Household, and how much did you get from those activities in 2011 crop season?

Sources of income	Average monthly income	Average Annual Income
Formal employment (e.g. Teacher, doctor)		
Brewing and selling local brew		
Carpentry and joinery		
Selling charcoal / firewood		
Petty business		
Others		
<b>Subtotal income from off farm activities.</b>		
<b>Grand Total income (Off farm and farm activates</b>		

**D. Sustainability of Irrigation scheme**

1. Did you engage largely in off farm activities last season?

1= Yes 2=No ( )

2. Did you get any training before this scheme was handed to you (farmers)?

1= Yes 2=No ( )

3. Is there any contract given to you from the former scheme operator on maintenance?

1=Yes 2= No ( )

4. Do you save money each year for maintenance purposes?

1=Yes 2= No ( )

5. If no, how do maintenance operations is performed?

..... No

6. Do you repair/construct plot bund before ploughing or paddling? 1=Yes 2=No

( )

7. When do you repair /construct plot bunds?

a) At the end of harvesting season ( )

b) Before starting the new season ( )

8. Was the irrigation water sufficient to make the crop grow well?

a) Sufficient ( )

b) Partially enough ( )

c) Not at all ( )

9. Do you know how to do proper seed preparation for various crops?

0=Yes 1=No ( )

10. What type of paddy do you used in this season?

1=SAROS (TXD 306) , 0= SUPA

**F. Benefit from farming in the scheme**

1. Has the crop yield increased due to irrigation?

1= Yes 0= No ( )

2. If yes, other reasons might have accompanied irrigation to increase the yields?

a) Adequate ( ) b) Availability of inputs ( )

b) Availability of credit ( ) d) Extension services ( )

e) Other Specify ( )

3. If No, what are the reasons that might have accompanied loss in crop yield?

a) Inadequate water ( ) b) Lack of inputs ( )

c) Lack of credits ( ) d) Lack of extension service ( )

e) Other Specify ( )

4. How do you benefit from farming in the scheme? (Tick appropriate)

a) Be assured of food security( ) b) Able to build good house ( )

c) Able to meet health requirement for the family ( )

d) Able to meet education requirement for the ( )

e) Able to meet dressing requirement ( )

f) Others (specify) ( )

5. What is the trend of your income from farming activities in the scheme?

**G. Farming techniques for other crops**

1. Do you cultivate crops other than rice? 1=Yes 2=No ( )

2. Which crops do you cultivate?

a)..... b).....

c)..... d).....

3. Do you irrigate on other crops? 1=Yes 2=No ( )

a) Increasing ( ) b) Decreasing ( )

c) No change ( )

**H. Other information**

4. Are you a member of the water user association/farmers organisation in the scheme?

1=Yes 2=No ( )

5. Have you paid organization contributions in the last season? 1=Yes 2=No ( )

6. If Yes, How much you were supposed to pay in total? ..... Tshs

7. How much did you manage to pay? ..... Tshs

8. Are there any technical personnel in the scheme? 1=Yes 2=No ( )

9. On your opinion, are the technical advices or services provided adequate?

a) Completely adequate ( )

b) Partially adequate ( )

c) Not adequate ( )

10 a) Are you a member in any microfinance institutions ie, SUCCOS?

1=Yes 2=No ( )

b) Do you have good access to loans from financial institutions?

1=Yes 2=No ( )

i. If no, what hinder you from accessing loans from these institutions?

.....

ii. ....

**J. Accesses to credits:**

Source	Accesses		
	Easy	Moderate	Difficult
Farmers' organization			
District council			
Banks (NMB,CRDB,VICOBA)			
NGO's			
Other Organizations (specify)			

11. How much credits have you received in 2010/11 season for farming activities?

.....Tshs

12. What are the interest rates for the credit offered?

13. Do you think the lack of these loans have effects on your paddy cultivation? 1=Yes

2=No

If yes, to what extent does it affects you? 1= low 2= moderate 3= high ( )

14. What are the problems related to the accessibility of land/plot in the scheme?

i. ....

ii. ....

14. What are the problems related to the fields/farms structures and water management?

i. ....

ii. ....

15. What challenges do you face in farming in the scheme?

i. ....

ii. ....

16. What are constraints related to access to extension service for you in the scheme?

i. ....

ii. ....

17. In your opinion, what can be done to deal with these challenges?

i. ....

ii. ....

**Appendix 2: Questionnaire for non- irrigators**

Questionnaire No.....

Date of Interview.....

Name of the respondent..... Age.....

Sex of the respondent.....Male/Female

**3. Marital status of the respondent.**

- a) Single ( )      b) Married ( )  
 c) Divorced ( )      d) Widowed ( )

**A. Socio-economic factors that influence production of smallholder-managed irrigation scheme**

4. The household size (number) ( )

5. Family members who engage in farming activities ( )

6. House hold members who engage in farming activities full time ( )

7. Household members who engage in farming activities part time ( )

**8. What is your level of Education?**

- a) No formal Education ( )  
 b) Primary Education ( )  
 c) Secondary Education ( )  
 d) Post Secondary Education ( )  
 e) Higher education ( )

9. Which crops do you cultivate? Name the most frequently cultivated and indicate if irrigated or not irrigated.

a).....

b).....

10. Who in your household is primarily responsible for taking care of the farming activities?

- a) Husband ( )
- b) Wife ( )
- c) Children ( )
- d) employees ( )

e) How many relatives are staying with your household ( )

11. Apart from crop farming, what is your main alternative source of income?

- a) Government employment ( )
- b) Self employment ( )
- c) Private company employment ( )
- d) Other ( )

**B. Land tenure/ownership and crop production**

12. What size of land do you own? .....acres

13. How did you obtain the land you own?

- a) Inherited ( )
- b) Bought ( )
- c) Given by village Government ( )
- d) Accessed free land ( )
- e) Others Specify ( )

3. In the last cropping seasons what size of land did you manage to cultivate 2010/2011?

	Area in acres
Land rented out	
Land rented in	
Potential Land uncultivated	
Total	



**C2: Costs of purchased inputs**

s/n	Activity	Crop 1.....			Crop 2.....			Crop 3.....		
		No. of units	Cost per unit (Tsh)	Total cost	No. of units	Cost per unit (Tsh)	Total cost	No. of units	Cost per unit(Tsh)	Total cost
xii.	Fertilizers									
xiii.	Insecticides									
xiv.	Herbicides									
xv.	Seeds									
xvi.	Hand hoes									
xvii.	Others									
xviii.										
<b>Grand total for inputs</b>										

**E. Household's Income**

1. How much money did you earn from farming activities in 2011 crop season?

Sources of income	Amount of output sold(Bags, kgs,e.t.c)	Price per unit (Tsh.)	Total amount (Tsh.)
<b>Sales of crops</b>			
Paddy (under rainfed)			
Maize			
Beans			
Banana			
Sunflower/Simsim			
Others			
<b>Sub- total income (crops)</b>			
<b>Livestock and livestock Product sales</b>			
Cattle			
Goat/ sheep			
Chickens			
Milk			
Eggs			
Skin			
Pigs			
Manure (Cow dung)			
Land rent out (If any)			
<b>Sub- total income</b>			
<b>Grand total</b>			

**F. Income from Off-Farm Activities**

What is your primary occupation? -----

What are other occupations you rely on? -----

Household and how much did you get from those activities in 2011 crop season?

Sources of income	Average monthly income	Average Annual Income
Formal employment (Teacher, doctor) Formal pension		
Brewing and selling local brew		
Carpentry and joinery		
Selling charcoal / firewood		
Petty business		
Others		
<b>Subtotal income from off farm activities</b>		
<b>Grand Total income (Off farm and farm activities</b>		

**G. Benefit from crop farming**

1. How do you benefit from farming activities?

- a) Be assured of food security ( )
- b) Able to build good house ( )
- c) Able to meet health requirement for the family ( )
- d) Able to meet education requirement for the family ( )
- e) Able to meet dressing requirement ( )
- f) Others (specify) ( )

2. What is the trend of your income from farming activities?

- a) Increasing ( )
- b) Decreasing ( )
- c) No change ( )

**H. Other information**

1. Are there any agricultural field officers in this area? 1=Yes 2=No ( )

2. On your opinion, are the technical advices or services provided adequate?

a) Completely adequate ( )

b) Partially adequate ( )

c) Not adequate ( )

3. Do you have good access to loans from financial institutions?

1=Yes 2=No ( )

If no, what hinder you from accessing loans from these institutions?

i. ....

ii. ....

**I. Accesses to credits:**

Source of loans	Accesses		
	Easy	Moderate	Difficult
Farmers' organization			
District council			
Banks (NMB, CRDB, VICOBA)			
NGO's			
SACCOS			
Other Organizations (specify)			

1 Do you think the availability of these loans affects your paddy cultivation?

1=Yes 2=No ( ) If yes, to what extend 1=high 2=moderate 3= high ( )

2. How much credits have you received in 2010/11 season for farming activities?

..... Tshs

3. What are the interest rates for the credit offered?

4. What are the problems/ challenges related to access land?

iii. ....

iv. ....

5. What are the problems related to the fields/farms structures and water management?

v. ....

vi. ....

6. What challenges do you face on farming activities in this area?

iii. ....

iv. ....

7. What are constraints related to access to extension service for you in the farming activities?

iii. ....

iv. ....

8. What in your opinion can be done to deal with these challenges?

iii. ....

iv. ....