IMPACT OF IRRIGATION FARMING ON WOMEN EMPOWERMENT, FOOD SECURITY AND POVERTY STATUS IN NORTH-WEST PROVINCE, SOUTH AFRICA

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DECLARATION

I, Sibongile Sylvia Tekana declare that the dissertation for the degree of Doctor of Philosophy in Agriculture Economics at the North West hereby submitted, has not previously been submitted by me for a degree at this university or any other University, that it is my own work in design and execution and that all material contained herein has been duly acknowledged.

Signed: 

Date:

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ABSTRACT

Women play a critical and potentially transformative role in agricultural growth in developing countries, but they face persistent obstacles and economic constraints limiting further inclusion in agriculture. This is because women are marginalised because of social and cultural exclusion they face in their communities. This study examine the impact of irrigation farming on women empowerment, food security and poverty status in the North West Province of South Africa. A probability sampling method involving simple random sampling techniques was adopted to select the respondents and a sample if 120 farmers was be randomly selected to obtain a representative sample from the participating farmers on the schemes. A structured questionnaire with open and closed ended questions was used to collect demographic information on their socio- economic status, women empowerment, food security, competency and training needs, institutions that support women. Data was analysed by using the Statistical Packages for Social Science (SPSS). Descriptive statistics such as frequency distribution, percentages, mean and standard deviation were used while Linear regression, Probit and FGT model were used as inferential statistics.

The results shows that most of the respondents were in the age bracket of 41 to 50 years (72%), married (42.2 %), primary education (32.5%). 66.3% of farmers have farming experience ranging from 1-10 years. With regard to income sources pension was the greatest non-farm contributor (30%). Fifty percent of the women had low SES scores,40% low in competency skills and more than 50% get support from different institutions for their farming productivity. Significant determinants of empowerment were expenditure (t = 1.68), drip irrigation type (t = 1.71). In the Probit model to analyse food security the results showed that the significant variables included household expenditure (t=-1.9), marital status (t= -2.37), non-farming activities(t=1.53), farming expenditure(t=1.76),income, central pivot(t=-2.71), sprinkler irrigation(t=0.77), micro(t=- 3.44) and drip irrigation(t=-2.19). The study also examine the empowerment indices to show different areas where women are empowered and this covered in this study include the use of income (53%) are disempowered, about 60.2% 0f women are disempowered in access to productive capital and access to credit ,while about 50% are empowered in leadership and decision making.

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DEFINITION OF ACRONYMS AND ABBREVIATION

FAO :Food and Agricultural Organisation

IFAD: International Fund for Agricultural Development

IFPRI: International Food and Policy Research Institute

IMT: Irrigation Management Transfer

PTO: Permission to Occupy

SADC: Southern Africa Development Communities

SES: Socio-Economic Status

STATSSA: Statistics South Africa

WEAI: Women Empowerment in Agricultural Index

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the study

Agriculture is a vital sector of the economy of many developing countries as it significantly contributes to domestic production and employment (FAO, 2006). Agriculture as an economic activity and as a provider of environmental services, it is critical for development (World Bank, 2008). Agriculture is the main source of livelihood for 86% of rural households and 75% of the poor people still live in rural areas and derive the major part of their income from the agricultural sector and related activities (Dethier and Effenberger, 2012).

Agriculture is crucial because of its significant contribution to ensuring food security, which remains a major challenge in many developing countries. World Bank (2007) noted that agricultural production is important for food security as it is a source of food for the majority of the rural poor, especially due to the variable nature of domestic production, which includes the limited tradability of food staples and foreign exchange constraints in terms of the ability to purchase imports. Close to half of South Africa's population (45%) resides in rural areas. In KwaZulu-Natal, 56.7% of the total population and 54% of women reside in rural areas. In South Africa, an estimated four million people engage in smallholder agriculture and the majority of these people are in rural areas (Baiphethi and Jacobs, 2009). The most common reason given for engaging in agriculture is to procure "an extra source of food''. More than half of the rural households in South Africa are headed by women and are among the poorest of the poor (Thabethe and Mathe, 2010). Women make up a substantial majority of the agricultural workforce and produce most of the food that is consumed locally (World Bank, 2008). The large proportion of agricultural production that is attributable to woman makes them the principal agents of food security and household welfare in rural areas. However, lack of skills, especially agricultural, among rural women results in

poor performance and negatively affects their livelihoods and that of their households (Machethe, 1990 cited in Chibanda *et al.*, 2009).

Women play a pivotal role in agriculture, FAO (2011) describes women in agricultural production in developing countries and noted that rural women manage households and pursue multiple livelihood strategies. Efforts towards ensuring food security have identified women farmers as key role player in many contexts and set up. Women can be farmers on their own farms and as unpaid workers on family plots. Women produce food (staples) and cash crops and manage mixed agricultural operations involving crops, livestock and fish farming (FAO, 2011). However, women's role in agriculture remains unrecognized in policy formulation and resource allocation (IFAD, 2010).

Among myriad of reasons for low agricultural productivity in many developing countries is the fact that women lack resources and opportunities to make the most productive use of their time. Quisumbig (1996) argues that woman's lower levels of human and physical capital result in lower agricultural productivity. In poor areas where men have been forced to migrate in search of work, women often have the sole responsibility for farming and raising children (IFAD, 2011). Women as smallholder farmers are *marginalized* and face significant challenges to engaging productively in agricultural activities. Rural women are vulnerable to both economic and social shocks and stresses such as indebtedness due to economic, food insecurity, health problems, lack of access to inputs and gender discrimination in the ownership of productive assets (Holmes & Jones, 2009). Nkala *et al.* (2011) also argue that women experience problems of inadequate farming knowledge and skills. IFPRI (2012) presented the Women's Empowerment in Agriculture Index (WEAI) tool to measure the roles and extent of women's engagement in the agriculture sector in five domains: decisions about agricultural production, access to and decision-making power over productive resources, control over use of income, leadership in the community, and time use. It also measures women's empowerment relative to men within their households.

A major intervention to improve agricultural productivity as the principal source of income for many households in rural areas of developing countries farmers is the introduction of irrigation to supplement water supply for farming activities. In the right environment and correct practices irrigation provides more yield than rain fed agriculture (IPTRID, 1999). It further suggests that with population growing at a high

pace the use of irrigation would contribute to increasing yields which can ensure food security. Irrigation as defined by IPTRID (1999) is "agriculture where the supply of water is increased by artificial means, involving the use of water control technology and including drainage to dispose of excess water". The improvement of irrigation is for the benefit of farmers so that they may realize a desired income. Neubert *et.al* (2007) indicated that the use of irrigation has doubled if not tripled farmer's income. Farmers in Iran who used irrigation even went to the extent of intensifying production by changing cropping patterns thus realising increased yields (Ijarpoor and Latif, 2011) and that irrigation had other positive impacts on the rehabilitation and availability of health, education, employment, accessibility and education. Most smallholder irrigation schemes are found in the former homelands of South Africa, where the incidence of poverty is high (May, 2000; Aliber, 2003). In these socio-economic environments, smallholders' irrigation schemes present an attractive opportunity for the development of local livelihoods. Louw et.al, (2008) stated that access to skills, technology, markets and factors of production can alleviate poverty. Total value or output can be maximized when factors of production are used applied together with advanced technology at their optimum levels.

To enhance the productivity and impact of agriculture through irrigation for food security and poverty alleviation, the New Growth Path for South Africa identified that employment creation is possible, both within economic sectors as conventionally defined and in cross-cutting activities and analysed the policies and institutional developments required to take advantage of these opportunities. The agricultural value chains was identified as a job driver through the restructuring of land reform to support smallholder schemes with comprehensive support around infrastructure, marketing, extension; upgrade employment in commercial agriculture especially through improved worker voice; measures to support growth in commercial farming while addressing price fluctuations in maize and wheat. This will target 300 000 households in smallholder schemes by 2020; agro-processing anticipates creation of 145 000 jobs by 2020; upgrade employment on commercial farms (currently total of around 660 000). It is expected that these projections will adequately cover women farmers since they form the bulk of the smallholder farmers (Department of Economic Development, 2011)

1.2 Problem statement

As stated by Kehler (2001) women are defined in a society according to their ability to carry and raise children whereas men are defined according to their ability to provide. Kehler (2001) further explains that the value that men have in sustaining the family is more appreciated that the women's contribution. Even when taking care of children, if they work on the farm they are expected to juggle all those activities that demand her time. Women are the ones who are mostly disadvantaged in that they live in rural areas and informal settlements with limited or no access to basic services that may hamper with their livelihood (Kehler, 2001). Since women are defined by their reproductive ability they are the ones who feel pinch the most when services are not accessible to them (Kehler, 2001). When services are made available and accessible they are able to save the time (that they would spend trying to look for alternative means to make up for services that are not provided to them) and this would increase their productivity on the farm. These may be services for either rehabilitation of irrigation systems, from extension officers and or basic services provided by the government. They are mostly employed on a seasonal or temporary basis receiving low remuneration compared to men, and receiving no additional assistances like medical, maternity or pension benefits even bonuses Kehler (2001). They are also not granted any rights to land (Kehler, 2001). This research seeks to investigate whether irrigation ensures an improved standard of living for women who are involved in an irrigation scheme. Women are farmers for various reasons, some become farmers because they inherited land from their parent(s) who have either passed away or are old and cannot carry out farm practices. Others assume the position because their partner has either passed away, migrated or they have separated. Women are also farmers because some have genuine interest in the field. They are gradually assuming their role in the farming sector even thou in other places it might be a taboo for a woman to be a farmer.

Women face more challenges in agriculture than men, as stated by FAO (2011) they do not have access to resources and opportunities for production like men do. This gap hinders optimum productivity and their overall contribution to the sector (FAO, 2011). If this gap is closed more would be supplied to the market and livelihoods of female farmers would be secured. Yields would increase by 20-30 percent if this gap is addressed, reducing numbers of the hungry in developing countries by 12-17 percent

(FAO, 2011). Government can bridge this gap through gender sensitive policies that can address women's needs and enhance their production potential.

Elsenburg (2009) stated that in 2007 there were 48 662 agricultural households in the North-West Province which is only a small proportion of the total households (nonagricultural households). Even if this is a small percentage it still shows that agriculture remains the main supplier of food and income for some households in the province. The Gini coefficient for agricultural households in North West Province for 2007 was 0.62 as against 0.75 for the whole of South Africa. This indicates high IPTRID (1999) indicated that poverty can be broken down into two categories which are absolute and relative poverty, absolute poverty being inability of a people to meet their basic needs while relative poverty being inability to access resources that are viewed as normal in a given society (IPTRID, 1999).

Women play a critical and potentially transformative role in agricultural growth in developing countries, but they face persistent obstacles and economic constraints limiting further inclusion in agriculture. The Women's Empowerment in Agriculture Index (WEAI) tool measures the empowerment and inclusion of women in the agriculture sector in an effort to identify ways to overcome those obstacles and constraints. The Index is a significant innovation in its field and aims to increase understanding of the connections between women's empowerment, food security, and agricultural growth. It measures the roles and extent of women's engagement in the agriculture sector in five domains: decisions about agricultural production, access to and decision-making power over productive resources, control over use of income, leadership in the community, and time use. It also measures women's empowerment relative to men within their households. A major indicator of empowerment is food security.

Several studies have been carried out to assess household food security in the semi-arid areas of Southern Africa. Most of these studies have shown that there are many factors that are involved in enhancing food security such as irrigation, land quality, incomes, size of household, wealth of farmers and land size. Obadire et al. (2010), identified low level of managerial and technical skills and inadequate training as the major determinants of low level of productivity and household food insecurity. Among these factors water has been highlighted as the most limiting factor to food security in rural

communal areas (FAO, 1997).The introduction of smallholder irrigation to enhance livelihood and food security has been long in the North West Province. There have been various degrees of support given to smallholder irrigation in the pre and post-apartheid periods in the North West Province. This study attempts to examine the impact of irrigation farming on women's empowerment, food security and poverty status.

1.3 Research questions

The research seeks to address the following questions:

1. What are the demographic characteristics of women in irrigation farming?
2. What livelihood assets are available to women in the irrigation farming?
3. What is the socio-economic status of the women farmers in irrigation farming?
4. Are women in irrigation farming food secured?
5. Does irrigation farming reduce poverty among women?
6. What is the level of women empowerment in irrigation farming?

1.4 Objectives of the study

The main objective of the study is to examine the impact of smallholder irrigation farming on women empowerment, food security and poverty status in the North West Province.

The specific objectives are to:

1. Determine demographic characteristics of women in irrigation farming;
2. Examine the livelihood assets available to women in the irrigation farming;
3. Describe the socio-economic status of the women farmers in the irrigation farming;
4. Investigate the food security status of women in irrigation farming;
5. Assess the poverty status of women in irrigation farming;
6. Identify the level of empowerment in irrigation farming;
7. Determine women's competency and training needs;

1.5 Hypothesis

H_0 – State the null hypothesis

H_A – State the alternative hypothesis

There is no significant relationship between socio-economic factors and food security.

There is no significant relationship between socio-economic factors status and empowerment.

There is no significant difference in poverty incidence among women in irrigation farming.

1.6 Definition of Concepts

Food security – the availability of nutritionally adequate and safe food, as well as an assured ability to acquire acceptable food in a socially acceptable way without resorting to emergency food supplies, scavenging, stealing or other such coping strategies.

Community food security- a condition whereby the residents in a community can obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximises community self-reliance and social justice.

National food security – is the condition whereby the nation is able to manufacture, import, retain and sustain food needed to support its population with minimum per capita nutritional standards.

Household food security- is the availability of food in one's home which one has access to.

Food availability -refers to the physical presence of adequate food suppliers, for instance the physical ability of a particular area of land to produce food.

Food accessibility – is the ability of people within a particular country or region to actually receive or gain access to food.

Food utilization- refers to the health conditions of the household to meet the dietary needs.

Food insecurity – is a situation in which individuals have neither physical nor economic access to the nourishment they need.

Chronic food insecurity - is a continuous insufficient food due to lack of resources to produce or acquire food.

Transitory food insecurity -is a temporary decline in the household's access to enough food. It is caused by instability of food production prices and incomes.

1.7 Chapter summary

This chapter presented the introduction to the study by creating a caveat and background, the objectives and justification for this study as well as the hypothesis set out in the study. The research questions highlighted the direction for the study and the issues covered in the implementation of the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

These section covers literature review of the study. The section covers the heading such as women in agriculture, women's access to productive resources, irrigation and poverty reduction, An overview of irrigation farming, women empowerment in agriculture which includes five domains of empowerment (5DE) and gender parity Index (GPI).Women, irrigation and poverty, Irrigation and food security.

2.2 Women in agriculture

Agriculture is a source of employment for most women; this differs across different regions (FAO, 2011). Women in agriculture play different roles; this depends largely on their level of education and farming competency level. Different roles also have a level of remuneration attached to it. They are mostly employed on a seasonal or temporary basis receiving low remuneration compared to men with no additional assistances like medical, maternity or pension benefits even bonuses Kehler (2001). Even when they are skilled they tend to receive low wages than men, however other industries like exports and agro processing affords women better opportunities. According to FAO (2011) contract farming and high-value products offer more opportunities to women than men, however the level of income unknown. Women have so many roles to play, they engage in family activities that do not generate income like taking care of children and other domestic chores. In agriculture they are preoccupied with agricultural crop production, tending livestock, managing the farms, selling their produce to the market.

In sub-Saharan Africa women were long encouraged to work for themselves, making it a norm for women to work in the agricultural sector, the highest labour force in the world is found in this region (FAO, 2011). Eastern and Southeastern Asia women are also involved in the activities of the sector; they are almost as high as in sub-Sahara Africa with China having a share of 48 percent of women in the labour force.

To assess whether *"female farmers are as productive as male farmers"* the basis for comparison is output per hector of land, or yield. According to FAO (2011) women are just as effectual as men and have the potential to achieve same yields however there is a need for equal distribution of resources. One cannot argue that men and women are the same, however in this global age they both should be presented with privileges that would not put one gender group better off while leaving the other worse off.

Women work in agriculture as farmers on their own account, as unpaid workers on family farms and as paid or unpaid labourers on other farms and agricultural enterprises. They are involved in both crop and livestock production at subsistence and commercial levels. They produce food and cash crops and manage mixed agricultural operations often involving crops, livestock and fish farming. All of these women are considered part of the agricultural labour force. Based on the latest internationally comparable data, women comprise an average of 43 % of the agricultural labour force of developing countries. The female share of the agricultural labour force ranges from about 20% in Latin America to almost 50 % in Eastern and South Eastern Asia and Sub-Saharan Africa. Women in sub-Saharan Africa have relatively high overall labour-force participation rates and the highest average agricultural labour-force participation rates in the world. Cultural norms have long encouraged women to be economically self-reliant and traditionally give women substantial responsibility for agricultural production in their own right (FAO, 2011).

2.3 Women's access to productive resources

Access to productive resources such as land, modern inputs, technology, education and financial services is a critical determinant of agricultural productivity. Agriculture is important to women, but female farmers have less access to the productive resources and services required by agricultural producers. Women are less likely than men to own land or livestock, adopt new technologies, use credit or other financial services, or receive education or extension advice. In some cases, women do not even control the use of their own time. While the size of the gender gap differs by resource and location, the underlying causes for the gender asset gap are repeated across regions: social norms systematically limit the options available to women. Regardless of cause or magnitude,

however, the gender asset gap reduces the agricultural productivity of women and thus involves broader economic and social costs (FAO, 2010).

According to FAO (2011) in developing countries there are about 43 % of women working in agriculture. Women become farmers for various reasons, some become farmers because they inherited land from their parent(s) who have either passed away or are old and cannot carry out farm practices. Others assume the role because their partner has either passed away, migrated or they have separated. Women are also farm because some have genuine interest in the field. They are gradually assuming their role in the farming sector even thou in other places it might be a taboo for a woman to be a farmer.

Women face more challenges in agriculture than men, as stated by FAO (2011) they do not have access to resources and opportunities for production like men do. This gap hinders optimum productivity and their overall contribution to the sector (FAO, 2011). If this gap is closed more would be supplied to the market and livelihoods of female farmers would be secured. Yields would increase by 20-30% if this gap is addressed, reducing numbers of the hungry in developing countries by 12-17% (FAO, 2011). Government can bridge this gap through gender sensitive policies that can address women's needs and enhance their production potential. According to STATSSA (2007) there are more women in all nine provinces who are involved in farming than men. This shows that if given resources women can be produce more agricultural output. The challenge that many arise from these is that there may be more women involved in farming however they receive very low or no remuneration hence there are less male farmers in all the provinces. Gauteng has the least number of farmers while the Western Cape has the highest number of farmers.

2.4 Irrigation and poverty reduction

For irrigation to be viable a reliable water source should be available. Water may be from dams or underground. To make use of the water from the rivers, a licensed right from the department needs to be used, and a charge is associated with that right. With farmers that use underground water, borehole water needs to be dug so as to access the water and again a fee will be charged for channelling that water source.

South African is known as a dry country which is likely to face water shortages in the near future (du Plessis *et.al*, 2002). Consent for farmers is to turn water into an economic good for crop production (du Plessis *et.al*, 2002). North-West Province has an annual rainfall of 300-700mm per annum (and most of the rainfall occurs in the summer seasons). Thus the use of irrigation schemes is a reliable means to ensure that crops are watered at right frequencies and time slots. As stated by Neubert *et.al.* (2007) irrigated agriculture is an improved means for food security other that rain-fed agriculture. Most irrigation schemes were formed by the past government of Bophuthatswana, and this government gave farmers these irrigation systems. Even with their small hectares irrigation schemes have the potential to increase to their potential yield because of the use of their irrigation methods. One can then say that irrigation can ensure poverty alleviation.

However there are other factors that should be considered one of them being the cost of water, electricity, labour and the maintenance associated with irrigation. These costs cause a reduction in their income, a worst case scenario would be when the crop fails to grow. Even in such a case the farmers has to meet her credit obligations though she did not generate income, thus the farmer becomes worse off. Irrigation can enable the farmers to generate income there are costs that may leave her worse off.

Motsi and Madyiwa (2007) have reported that poor maintenance and operation of irrigation has affected the performance of irrigation schemes. Maintenance is largely affected by the design of scheme, capital available, resources and individuals running the scheme (Motsi and Madyiwa, 2007). Commercial farmers who own irrigation systems are in a position to make any decision for they stand as individuals while in irrigation schemes farmers always take collective decisions (Motsi and Madyiwa, 2007). This may affect the functionality of the scheme when disagreements take place.

Motsi and Madyiwa (2007) suggest that women and children have many off farm responsibilities and further more they have to fulfill their on farm obligations. Planners must bear in mind challenges faced by women; schemes must be friendly to both men and women.

2.5 An overview of irrigation farming

Irrigation is the supply of water to agricultural crops by artificial means designed to permit farming in arid and semi-arid or semi-humid regions. As such, irrigation plays a great role in providing water to expanding population and seems destined to play an even greater role in the foreseeable future. This is because the requirements of a growing population demand intensification of land and water use for increasing and stabilizing agricultural production (Kijne, 1999).

The main purpose of irrigation establishment around the world is to provide industrial crops to the growing agro-industries. Initially, irrigation was seen as part of the modernisation and socialisation of the country's economy. Moreover, irrigation schemes were considered an important investment for improving food security and rural incomes through increased agricultural productivity and production as well as the growing pressure on the land by bringing the unused land under cultivation.

Smallholder irrigation development has shown throughout the world that it can be used as a key drought mitigation measure and as a vehicle for the long- term agricultural and micro-economic development of a country. Successful smallholder irrigation can result in increased productivity, improved incomes and nutrition, employment creation, food security and drought relief savings for the government (FAO, 2000). Over the last three decades, a large number of countries around the world have adopted programmes to transfer management of irrigation systems from government agencies to water users associations or other private sector entities (Johnson, *et al.,* 1995).

In Mexico, IMT is considered as one of the most successful and ambitious programme in the world. The main objective of the programme was to reduce public expenditure on irrigation operation and management. The programme also provided on farm development initiatives, to enhance farm level productivity and water conservation. A further objective was to restore economic growth by using a system of pricing water-based on international prices, marginal costs, or scarcity value (Kloezen *et. al* 1997).

In Africa the irrigation management transfer began with reforms that entailed the drastic curtailment of the functions of parastatal agencies responsible for providing support services and management of irrigation schemes. In many African countries, the management of smallholder irrigation schemes by parastatal agencies has left behind a

legacy of a dependent and an impoverished group of farmers. Often, such management has degenerated into oppressive spoils systems that destroyed all pre- existing informal institutions (Kabutho and Mutero, 2002).

The downsizing and withdrawal of government support have led to the contraction or collapse of smallholder irrigation systems across Africa, from Sudan to South Africa, Senegal and Kenya. In contrast to the failure of state-sponsored smallholder irrigation, commercial irrigation operations in which commercial farmers pay for efficient irrigation services have generally remained operational and profitable (Shah *et al.,* 2002). Given that experience, Shah *et. al.* (2002) call for a shift in government approach to irrigation management in Africa, with private-sector firms or professionals.

In South Africa, the term smallholder or small-scale irrigation is mainly used when referring to irrigated agriculture practised by black people. South Africa has about 1.3 million ha under irrigation, of which 0.1 million ha is in the hands of smallholders (Backeberg, 2006). Smallholders have been categorised into four groups, namely: farmers on irrigation scheme; independent irrigation farmers; community gardeners; and home gardeners (De Lange, 1994; Crosby *et al;* 2000; Du Plessis *et al* 2002). According to Backeberg (2006), smallholders' irrigators in South Africa ranges between 200 000 and 250 000ha but most of them are farming on small plots primarily to provide food for home consumption.

Bruwer and Heerden (1995) and Backeberg and Groenewald (1995) have documented the history of irrigation development in South Africa at large, identifying several eras, which Backeberg and Groenewald (1995) linked to economic development of the country. The different eras identified were characterised by specific policy and irrigation technology. These eras can be identified as follows: the first era of smallholder irrigation development occurred during the 19th century and can be referred to as the peasant era.

The second era was referred to as the mission diversion scheme era, because it was associated with mission activity and the emergence of African peasantry (Bundy, 1988, Bruwer and Van Heerden, 1995). Smallholder irrigation development were also private and the technology used (river diversion) was similar. The peasant and mission diversion scheme era was not very important and much of what was developed had seized to function by the end of the 19th century.

Renewed smallholder irrigation development occurred several decades later in the form of canal irrigation schemes. Most of the smallholder schemes that were established during this era were constructed after the Second World War. They were primarily aimed at providing African families residing in the "Bantu Areas" with full livelihood (The Commission for the Socio-Economic Development of the Bantu Areas within the Union of South Africa, 1955, hereafter referred to as the Tomlinson Commission, 1955). The "Bantu Areas" were created by the Land Act of 1913 and the Land and Trust Act of 1936, which largely restricted land ownership by black people in South Africa to these territories. The Tomlinson Commission (1955) identified "smallholdings on irrigation schemes in the north of South Africa that were supervised by Europeans" as the most successful smallholder farm enterprises in the "Bantu Areas". Surveys established that in 1952-53, on this type of schemes, the mean farm income derived from plots of 1.5 morgen (1.28 ha) and a livestock holding of 5.2 animal units, was £1P/ year. On average, 55 % of this income was obtained in the form of own consumption and 45 % from the sale of produce. By contrast, The Commission (1955) found that nationwide, the mean annual income among rural families with livelihoods that were completely land-based was only £57. Consequently, the Commission (1955) recommended that smallholder irrigation development be used as one of the strategies to provide full land-based livelihoods to black families in the "Bantu Areas".

The Tomlinson Commission (1955) covered 122 smallholder schemes, existing or under construction, covering a total area of 11 406 ha involving a total of 7 538 plot holders in these areas. The Tomlison Commission (1955) identified a total area of 54 051 ha that had the potential for irrigation development in these territories. It estimated that exploitation of this potential could enable the settlement of 36 000 farmer families. The size of the plots on these schemes typically ranged between 1.5 and 2 morgen (1.28 to 1.71 ha), but both schemes with larger and smaller plots were also established (Bembridge, 2000; Van Averbeke *et al.,* 2006).

The plot size on these schemes was considerably smaller than the 8 ha to 20 ha plots that were allocated to white settler farmers on irrigation schemes developed during the Great Depression and World war II. These schemes were established for the same purpose as the smallholder schemes, to provide (poor) white families with full land-based livelihoods (Bruwer and Van Heerden, 1995; Backeberg and Groenewald, 1995).

The difference between the plot size allocated to white and black farmers suggests that irrigation planning proceeded under the assumption that black families required less land (and income) to attain a full livelihood than white families.

On most smallholder canal schemes developed during this period the land was detribalised and ownership was transferred to the state. Farmers on these schemes held their plots by means of Permission to Occupy (PTO). This form of tenure provided the state with the necessary powers to prescribe land use and to expel and replace farmers whose practices did not comply with the stated rules (Van Averbeke, 2006). In selected cases, the state effectively used these powers to enforce the overall objective of the schemes by evicting poorly performing families (Van Averbeke, 2006).

The third period of smallholder irrigation development can be referred to as the independent homeland era. This period in smallholder irrigation development lasted from 1970 until 1990's and was an integral part of the economic development of the homelands. The post-world war policy of Apartheid aimed at making black South Africans citizens of specific independent homelands. Spatially, these homelands had their origin in the "Bantu Areas". Each homeland was to cater for a particular cultural or language group. To give credence to the concept of independence, it became imperative that the economy of the different homelands improved, because without exception, they were islands of underdevelopment and poverty (Beinart, 2001). The establishment of new irrigation schemes with funding from South Africa, formed part of the economic development strategy of the homelands (Van Rooyen and Nene, 1996; Lahiff, 2000). Agriculture was regarded as the main internal development opportunity for the homelands, because the resource base of these territories had remained essentially rural.

Irrigation development during the independent homeland era was characterised by modernisation, functional diversification and centralisation of scheme- management. Technologically, this period coincided with the third phase of the public storage scheme era in South African irrigation development identified by Backeberg and Groenewald (1995), which Bruwer and Van Heerden (1995) referred to as the recent development phase. Typical examples of large schemes (>500 ha) developed during this era were found mainly in the Eastern Cape and included schemes at Keiskammahoek, Tyefu, Xonxa and particularly Ncora (Van Averbeke*et. al.,* 1998). The irrigation and farming

technology that was implemented on these large schemes was amongst the most modern that was available at the time, but, even on most smaller schemes, pressurised overhead irrigation systems were used instead of surface irrigation. On the large schemes, economic viability was pursued by means of a strategy of functional diversification. Typically included were a commercial function in the form of a central unit, which was farmed as an estate, a commercial smallholder function in the form of medium -sized plots, also called mini-farms, of 5 to 12 ha in size, and a subsistence function in the form of food plots, ranging from 0.1 ha to 0.25 ha in size (Van Averbeke*et. al.*, 1998). It can be argued that functional diversification was a way of catering for rural livelihood diversity, although this concern was not stated explicitly in the plans. In practice, however, functional diversity provided rural homesteads with different options to benefit from irrigated agriculture, depending on the structure of existing livelihood. For example, the mini farms catered specifically for homesteads that sought full land-based livelihoods.

The food plots provided homesteads that derived their livelihood from external sources, such as male-migration or old-age pensions, with an opportunity to enhance these livelihoods by producing food for home consumption. The estate component offered opportunities to members of rural homesteads who were searching for employment and monetary income close to home. Management of these large schemes was centralised in the hands of specialised parastatals (Van Rooyen and Nene, 1996; Lahiff, 2000). The large schemes established during the independent homeland era were socially and economically very complex and proved costly to maintain. Social unrest and conflict during the late 1980's further affected their sustainability. Following the democratisation of South Africa in 1994, provincial governments decided to dismantle the agricultural homeland parastatals they had inherited. This decision particularly affected the large schemes, because they were the most complex and had been centrally managed from inception, resulting in exceptionally high levels of dependency among farmers (Van Averbeke et al., 1998). Partial or total collapse of production followed this decision almost immediately (Bembridge, 2000; Laker, 2004).

In South Africa, irrigation was introduced after the arrival of European settlers, although really developing from 1912 onwards. In the former "Bantustan" or Native areas, minor irrigation development occurred before 1950. Most of the irrigation schemes in the Bantustan were established after the publication of the report from the

Tomlison commission on the socio-economic development of the Bantustan (Perret, 2000)

Irrigated agriculture in South Africa comprises a diverse group of subsistence, emerging and commercial farmers, permanent and seasonal labour and their dependent families. The scale and success of irrigated agriculture is also highly diverse ranging from large commercial enterprises, competing on the world market, through successful small-scale enterprises and community gardens to poorly performing initiatives still heavily dependent upon government support (FAO, 2000). South African smallholder irrigation schemes are multi-farmer irrigation projects larger than 5 hectares (ha) in size that were either established in the former homelands or in resource-poor areas by black people or agencies assisting their development. Van Averbeke and Mohamed (2007) indicated that 287 smallholder irrigation schemes existed in South Africa in 2004. Estimates of the combined command areas covered by South African smallholder irrigation scheme range between 46 000ha and 49 500 hectares (ha). This represents about 47% of the total smallholder irrigation area and 3.6% of the 1.3 million ha under irrigation in South Africa.

Investing in smallholder irrigation is one of the most effective ways of developing smallholder agriculture and, thus, contributes to poverty alleviation. Irrigation development benefits the rural poor in various ways including: (a) reduced food prices resulting from increased production; and (b) increased on-farm and off-farm employment leading to income generation for the poor. Thus, irrigation can contribute to food security. Smallholder irrigation schemes have not performed well in Africa. These schemes have performed poorly in terms of yield and economic returns (Barghouti and Le Moigne, 1990; Underhill, 1990). The poor performance of smallholder irrigation schemes means that farmers have not been able to produce enough yields to match the demand for food (Machete *et al,* 2004).

According to FAO (2000), the success of smallholder irrigation development in South Africa has been limited compared with other countries in the sub-region. Schemes specifically designed and constructed for many farmers (smallholder schemes) have been planned in the same way as those for commercial farms with sophisticated infrastructure and field equipment expected to be shared between several farmers. Design solutions appear to have been scaled down versions of the first world-class

technology rather than being suitable for smallholders. Scheme management and operations were centralised and done by the government or government agencies. In many places, this has resulted in unsustainable, poorly performing small-scale irrigation schemes with a high level of dependency among the farmers and cultivators (FAO, 2000).

2.6 Women empowerment in agriculture

According to IFPRI (2012) Women Empowerment in Agricultural Index (WEAI) is a composite measurement tool that indicates women's control over critical parts of their lives in the household, community, and economy. It helps in identifying women who are disempowered and understand how to increase autonomy and decision-making in key domains. The WEAI is also a useful tool for tracking progress toward gender equality, which is one of the Millennium Development Goals. The Women's Empowerment in Agriculture Index is an innovative new tool composed of two sub-indices: one measure the five domains of empowerment for women, and the other measures gender parity in empowerment within the household. It is an aggregate index reported at the country or regional level that is based on individual-level data on men and women within the same households.

2.6.1 Five domains of empowerment (5DE):

This sub-index assesses whether women are empowered across the five domains examined in the WEAI. For the women who are disempowered, it also shows the percentage of domains in which they meet the required threshold and thus experience "sufficiency."The 5DE sub-index captures women's empowerment within their households and communities (IFPRI,2012)

2.6.2 Gender Parity Index (GPI)

This sub-index reflects the percentage of women who are as empowered as the men in their households. For those households that have not achieved gender parity, the GPI sub-index shows the gap that needs to be closed for women to reach the same level of empowerment as men. Based on both sub-indexes, the WEAI is thus an aggregate index

that shows the degree to which women are empowered in their households and communities and the degree of inequality between women and men within the household. Therefore, progress toward empowering women in agriculture will be achieved by empowering them in the five domains and achieving gender parity within the household.

Table 1: The five domains of empowerment in the WEAI

Domain	Indicators	Weight
Production	Input in productive decision	1/10
	Autonomy in production	1/10
Resources	Ownership of assets	1/15
	Purchase, sale or transfer of assets	1/15
	Access to and decision on credit	1/15
Income	Control over use of income	1/5
Leadership	Group member	1/10
	Speaking in public	1/10
Time	Workload	1/10
	Leisure	1/10

Sources: IFPRI 2012.

2.6.3 Five Domains of Empowerment

The five domains are agricultural production, resources, income, leadership, and time (see Figure 1), and they comprise ten indicators. Each domain is weighted equally, as are each of the indicators within a domain. The 5DE sub-index is constructed using a robust multidimensional methodology known as the Alkire Foster Method. It is a

measure of empowerment rather than disempowerment that shows how many domains women are empowered in. The 5DE sub-index contributes 90 percent of the weight to the WEAI (IFPRI 2012).

The domain indicators are built on the following definitions.

- **Production:** Sole or joint decision making over food and cash-crop farming, livestock, and fisheries as well as autonomy in agricultural production.
- **Resources:** Ownership, access to, and decision making power over productive resources such as land, livestock, agricultural equipment, consumer durables, and credit.
- **Income:** Sole or joint control over income and expenditures.
- **Leadership:** Membership in economic or social groups and comfort in speaking in public.
- **Time:** Allocation of time to productive and domestic tasks and satisfaction with the available time for leisure activities.

A woman is defined as empowered in 5DE if she has adequate achievements in four of the five domains or is empowered in some combination of the weighted indicators that reflect 80% total adequacy. A key innovation of the Index is that it is able to show in how many domains women are empowered and at the same time reveal the connections among areas of disempowerment. This enables decision makers to focus on improving the situation of the most disempowered women. In addition to tracking the nature of empowerment in five domains, the WEAI measures how empowered women are relative to men in the same household, which is critical to understand the gender empowerment, gap (IFPRI 2012).

The empowerment index applied in Uganda covered five spatially dispersed rural districts in the northern region (Amuru and Kole), central region (Luwero and Masaka), and eastern region (Iganga). The 5DE for the pilot districts in Uganda shows that 37.3 percent of women are empowered. The 62.7 percent of women, who are not yet empowered, on average, have still achieved empowerment in 64.4 percent of dimensions. Thus the overall 5DE is 37.3% + (62.7% x 64.4%) = 0.777.The GPI for the selected districts of Uganda shows that 54.4 percent of women have gender parity with

the primary male in their household. Of the 45.6 percent of women who are less empowered, the empowerment gap between them and the male in their household is 22.4 percent. Thus the overall GPI is (1-(45.6% x 22.4%)), or 0.898 (IFPRI, 2012)

In terms of empowerment, for Wealth, 29% of women in the poorest quintile were empowered, compared with 62%t in the richest 20% of the population. In the second and third quintiles, around 27% of women were empowered in agriculture, rising to 40 % in the fourth quintile and 62% in the fifth. For Education level, 35% of women with less than a primary-school education are empowered while 45% of those who have completed primary school are empowered. In terms of Age and hunger: Twenty-eight percent of women under 26 are empowered in agriculture, 53% of women between 46 and 55 years old are empowered, and 45% of those between 56 and 65 years old are empowered. In contrast, the rates of empowerment among males are less distinct by age group. The percentage of disempowered women is significantly higher in households reporting higher hunger scores. For other domains women who are empowered in agriculture also reported significantly greater decision making and autonomy with respect to almost all domains. Similar to the data from Guatemala, the variable "autonomy" showed even greater differences between those who are empowered in agriculture and those who are not (IFPRI 2012).

In Guatemala, the 5DE for the Western Highlands shows that 22.8% of women are empowered. The 77.2% of women who are not yet empowered, still have, on average, adequate achievements in 58.3% of dimensions. Thus the overall 5DE is {22.8% + (77.2% x 58.3%)} = {1 − (77.2% x 41.7%)} = 0.678. The GPI for the Western Highlands of Guatemala shows that 35.8 % of women have gender parity with the primary male in their household. Of the 64.2% of women who are less empowered, the empowerment gap between them and the male in their household is quite large at 29 %. Thus the overall GPI is (1 − (64.2% x 29.1%)), or 0.813. For wealth, 19% of women in the poorest quintile are empowered, compared with 27% in the richest 20% of the population. It is striking that on average 76% of women in the top three wealth quintiles are not yet empowered (including 73% of the richest 20 %, indicating that wealth is a very imperfect proxy for women's empowerment in agriculture. Indeed, the associations with wealth are not statistically significant. For education, only 20% of women with less than a primary-school education are empowered in agriculture while

35 % who have completed primary school are empowered. In terms of Age and hunger, 31% of women aged 26 to 45, and 29% of those older than 65 are empowered, compared with 6% of those under 26 and less than 19% of those in other age cohorts.

In contrast, among males the levels of empowerment were constant across age categories. The percentage of disempowered women is higher in households reporting higher hunger scores, although this association is not statistically significant. In Guatemala, there was a clear association between women's empowerment in agriculture and empowerment in other domains: greater decision making and autonomy with respect to minor household expenditures, serious health problems, protection from violence, religious faith, their own daily tasks, and use of family planning. Further, the variable "autonomy" showed even greater (and statistically significant) differences between those who are empowered in agriculture and those who are not. For example 85% of women who are empowered in agriculture feel they could make decisions related to serious health problems, compared to 74% among women who are not empowered in agriculture(IFPRI 2012).

A study conducted by Motsi and Madyiwa (2007) shows women in Hama Mavhaire, Nyaitenga and Chitora irrigation schemes were not given a chance to enhance their skills of irrigation maintenance because it was perceived as a duty carried out by men. The committee elected in this irrigation scheme to maintain the pumping systems were males only so a female's task was to carry normal farm operations. This study further shows that if men in the irrigation scheme are not able to maintain pumps themselves their boy children and or hired labour would assume the responsibility. This shows that females were not give a chance to learn.

2.7 Women, irrigation and poverty

According to Tekana and Oladele (2011) eighty four percent of their respondents agreed that the use of irrigation contributes greatly to the improvement of rural livelihood. Research conducted by Louw *et al.* (2008) shows that the Northern Cape irrigation agriculture provides jobs to approximately 60 041 people with 37,56% permanent labourers and 62, 44% as seasonal or casual labourers. However IFAD (2007) reports that many female farmers in irrigation are still poor marginalized with no

food security. Farm businesses for smallholder farmers do not generate adequate income that ensures farmer's needs are all covered. This is supported in a study conducted by du Plessis *et .al*, (2002) which shows that most farmers in the irrigation schemes have other means of generating income other than agricultural work. Revenues generated from cash crops are usually controlled by men. This means that women cannot use money that they worked very hard to generate (IFAD, 1998).

As highlighted by Neuber *et.al.* (2007) small-scale farmers who are part of irrigation schemes realised an improved and increased supply of food that eventually lead them to being food secure. Farmer's income have doubled and even tripled because of the use of irrigation systems. The use of irrigation has even made it possible for rural dwellers to have drinking water reducing the amount of time women spend collecting water. . However irrigation had a negative impact effect on the health of farm workers because of the use of pesticides, but with higher income margins they are able to afford healthcare services.

Ijarpoor and Latif (2011) stated that the use of irrigation has increased fruits and vegetable yield of farmers in Iran who are part of the identified irrigation schemes. The yields have increased so much that they are able to supply their produce to the markets earlier than other farmers who do not use irrigation systems. The respondents expressed that even basic services like education, water supply, jobs and health centre were made available upon the growing use of irrigation systems. Even literacy level of rural dwellers improved.

According to IPTRID (1999) poverty can be reduced by giving irrigation access to both men and women. A significant difference in income and nutrition has been made in female headed household who have been given access to irrigation systems in Zimbabwe, Tanzania, Kenya and Gambia (IPTRID, 1999).

As stated by Motsi and Madyiwa (2007) irrigation did not empower women to make decisions as much as it empowered men, 49.3 percent of men made the decisions while only 27, 7 percent of female were empowered to make decisions. The low percentage of females who make decisions was attributed to the local cultural perceptions on women. Irrigation schemes in Hama Mavhaire, Nyatenga and Chitora empowered women and children with necessary farm skills as most of the farm operations were carried out by 60% women and children (Motsi and Madyiwa, 2007). However at

Nyitenga and Chitora irrigation schemes in Zimbabwe women and children were not given opportunities to maintain irrigation systems thus (Motsi and Madyiwa, 2007) they have knowledge on other farm operation yet no skills on maintaining irrigation systems. It was also found that women who make more decisions and participate in most farm duties do so because they head their households.

Women do not use water for the purpose of farming only but also for domestic use (IFAD, 2007). They find it useful to use both rainfall runoff and irrigation water for other used other than irrigating their fields (IFAD, 2007). The community uses water for a vast number of reasons, domestic and or for farm purposes, however water projects in the past either focused of water for either irrigation of for domestic use (IFAD, 2007). As stated by IFAD (2007) in some irrigation scheme it is considered illegal to use irrigation water for household purposes and this has a negative effect on the availability of household water. Availability of irrigation schemes is also advantageous to women in that they save hours that they could have spent to collect water. Irrigation has also provides water for drier areas ensuring supply of food and improved livelihood.

Most of the water in South Africa is being used for agricultural purposes and irrigated agriculture needs maintenance and improvement to meet the needs of the growing population (Armitage 1999). The cost of water is an important factor to be considered since water is becoming increasingly scarce and highly demanded by non-agricultural users (du Plessis *et.al*, 2002).As stipulated by du Plessis *et.al.* (2002) the success and adoption of irrigation systems relied on farmers' literacy levels and circumstances under which farming took place. Even thou farmers need skills, management skills are also of importance in an irrigation scheme. Lack of coordination and corporation among management contributes to the failure of most irrigation schemes or the ineffectiveness thereof. In a study conducted by du Plessis *et.al.*, (2002) problems identified in the management of the schemes were an attitude towards risks that may be associated with the use of irrigation with their limited knowledge A study carried out in the Eastern Cape by Tlou *et.al.*, (2006) shows that the conditions and problems of many small irrigation schemes in South Africa can be attributed to the historical background of the country (apartheid regime), goals set out for SIS's and the performance of these schemes. Even from the era of Bantustans the objectives of SIS's were to produce food for the locals and own consumption with little or no market opportunities to grow to

commercial farming. When one produces there are costs that are incurred, so income is needed to cover those costs. It also shows that production for own consumption is no longer is relevance (Tlou *et.al.* 2006). In 1994 the government extracted its support of irrigation schemes through irrigation transfer of management (IMT). This has caused some negative effect of irrigation schemes and led to others becoming none functional.

Du Plessis *et.al.*, (2002) showed that farmers have an interest in expanding their farms however due to lack of personal finance to do so they view it as a big obstacle. Most of farmers do not have title deed so they cannot use their land as collateral to acquire credit. Smallholder farmer's cash flows poor which puts them at a disadvantage whenever trying to acquire credit (du Plessis *et.al*, 2002).

2.8 Irrigation and food security

Food security (FS) ''exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'' . It includes the availability of nutritionally adequate and safe foods and an assured availability to acquire acceptable foods in socially acceptable ways. FS is, therefore, intimately related to the fulfilment of basic human rights. When family household conditions do not guarantee access to food, the household can be called food insecure. Food insecurity (FI) is experienced when there is: uncertainty about future food availability and access; insufficiency in the amount and kind of food required for a healthy lifestyle; or the need to use socially unacceptable ways to acquire food. FI is most prevalent in countries and populations subject to poverty and social exclusion, but it is also present in some of the most affluent societies (FAO.1996)

2.8.1 Food security

South Africa faces a wide spectrum of food security challenges, conceptually ranging from national-level to household issues. At the national level, challenges undermining South Africa's ability to achieve food security is inadequate safety nets and weak disaster management systems. These challenges have implications for vulnerable households, in addition to a range of other household level challenges. In the 1996 Rome declaration on World Food Security, food security is defined as "Food that is available at all times, to which all persons have means of access, that is nutritionally

adequate in terms of quantity, quality and variety and is acceptable within the given culture." The current food security challenge in South Africa consists of two dimensions. The first dimension seeks to maintain and increase the ability of South Africa to meet its national food requirements. This involves meeting these needs from domestic agricultural resource, import food items that cannot be produced efficiently, and to export commodities with comparative advantage. The second dimension seeks to eradicate the widespread inequalities and grinding poverty among the majority of households that is manifested by inadequate and unstable food supplies, lack of purchasing power, weak institutional support networks, poor nutrition, inadequate safety nets, weak food emergency management systems and unemployment(FAO,2006).

The food security pillars identify by FAO (2006) were food Availability (effective or continuous supply of food at both national and household level); food Access or effective demand (acquisition of sufficient food on a sustainable basis on national and households), Reliability (utilisation and consumption of safe and nutritious food); food distribution (equitable provision of food to points of demand at the right time and place). The food availability in any household had a pattern within a time frame which was either increased, decreased or was at a constant level (Obadire et al., 2010).

Poverty and food insecurity in South Africa is the result of several centuries' worth of colonial and apartheid policies, designed specifically to create general conditions unfavourable to the wellbeing of black people in all its aspects, especially in the former homelands. In order to design effective policy interventions to redress the injustices of the past, it is important to better understand these historical processes. Contemporary South Africa evolved at the turn of the 20th century from an agrarian setting through the rapid growth of commodity markets that sprung around major industrial mining, urban population and commercial agriculture. Initially, African farmers and entrepreneurs had successfully participated in the growing commodity markets under conditions of relative land abundance, low population size, low production, processing and distribution technologies, weak government interventions and relatively undistorted markets. Food insecurity and poverty among the majority African population, which at the time was largely constituted of independent producers and entrepreneurs, was almost non-existent. With political and economic forces that led blacks to become the expected providers of wage labour to mining, industry and large-scale agriculture, this

situation of relative food security in South Africa among the majority population was to change. Impelled by its social and economic imperatives, successive white governments throughout the greater part of the 20th century transformed agrarian 19th century society through a two-pronged strategy that set in motion a process that would simultaneously cripple and debar African farming and entrepreneur development.

According to Statistics South Africa, (2000) the description of the household and intra-household food insecurity currently about 35% of the total population, or 14.3 million South Africans are vulnerable to food insecurity. Among these, women, children and the elderly are particularly more vulnerable. Gauteng and the Western Cape are wealthier provinces with the least number of poor households at less than 12% each. On the other extreme end, the Free State, Eastern Cape and Northern provinces have the worst of poverty in South Africa with Mpumalanga, KwaZulu-Natal, Northern Cape and North West Provinces in the middle of the group. According to Stats SA (2001) nearly one third of all South African households are female-headed which are considerably poorer than male-headed households. The reasons adduced for the trend of poverty in South Africa and the provinces include: Inadequate Safety Nets (Poor households are typically characterized by few income-earners, and many dependants); Weak Support Networks and Disaster Management Systems (lacking information on risky and vulnerable areas, with respect to food access and use); inadequate and unstable household food production (many households can be described as deficit producers, but net consumers of purchased food, and reliance on non-farm income to meet most of their household needs); lack of purchasing power (lack of cash for purchase and limited scope of income opportunities)

2.8.2 Food security context in South Africa

South Africa is unlikely to feature at the top of the agenda at any international dialogue on food security. The country is a net exporter of agricultural commodities and has a high per capita income, even for an emerging economy. There are no tight foreign-exchange constraints and the country is not landlocked. The innovative constitution entrenches the right to adequate nutrition and this is the basis of the national Integrated Food Security Strategy (IFSS). Taking all these features into account one could easily

conclude that food ought to be available and accessible in South Africa at all times. But is this conclusion correct? The confusing reality is that despite all the favourable indicators and South Africa's national food secure status about 14 percent of the population is estimated to be vulnerable to food insecurity and 25 percent of children under the age of six years are reckoned to have had their development stunted by malnutrition (HSRC, 2004).

South Africa's inability to meet basic needs has a variety of causes but, but in contrast to most other countries, poverty and hunger are particularly shaped by the legacy of apartheid. One aspect of that system was the deliberate dispossession of assets, such as land and livestock from members of the black majority, while denying them opportunities to develop, access to markets, infrastructure and human capital. In addition until 1985 agricultural policies pursued self-sufficiency, thus protecting domestic commercial farm production, often at the cost of consumers resulting in a total welfare loss for the country as a whole(agriculture policy unit 1997). Post-apartheid policies including the IFSS all aimed to address the adverse impact of apartheid and move the country forward as a unity.

As a consequence of the policy debates on agriculture and food security, the IFSS turned out to be a multidimensional strategy, structured mainly around household food security in rural areas. The arrangements proposed in the strategy appear to be an innovative blend of mechanisms with clear programmes, coordinating units and multi-sectoralfora to stimulate and support programmes that would engage creatively with food insecurity. Section 27(1) of the South African constitution states clearly that 'Everyone has the right to have access to sufficient food and water...The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of each of these rights.'(IFSS, 2002).The vision of the IFSS is to attain universal physical, social and economic access to sufficient, safe and nutritious food by all South Africans at all times to meet their dietary and food preferences for an active and healthy life. This vision is closely aligned with the definition of food security provided by the United Nations Food and Agriculture Organisation (FAO, 2003).

In sub-Saharan Africa, two thirds of the working population still make their living from agriculture, especially commercial agriculture (ILO, 2007). Approximately 70 percent of the population live in rural areas where crop and animal production, fisheries and

forestry activities are direct sources of food and provide income with which to buy food. Increased and diversified food production for family consumption or as a source of income is a basic prerequisite for improved household food security (FAO, 1997). Even though total food supply may be secure in a country or a region, households or individuals may not have access to adequate food. It is thus important for policy makers to distinguish food security at the national, regional and household levels (FAO, 1997).

Achieving household food security requires broad policy instruments such as strategies for increased production, supply and price stabilisation, employment, land distribution, macroeconomic growth and income stabilization. With respect to agriculture more support will be necessary for extension work, credit availability, irrigation and encouragement of greater use of inputs such as fertilizer and improved seeds. Because of agriculture's central role in generating employment and income in rural areas, policies aimed at increasing agricultural production and productivity are essential for improved household food security and nutrition in Sub-Saharan Africa. However this does not mean that focus must be only on food production for domestic consumption. Research by the international food policy research institute (IFPRI, 2002) in the Gambia, Kenya and Rwanda showed that cash crop production can result in significant increases in household income and improved household food security (Kennedy & Haddad, 1992). In this context, it is important to emphasize not only the absolute level of income, but also the control of income and the source as these can significantly influence household food security FAO, 1997).

Food enters a household in a variety of ways. A household may produce food when it has the human and material resources to do so, and such households are said to have direct access to food. The ability of farmers to produce in adequate amounts and sufficient variety depends to a large extent on their access to resources. Food is also purchased; most households purchase a portion of their dietary requirements depending on need and affordability. This type of food acquisition represents economic access. Rural farming households regularly purchase a proportion of food commodities which they do not produce themselves. Given the ways food is accessed, diversity of food income sources is considered to be one of the main practices against risk in agrarian communities (FAO, 1997).

There are many areas where smallholder's food security comes under risk such as: failure or loss of crop production due to pests and drought; agricultural trade due to disruption of exports and imports; large sudden food price rises and loss or lack of employment. Households which are most at risk are: smallholder's with little income diversification and limited access to improved technology such as seeds, fertilizer, irrigation and pest control (FAO 1992).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter describes the procedures and the methods followed in compiling this thesis. This study is quantitative in nature and utilizes data from the primary survey from smallholder irrigation farmers in the North West Province. This chapter outlines the study area, population, sampling procedure and technique, sample size, data collection strategies, data collection instrument, data analysis as well as ethical consideration.

3.2 Study area

The study was conducted in the North West Province covering small holder irrigation farming in the Taung, Nyetse, Molatedi, Mayaeyane area. The province lies between 22 and 28 degrees longitude east of the Greenwich Meridian and between 25 and 28 degrees latitude south of the Equator (Cowley: 1985). The region is situated 1.200mm above sea level and has an annual rainfall of 430mm. The climate is very dry, especially in winter and summers are hot with temperatures ranging from 16-38 degree Celsius. Agriculture plays an important role with approximately 60% of rural livelihood.

3.2.1 Taung irrigation

The scheme is divided into five cooperatives which are Bosele, Ipelegeng, Reaitlhoma, Rethuseng, and Tshidiso. The scheme is located in the western part of the North West Province in the Dr Ruth Mompati District Municipality. There is predominantly good access during all seasons since the gravel road to the farm is well maintained. GPS coordinates: 27° 34 south and 24° 44 east. The dominant people in the area are the Tswana but characterized by rural poverty. Household food plots play an important part in livelihoods. The majority (53%) of households are male-headed whereas 40% is female- headed. The area has uniform terrains that consist out of slightly irregular plains and pans, hills and escarpments. It lies between an altitude of 1100m –1300 m

above sea level and has a slope factor of between 0-9 %. The area is generally dry with average annual rainfall of 318mm per annum and the area experiences high temperatures ranging between 18.7°C and 38.5°C. Securing crop production from rainfed agriculture is impossible hence the project abstracts water from the Vaal dam which is located 50 km from the irrigation farm. Irrigation system is pivot. The size of the scheme is 1054 hectares and plots are divided into 7.5 and 10ha respectively. Individuals within the scheme have expressed interest in household food production as well as income generation from the produce. Water security could prove to be a challenge to sustain small-scale farming due to large-scale irrigation farming as well as other water demand activities in the area – such as mining. Additionally, farmers have to pay water fee of R600/annum which sometimes is a challenge.

3.2.2 Molatedi Irrigation Project

Molatedi project is located in the western part of the North West Province in the Bojanala District Municipality and it is 250kms by road from Rustenburg. There is predominantly good access during all seasons since the gravel road to the farm is well maintained. GPS coordinates: 24° 51 South and 26° 27 East. The dominant people in the area are the Tswana but characterized by rural poverty. Access to the farm is difficult as it is 250 km from Rustenburg town with rugged terrain and impassable roads especially during the rainy season. However, only one family is actively involved farming only 2 ha of the 24 ha land. Household food plots play an important part in livelihoods.

The area has uniform terrains that consist out of slightly irregular plains and pans, hills and escarpments. It lies between altitudes of 1100m –1300 m above sea level. The area is generally dry with average annual rainfall of 450 mm and the area experiences high temperatures ranging between 21°C and 32°C. Securing crop production from rainfed agriculture is impossible hence the project abstracts water from the Madikwe River which feeds the Molatedi dam which is located 2 km from the irrigation farm. Due to high rate of theft, the farmer has moved from vegetable farming to tobacco production. Water security could be a concern because of many activities using water from the same source – domestic for the households in Madikwe town and Gaborone, irrigation

schemes and the mining sector in Rustenburg. Marketing of produce is another challenge since the farm is remotely located in the bushes.

3.2.3 Nyetse Project

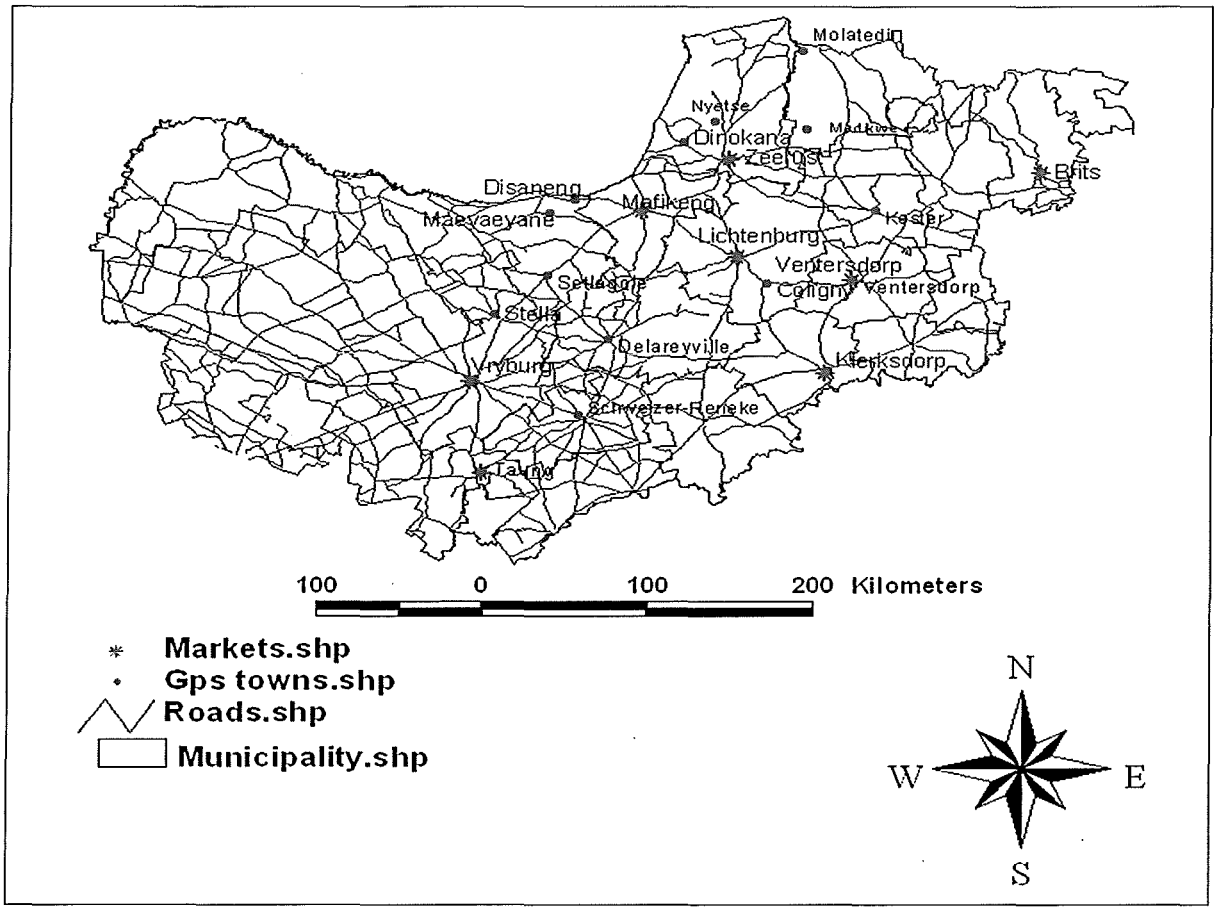
Nyetse project is located in the western part of the North West Province in the Ngaka Modiri Molema District Municipality and it is 30.8kms and 98.4km by road from Zeerust and Mafikeng respectively. There is predominantly good access during all seasons since the gravel road to the farm is well maintained. GPS coordinates: 25° 17 South and 26° 02 East. The dominant people in the area are the Tswana but characterized by rural poverty. The entire farm is 80ha with active farming operating from 25 ha, with possible expansion to the entire farm area as soon as the water tank under construction is finalized.

Active farming started in 2007, the farm is surrounded by hills and natural vegetation that acts as wind breaks during the months of July and August. The area is generally dry with average annual rainfall of 439mm and experiences high temperatures ranging between 19.4°C and 30.8°C. Securing crop production from rainfed agriculture is impossible hence; the project uses ground water with boreholes drilled 110m deep where the water feeds into tanks located within the farm. Individuals within the farm have expressed interest in household food production as well as income generation from the produce. Water security is not of great concern since ground water reserves are plenty in the area and the hills around the farm augment precipitation. Another dam (~2m cubic litres) is under construction to alleviate water shortages. Women farmers present a large percentage of the producers on the scheme and the farm owner is transferring farming and marketing skills to the locals.

3.2.4 Mayaeyane

Mayaeyane project is located in the western part of the North West Province in the Ngaka Modiri Molema District Municipality. There is predominantly good access during all seasons since the gravel road to the farm is well maintained. GPS coordinates: 25° 53 South and25° 08 East. The dominant people in the area are the Tswana but characterized by rural poverty. However, most of the active farmers are

women. The farm is situated within the arid tropical savannah climate with a mean annual summer rainfall of 571 mm. The rainfall is unreliable and is highly variable. The mean monthly minimum and maximum temperature vary from 4.0°C in July to 17.1°C in January and 20.4°C in July to 29.7°C in February respectively. Variability in rainfall entails impossibility of rainfed. Individuals within the farm have expressed interest in household food production as well as income generation from the produce. Water security could prove to be a challenge to sustain small-scale farming due to the granite rock which is a hard, igneous rock and is impermeable that produces a landscape of high ground, wet and water logged areas especially during the rainy season.



3.3 Research design

The research design of the study is descriptive and qualitative. Bless and Higson-Smith (2000) describes this kind of a study which is concerned with the condition that exist, practices that prevail, beliefs and attitudes that are held, processes that are held. The study furthermore assess the demographic characteristics of the participants on the

scheme, examine the livelihood strategies they are engaged to combat food security, assess the socio-economic status of the farmers due to the irrigation scheme, assess the contribution of the scheme to the farmers livelihood, identify the capital asset that is available because of the irrigation and identify the role of the scheme in empowering the rural women to achieve food security.

3.4 Population

The total population of 120 women was identified during the recognisance survey in the province. Raosoft sample size calculator with a confidence interval of 95% and 5% error was used to calculate a sample size of 84 women. From the recognisance survey in the province, the functional irrigation scheme in the province includes Taung, Madikwe, Nyetse and Maiyeyane/Disaneng. Due to the non-functionality of the government programmes, the women farmers own the plots on the scheme and take decision on their plots for production progress and other are located outside the scheme

3.5 Sample and sampling techniques

A probability sampling method involving simple random sampling techniques was adopted to select the respondents. A sample if 84 women farmers were randomly selected to obtain a representative sample from the women farmers on the irrigation farms. A sample size formula by Sarantakos, (1998) which is N=N-120/1+N (e^2), gives a sample size 93. However due to constraints, time and resource challenge, a representative sample size of 84 was selected from the study population of 120. A simple random sampling technique draws sample from an identified population in such a way that every unit in that population has precisely the same chance (probability) of being included in the sample. Women on the irrigation farms who have individual plots and take their production decision as well as those near the established schemes were selected.

3.6 Data collection

3.6.1 Data collection instrument

Data for this study was generated from primary sources based on the objectives of the study. Interview schedule was used to elicit information from the respondents. Data was collected with a structured questionnaire which was developed based on the study objectives and review of literature. An open and close-ended questionnaire was used to collect demographic information like age, gender, marital status, educational level, household size, household headship, and number of dependents, household income and expenditure in the first section. The second section was on the livelihood strategies which include four capital assets; like natural, physical, human, financial capitals were used to measure the livelihood strategies used by the farmers on the scheme. The financial capital was measured on a three scale indicating availability, adequacy and non-adequacy. Physical capital was about the infrastructure, human capital was about knowledge and skills and natural capital about natural resources, mainly land and water. The third section was on socio-economic status, considering access to credit and farm incomes. The last section was on food availability and accessibility. The questionnaire was designed in such a way as to avoid ambiguity, sensitivity and provocativeness.

3.7 Measurement of variables

The variables in the study include the personal characteristics of the farmers, the livelihood strategies and their food security status. The levels of measurement and their analysis were indicated in Table 1.

Table 2: Measurement of variables

Variable	Level of Measurement	Analysis
Age	Interval	Frequency, percentages, regression
Marital status	Nominal	Frequency, percentages, regression
Religion	Nominal	Frequency, percentages
Number of dependants	Interval	Frequency, percentages
Household size	Interval	Frequency, percentages, regression
Total male in household	Interval	Frequency, percentages
Total female in household	Interval	Frequency, percentages

Educational level	Ordinal	Frequency, percentages, regression
Farming experience	Interval	Frequency, percentages, regression
Tenure status	Nominal	Frequency, percentages
Farm size in Ha	Interval	Frequency, percentages
Member of farmers group	Ordinal	Frequency, percentages, regression
Contact with extensions	Ordinal	Frequency, percentages, regression
Access to financial capital	Interval	Frequency, percentages, regression
Access to human capital	Nominal	Frequency, percentages, regression
Access to physical capital	Interval	Frequency, percentages, regression
Non-Farm activity	Nominal	Frequency, percentages, regression
Income	Interval	Frequency, percentages,
Expenditure	Interval	Frequency, percentages
Livelihood	Interval	Frequency, percentages, Dependent variable in regression
Food security status	Nominal	frequency, percentages, regression
Socio economic status	Interval	Frequency, percentages, standard deviation
Poverty status	Nominal	Frequency, percentages, regression
Level of employment	Interval	Frequency, percentages,
Competency	Interval	Frequency, percentages, standard deviation
Training Needs	Interval	Frequency, percentages, standard deviation

3.8 Data analysis

Data was analysed by using the Statistical Packages for Social Science (SPSS). The descriptive statistics such as frequency distribution, percentages, mean and standard deviation were used to describe the personal characteristics of the women farmers on the scheme. Tables were used to enhance the readability of the results. The linear regression model was used to determine empowerment while in determining food security, Probit model was used. The F-test and ANOVA was used to test the significance of the simple linear regression.

3.8.1 Analytical models

3.8.1.1 Food security model

Probit model was used to determine the influence of independent variable on the dependent variable while the linear regression model was used to determine empowerment. In determining food security, eighteen independent variables were

identified and they include age, gender, marital status, number of dependents, household size, educational level, labour sources, farming expenditure, income, central pivot irrigation, sprinkler irrigation, micro irrigation, drip irrigation, flood irrigation, access to financial capital, access to human capital, access to physical capital and size of farm.

Model Specification

$Y_Z = f(\beta_0 Y_0 + \beta_1 Age + \beta_2 Gender + \beta_3 Marital\ status + \beta_4 dependents + \beta_5 household\ size + \beta_6 Educational\ level + \beta_7 labour\ source + \beta_8 farming\ expenditure + \beta_9 income + \beta_{10} central\ pivot + \beta_{11} sprinkler\ irrigation + \beta_{12} micro\ irrigation + \beta_{13} drip\ irrigation + \beta_{14} flood\ irrigation + \beta_{15} access\ to\ financial\ capital + \beta_{16} access\ to\ human\ capital + \beta_{17} access\ to\ physical\ capital + \beta_{18} farm\ size$

3.8.1.2 Empowerment model

To determine the empowerment, a composite score was generated from the five domains.

H_e is the empowered headcount ratio, which equals $(1-H_p)$;

A_e is the average adequacy score of disempowered individuals, which equals $(1-A_P)$.

Measuring the 5DE results in a number ranging from zero to one, where higher values indicate greater empowerment. X_5

$5DE = H_e + H_p(A_e)$, where $He + H_p = 100\%$ and $0 < A_e < 100\%$.

The variables in the study include personal characteristics of the farmers on irrigation scheme, their production characteristics and indices. The relationship between the household food security and the independent variables was estimated using a probit model

Linear regression model was used to isolate factors determining empowerment with particular reference to the effects of socio-economic characteristics; irrigation type, livelihood activities on the irrigation scheme. The F-test and ANOVA was used to test the significance of the simple linear regression.

Model specification for empowerment

$Y = f(X_0 + X_1\ age + X_2\ gender + X_3\ marital\ status + X_4 number\ of\ dependents + X_5\ household\ size + educational\ level + X_7\ labour\ source + X_8\ income + X_9\ use\ of\ centre\ pivot\ irrigation + X_{10} use\ of\ flood\ irrigation + X_{11}\ use\ of\ sprinkler\ irrigation + X_{12}\ use\ of\ micro\ irrigation + X_{13}\ use\ of\ drip\ irrigation + X_{14}\ farm\ size + X_{15} farmng\ expenditure.$

3.9 Ethical consideration

The study took into account the ethical consideration which was addressed through voluntary participation. The respondent's right to privacy was exercised by obtaining consent. Anonymity was also ensured to avoid biased responses from the respondents. Permission was sought from the University ethics committee and the Provincial Department of Agriculture. The final version of the questionnaire was administered to the sampled farmers and participation was voluntary. In terms of validity, the questionnaire was tailored to suit the needs of the subject to whom it is intended.

3.10 Reliability and validity

To ensure reliability of the questionnaire, a split half technique was used to determine r^2 0.85 reliability coefficient. Scores obtained from the pre-test were subjected to Cronbach alpha test.

3.11 Chapter summary

This chapter gave an overview on how the study was conducted. The study was conducted in three districts of the North West Province namely: Dr Ngaka Modiri Molema district, Bojanala district and Dr Ruth Segomotsi Mompati district. A sample of 84 farmers was interviewed from the list of farmers that was obtained from the extension workers. The target group were women farmers in irrigation farming both on the scheme and those who farm within the radius of the scheme. A questionnaire was designed as the primary tool for data collection and the process of collecting data involved face to face interviews and group discussions. Data collected were coded and entered into Microsoft Excel and then transferred to Statistical Package for Social Scientists (SPSS). To analyse data, descriptive and inferential statistics were used.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Introduction

The chapter presents the results of data analysis and research findings.

4.2 Demographic characteristics

The results in Fig 1 show the age distribution of the respondents. The largest age group ranging from 41 to 50 years which accounts for 72%. The age group between 58- 62 accounts for 16% while the respondents' age between 21-40 years accounts for 13%. This confirms the preposition of young people in agriculture is low. Akinbile et al (2007) stated that active participants in farming activities are between the ages of 40 and 50 years in South West Nigeria.

Fig 1 also indicates that 46.7 % of farmers have household size of 6-10 persons. Larson and Kanyangwa (1990) argues that if household size is small and is headed by female this could cause shortage of labour during the peak season and that also impact on the household income. According to Maffioli et al 2007, female-headed household tend to be small in size, have low incomes and less likely to adapt to technology and this hinders agricultural production. Sabo (2006) also indicated that in Nigeria women farmers with large family size are better off because that necessitated the household to learn new technologies for augmenting production and increasing returns.

Fig 1 also shows that 42.2 % of women in the irrigation farming are married suggesting that greater proportion of the farmers in the scheme are married, 31.3% are single and 26.5% are widowed. This indicates that women especially married women cannot make decision on their own but often consult with their husbands when it comes to decision making. FAO (1995) also asserted that due to socio-cultural factors women have little decision authority in agricultural production.

The results in Fig 1indicate that 32.5% have primary education while 26.5% percent have secondary and high school education, 11% have no formal schooling and only 3% have tertiary education. The low levels of education among women will impact on decision making in managing the irrigation. Education is important to farm production because of the rapid change in technology and economic environment.

According to Weir (1999) there are several avenues by which schooling may create economic benefits in rural areas; household receives income in cash and in kind from farming and off- farming activities, wage employment and remittance from migrants. Education may increase the probability of success in each of these endeavours and in so doing diversify household income sources to reduce risks and improve economic security.

The findings in this study also indicated that 66.3% of women farmers have farming experience ranging from 1-10 years indicating that they are new entrants into farming while only 1.2% indicates experience of more than 40 years. Iheanacho (2000) also indicate that farmers who have been long in a business are usually older and more resistant to change than new entrants.

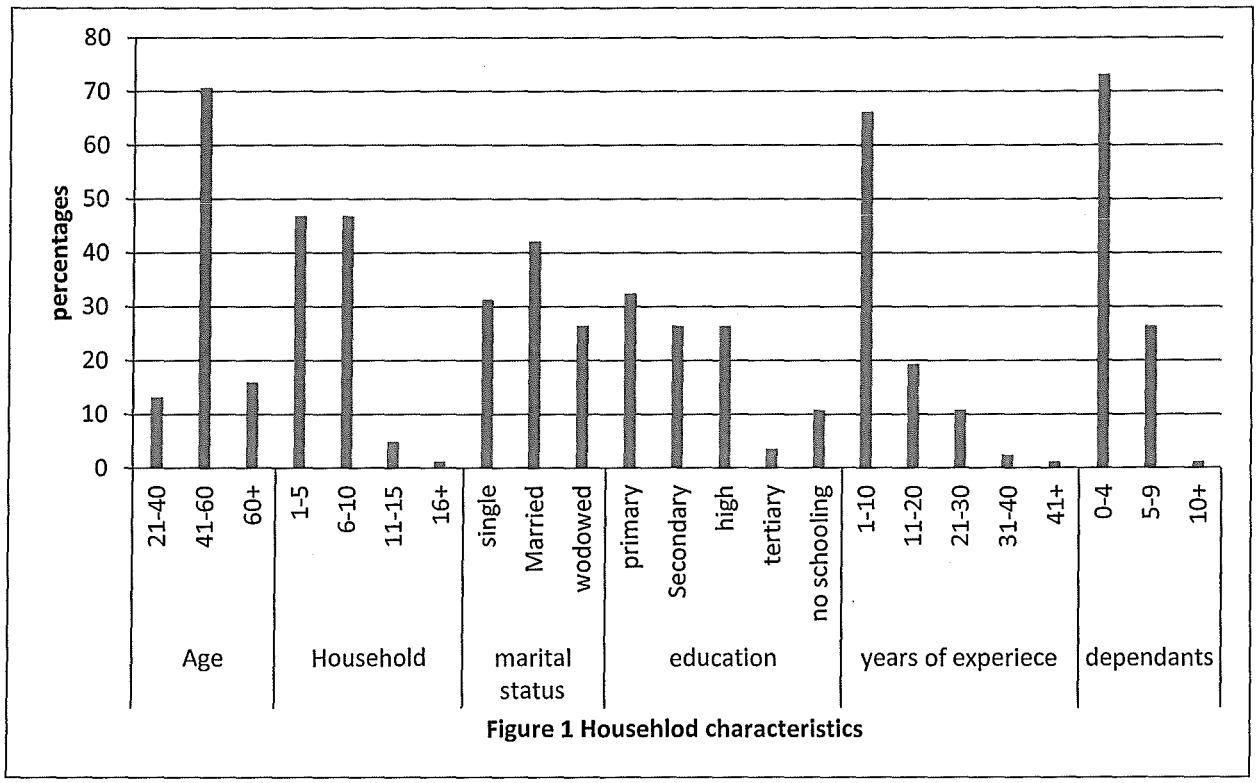


Figure 1 Househlod characteristics

4.3 Source of household income

The sources of household income are divided into two broad categories: farm and non-farm activities. Farm incomes include sales from farm produce, leasing of equipment and rent from land while non-farm activities include pensions remittance, wages,

grants, and other sources. Figure 2 indicates that pension is the greatest non-farm income contributor (30%). This is followed by grants at 21.4%, remittance at 18.4%, Wages 14.2% and others 2.3 %. In farming activities the highest contributor is sales from farm produce 8.6% followed by leasing of farm machinery (2.2%) and rent only contributing 2.2 %. According to Babatunde (2006) farming as a primary source of income has failed to guarantee sufficient livelihood for most farming household in developing countries.

De Janvry and Sadoulet (2001) emphasised that off farm income have been widely documented as an important strategy for overcoming credit constraints faced by rural households in developing countries. Some studies in Uganda have linked off-farm income to poverty reduction (Ellis and Bahiigwa, 2003). McNally (2001), Goodman and Mishra (2002), argued that the pursuit of off-farm income by farmers may undermine their adoption to modern technology by reducing the amount of household labour allocated for farming enterprise. A study in Nigeria proved that off-farm income has a positive and significant effect on farm output and demand for purchased input. The results from this study challenge the notion that participation in off farm activities may lead to decline in own-farm agricultural production due to competition for family labour between farm and off –farm works, rather they tend to suggest that there is indeed an element of complementarity and positive spill over between farm and off-farm sector s of the rural economy. In summary, off-farm income is expected to provide farmers with liquid capital for purchasing production input such as improved seeds and fertilisers.

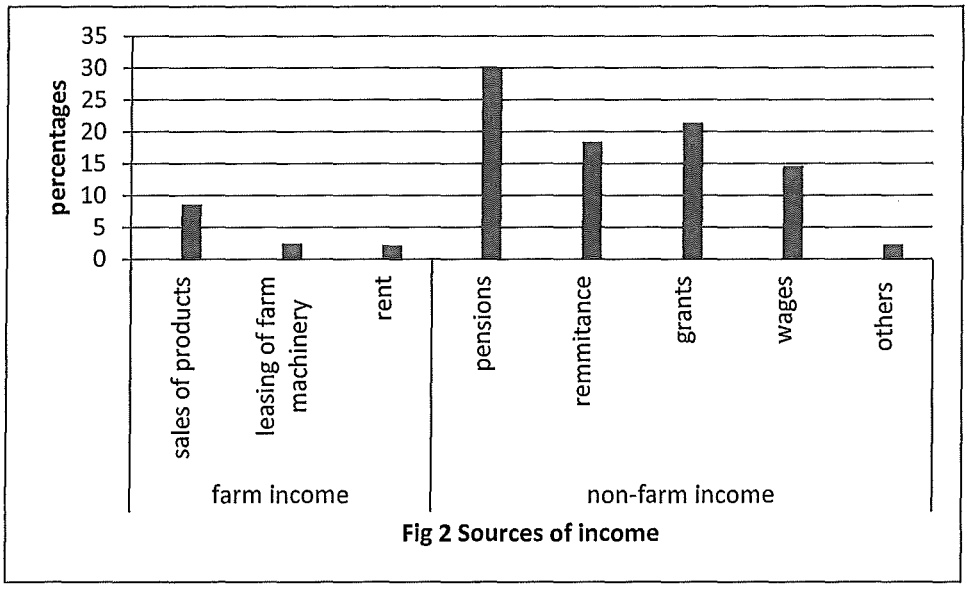


Fig 2 Sources of income

4.4 Influence of Political, Cultural and Social Institutions on land, water access and use

To examine the influence of political, cultural and social institutions on land water access and use among women farmers, a rating scale of High, moderate and low was used. In Table 2, 82.1% of women farmers indicated that the political institutions have assisted them to have high access to land. Also, 35.7% have indicated that they have more land that is available and that its productivity has increased. In terms of water accessibility, 58.3% of the women indicated that the political institution did not assist them to have water access because of the water policies that have changed, 65.4 % of women reported that water availability is very high while 72.5% have indicated that the availability of water has increased its productivity

In relation to the influence of the political institution on the control of land for production purpose, water sources and access to water, about 69 percent of women indicated that women since they have the tenure right, it has increased their land productivity. According to FAO (2005), land tenure systems, for instance, are based on discriminatory policies. While most African states have considered agriculture the backbone of their economies and acknowledge the significant role of women in the agricultural sector, few have paid much attention to the land tenure systems which have been discriminating against women. This problem is more pronounced in countries where the migrant labour system has led to an increase in female heads of household who lack power and control over the land they work. This condition is worsened by the fact that the existing rural credit policies are also blind to the existing discriminatory systems. Women agricultural producers are not benefiting from rural credit facilities and this limits their contribution to promoting sustainable development in this sector. About 69.1 % of women also indicated that because of political influence water sources in terms of production has improved. According to FAO (2012), in order to raise water productivity, it is necessary to deliver and apply water to crops more efficiently and to increase crop yields per liter of water consumed. This can be done by using drip-sprinklers and other micro-irrigation systems, changing cropping patterns and growing methods to get more crops per drop, and adopting high-yielding and early-maturing

crop varieties. Women 67.9% also indicated that the local political influence has helped them to have access to water for irrigation.

With regard to access to land, 77.4% of women farmers indicated that local and traditional authorities have assisted them to have access to land. Overall, women's access to land in African societies is quite restricted, even in cases where the law protects women's rights to land, traditional customs inhibit their access and control over land. An example from Mozambique points out that customary law protects single-women and widowed women in access to land. However, there are customs that constrain women's access to land. Single-women can gain access to land through their fathers, brothers or uncles. But, upon marriage in patriarchal communities women's access to land held by these relatives is lost, as they are expected to have access to land through their husbands (Gawaya, 2008). Generally, women tend to have smaller land holdings and less fertile plots.

About 70% of women assisted by the traditional authorities with the availability of land. Based on the table 4, women 77.4% also indicated that the local traditional authorities have assisted them have access to land. In terms of access to water, 58.4 % of women indicated that the local, cultural and traditional authorities do not help them in anyway with accessing water. Sokile et al (2003) also indicated that since the new water act the local traditional authorities were overlooked and this place the local politician at the top in terms of making sure that local people have access to water in most rural areas. In most case you find that the local chieftains and the local councilors do not work together when allocating water sources. Molden (2007) also mentioned that women's access to irrigation water, particularly in smallholder irrigation schemes also depends on the choice of technology and training. In cases in which women have not been trained in the appropriate use of .the technologies introduced in irrigation systems, they have not benefited from water availability.

In terms of access to local and traditional authorities, 63.1 percent mentioned that because of intervention by the local authorities they have access to productive land but when it comes to water accessibility and productivity 54.8% and 64 .2% of farmers respectively argued that local authorities are not assisting them in any way. 63.1 percent of the farmers respectively indicated that there is lack of infrastructure and markets are not available to sell their produce. Fifty percent do not belong to any social

groups because they belief that they are not benefiting. Most farmers 54.8% indicated that they are not water secured. About 45.3 percent of the farmers indicated that they have not benefitted from changes in land reform policies and that water reforms have also affected them negatively. They have also indicated these have affected their income generating activities 51.5%.

About 53.5 percent of women farmers indicated that they do not have any coping strategies to address the problem of land reform and they feel helpless because the government process to land redistribution is very slow and not reaching them while 45.2 percent indicated that they have devised some strategies to cope with water reform and income generating activities by being involved in non -farm income generating activities. About 54% indicated that the society has respect for them as they are involved in farming.

Table 2: Influence of Political, Cultural and Social Institutions on land water access and use

Political	High	Moderate	Low
Land reform			
Access to land	20(23.8)	49(58.3)	15(17.9)
Land availability	7(8.3)	23(27.4)	54(64.3)
Land productivity	7(8.3)	23(27.4)	52(61.9)
Water reform			
Access to water	9(10.7)	26(31.0)	49(58.3)
water availability	12(14.2)	43(51.2)	29(34.5)
water productivity	12(14.2)	49(58.3)	23(27.4)
Local political institutions influence the control of land in terms of production	18(21.4)	40(47.6)	26(31.0)
Local political institutions Influence of control of water resources in terms of production	22(26.2)	36(42.9)	26(31.0)
Local political institutions affect the access to water	23(27.4)	34(40.5)	27(32.1)
Local , cultural and traditional authorities			
Access to land	12(14.3)	53(63.1)	19(22.6)
Land availability	15(17.9)	44(52.4)	25(29.8)
Land Productivity	18(21.5)	45(53.6)	21(25.0)
Water access	13(15.2)	25(29.8)	46(54.8)
Water productivity	2(2.4)	28(33.3)	54(64.2)

Available infrastructures	4(4.8)	27(32.1)	53(63.1)
Access to markets	17(20.1)	14(16.7)	53(63.1)
Social group	20(23.8)	11(13.1)	53((63.1)
Benefits of social group	17(20.2)	25(29.8)	42(50.00
Water security	21(25.0)	17(20.2)	46(54.8)
Adjustment /changes in land reforms	17(20.2)	29(34.5)	38(45.3)
Adjustment /changes in water reforms	11(13.1)	26(31.0)	47(55.9)
Adjustment /changes in income generating activities water reforms	12(14.3)	22(26.2)	50(51.5)
Coping strategies in terms of land reforms	8(9.5)	31(36.9)	45(53.5)
Coping strategies in terms of water reforms	17(20.2)	38(45.2)	29(34.6)
Coping strategies in terms of income generating activities	16(19.0)	38(45.2)	30(35.7)
Societal perceptions about your participation in farming	30(35.7)	34(40.5)	20(23.8)
Societal perceptions about your participation in your income generating activities	0	45(53.6)	39(46.4)

Footnote: figures in parenthesis are percentages.

4.5 Access to livelihood assets

Table 3 shows access of women farmers to livelihood assets. Table 3 shows that 84.3% of the farmers obtain their credit from relative but 62.75% of them indicated that it is not adequate. Seventy nine percent of the farmers also indicated banks are the other source of credit even though only 6% of the farmers indicated that credit from the banks is adequate. Credit is important for farmers because it helps them to secure fertilizers, improved varieties of seed and other technologies on the farm. Inadequate finance can also prevent farmers from investing in new methods of crop production and irrigation (FAO, 2008). Lack of access to credit is one factor that reduces women's efficiency and productivity. Machete et al (2004) argued that one of the most critical problems threatening the viability of smallholder irrigation is the absence of credit. Access to credit need collateral mostly in the form of land right which some farmers do not possess particularly women.

Table 3 shows that 68.7 % of farmers indicated that they have received training while 27.7% stated that the training received were not adequate. Extension service is important in boosting agricultural productivity and 62.7% of farmers reported to have received extension service while 15. 7% indicated that it is not adequate. With regard to skills training, 63.9% women received training in equipment handling, 62.7 in soil management, 56.6% in water management, 56.6% in crop management, 53% in record keeping while only 38.6% in financial management. Curtis (1994) argued that an understanding of financial management will generate a continuous flow of irrigation schemes profitability, liquidity and reducing risks and this will provide a basis of forward planning for farmers.

With regard to access to physical capital, table 3 indicate that 67.5% indicated that there is availability of water canals. Fifty nine percent reported availability of road access, electricity availability 72.3%, access to markets 44.6%, storage facilities 62.7% and 39.8% of them have transport facilities to take their produce to the market.

Table 3: Access to livelihood assets

FINANCIAL CAPITAL	**Availability**		**Adequacy**	
	Yes	**No**	**adequate**	**Not adequate**
Access to Credit from:				
Banks	66 (79.5)	17 (20.5)	5 (6.0)	63 (75.9)
Cooperatives	68 (81.9)	15 (18.1)	2 (2.4)	67 (80.7)
Money lenders	67 (80.7)	16 (19.3)	4 (4.8)	63 (75.9)
Relatives	70 (84.3)	12 (14.5)	18 (21.7)	52 (62.7)
Personal savings	65 (78.3)	18 (21.7)	17 (20.5)	49 (59.0)
Contractors	52 (62.7)	31 (37.2)	10 (12.0)	43 (51.8)
Government subsidies	51 (61.4)	32 (38.5)	9 (10.8)	45 (54.2)
HUMAN CAPITAL	**Availability**		**Adequacy**	
	Yes	**No**	**adequate**	**Not adequate**
Training	57 (68.7)	26 (31.3)	35 (42.2)	23 (27.7)
Vocational training	20 (24.1)	63 (75.9)	16 (19.3)	5 (6.0)

Extension service	52 (62.7)	31 (37.3)	40 (48.2)	13 (15.7)
SKILLS TRAINING	**Availability**		**Adequacy**	
	Yes	**No**	**adequate**	**Not adequate**
Record keeping	44 (53.0)	39 (47.0)	38 (45.8)	6 (7.2)
Water management	47 (56.6)	36 (43.4)	37 (44.6)	8 (9.6)
Equipment handling	53 (63.9)	30 (36.1)	40 (48.2)	11 (13.3)
Financial management	32 (38.6)	51 (61.4)	21 (25.3)	12 (14.5)
Soil management	52 (62.7)	31 (37.3)	39 (47.0)	13 (15.7)
Crop protection	47 (56.6)	36 (43.4)	38 (45.8)	8 (9.6)
	Availability		**Adequacy**	
PHYSICAL CAPITAL	**Yes**	**No**	**adequate**	**Not adequate**
Transport	33 (39.8)	50 (60.2)	10 (12.0)	22 (26.5)
Water supply	56 (67.5)	27 (32.5)	27 (32.5)	29 (34.9)
Markets	37 (44.6)	46 (55.4)	10 (12.0)	29 (34.9)
Road accessibility	49 (59.0)	34 (41.0)	24 (28.9)	24 (28.9)
Electricity	60 (72.3)	23 (27.7)	49 (59.0)	12 (14.5)
Storage	52 (62.7)	31 (37.3)	27 (32.5)	24 (28.9)

Footnote: Figures in parenthesis are percentages.

4.5.1 Livelihood aspirations

The study revealed that women want to improve their standard of living and live a quality life. Those who could articulate their aspiration, talked about constructing a better house and providing better education to their children. Except for the few women who are constrained by religious constraints, all of them want to improve their income by engaging in some of the activities/occupations, which they currently see as relevant like non- farm business including tuck/spaza shops and livestock including dairy, piggery, poultry etc. Though many women in all the locations are keen on starting some

non-farm business activity, none of them was able to suggest the kind of support and services they require for doing the same, except credit. All believed that if they could get credit, they could engage successfully in these activities. This clearly reveals their lack of experience of setting up new activities and also the lack of awareness and knowledge about other kinds of services and support (technical training, entrepreneurial skills, market links etc).

Rural women often undervalue their knowledge and capabilities and thus do not volunteer to participate in irrigation farming projects, even though the projects interest them. One of the major factors that hinder women's participation in irrigation projects is related to their low literacy, resulting in a lack of relevant skills for participation and low self-confidence. In cases where women do want to take up leadership positions, they are not allowed to do so because of prevailing social norms (Chancellor, 1996)

4.6 Women's socio-economic status

Table 3 indicates the socio-economic status of women farmers. This is to indicate the average cultural and material position among women farmers in smallholder irrigation farming. Table 4 shows 48 items on which the socio-economic status was measured, the following are significant. The table indicate that 51.6 % of the respondents children are in primary school, 82.8% own houses while 78% of those houses are brick/ cement house and this indicates that socially farmers are better off. In terms of the position in the society 75.6% indicated that they do not have much role they play in the society. In terms of All the respondents have household appliances like fridge (88%), curtains (100%), standing mirrors (68.7%), frying pan (69.9%), metal spoons (100%),wall clock (59%), wardrobe (90.4%),dining table (78.3%), photo frames (53%) and electrical appliance like kettle (88%),electric iron (84.3%), and television set (91.6%) , electric stove(84.2%)and radio(73.5%). Most respondents have personal belongings like shoes(100%) jackets(81.9%). The respondents (97.5%) have cell phones as a means of communication and this will also help them get information on time.

Table 4: Indicators of Women Farmers Socio-Economic Status

SOCIO-ECONOMIC STATUS INDICATORS	Yes	No
Children in school: Primary	43 (51.6)	40 (48.0)
Secondary	22 (26.4)	60 (72)
High school	31 (37.2)	52 (62.4)
Higher institution	6 (7.2)	77 (92.4)
Children who are graduates	11(13.2)	72 (86.4)
Children who work in civil service	20 (24.0)	63(75.6)
Ownership of a house	69 (82.8)	14 (16.8)
Cement	65 (78.0)	17 (20.4)
Mud	7 (8.4)	73 (87.6)
Shack	4 (4.8)	76 (91.2)
Other	8 (9.6)	72 (86.4)
Rooms in the house	66 (79.2)	17 (20.4)
Position in the society	20 (24.0)	63 (75.6)
Community representative	10 (10.0)	73 (87.6)
Committee representative	19 (23.8)	64 (76.8)
Shoes	83 (100)	0 (0)
Plates	83 (100)	0 (0)
Cups	83 (100)	0 (0)
Pots	83 (100)	0 (0)
Electric stove	71 (84.2)	12 (14.4)
Two plate stove	32 (38.4)	51 (61.2)
Good type mattress	59 (71.1)	24 (28.9)
Goats	12 (14.5)	71 (85.5)
Pig	3 (3.6)	80 (96.4)
Cattle	15 (18.9)	68 (81.9)
Sheep	6 (7.2)	77 (92.8)
Ladder	18 (21.6)	65 (78.3)
Gloves	32 (38.4)	51(61.4)
Television set	76 (91.6)	7 (8.4)
Radio	61 (73.5)	22 (26.4)
Vehicle	26 (31.3)	57 (86.7)
Touch light	25 (30.1)	58 (69.9)
Wall clock	49 (59.0)	34 (41.0)
Ward robe	75 (90.4)	8 (9.6)
Dining table	65 (78.3)	18 (21.6)
Curtains	83 (100)	0 (0)
Frying pan	58 (69.9)	25 (30.1)
Wheel barrow	62 (74.7)	21 (25.3)
Standing mirror	57 (68.7)	26 (31.3)
Kettle	73 (88.0)	10 (12.0)
Electronic iron	70 (84.3)	13 (15.7)
Metal spoon	83 (100)	0 (0)
Coal iron	22 (26.5)	61 (73.5)
wrist watch	32 (38.6)	51 (61.4)

Bicycle	17 (20.4)	66 (79.5)
Photo frame	44 (53.0)	39 (47.0)
cell phone	81 (97.6)	2 (2.4)
Fridge	73 (88.0)	10 (12.0)
Winter jacket	68 (81.9)	15 (18.1)

4.7 Women skills capacity and training needs

Table 5 indicates women farmer's competency skills. Based on the enterprises found on the irrigation, a scale was developed to measure their competence in skills related to these enterprises. Table 5 indicated 23 competency skills and women were found to be competent in only four areas and these are: soil preparation for ploughing (51.6%), knowledge of crop rotation (55.2%) irrigation scheduling and frequency(54%)and knowledge on the amount of water to use (52.8%) skills capacity. Collet and Gale (2009) stated that the skills to improve productivity, increase adaptability to deal with changes and crisis and facilitates the diversification of livelihood to manage risks are at a premium in rural areas. Women competence in agricultural production and marketing skills are very low with percentages ranging from 1.2% to 8.4%. Integrating agricultural training with enterprise training can help women to manage and market their farm production more effectively, to take advantage of new agricultural opportunities. The implication of the low competence in the listed activities related to the enterprise in irrigation farming indicated areas for training needs.

Table 5: Women farmers' skills capacity

Skills and training needs	Not competent	competent	Very competent	Means	Mean Rating
Soil preparation for ploughing	36	43	4	1.60	3rd
Determining inter and intra row spacing	37	41	5	1.60	3rd
Determining seed depth	39	40	4	1.56	5th

Selecting appropriate planting methods for various crops	39	39	5	1.57	4th
Evaluating soil profile in farming areas	44	35	4	1.50	7th
Evaluating farming land for soil and water conservation	45	36	1	1.43	8th
Recommending suitable soil and water conservation measures for specific farm lands	48	32	3	1.44	7th
Knowledge of crop rotation	34	46	3	1.61	2nd
Calculating the amount of fertilizer to apply for various crops	52	30	1	1.37	11th
Appropriate application of herbicide and fungicide	52	29	2	1.38	10th
Calibrating planters and seeders for various crops	55	25	3	1.36	12th
Planning and carrying out harvesting appropriately for various crops	49	31	3	1.43	8th
Irrigation scheduling and frequency	35	45	3	1.60	3rd

Knowledge on the amount of water to use	32	44	7	1.68	1st
Knowledge of the market for your produce	57	24	2	1.32	13th
Price determination for your produce	49	33	1	1.40	9th
Knowledge of reading and interpreting market information	64	17	2	1.24	14th
Knowledge of the marketing contracts	67	16	0	1.18	16th
Value adding	65	17	1	1.21	15th
Service provider for Storage facilities	56	23	4	1.36	12th
Farm record keeping	49	39	4	1.65	2nd
Financial management	49	30	4	1.44	7th
Packaging	47	34	2	1.44	7th

4.8 WOMEN EMPOWERMENT

4.8.1 Women's role in household decision making on production and income generation.

Table 6 shows that 73.8 % of women farmers participate in decision making on cash crop farming. Galdwin (1992) reported that in Malawi hybrid cash crops are produced by male while local variety crops are produced by women. About 57.2% of women do not participate in decision making about which food crop to grow but according to Pitcher (1996) in Malawi women participate in decision making on which food crops to grow because it is mainly for household consumption. Women have the responsibility of feeding their families and onl\y after that can they take a decision of engaging in

non-farming activities. Table 5 shows that 83.4% of women do not participate in decision making on non-farm economic activities, more women (66.7%) also have less input in decision making in non-farm economic activities and also in the use of income generated in wage and salary employment with 66.7% .

Table 6: Women's role in household decision making on production and income generation.

	Participation in decision making		Input in decision			Input in use of income		
Activity	Yes	No	More	Less	average	More	less	Average
Food crop farming	36(42.9)	48(57.2)	3(3.6)	39(46.5	42(50)	12(14.3)	40(47.6)	32(38.1)
Cash crop farming	62(73.8)	22(26.2)		45(53.5)	39(46.4)	3(3.6)	38(45.2)	43(51.2)
Livestock raising	22(26.2)	62(73.8)	3(3.6)	54(64.3)	27(32.1)	6(7.1)	49(58.4)	29.34.5))
Non-farm economic activities	14(16.7)	70(83.4)	6(7.2)	56(66.7	22(26.2)	6(7.1)	56(66.6)	22(26.2)
Wage and salary employment: in kind or monetary work both in agriculture and other wage work	28(33.3)	56(66.7)	3(3.6)	49(58.4)	32(38.1)		56(66.7)	28(33.3)

4.8.2 Access to productive capital in smallholder irrigation farming

Table 6 indicates thirteen items that measure women's access to productive capital but they have access to only five items which are access to agricultural land (72.6%), ownership of most productive assets (64.3%) and 66.7% are involved in decision making about the use of these productive capital. Koopman (1983) agrees that in Cameroon, patrilineal lineages women have access to land only through male relatives and after marriage the access is withdrawn. From table 6 about 85.7% own houses, 72.6% of the women owns this productive capital, 89.3% decide how to use or dispose these productive capital. The table also shows that 83.3% of women have large consumer durables, 82.1% of these owned by women and 91.7% of them making the decision to use or dispose. Only 7.1 % owns mechanised farm equipment while 41.3 % have non-mechanised farm equipment.

According to Galdwin and Macmillan (1989) as population pressure increases, agricultural production is moving away from a more traditional practice to a more mechanised farming and this implies that women's workload is increasing as they have to do more of weeding and harvesting. About 85.7% have access to cell phone and this will help them to get information pertaining to their production from the extension officers on time and about 52.4% do not have access to transport to take their produce to the market. On the available productive capital, most of the women are the major decision makers of renting or mortgaging or purchasing the productive capital with the percentages ranging from 61 to 100%. Saito (1994) also noted that women's participation in agricultural production and men migrating to work outside agriculture gives them a lot of opportunity to take decision on the use of productive capital.

Table 7Access to productive capital by women in irrigation farming

Productive capital	Ownership		Quantity		Owner of most assets				Decision to give		
	Yes	No	Less than 10	Above 10	Wife	Husband	Both	Group	Wife	Husband	Both
Agricultural land	61(72.6)	23(27.4)	31(40.6)	50(59.5)	54(64.3)	9(10.7)	21(25.0)	7(8.3)	56(66.7)	9(10.7)	25 (22.6)
Large livestock(cattle)	15(17.9)	69(82.1)	81(95.3)	3(3.6)	77(91.6)	2(2.4)	5(6.0)	3(3.6)	68(81.0)	14(16.7)	2(2.4)
Small livestock (goats, sheep)	20(23.8)	64(76.2)	79(94.1)	5(6)	77(91.6)		7(8.3)		79(90.5)	3(3.6)	2(2.4)
Poultry	20(23.8)	64(75.2)	78(92.8)	6(7.2)	82(97.6)		2(2.4)		82(97.7)		2(2.4)
Farm equipment (non-mechanized	12(14.3)	72(85.7)	84(100)		78(92.8)		3(3.6)	3(3.6)	78(92.8)	3(3.6)	3(3.6)
Farm equipment (mechanized	6(7.1)	78(92.8)	84(100)		84(100				84(100)		
Nonfarm business equipment	13(15.5)	71(84.5)	84(100)		81(96.4)		3(3.6)		82(97.6)		2(2.4)
House (and other structures)	72(85.7)	12(14.3)	84(1000		61(72.6)	2(2.4)	21(25.0)		75(89.3)	2(2.4)	7(8.3)
Large consumer durables (fridge, TV, sofa)	70(83.3)	14(16.7)	84(100)		69(82.1)	2(2.4)	13(15.5)		77(91.7)	2(2.4)	5(6.0)
Small consumer durables (radio, cookware)	72(85.7)	12(14.3)	84(100)		71(84.5		13(15.5)		82(97.6)		2(2.4)
Cell phone	72(85.7	12(14.3)	84(100)		75(89.2)		9(10.7)		84(100)		
Other land not used for agricultural purposes (pieces, residential or commercial land)	11(13.1)	73(86.9)	84(100)		82(97.7)		2(2.4)		80(95.2)	2(2.4)	2(2.4)
Means of transportation (bicycle, motorcycle, car)	40(47.6)	44(52.4)	84(100)		82((97.7)		2(2.4)		69(82.1)	3(3.6)	12(14.3)

4.8.3 Access to credit by women in irrigation farming

The table 8 shows that 75% to 86.9% of women have access to credit with respect to the different lending sources and they also take decision from which source to borrow from and about (97.6%) being from the informal lender and decides from which source to borrow and the amount to be borrowed. Mehra et.al (2008) noted that one factor that reduce women's efficiency and productivity is lack of access to credit. Access to credit is important for securing fertilizer, improved varieties of seed and other technologies on the farm. Inadequate finance also prevents farmers from accessing all the complementary inputs required to maximize the productivity of land and water resources. Godfrey (2010) also noted that the perception that women produce crops for subsistence and not for the market and that they have less secure land tenure, makes the provider of credit to gear the provision of credit towards men and this affect women's access to credit.

According to Yunus and Jolis (1998) women traditionally had less access to financial alternatives and ordinary credit lines and incomes. They are seen to have inequitable share of power in household decision making. In Bangladesh the Grameen Bank was established with the aim of uplifting the women by giving them credit without collaterals. Yunus (1998) also found that lending to women generate considerable secondary effect including empowerment of the marginalised segment of society.World Bank (1998) also concluded that women's access to micro-credit empowers them through greater access to resources control and decision -making on those resources.

Meena (1992) emphasised that women farmers not benefiting from the rural credit facilities limit their contribution to promoting sustainable development in the agricultural sector. According to Anyanwu (2004) and Okojie et al (2010) in Nigeria most women access credit from the informal financial institution than the formal institutions and this is because in the formal institution access to credit is difficult because of lack of bank accounts, lack of information regarding the procedure for accessing credit and lack of collaterals.

Table 8: Access to credit by women in irrigation farming

Lending source	loan or borrowed cash/in-kind from [SOURCE] in the past 12 months?		Decision maker to borrow from [SOURCE]			decision maker about use of money/ item borrow from [SOURCE]?			Use of credit from the source	
	Yes	No	Wife	Husband	Both	Wife	Husband	Both	Yes	No
Non-governmental organization (NGO)	63(75.0)	21(25.0)	66(78.6))	18(21.4)		81(96.4)	3(3.6)		5(6.0)	79(93.9)
Informal lender	73(86.9)	11(13.1)	76(90.4)	8(9.5)		82(97.6)	2(2.4)		2(2.4)	82(97.6)
Formal lender (bank/financial institution)	69(82.2)	15(17.9)	79(94.0)	2(2.4)	3(3.6)	79(94.0)	2(2.4)	3(3.6)	12(14.3)	72(85.7)
Friends or relatives	70(83.3)	14(16.7)	80(94.0)	3(3.6)		79(94.0)	5(6.0)		13(15.5)	71(84.6)

4.8.4 Leadership role and group membership of women in irrigation farming

Table 9 shows that 88.1% of women have confidence of speaking in public while 44% have confidence in ensuring payment of services and 54.8 % do have confidence to confront misbehaviour while 11.9% cannot speak in public. The table shows eight different categories of community group and only three of the following are available in their community, water user groups (57.1%), trade and business groups (81%) and civic groups (79.8%). Of all the community groups that are available 65.5% indicated that they have taken membership in only one group which is the civic group. 82.1 % - 92.8% of women indicated that they are not interested in belonging to any community group. The only two groups that have more group membership are trade and civic association groups. In all the groups, members have less input on decisions (54 .7% -90.5 %).

Quisumbing and Meizen-Dick (2001) noted that women with little education may feel that they have nothing to contribute therefore it is not worth their time and effort to participate. Women groups can be a vehicle for both individual and collective empowerment in decision making. Meizen dick and Quisumbing(2001) noted that for example in Zimbabwe women in areas with dense networks women 's associations plays a more effective role in decision relating to location of water points, water use rules and other aspects of water management. When women farmers' access to membership and leadership positions in these organizations is restricted, by law or custom, their access to resources and their ability to make their views known to policy makers and planners is also restricted. The obvious results are the inability of women farmers to carry out their roles in agriculture and food security to optimum potential.

Table 9: Leadership role and group membership of women in irrigation farming

Confidence speaking in public to help decide on infrastructure (roads, water supplies) to be built in the community.	Yes	No
	74(88.1)	10(11.9)
Confidence speaking in public to ensure proper payment of irrigation services, or other similar programs?	37(44.0)	47(56.0)
Confidence speaking in public to ensure protest the misbehavior of authorities or elected officials in the scheme?	38(45.2)	46(54.8)

Table 9: Group membership of women on the smallholder irrigation farming

Group categories	availability of group in your community		Membership		Input in making decisions		Reason for nc membership
	Yes	No	Yes	No	Less	More	Not interested
Agricultural / livestock/crop producer's group (including marketing groups)	35(41.7)	49(58.3)	3(3.6)	81(96.5)	72(85.7)	12(14.3)	72(85.7)
Water users' group	48(57.1)	36(42.9)	39(46.4)	45(53.6)	67(79.8)	17(20.2)	56(66.6)
Credit or microfinance group	5(6.0)	79(94.0)	8(9.5)	76(90.4)	76(90.5)	8(9.6)	75(89.3)
Mutual help or insurance group (including burial societies)	28(33.3)	66(66.7)	18(21.4)	66(78.5)	66(88.6)	18(21.4)	69(82.1)
Trade and business association	68(81.0)	16(19.0)	34(40.5)	50(59.5)	52(61.9)	32(38.1)	60(71.4)
Civic groups (improving community) or charitable group (helping others)	67(79.8)	17(20.3)	55(65.5)	29(24.5)	46(54.7)	38(45.3)	36(42.9)
Local government	7(8.3)	77(91.9)	16(19.1)	68(81.0)	64(76.2)	20(23.8)	78(92.8)
Religious group	31(36.9)	53(63.1)	24(28.6)	60(71.4)	67(79.8)	17(20.2)	25(29.8)
Other (specify)	19(22.6)	65(79.4)	15(17.9)	69(82.1)	65(77.4)	19(22.6)	24(28.6)

4.8.6 Decision making by women in irrigation farming

Table 10 shows the entire ten categories that women make decision on. The table indicates that women can make decision on their own only on six categories which are, on types of crops to grow (74%), crops to market (94.1%), livestock rearing(90.5%) non-farm business activity and wage/salary (94.1%). The table also indicated that in all the decision making categories women find themselves always making personal decision on livestock rearing and non-farm business activities (58.3%) wages or salary (72.6%).

The lack of recognition of the role women play as decision makers is one of the major reasons for women's poor access to productive resources. As a result, most of the agriculture and water initiatives that aim at enabling poor and vulnerable farmers to improve their livelihoods and provide access to productive resources fail to take into account women's concerns about the multiple uses of water. Women use water for agriculture, domestic tasks, health and sanitation, while men's water use priorities mainly revolve around agriculture or livestock.

Table 10 Decision making of women on the smallholder irrigation farming

Category	Decision maker			extent of personal decisions-making			
	Wife	Husband	Both	None	Rarely	Sometimes	Always
Agricultural production	24(28.6)	20(23.8)	40(47.6)	37(44.1)	11(13.1)	3(3.6)	33(39.3)
What inputs to buy for agricultural production?	32(38.1)	20(23.8)	32(38.1)	35(41.7)	8(9.5)	5(6.0)	36(42.9)
What types of crops to grow for agricultural production?	63(74.0)	13(15.5)	2(2.4)	37(44.0)	3(3.6)	3(3.6)	34(40.5)
When or who would take crops to the market?	79(94.1)	3(3.6)	8(9.5)	17(20.2)	21(25.0)	6(7.1)	40(47.6)
Livestock raising?	76(90.5)		8(9.6)	11(13.1)	15(17.9)	9(10.7)	49(58.3)
Non-farm business activity?	79(94.1)	3(3.6)	2(2.4)	5(6.0)	21(25.0)	9(10.7)	49(58.3)
Your own (singular) wage or salary employment?	79(94.1)	3(3.6)	2(2.4)	5(6.0)	18(21.4)		61(72.6)
Major household expenditures? (Such as a large appliance for the house like refrigerator)	42(50.0)	11(13.1)	31(36.9)	15(17.9)	47(56.0)	19(22.6)	3(3.6)
Minor household expenditures? (Such as food for daily consumption or other household needs)	37(44.1)	14(16.7)	33(39.3)	15(17.9)	46(54.8)	22(26.2)	1(1.2)

Footnote: values on parenthesis are percentages.

4.9 EMPOWERMENT INDICES AMONG WOMEN IN SMALLHOLDER IRRIGATION FARMING

In this study a modified Women Empowerment in Agricultural Index (WEAI) was used because the questionnaire did not cover time budgeting. The empowerment indices covered in this study include the use of income, access to productive capital, access to credit , leadership roles and decision making. From the scoring of the empowerment indices the mean was calculated for each of the indices and used as the cut- off point. Women with scores below the mean depict disempowerment while those above the mean indicate empowerment.

4.9.1 Use of Income

Table 10 indicate that 56% of women in terms of the control over the use of income use are below the mean score of 16.80 which implies that they are disempowered in the control of the use of income as a index of empowerment. According to FAO (2000), women tend to spend most of their income on basic household needs such as household essentials while men tend to retain more of the income they control for their personal use such as buying alcohol, drinking and leisure. The study also indicated that in certain parts of Uganda, such as Apac and Kumi, husbands are more likely than elsewhere to entrust the income to their wives, to prevent its misuse. But some men are afraid to do so, in case the women might be tempted to leave them.

4.9.2 Access to Productive Capital

Table 10 indicate the proportion of women below the mean (78.99) for access to productive capital as an index of empowerment is 60.2% . This shows that women are disempowered in terms of the access to productive resources as an index of empowerment. Lopi (2004) argued that although policies aimed at creating enabling environments have been established in nearly all countries for women to access, own, control, use and manage land for productive use still remains to be a challenge. According to Lopi (2004), promoting women's full access to, and control over productive resources such as land, livestock, markets, credit, modern technology, formal employment, and a good quality of life in order to reduce the level of poverty among women, is a SADC declaration on gender and development. If women are disempowered they are very vulnerable and it impacts on their human dignity.

The lack of recognition of the role women play as decision makers is one of the major reasons for women's poor access to productive resources. Gender-based farming systems where men and women cultivate separate fields are common in many parts of sub-Saharan Africa. This reality has often been ignored in irrigation development projects and led to gender inequity in access to productive resources. It has also resulted in the partial or total failure of irrigation schemes. Moreover, key decisions regarding site selection, beneficiaries, land (re)allocation and water rights are made during the planning phases of water-related investment projects and thus form the basis of gender inclusion or exclusion in the projects. The gender approach of agencies and projects, as well as the local class and gender hierarchies, is also one of the causes of gender-related inequities in access to water resources in Sub-Saharan Africa (Van Koppen, 1998).

4.9.3 Access to credit

Table 10 indicates that 60.2% of women in terms of access to credit are below the mean score of 113.56 showing that women are disempowered in terms of access to credit as an index of empowerment. Paradza (2012) ascertained that lack of collateral; low levels of education with a resultant lack of numeracy and access to information are factors contributing to the fact that 10% of agricultural credit in SADC (16 countries of Southern Africa) region being accessed by women. In some instances women need the consent of their spouses in order to access credit and this makes them to lose confidence in themselves and disempowered.

According to FAO (1995), direct consequence of women's lack of access to land and membership in rural organizations is their lack of access to credit. Land is usually required as collateral for loans, on the one hand, and, on the other, credit schemes are often channeled through rural organizations to their members. This is a serious obstacle to improving women's agricultural productivity, as without credit women farmers are unable to buy inputs such as seeds, fertilizers, and improved technologies, or to hire labor. Paradoxically, women are more likely than men to repay loans. Both men and women farmers often have different responsibilities in agricultural production and food security, both need credit according to their needs. It is thus important for women to have not only access to credit but also control over the use of the credit so that it is not

diverted to male-dominated production systems, at the expense of women's productive activities.

FAO (1994) indicated that a study of credit schemes in Kenya, Malawi, Sierra Leone, Zambia and Zimbabwe showed that women received less than 10 percent of credit directed to smallholders and only 1 percent on total credit to agriculture. Shortage of good quality agricultural land for smallholders is a problem in many regions of the world due to environmental degradation, conversion of land for nonagricultural purposes, population pressure and consolidation of land in the hands of fewer and fewer large landowners, including transnational corporations. Access to land through ownership or secure tenure is, on the other hand, the sine qua non of improving agricultural productivity. Without secure land rights, farmers have little or no access to credit or the benefits of membership in rural organizations which are often conduits of agricultural inputs and services. Moreover, with no stake in the land or assurance of access to it, farmers have few incentives to engage in sustainable agricultural practices or to consider the long-term environmental impact of the exploitation of the land.

4.9.4 Leadership role

The table 10 indicates that 51.8% of women in terms of leadership roles are above the mean score of 43.98. This indicates that in terms of women engagement in leadership roles the difference is very marginal when compared with the mean score. This could be because of the fact that due to unequal gender norms and relations, women have a lower socio-economic status, compared to their male counterparts, which limits their opportunities to access and participate in formal groups .

World Bank (2009) and FAO (2011) justifies the fact that Women's freedom is constrained by men's control over their mobility, by socio-cultural expectations that they are primarily responsible for all domestic work, and in relation to this, by their uneven reproductive, productive, and community work burdens. Their restricted access to, control over, and ownership of land, credit, and information, as compared to men, disadvantage them from meeting conditions of formal group membership and leadership. However, Gizachew, 2011) stated that when women gain leadership positions, it helps them to build their self-confidence, exercise their political leadership, and gain respect from their male and female peers. There is some evidence also in the

context of Ethiopia that when there are women in leadership roles, there is a greater likelihood of other women participating in the organization (Oxfam International 2013).

According to FAO (1994), women membership in rural organizations such as cooperatives, agricultural producers' organizations and farmers' associations, is important for access to productive resources, credit, information, training and other support services. These organizations also represent the interests of their members in relation to governments, project management, and development policy makers and planners at different levels. When women farmers' access to membership and leadership positions in these organizations is restricted, by law or custom, their access to resources and their ability to make their views known to policy makers and planners is also restricted. The obvious results are the inability of women farmers to carry out their roles in agriculture and food security to optimum potential.

The same agrarian reform programmes that have given land titles to male heads of households and thus restricted women's ownership of land, have also restricted membership in agrarian reform organizations and cooperatives to male heads of household. Even where women do have access to membership in cooperatives and other rural organizations, they make up a small minority of the leadership. In Zimbabwe, for instance, women constitute 75 percent of the officers. In Benin, women make up 25 percent of the cooperative members, but cover 12 to 14 percent of the leadership positions (FAO, 1994)

4.9.5 Decision making

Table 10 indicates the proportion of women above the mean (38.29) for decision making as an index of empowerment is 53% which implies that they are empowered in decision making. Most women are not married and this could be the reason they are actively involved in decision making. Women have been facing huge challenges in the area of decision making firstly because of tradition, secondly men are not giving them opportunity to make decision especially when it comes to farming activities, thirdly because of their internal inferiority complex whereby there are not even sure if the decisions that they want to take will bear some fruits and that will make them to be very aversive in terms of decision making. When it comes to the sales of assets or crops the women that will be the prerogative of the women since most of them are not married

The Grameen Bank in Bangladesh and other microcredit institutions are an exception because they give small loans to poor men and women. Access to these resources helps the women or men use their labour more effectively by enabling them to make decisions and adjustments in allocating resources under changing economic and climate conditions (IFAD,2004)

4.9.6 Total empowerment score

Table 10 indicate that 60.2% of women were below the mean of 291.61, which implies that women are disempowered. According to IFPRI (2012) an individual is identified as empowered in 5DE, the domains used as indices of empowerment if there is an adequate achievement in four of the five domains or enjoys adequacy in some combination of the weighted indicators that sum to 80 percent or more, or has an adequacy score of 80 or above. Women are reflecting empowerment adequacy in only two indicators that are leadership role and decision making and disempowerment in three indicators.

Table 11: Empowerment indices among women on smallholder irrigation schemes

Income	Use of income	Productive Capital	Access to credit	Leadership	Decision	Total empowerment score
X	16.80	78.99	113.56	43.98	38.29	291.61
Sd	8.55	35.41	38.24	10.85	10.64	84.48
Low	47(56)	50(60.2)	50(60.2)	43(51.8)	44(53.0)	50(60.2)
High	36(44)	33(39.8)	33(39.8)	40(48,2)	39(47.0)	33(39.8)

4.10 Inferential Statistics

4.10.1 Determinants of women empowerment

The influence of the socio-economic characteristics and empowerment model was estimated using linear regression with the equation:

$Y=f(X_0 + X_1$ age + X_2 gender + X_3 marital status + X_4number of dependents +X_5 household size + X_6 educational level + X_7 labour source + X_8 income + X_9 use of centre pivot irrigation + X_{10}use of flood irrigation + X_{11} use of sprinkler irrigation + X_{12} use of micro irrigation +X_{13} use of drip irrigation + X_{14} farm size + X_{15}farmng expenditure and the results of the estimated model is presented in Table 12.

The independent variables were significantly related with an F value of 1.94, $p < .05$. Also, an R value of 0.607 showed that there was a strong correlation between socio-economic characteristics and empowerment. The results further predicted 37% of the variation in socio economic characteristics. Three out of sixteen independent variables were significant; with two variables being significant at 10% (expenditure and the use of drip irrigation system); while only one variable was significant at 5% (use of micro irrigation system). Significant determinants of empowerment were expenditure (t = 1.68), use of drip irrigation type (t = 1.71). These findings imply that, the higher the household expenditure, use of drip irrigation system and micro irrigation system, the higher the empowerment. However, age, marital status, number of dependant, household size, educational levels, non-farming activities, income, use of central pivot system, use of flood system, use of sprinkler, farm size and food security status do not have a significant correlation with empowerment of women farmers in irrigation farming.

Table 12: Multiple regression analysis between socio-economic characteristics and empowerment

Variables	B	Std error	Beta	t	Sig
Constant	93.698	126.764		.739	.463
Age	-.129	.551	-.032	-.233	.816
Marital status	-.958	8.828	-.015	-.108	.914
Number of dependents	3.198	2.721	.148	1.175	.244
Household size	-.157	2.118	-.010	-.074	.941
Education	-1.102	4.291	-.035	-.257	.798
Labour source	3..588	6.004	.071	.598	.552
Non farming activities	8.563	15.677	.059	.546	.587
Central pivot irrigation type	-6.734	24.291	-.069	-.277	.783
Flood irrigation type	-27.368	31.547	-.121	-.868	.389
Sprinkler irrigation type	31.899	25.504	.261	1.251	.216
micro irrigation type	54.515	24.269	.383	2.246	.028
Drip irrigation type	15.489	9.062	.301	1.709	.092
Farm size	-3.718	17.197	-.027	-.216	.830
R	.607				
R square	.369				
F	1.936				
P	.026				

4.10.2 Probit regression analysis showing relationship between socio-economic characteristics and food security

$Y_Z = f(\beta_0 Y_0 + \beta_1 Age + \beta_2 Gender + \beta_3 Marital\ status + \beta_4 dependents + \beta_5 household\ size + \beta_6 Educational\ level + \beta_7 labour\ source + \beta_8 farming\ expenditure + \beta_9 income + \beta_{10} central\ pivot + \beta_{11} sprinkler\ irrigation + \beta_{12} micro\ irrigation + \beta_{13} drip\ irrigation + \beta_{14} flood\ irrigation + \beta_{15} access\ to\ financial\ capital + \beta_{16} access\ to\ human\ capital + \beta_{17} access\ to\ physical\ capital + \beta_{18} farm\ size$

The table 13 shows the result of the probit model used to determine the influence of the independent variable on the food security status of women farmers in the irrigation farming. The model has a good fit and it is significant at 1%. The autonomous level of food security is 3.87. Nine explanatory variables were significant while the other nine were insignificant. The significant variables include household expenditure, Marital status, non-farming activities, production expenditure, income, central pivot, sprinkler irrigation, micro and drip irrigation. The insignificant variables were access to financial capital, access to human capital, access to physical capital, age, household size, number of dependents, educational level, size of farm and flood irrigation

The probit model was employed to determine factors that influence food security among women farmers in the smallholder irrigation farming. The probit model seeks to explain the probability of food security as a result of any of the eighteen identified independent variables. The signs of the coefficients of independent variables and significance of the independent variables were used in determining largely the impact of each variable on the probability of food security among women farmers. The household expenditure of smallholder's farmers has a negative coefficient and it is statistically significant at 5 percent. This indicates that there is inverse relationship between household expenditure and food security. An increase in household expenditure will make the household to be food secured and a decrease in household expenditure will make the household to be food insecured. This shows that if the household expenditure is high, the household is spending money on other things other than food hence food security and when the household expenses decrease, they will be food insecurity.

The sign of coefficient of access to financial capital did not comply with a priori expectation and is not statistically significant. Access to human capital has a negative

coefficient and there is no relationship between food security and access to human capital. Access to physical capital also did not have any significant relationship with food security. The sign of the coefficient of the age of farmers did not have any significant relationship with household food security. Marital status has a negative coefficient and it is statistically significant at 5 percent. This also indicates that there is a direct relationship between marital status and food security. There is 1.8% probabilities that married women will be more food secured than those who are single, divorced or widowed. The education level has a negative coefficient and it is not statistically significant.

Household size and number of dependents have positive coefficients but not statistically relevant. The sign of the coefficient of production income for farmers comply with priori expectation; it is positive and also statistically significant at 5 percent. An increase in production income will increase household food security status while a decrease in income will decrease the food security status of the household. There is a 100% probability of surplus income from the production will be spent on food hence household will be food secured. The production expenditure has a positive coefficient and is statistically significant at 1%. This shows that when production expenses are low, household food security will be secured and when the production expenses are higher, the household will be food insecure because most of the money will be spent on production inputs rather than on food. This relates to scale of production rather than production expenditure only.

The coefficient of farm size is positive but is not statistically significant. Household income is positive and statistically significant at 10%. This indicates that the higher the income the more the household is food secured and the lower the income the vulnerable will be the household in terms of food security. The coefficient sign of the central pivot system is negative but statistically significant at 1%. This is an indirect relationship indicating that farmers using the central pivot system are not food secured as compared to the other irrigation type, cost and technical ability to manage the infrastructure. With the flood irrigation type the coefficient is positive but not significant. The sign of the coefficient for sprinkler irrigation and drip are negative but statistically significant at 5% respectively. This shows an inverse relationship indicating that farmers on the sprinkler and drip type of irrigation are food secure compared to other irrigation type.

The coefficient sign of the micro system is negative but statistically significant at 5% indicating that food security is determine by the irrigation type.

Table 13: Probit analysis of food security on women farmers in the irrigation schemes

Parameters	Estimates	Std error	Z	Sig
Intercept	-.3.87	.758	5.117	.000
Household expenditure	.000	.000	-1.937	.053
Access to financial capital	.021	.014	1.531	.126
Access to human capital	-.002	.008	-.280	.779
Access to physical capital	.012	.018	.633	.527
Age	.003	.003	.964	.335
Marital status	-.121	.051	-2.365	.018
Education	-.013	.023	-.564	.573
Household size	.018	.013	1.363	.173
Number of dependents	.017	.016	1.034	.301
income	.000	.000	6.909	.000
Production expenditure	.000	.000	1.762	.078
Farm size	.177	.116	1.529	.126
Non-farming activities	.173	.092	1.873	.061
Use of central pivot irrigation type	-.429	.158	-2.714	.007
Use of flood irrigation type	.146	.189	.772	.440
Use of sprinkler irrigation type	-.352	.167	-2.102	.036
Use of micro irrigation type	-.560	.163	-3.435	.001
Use of drip irrigation type	-.199	.054	-2.199	.028
Chi-square	1459.05			
P	.000			
Df	64			

4.11 Forster Greer Thorbecke Analysis

Table 14 shows the results of Forster Greer Thorbecke analysis that was used to measure the poverty status of women farmers in irrigation farming. In this study household income was used as the welfare measure. The poverty line was set at 1USD = R9.2 as a level of welfare corresponding to some minimum acceptable standard of living in South Africa. The poverty line acts as a threshold with households falling below the poverty line considered poor and those above poverty line non poor. At α =0: this indicated poverty incidence/poverty headcount ration. This was the share of the population whose income was below the poverty line. The results indicated that about 15% of the respondents are living below the threshold of R9.2 per day. This implies majority of the farmers in the irrigation farming are well off, this could be because of

the support such as (tractors, seeds and market information) that farmers receive from government. The gross income was used in this calculation due to limitations of recall of records by the respondents; consequently the results cannot be interpreted as only 15% of the respondents being poor.

At $\alpha = 1$: this indicated depth of poverty, this provided information regarding how far off respondents are from the poverty line. The results indicated 0.005 as depth; the interpretation is that per capita income of farmers that are below the poverty line needed to be increased by 0.5% to meet the level of poverty line. While $\alpha = 2$: indicated severity of the farmers from the poverty line. The results showed severity of 0.1%, this implied that the gap of respondents from the poverty line is very small. Respondents who are poor are not much further from the poverty minimum threshold that was set at R9.2. The incidence of poverty, depth and severity is very low for farmers who are on irrigation farming since irrigation allows continuous cropping and higher yield than non-irrigated plots. Namara *et al* (2011) also found that incidence, depth and severity of poverty by access to irrigation are lower for farmers that have access to irrigation.

Table 14: Forster Greer Thorbecke Analysis

Index	Estimated value	Estimated value	Estimate value
FGT	0.3353	0.17	0.11781
Poverty line	9.2	9.2	9.2
Edge	0	1.6058	3.15

4.8 Chapter summary

This chapter gives an overview of how the data was analysed. The descriptive analysis was used to explain the demographics of the women in the schemes. The linear regression model was used to determine empowerment while in determining food security, probit was implemented. To determine the empowerment, a composite score was generated from the five domains.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter highlight the summary, conclusion and recommendation of the study. It narrows the objective of the study which is to determine the impact of the irrigation farming on empowerment, food security and poverty alleviation among women farmer. The summary covered the objectives of the study, sampling techniques, sample size, data collection method and analysis.

5.2 Summary

The main aim of the study was to assess the impact of irrigation farming on women empowerment, food security and poverty status. The objectives were to identify demographic characteristics of women in irrigation farming; examine livelihood assets available to them; assess their socio-economic status; assess the food security status of their household; their poverty status and also determine the level of empowerment as a result of irrigation farming. Assess demographic characteristics of women in irrigation farming. The study was conducted in North west province covering smallholder irrigation farming in the Taung, Nyetse, Molatedi, Mayaeyane area.

The study used the probability sampling method of simple random sampling techniques to select the respondents. A sample of 84 farmers were randomly selected. Data for this study was generated from primary sources through the structured questionnaire based on the objectives of the study. Descriptive statistics such as frequency distribution, percentages, mean and standard deviation were used to describe the personal characteristics of the women farmers on the scheme. Tables were used to enhance the readability of the results. The linear regression model was used to determine empowerment while in determining food security, probit model was used.The F-test and ANOVA was used to test the significance of the simple linear regression. Forster Greer Thorbecke analysis was used to measure the poverty status of

women farmers in irrigation farming. In this study household income was used as the welfare measure. The poverty line was set at (1USD = R9.2) as a level of welfare corresponding to some minimum acceptable standard of living in South Africa.

5.3 Major findings

The findings from the study show the age distribution of women farmers. The largest age group ranging from 41 to 50 years of age accounts for 72%. The study also shows that 42.2 % of the farmers in the scheme are married, 31.3% are single and 26.5% are widowed. The results also indicated that 32.5% have primary education while 26.5% have secondary and high school education respectively, 11% have no formal schooling and only 3% have tertiary education. The findings in this study indicated that 66.3% of farmers have farming experience ranging from 1-10 years. With regards to income sources the study revealed that pension is the greatest non-farm contributor at 30%, followed by grants at 21.4%, remittance at18.4%, wages at 14.2% and others at 2.3 %.

The findings from the study with regard to the socio economic status also indicated that 51.6 % of the respondents' children are in primary school. The findings also indicated that 82.8% of respondents own houses while 78% of people whose houses are brick/ cement house. This indicates that farmers are socially better off.

The findings of the study indicated that out of 23 competency skills levels women were found to be competent in only four of the skills: soil preparation for ploughing (51.6%), knowledge of crop rotation (55.2%) irrigation scheduling and frequency (54%) and knowledge on the amount of water to use (52.8%) skills capacity. The findings also indicated that (82.1%) of women farmers indicated that the political institution has assisted help them to have high access to land. 35.7%) have more land available, 58.3% have water access, (65.4%) have water availability while 72.5% have indicated that the availability of water has increased their productivity

The study also indicated the empowerment indices covered in this study include the use of income, access to productive capital, access to credit, leadership roles and decision making. From the scoring of the empowerment indices the mean was calculated for each of the indices and used as the cut- off point. Women with scores below the mean depict disempowerment while those above the mean indicate empowerment.

The findings of multiple regression model to isolate the determinants of women empowerment indicated that the independent variables were significantly related with an F value of 1.94, $p < .05$. Also, an R value of 0.607 showed that there was a strong correlation between the empowerment and socio-economic characteristics. The results further predicted 37% of the variation in socio economic characteristics. Three out of sixteen independent variables were significant; with two variables being significant at 10% (expenditure and drip irrigation system); while only one variable was significant at 5% (micro irrigation system). Significant determinants of empowerment were expenditure ($t = 1.68$), drip irrigation type ($t = 1.71$).

The study also indicated through a regression model that the determinants of food security status of women in irrigation farming were significant. The significant variables include household expenditure, marital status, non-farming activities, farming expenditure, income, central pivot, sprinkler irrigation, micro and drip irrigation. The insignificant variables were access to financial capital, access to human capital, access to physical capital, age, household size, number of dependents, educational level, size of farm, the use of flood irrigation.

5.4 Conclusion

The following conclusion can be drawn based on the findings and focusing on the objectives of the study. The higher the age, educational, income and socio- economic status more the of the farmers and the availability of women on the males on the scheme, the more empowered they will be. The more accessible the livelihood assets are to women, the more they feel empowered. The socio-economic status indicators of women are very low and this shows that the irrigation scheme should contribute to boost the socioeconomic status of women so that they can feel empowered. The irrigation schemes also play a significant role in empowering women farmers to achieve food security and improve their standard of living.

Irrigation development has made it possible for other rural infrastructure to be developed in areas which otherwise could have remained without like roads. Irrigated agriculture is an essential component of any strategy to increase global food supply.

The irrigation schemes also play a significant role in empowering women farmers to achieve food security and improve their standard of living. The smallholder irrigation scheme has resulted in increased income that is translated to increased expenditure, investments and trade and in this way women feel much empowered. Income afforded them to meet some of the basic requirements like sending children to school improvement in their livelihood and even income to cover some farm inputs. At the household level an increase in income has led women to build better houses. The benefit of irrigation has resulted in lower food prices higher employment and more rapid agricultural and economic development. The women's acquisition of assets has improved

5.5 Recommendations

From the discussion above, the researcher would like to make the following recommendations:

- In order to empower women and for the irrigation schemes to be sustainable government and non-government organisation should come up with economic recovery programmes such as farm mechanisation to ensure viability and sustainability of irrigation on rural livelihoods.

- The irrigation schemes should empower and improve women socio-economic status.

- Government, through irrigation development should ensure that rural infrastructure like roads are well developed so that people in farming can have access to inputs on time and also empower women to have access the markets.

- Government provide extension service so that women's productivity in irrigation scheme can be improved.

- Women farmers should receive training to improve on their competency skills in different enterprises in the scheme.

- Institutional support should be given to women farmers in order to access land and water and improves their productivity.

- Women to should be empowered in decision making, access to productive capital, credit and leadership role to reach their potential.

- Continuous monitoring and evaluation of irrigation schemes by the North-West Department of Agriculture jointly with farmers is necessary to provide feedback to farmers and in order to assist them improve their productivity.

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ADDENDICES

QUESTIONAIRE ON EMPOWERMENT OF WOMEN IN RURAL AREAS THROUGH WATER USE SECURITY AND AGRICULTURAL SKILLS TRAINING FOR GENDER EEQUITY POVERTY REDUCTION IN THE NORTH WEST PROVINCE

Dear Respondents

This questionnaire is for data collection on research on EMPOWERMENT OF WOMEN IN RURAL ARES THROUGH WATER USE SECURITY AND AGRICULTURAL SKILLS TRAINING FOR GENDER EEQUITY POVERTY REDUCTION IN THE NORTH WEST PROVINCE. The information provided will be treated as confidential as no name is required and the analysis will be group referenced. Could you please spare some of your valuable time in responding to questions. Thanks for your anticipated cooperation

Personal characteristics

Age: _____
Marital status: Single Married Widowed Divorced
Race: African White Coloured Indian other: _____
Religion: Christianity Bahai Hinduism Islam Other: _____
Number of dependant(s): _____
Number of household: _____
Total number of people in the household: Male Female
Highest educational level: Primary school Secondary School High School College University
No formal education
Number of months /years in farming: _____
Tenure status: Personal Rented Allocated
Farm size: _____
Are you a member of farmers group? Yes, No
Do you have contact with extension agent? Yes, No
If yes how often? Regularly Occasionally Rarely
Is the extension officer from: GovernmentNon-governmental NGOParastatals (CASIDRA/ARC)
Number of workers: _____
What are your labour sources: Self Family Hired
How long have you been farming _____years?
How long have you been part of an irrigation scheme? _____Years?
Name of the irrigation scheme_____
Number of workers in the scheme: Female Male
Do you engage in non-farming activities? Yes No
If yes name them:_____
Indicate the farming enterprises in which you are engaged? (Mark with an X)

Crops	Ha	Income
Maize		
Wheat		
Sunflower		
Sorghum		
Groundnut		

Barley		
Lucern		
Tomatoes		
Potatoes		
Cabbage		
Spinach		
Pumpkins		
Green pepper		
Onion		
Garlic		
Green beans		
Citrus		
Carrots		
Beetroot		
Mushroom		
Lettuce		
Cucumber		

Type of irrigation systems

Central pivots irrigation systems	
Flood irrigation systems	
Sprinkler irrigation systems	
Micro irrigation systems	
Drip irrigation systems	
Other:	

Source of water for the irrigation scheme

Dam	
River	
Reservoir	
Bore hole	
Municipal water	
Fountain	
Other	

Irrigation is owned by

Privately owned		
Community		
Government department		
Private stakeholders		
Other:		

Total income annually

Source of income	Rand (R)
Leasing farm equipment	
Rent	
Remittances	
Government grants	
Animal Production	
Other:	

Total expenditure annually: Production purposes

Expenses	Rand (R)
Maintenance of irrigation technology	
Seeds	
Water	

Electricity	
Transportation	
Workers salary	
Fungicides, pesticides	
Fertilizers	
Other farm expenses:	

Expenses: personal use

Expenses	Rand (R)
School fees	
Transportation/ fuel	
Food	
Electricity	
Water	
Clothes	
Entertainment	
Saving (funeral, society, bank e.t.c)	
Other:	

Reasons for involvement in the scheme please tick. You may tick more than one

Personal interest	
Only source of income	
Husband / partner has migrated	
Community development	
Other:	

Indicate your source of information

	Use	
Television	Use	Non use
Radio		
Newspaper		
Cell phones		
Internet		
Community library		
Extension workers		
SMS		
Other		

LIVELIHOOD ASPIRATIONS

FINANCIAL CAPITAL	Availability	Very adequate	Not adequate
Access to Credit from:			
Banks			
Cooperatives			
Money lenders			
Relatives			
Personal savings			
Contractors			
Government subsidies			
HUMAN CAPITAL			
Training	Yes, No		
Vocational training	Yes, No		
Extension service	Yes, No		
Skills training			
Record keeping	Yes, No		
Water management	Yes, No		
Equipment handling	Yes, No		
Financial management	Yes, No		
Soil management	Yes, No		
Crop protection	Yes, No		
Any other (Specify)	Yes, No		
How often do extension officers visit you?	Frequently	1	
	Sometimes	2	
	No Visits	3	
PHYSICAL CAPITAL			
Transport	Yes, No		
Water supply	Yes, No		
Markets	Yes, No		
Road accessibility	Yes, No		
Electricity	Yes, No		
Storage	Yes, No		
Irrigation types	Sprinkler		
	Pivot		

	Dragline		
NATURAL CAPITAL			
Land	Yes, No		
Type of tenure	Leased	1	
	Permission to occupy	2	
	Communal land	3	
	Others	4	
If rented, how much do you pay?			
The size of the land cultivated			
Total size of the land			

SOCIO-ECONOMIC STATUS INDICATORS

SOCIO-ECONOMIC STATUS INDICATORS	Yes	No	Quantity
Total number of children			
Children in school: Primary			
Secondary			
High school			
Higher institution			
Children who are graduates			
Children who work in civil service			
Ownership of a house			
Cement			
Mud			
Shack			
Other			
Rooms in the house			
Position in the society			
Community representative			
Committee representative			
Shoes			
Plates			
Cups			
Pots			
Electric stove			
Two plate stove			
Good type mattress			
Goats			
Pig			
Cattle			
Sheep			
Ladder			
Gloves			

Television set			
Radio			
Vehicle			
Touch light			
Wall clock			
Ward robe			
Dining table			
Curtains			
Frying pan			
Wheel barrow			
Standing mirror			
Kettle			
Electronic iron			
Metal spoon			
Coal iron			
wrist watch			
Bicycle			
Photo frame			
cell phone			
Fridge			
Winter jacket			

WOMEN EMPOWERMENT

Role In household decision making around production and income generation.

Activity	Did you participate in [activity] in the past 12months YES NO	How much input did you have in making decision about [activity]	How much input did you have in decisions on the use of income generated from [activity]
Food crop farming			
Cash crop farming			
Livestock raising			
Non-farm economic activities			
Wage and salary employment: in kind or monetary work both in agriculture and other wage work			

Access to productive capital

Productive capital	Do you have Yes No	How many do you have?	Who owns most	Who decide to give away most of the time?	Who decide to mortgage or rent?	Who keeps majority if marriage is dissolved	Who decides a new purchase
Agricultural land							
Large livestock(cattle)							
Small livestock (goats, sheep)							

Poultry							
Farm equipment (non-mechanized							
Farm equipment (mechanized							
Nonfarm business equipment							
House (and other structures)							
Large consumer durables (fridge, TV, sofa)							
Small consumer durables (radio, cookware)							
Cell phone							
Other land not used for agricultural purposes (pieces, residential or commercial land)							
Means of transportation (bicycle, motorcycle, car)							

Access to credit

Lending source	Has anyone in your household taken any loans or borrowed cash/in-kind from [SOURCE] in the past 12 months? Yes, cash Yes, in-kind Yes, cash and in-kind No Don't know.....	Who made the decision to borrow from [SOURCE]?	Who makes the decision about what to do with the money/ item borrow from [SOURCE]?	If more credit had been availabl e from this source, would you have used it? Yes No.....	Why would you not have borrowed more from [SOURCE]?	Did you want to borrow or get a loan from [SOURCE] in the last 12 months but did not? Yes No.....	Why were you not able to borrow from [SOURCE]?
Non-governmental organization (NGO)							

Informal lender							
Formal lender (bank/financial institution)							
Friends or relatives							

Individual leadership and influence in the community.

Do you feel comfortable speaking in public to help decide on infrastructure (roads, water supplies) to be built in the community?	Yes , but with great deal of difficulty Yes , but with little great deal of difficulty Yes , fairly comfortable Yes, very comfortable No, not at all
Do you feel comfortable speaking in public to ensure proper payment of irrigation services, or other similar programs?	Yes No
Do you feel comfortable speaking in public to ensure protest the misbehavior of authorities or elected officials in the scheme?	Yes No

Group membership

Group categories	Is there a [GROUP] in your community? Yes No	Are you an active member of this [GROUP]? Yes No	How much input do you have in making decisions in this [GROUP]?	Why are you not a member of this [GROUP]?
Agricultural / livestock/crop producer's group (including marketing groups)				
Water users' group				
Credit or microfinance group				
Mutual help or insurance group (including burial societies)				
Trade and business association				
Civic groups (improving community) or charitable group (helping others)				
Local government				
Religious group				
Other (specify)				

Decision making

Category	Who normally takes decision?	To what extent do you make personal decisions
Agricultural production		
What inputs to buy for agricultural production?		
What types of crops to grow for agricultural production?		
When or who would take crops to the market?		
Livestock raising?		
Non-farm business activity?		
Your own (singular) wage or salary employment?		
Major household expenditures? (Such as a large appliance for the house like refrigerator)		
Minor household expenditures? (Such as food for daily consumption or other household needs)		

Competency and Training needs

Skills and training needs	No competent	competent	Verycompetent
Soil preparation for ploughing			
Determining inter and intra row spacing			
Determining seed depth			
Selecting appropriate planting methods for various crops			
Evaluating soil profile in farming areas			
Evaluating farming land for soil and water conservation			
Recommending suitable soil and water conservation measures for specific farm lands			
Knowledge of crop rotation			
Calculating the amount of fertilizer to apply for various crops			
Appropriate application of herbicide and fungicide			
Calibrating planters and seeders for various crops			
Planning and carrying out harvesting appropriately for various crops			
Irrigation scheduling and frequency			
Knowledge on the amount of water to use			
Knowledge of the market for your produce			
Price determination for your produce			
Knowledge of reading and interpreting market information			
Knowledge of the marketing contracts			
Value adding			
Service provider for Storage facilities			
Farm record keeping			
Financial management			
Packaging			

Political , Economic, social Institutional, and cultural environments within which women operate

Access to resources

How has land reform affected your access to land?.....

.....

.....

.....

How has land reform affected land availability?...

.....

.....

.....

How has land reform affected productivity?...

.....

.....

.....

How has water reform affected your access to water?

.....

.....

.....

.....

.....

How has water reform affected water availability

.....

.....

.....

How has water reform affected productivity?...

.....

.....

.....

How has the local and traditional authorities affected your access to land.....

.....

.....

How has the local and traditional authorities affected land availability?.....

.....

.....

.....

How has the local and traditional authorities affected land productivity?.....

.....

.....

.....

How has the local and traditional authorities affected access to water?

.....

.....

.....

.....

.....

How has the local and traditional authorities affected water productivity?

.....

.....

.....

.....

.....

What are the available infrastructures?...
.....
.....
.....

Do you have access to markets? Yes, No
Do you belong to any social group? Yes, No
If yes, how do you benefit from the group?
.....
.....
.....
.....
.....
What are the water use security do you have?.....
.....
.....
.....
What are the adjustments/ changes you desire to see concerning land reforms
.....
.....
.....
.....
.....
What are the adjustments/ changes you desire to see concerning water reforms
.....
.....
.....
.....
.....
What are the adjustments/ changes you desire to see concerning income generating activities.
.....
.....
.....
.....
.....
What are your coping strategies in term of the land reforms?.....
.....
.....
.....
What are your coping strategies in term of the water reforms?.....
.....
.....
.....

What are your coping strategies in term of the income generating activities?.....
.....
.....

INSTUTITIONS

Political institutions

How does the of the local political institution influence the control of land in terms of production?.....

.....
.....
How does the of the local political institution influence the control of water resources in terms of production?
.....
.....
How does the local political institution affect the access to land resources?
.....
.....
.....
.....
.....
How does the local political institution affect the access to water?
.....
.....
.....
.....
.....

Institutional linkages
How are your linkages with the following institutions?

INSTITUTIONS	STRONG	MEDUIM	WEA K	NO LINKAGE
ARC				
NGO				
EXTENSION				
Others				

What are the benefits that you get from such linkages?
.....
.....
.....
.....
.....
How do these linkages support you to improve your livelihood?
.....
.....
.....
.....
.....
Cultural institution
What are the societal perceptions bout your participation in farming?.....
.....
.....
.....
What are the societal perceptions about your income generating activities?..... .....
.....
.....
What are the societal norms and values in your income generating activities?
.....
.....
.....
.....
.....

Economic institutions : What are your financial sources?

Sources	Yes	No
Banks		
cooperatives		
Relatives		
Friends		
Social clubs		
Burial society		
Micro finances		
Moneylenders(mashonisa)		

How are these sources supporting your livelihood?.....
.....
.....
How are these sources improving your livelihood?.....
.....
.....

Food security

How many meals do you and your household eats per day?.....
Did you and your household ever cut the size of your meals or skip meals? Yes, No
How often did this happen?.....
.....
Did you and your household not eat for the whole day because there wasn't enough money for food?
Yes, No
How often did this happen?.....
.....
Did you and your household ever eat less than you felt you should because there wasn't enough money to buy food? Yes, No
Do you afford to buy food for your household? Yes, No
How much do you spend on food per month?.....
.....

List of food items consumed by the household	quantity	Price/unit	Total
Maize			
Mabele			
Sample			
Melies rice			
Rice			
Flour			
Vegetables			
Oil			
Fish			
Beans			
Meat			
Beverages			

Poverty status

Do you consider your household to be	Yes	No
Very poor		
averagely poor		
Not poor		

What do you think has led your household to be in poverty?

What has led your household to be in poverty?	Yes	No
Cannot afford/ lack of agricultural inputs(fertilizers, seeds)		
Prices of inputs high		
Unavailability of agricultural inputs		
Late delivery of inputs by suppliers		
Low agricultural production		
Drought		
Lack of adequate land		
Prices of agricultural produce too low		
Lack of buyers for agricultural produce		
Lack of capital to start or expand agricultural business		
Lack of credit to start agricultural production or buy inputs		
Lack of employment opportunities		
Prices of commodity too high		
Salary/ wages too low		
Business to doing too well		
Too much competition		
Decline in the economy		

Household coping strategies against poverty

Household coping strategies against poverty	Yes	No
Piece jobs		
Relief food from the government		
Substituting ordinary meals		
Reducing the number of meals		
Government grants		
Reducing other household items (soap, tissues)		
Informal borrowing from friends, neighbors		
Formal borrowing in cash or kind		
Pulling children out of school		
Vending		
Sales of assets		
Begging from streets		
Asking from friends, neighbors or relatives		
Help from religious or charitable organization		