

**IMPACT OF IRRIGATION FARMING ON LIVELIHOOD STRATEGIES,
HOUSEHOLD FOOD SECURITY AND POVERTY STATUS AMONG
SMALLHOLDER FARMERS IN THE NORTH-WEST PROVINCE, SOUTH
AFRICA**

BY

ABONGILE BALARANE: 18006663

**DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF REQUIREMENTS
FOR MASTER OF SCIENCE DEGREE IN AGRICULTURAL ECONOMICS**



060043315M

North-West University
Mafikeng Campus Library

**DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION OF THE
NORTH WEST (MAFIKENG CAMPUS), FACULTY OF AGRICULTURE, SCIENCE
AND TECHNOLOGY**

SUPERVISOR: PROF.O.I.OLADELE

NOVEMBER 2013



DECLARATION

I, Abongile Balarane student number 1800666, hereby declare that this thesis: Impact of irrigation farming on livelihood strategies and food security status of smallholder maize farmers in the North West Province. Submitted to the Faculty of Agriculture, Science and Technology of the North West University in fulfillment of the requirements for the Master's degree in Agricultural Economics is my original work and the sources contained herein have been duly acknowledge.

Date: 29-11-2013

Abongile Balarane



ACKNOWLEDGEMENT

I express my profound gratitude to my supervisor; Prof O.I.OLADELE for his useful contribution, guidance and overwhelming impact on the success of this study. The preparation and writing up of this research proved to be extremely difficult and time consuming. However, the task was made considerably easier by the capable and energetic supervision of him; he was always there from the beginning to the end of the study.

I also extend my gratitude to the Maize Trust. This work was conducted through a bursary from the Trust. I am truly grateful for the financial support that you gave me throughout the research period. My sincere gratitude also goes to North West Department of Agriculture for providing the generous support of visiting the farmers with the extension officers. Thank you for the great assistance, continue with the great job. I am also grateful to the respondents of this study and for those who assisted me during the field. Special attributes are owed to all my brothers and sisters for all their encouragement and support. Finally to my colleagues Sibongile Tekana and Masego Moobi, I thank you guys for all the support and for believing in me.

ABSTRACT

The study was designed to assess the impact of irrigation schemes on livelihood strategies and food security status of smallholder maize farmers in North West Province of South Africa and covered three districts of the North West Province namely: Dr Ngaka Modiri Molema district, Bojanala district and Dr Ruth Segomotsi Mompati district. In this study, a descriptive survey design was used and a sample of 66 farmers was interviewed from the list of farmers obtained from the extension workers. The targeted group was male farmers in irrigation farming and those who farm within the radius of the irrigation 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.

The results of multiple regression analysis of relationship between irrigation farming and livelihood strategies showed that the independent variables were significantly related to livelihood strategies of the farmers with an F value of 8.067, $p < 0.05$ and R value of 0.788 showed that there was strong correlation between the independent variable and the household livelihood strategies. Significant determinants were marital status ($t = 2.43$), number of household ($t = 5.41$), nonfarm activity ($t = 1.73$) and income ($t = 6.59$).

The probit model was used to determine the influence of the socio-economic variables on household food security status. The model has a good fit and significant with two explanatory variables being significant while eleven variables were insignificant. The significant variables were Income and Land. The results of Forster Greer Thorbecke showed that about (1.5%) of the respondents are living below the threshold of (R9.2) per day, while the per capita income of respondents that are below the poverty line needed to be increased by (0.5%) to meet the level of poverty line. The results also showed severity of (0.1%), this implied that the gap of respondents from the poverty line is very small

Key words: Irrigation farming, Smallholder farmers, Livelihood strategies, Food security and Poverty status.

TABLE OF CONTENTS

DECLARATION.....	i
ACKNOWLEDGEMENTS.....	ii
ABSTRACT	iii
TABLE OF CONTENTS.....	iv
LIST OF FIGURES.....	vii
LIST OF TABLES.....	viii
ACRONYMS.....	ix
CHAPTER ONE	1
INTRODUCTION.....	1
1.1 Role of agriculture.....	1
1.2 Background on food security.....	3
1.3 Livelihoods	4
1.4 Irrigation in South Africa	5
1.5 Aim of the study	7
1.6 Objective of the study.....	7
1.7 Hypothesis	7
1.8 Outline of the study	8
CHAPTER TWO	9
2.0 LITERATURE REVIEW.....	9
2.1 Introduction	9
2.2 Historical origins of food insecurity in South Africa	9
2.3 Household and Intra-household Food Insecurity.....	10
2.4 Food security in Households	11
2.5 Livelihoods and food security situation in South Africa.....	13
2.6 Contribution of smallholder and subsistence agriculture to food security	15
2.7 Effect of Irrigation on poverty reduction.....	17
2.8 Effect of irrigation on food security	22

2.9	Sustainable Rural Livelihoods.....	24
2.10	Challenges faced by irrigation farmers.....	26
2.11	Chapter summary.....	28
CHAPTER THREE		29
3.0	RESEARCH METHODOLOGY	29
3.1	Introduction	29
3.2	Study area	29
3.3	Research Design	30
3.4	Population of study.....	31
3.5	Sampling procedure and Sample size.....	31
3.6	Data collection techniques.....	32
3.7	Data analysis.....	32
3.8	Measurement of variables.....	35
3.9	Ethical considerations.....	36
3.10	Chapter summary.....	36
CHAPTER FOUR.....		37
4.0	RESULTS AND DISCUSSION	37
4.1	Introduction	37
4.2	Demographics of the farmers in the study area	37
4.3	Types of farming enterprises practiced by farmers on irrigation farming.....	39
4.4	Different types of irrigation systems used by smallholder farmers on irrigation farming.....	41
4.5	Sources of income to smallholder farmers	42
4.6	Farmer's annual production expenditure.....	43
4.7	Farmers personal expenses	44
4.8	Reasons for involvement in irrigation farming.....	46
4.9	Sources of information to farmers	47
4.10	Access to livelihood assets by irrigation farmers	48
4.11	Smallholder farmer's competency skills and training needs.....	52
4.12	Influence of political, social, traditional institutions on farmers access to livelihood land and water	54
4.13	Household Food Security and Poverty Status.....	56
4.14	Reasons identified by household as causes of poverty.....	58
4.15	Household coping strategies against poverty	59

4.16	Determinants of livelihood strategies on irrigation farming	60
4.17	Determinants of food security on irrigation farming.....	61
4.18	Forster Greer Thorbecke Analysis.....	62
4.19	Chapter summary.....	64
CHAPTER FIVE		65
5.0	FINDINGS, CONCLUSION AND RECOMMENDATIONS	65
5.1	Introduction	65
5.2	Summary.....	65
5.3	Major Findings	66
5.4	Recommendations	67
REFERENCES		69
APPENDIX.....		83

LIST OF FIGURES

Figure 1: Farm enterprises practiced by farmers.....	41
Figure 2: Farmers sources of income.....	43
Figure 3: Annual production expenditure.....	44
Figure 4: Farmers personal reasons for involvement in the irrigation farming.....	46
Figure 5: Sources of information to farmers.....	48

LIST OF TABLES

Table 1: Measurement of variables.....	35
Table 2: Demographics of the farmers in the study area.....	38
Table 3: Different types of irrigation systems used by smallholder farmers.....	42
Table 4: Personal expenses among smallholder farmers.....	45
Table 5: Access to livelihood assets by smallholder farmers.....	51
Table 6: Competency and training needs.....	53
Table 7: Political, local traditional authorities.....	55
Table 8: Household poverty status.....	57
Table 9: Reasons for the household to be in poverty.....	59
Table 10 Coping strategies against poverty.....	60
Table 11: Determinants of livelihood strategies.....	61
Table 12: Determinants of food security.....	62
Table 13: Forster Greer Thorbecke analysis.....	63

LIST OF ACRONYMS

CASP	: Comprehensive Agricultural Support Programme
DOA	: Department of Agriculture (South Africa)
ECA	: Economic Commission for Africa
FGT	: Forster Greer Thorbecke
FAO	: Food and Agricultural Organisation
GDP	: Gross Domestic Product
GHS	: General Household Survey
HSRC	: Human Science Research Council
ICT	: Information Communication Technology
IFAD	: International Fund for Agricultural Development
IFSS	: Integrated Food Security Strategy
LRAD	: Land Redistribution for Agricultural Development
MDG	: Millennium Development Goals
STATS SA	: Statistics South Africa
UNECA	: United Nations Economic Commission for Africa
UNDP	: United Nations Development Programme
USDA	: United States Department of Agriculture
WFS	: World Food Summit

CHAPTER ONE

1.0 INTRODUCTION

1.1 Role of agriculture

Agriculture is multi-disciplinary and over time, agricultural science has grown to address real life's multi-faceted problems. Agricultural science includes environment and natural resources management, among other disciplines. Agriculture is defined as the production, processing and distribution of food, fish, forest products and fiber.

Agriculture is considered critical to social, economic growth and poverty reduction and has been described as the backbone of the economies of most African countries and the main economic base for smallholder farmers in Africa. However a different school of thought argued that despite the long held thinking regarding the role of agriculture in development, emphasis was shifting towards opportunities in non-agricultural growth that are perceived to have potential to reshape development strategies in many African countries. Nevertheless, a study carried out by Diao *et al.* (2007) concluded that despite recent skepticism, agricultural growth is still important for most low-income African countries. Empirical evidence from various country case studies conducted in Africa indicated that pro-growth and pro-poor performance of agriculture will continue to depend on the broad participation of smallholder farmers and that food staple growth generates more to poverty reduction than other agricultural subsector (Diao *et al.*, 2007:).

About 2/3 of developing countries depend on agriculture for their livelihood and 75% of these farmers are small-scale farmers (Bunders & Broerse, 1991). About 3/4 of Africa's population is found in rural areas and 60-90% of the total labor force is employed in the agricultural sector. According to the Economic Commission for Africa and the African Union, agriculture employs about 70 per cent of the work force and generates on average 30 per cent of Africa's GDP.

In sub-Saharan Africa, small-scale farmers constitute about 73% of the rural poor. Agriculture is linked to food security and will remain a primary source of growth and means of poverty reduction and backbone of rural economy in Africa (IFAD, 2001). The

agricultural sector could also be the main contributor to poverty reduction. Diao *et al.* (2007:1) posited that linkages between agriculture to the rest of the economy can generate employment and intensive patterns of development. However, the ability of agriculture to reduce poverty and generate growth varies across and within countries.

Africa has battled with food insecurity and agricultural production for a long time. It is noteworthy that although poverty levels have fallen globally, Sub-Saharan Africa is the only developing region where there has been a decline in per capita food-grain output and where the number of people living below poverty line has doubled over four decades. About 46% of the populations live on less than a dollar a day (UNDP 2005; ECA 2006b). Less than 6% of Africa's arable and permanent crop land is irrigated (ECA, 2005) and most of the land on agriculture is not arable. Nevertheless, some positive growth in agriculture in Africa was registered from 2002, for example in Eastern Africa growth in the agricultural sector increased from 2.5% in 2003 to 5.8% in 2004 (ECA, 2005). Africa, like the rest of the world, needs to attain the United Nation's Millennium Development Goals (MDGs) and the World Food Summit (WFS) goals, with the aim of reducing the number of hungry people from 790 million to 400 million by 2015. To attain the goal of reducing poverty by 50% by 2015 the African economies need to grow at 7% per annum. Another target set required that a current national strategy for sustainable development be in place in every country by 2005 to ensure current trends in the loss of environmental resources including forests, fisheries, fresh water, climate, soils, biodiversity, stratospheric ozone, the accumulation of hazardous substances and other major indicators are reversed at both national and global levels by 2015 (ECA, 2005).

The Millennium Development Goals, World Food Summit goal and other goals are key driving forces of Africa's agricultural sector. As stressed by the World Bank (2006b:11), Africa needs to make agriculture more productive and sustainable, connect poor people to markets, enhance human development, get services to poor populations (especially women) and use natural resource assets well if the MDGs are to be achieved. Agriculture is regarded as the engine of development in most developing countries.

Agricultural development is usually measured in terms of increase in production and productivity and is often brought about by the adoption of new technologies. Specifically

agriculture is a significant factor in the improvement of the living conditions of the rural people farmers. All agricultural business activities involved in the movement of commodities from production to consumption is marketing. According to IPTRID (1999) agricultural development can also be through irrigated agriculture which remains a resource that many poor producers want and still ask for. It remains a vital activity in the livelihoods of many small producers who value the security it provides. It can also be a vehicle to provide basic needs for and reduce the vulnerability of poor people. People in the irrigated area can benefit directly by increased and more stable incomes from increased cropping intensities, improved yields, new farm enterprise technology mixes and the appreciation of the value of land with access to irrigation. Indirectly they benefit from a more even spread of an increase in farm incomes, lower food prices, better nutrition and more water for domestic uses that can improve health.

1.2 Background on food security

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. Food Availability: An effective or continuous supply of food at both national and household level. This is affected by input and output market conditions, as well as the production capabilities of the agricultural sector.

Food Access or effective demand: The ability of the nation and its households to acquire sufficient food on a sustainable basis. This addresses issues of purchasing power and consumption behaviour.

Reliability: Utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. This brings out the importance of non-food inputs in food security.

Food distribution: Equitable provision of food to points of demand at the right time and place. This spatial/time aspect of food security relates to the fact that a country might be food-secure at the national level, but still have regional pockets of food insecurity at

various points of the agricultural cycle. Further, the FAO speaks of food security basis when all members of a household can be supplied with sufficient and adequate food whether through their own production which is farming livestock or crop production or supplied by purchasing food (Judt Christine).

Food insecurity and malnutrition are highest in provinces with large rural populations, such as Kwa-Zulu Natal, Limpopo, Eastern Cape and the Free State (Department of Agriculture, 2007). The demands of the colonial and apartheid eras for male labor in urban areas have resulted in the erosion of the fundamentally agrarian existence of Black Africans, and a subsequent increased reliance on non-farm and non-rural incomes. There is a greater reliance on purchased food as opposed to own-produced food which exposes vulnerable households to the adverse effects of price fluctuations.

For example, the 17% inflation on food prices between 2001 and 2002 had a disproportionate and devastating impact on the living standards of the predominantly rural ultra-poor, which spent more than 50% of their income on food (Stats SA, 2004). 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). Food insecurity and poverty are locked into the same destructive cycle. Poverty is the leading cause of food insecurity, and food insecurity is a major contributor to the continuity of poverty.

1.3 Livelihoods

A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stress and shocks maintain or enhance its capabilities and assets and provide sustainable livelihood opportunities for the next generation and which contributes net benefits to other livelihoods at the local and global levels in the short and medium term. Ellis (2000) postulates that livelihoods comprise of assets, activities and access to these that together determine the living gained by households or individuals. Households attempt to diversify their livelihood strategies by optimising the use of their capabilities and assets. Households with well-diversified assets and livelihood strategies can cope better than those with a more limited asset base and few livelihood resources (De Satgé, 2002) thus creating

a veritable safety net for these households. Diversified sources could include a combination of salaries or wages obtained through employment, remittances, social grants, and even income or perhaps food generated through agricultural activity.

Households have different capacities to make a living and these are closely linked to household assets or resources (De Satgé, 2002:61) divide assets into five types of capital of which most are measured in the General Household Survey (GHS) to at least some extent, namely: Human capital includes the education, health status of household members and the ability of households to leverage income through employment. Social capital includes all social resources such as social networks, which households can draw upon to attain their goals. Natural capital refers to the land and natural resources to which households have access. Physical capital is essential to achieve livelihood goals and include access to basic services such as water, sanitation and electricity, as well as equipment and mediums of communication.

1.4 Irrigation in South Africa

South Africa has an estimated 1.3 million ha of irrigated land for both commercial and subsistence agriculture. Irrigated agriculture consumes more than 60% of the groundwater. About two thirds of South African small holder irrigates schemes are dedicated to food plots of 300.000 black people (Perret, 2002a). Demand for water is increasing worldwide, especially in developing countries. Increasing water scarcity implies that options for water resource development are becoming limited. This increased demand on water is due to population and economic growth, industrialisation, urbanization, provision of water and sanitation services to previously disadvantaged people and environmental requirements.

Irrigation has long played a key role in feeding expanding populations and is undoubtedly destined to play a still greater role in the future (FAO, 1997a). It not only raises the yields of specific crops, but also prolongs the effective crop-growing period in areas with dry seasons, thus permitting multiple cropping (two or three, and sometimes four, crops per year) where only a single crop could be grown otherwise. With the security provided by irrigation, additional inputs needed to intensify production further (pest control, fertilizers, improved varieties and better tillage) become economically feasible (FAO, 1997a). Irrigation reduces the risk of these expensive inputs being wasted by crop failure resulting

from lack of water. The practice of irrigation consists of applying water to the part of the soil profile that serves as the root zone, for the immediate and subsequent use of the crop (FAO, 1997b). Well-managed irrigation systems are those which control the spatial and temporal supply of water so as to promote growth and yield, and to enhance the economic efficiency of crop production.

Everywhere in the world food is the main demand need by man, agriculture is the production of both livestock and crop production. Agriculture in many developing countries is the main dominant employer throughout the world. Farming is an old practice which has been practiced from generation to generation. Small-scale farmers are defined as peasant farmers who practice their farming activities by the use of old farming methods and who produce for their own consumption and sell the remainder to the nearby people.

Irrigation growth offers possibilities for reducing risks of food shortages at all levels, increasing overall supply of food, creating economic opportunities for vulnerable people and improving dietary diversity and the quality of food consumed by farm household (Lyne *et al.*, 2009).

Small-scale irrigation in South Africa originated mostly from a food security perspective and two types of schemes can historically be distinguished: 1) former Bantustan schemes, currently accounting for 46,000 to 47,500 ha and 2) community schemes or garden schemes representing about 50,000 ha (Backeberg, 2006; Perret, 2002).

The first type of schemes dates from the 1950's and 1960's. Their objective was to provide farmers in the homelands with opportunities to produce their own food and possibly a surplus for sale. The size of these schemes varied significantly, ranging from 30 to 2000 ha, with an average size of about 200 ha, and a fixed farm size per beneficiary of about 1.5 ha. These schemes however were neither financially viable nor self-sustaining since capital or operation costs were never covered by operation outputs and profit. Instead, underpricing and government subsidisation of water infrastructure and services, and management by parastatal agencies generated dependency and ignorance on the farmers' side (Perret and Geysler, 2007). After reinstallation of democracy in South Africa, policies, including those for agriculture were reformed and the homelands were reincorporated in the State. This study was designed to investigate the extent to which irrigation farming has

impacted the livelihood strategies and food security status of the smallholder farmers in the irrigation farming and those who farm within the radius of the irrigation schemes.

1.5 Aim of the study

The study aimed at analysing the impact of irrigation farming on livelihood strategies and food security status of smallholder farmers in North West Province of South Africa. This was done by looking at actual factors that affect the livelihood strategies of smallholder farmers and their food security status from the irrigation farming. This was done by analysing which livelihood options can the smallholder farmers have easily access to from income generated from irrigation farming. On the other hand the study also aimed at analysing the food security status of the farmers in the irrigation farming by looking at three pillars of food security which are food access, reliability and food distribution.

1.6 Objective of the study

1.6.1 Main objective

The main objective of the study was to assess the impact of irrigation farming on livelihood strategies, food security and poverty status of smallholder farmers in North West Province, South Africa.

Sub objectives of the study were:

- to describe the socio-economic profile of farmers on irrigation scheme.
- to analyse the impact of irrigation farming on livelihood strategies of farmers.
- to analyse the impact of irrigation farming on household food security of farmers.
- to analyse the impact of irrigation farming on poverty status of farmers

1.7 Hypothesis

The null hypothesis to be tested is that there is no significant relationship between livelihood strategies of smallholder farmers in the study area and food security status.

1.8 Outline of the study

The study is divided into five chapters. Chapter one provides an overview of the study, highlighting the background, problem context, objectives, aim of the study and hypotheses. Definitions of key terms were also outlined. The review of smallholder farmers, history of irrigation schemes and history of household food security of farmers in South Africa is outlined in Chapter two. In Chapter three the methods used to collect and analyse data are identified and explained. Chapter four is the results and discussions of the respondents using graphs, tables and figures. Chapter five is the summary, conclusions and recommendations of the dissertation.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on impact of irrigation schemes on livelihood strategies and food security a comparison of irrigation schemes in different countries. The focus is on the following historical origins of food insecurity in South Africa, food security on household, food security in South African context, effect of irrigation on poverty reduction and rural livelihoods and farming on smallholder irrigation schemes in South Africa.

2.2 Historical origins of food insecurity in South Africa

Poverty and food insecurity in South Africa is the result of several centuries of colonial and apartheid policies designed specifically to create general conditions unfavorable to the well-being of black people in all its aspects, especially in the former homelands. 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 centers. 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 (DAFF, 2002).

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.

2.3 Household and Intra-household Food Insecurity

According to Statistics South Africa, 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. Furthermore in 1996 nearly a third or 2.8 million of households spent less than R1 000 per month, while only 18% or 1.63 million households spent more than R3 500 per month. These figures disguise the bi-polar mode of income distribution that characterizes South Africa; simply put, however, South Africa has many poor, food-insecure people and a few wealthy ones.

The distribution of poverty in the country is uneven in its spread and intensity. 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. In the middle group are Mpumalanga, KwaZulu-Natal, Northern Cape and North West Provinces. The average household of Gauteng spends about R7742 per month compared to R2 665 in the Eastern Cape. Within the provinces there is an also unequal level of poverty according to urban and rural location, race and gender.

According to Stats SA (2011) nearly one third of all South African households are female-headed which are considerably poorer than male-headed households. Nearly 52% of female headed households spent less than R1 000 per month in 1996, in contrast to 35% of male-headed households that spent less than R1 000 in the same period. Nearly 25% of male-headed households spent more than R3 500 per month compared to only about 8% of female-headed households in the same quintile. The relative poverty of female-headed households who spent less than R1 000 per month was nearly 80% in the Eastern Cape, compared to only 26% of relative poor Gauteng female-headed households that spent less than R1 000 per month. About 73% of all households receive monthly incomes of less than R2500 in and only 27% receive incomes of more than R2500 per month. Almost half of South African households earn a monthly income of R1000 or less.

2.4 Food security in Households

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 (DAFF, 2002). These challenges include:

Inadequate Safety Nets: Poor households are typically characterized by few income-earners, and many dependants. They are also often primarily dependent on migrant remittances and social security grants, making them vulnerable to food insecurity. Rural households are particularly vulnerable because of their reliance on the remittances from the urban areas. In South Africa, they are also frequently constrained by a lack of economic activities in close proximity to their communities, inappropriate farmer support services, and face constraints to gaining access to employment elsewhere, such as a lack of information and transport. At the national level, the challenge is to create the economic conditions that favor poor, food-insecure households. This means instituting changes that actively foster the participation of all in the mainstream economy, and thereby minimizing poor households' dependency on government assistance. In other words, social safety nets should be viewed as a policy of 'last resort', helping those food insecure households that have not benefited from the enabling, pro-poor economic environment that government has supported (Demetre et al, 2009)

Weak Support Networks and Disaster Management Systems: In order to develop new policies and implement food security programmes, policy-makers at all levels of government require considerable information on the conditions of food demand and supply in different parts of the country. This information can be used to identify risky and vulnerable areas, with respect to food access and use. Food security information is multi-sourced and, when using existing data collection systems through established agencies, cooperation and coordination is key to establishing efficient and cost-effective systems.

One such example of weak institutional support networks relates to disaster management systems. South Africa does not yet have a structured system of dealing with food security disasters, such as droughts or floods. These disasters, which occur at regular intervals, can substantially threaten the food security position of agriculture-based households. With few reserves to draw on, these households are hit hard by crop failure and asset loss (Aliber, 2009)

Inadequate and Unstable Household Food Production: Hunger and malnutrition in South Africa stem from insufficient, unstable food supplies, at the household or intra-household level. The majority of producers in the former homelands are unable to feed their families from their narrow production base. They are deficit producers, and hence, net consumers of purchased food, and rely on non-farm income to meet most of their household needs. Even non-catastrophic events such as seasonal, climatic variation are enough to push many of these households onto the verge of a food crisis. Government assistance is often a major source of income for many of these households, given the high level of rural unemployment and dwindling migrant income transfers. As a result, many rural areas experience periodic bouts of hunger.

Lack of purchasing power: The majority of households in South Africa lack cash to purchase food. Underlying the lack of purchasing power is the limited scope of income opportunities, especially in the rural areas. Unemployment rates have remained high at 38%, despite other decent economic indicators. Black households have the lowest standards of living and are much more vulnerable to poverty, and food insecurity. Although food insecurity is highest among Africans, it also affects a significant number of Coloured and Indian households. There are also some pockets of food insecurity among urban whites. The HIV/AIDS epidemic and other communicable diseases have further undermined food-insecure households.

2.5 Livelihoods and food security situation in South Africa

Although South Africa has managed to maintain its ability to meet national food requirements (Department of Agriculture, 2002: 20), large numbers of households do not enjoy food security. The 2005 National Food Consumption Survey found that 52% of households experienced hunger and that at least a third of households were at risk. South Africa is characterized by high levels of income poverty and inequality (Altman & Jacobs, 2009: 345) and poor households often suffer inadequate or unstable food supplies as well as poor nutrition. According to the Department of Agriculture (2002: 19) these households are often characterized by high unemployment, inadequate safety nets, insufficient capital or access to land, and meager purchasing power. Poverty and food insecurity in South Africa are some of the legacies of race-based socio-economic development practices that were enforced throughout history.

Although poverty is a widespread problem in South Africa, it is unevenly distributed in terms of spread and intensity. The most urbanized provinces, Gauteng and Western Cape, tend to have the lowest percentage of poor households, while the majority of poor households are found in the predominantly rural provinces of Limpopo, Mpumalanga and Eastern Cape. Food security has to be addressed within the context of other developmental issues such as poverty, increasing commodity prices, including electricity, sources of income, social protection, rural and urban development, changing household structures, health, access to land, water and sanitation, education to name a few. South Africa faces a wide spectrum of food security challenges that include high levels of poverty, unemployment, inadequate safety nets, and unstable household food production.

Poverty stricken households lack money to buy food. These households are constrained by the inability to secure employment or to generate income. Poor households are typically characterized by few income-earners and many dependents, and are particularly vulnerable to economic shocks.

Since 1994, Government has attempted to address these challenges by increasing spending on a variety of social programs including school feeding schemes, free health services for children younger than 6 years, health services for pregnant and lactating women, and well-targeted cash transfers or social grants (DoA, 2002:12). Social grants have been shown to

benefit poor and vulnerable people and their broader households by inter alia elevating consumption, welfare and access to social services, by improving the ability of households to deal with risk and insecurity by facilitating the development of local markets, and increasing investments in productive assets and activities (Neves, Samson, Van Niekerk, Hlatshwayo and du Toit, 2009). In fact social grants have been the most important contributor to reducing poverty and food insecurity. Although social grants have played a vital role in improving food security among poor households the current high levels are arguably not sustainable. Small-scale agricultural activity is often mooted as a potentially sustainable contributor to food security.

The integrated food security strategy in South Africa was introduced due to 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-sectoral fora to stimulate and support programmes that would engage creatively with food insecurity.

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).

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.

2.6 Contribution of smallholder and subsistence agriculture to food security

Smallholder and subsistence farmers have largely been neglected by policy makers despite the fact that subsistence/smallholder production in particularly rural areas could greatly mitigate households' vulnerability to food insecurity. Although studies suggest that rural households have historically been able to produce most of their own food, rural and urban households in South Africa have increasingly become net consumers rather than producers of food. Unlike their counterparts in the rest of sub-Saharan Africa, rural households in South Africa are much more likely to purchase food and much less likely to exploit the environment to generate income or to produce food. Although households are continually looking at opportunities to diversify their livelihoods and lessening their reliance on cash markets, households generally engage in activities aimed at maximizing their non-agricultural sources of income (Baiphethi and Jacobs, 2009:7). Rebuilding agriculture and specifically the role of small scale and subsistence farmers in rural and urban areas is a serious challenge.

Agriculture comprises crops, livestock and the utilisation of forestry and fishery resources and encompasses the production of food, fibre and related products. The agricultural sector in South Africa is divided into commercial and subsistence sectors at two ends of the spectrum, flanking emerging/small scale-farmers in between (DOA, 2002).

Not much is known about the smallholder and subsistence agricultural sector besides the fact that the sector is relatively poorly organized and under resourced. A 1998 Eskom survey identified 2.1 million small scale and emerging farmers in South Africa. By 2007 approximately 240 000 black farmers provided a livelihood to about a million household members while employing up to half a million workers. According to this report 3 million small scale farmers produced food to meet household consumption needs (Aliber and Hart, 2009). Despite misgivings about the production potential of the sector, Aliber and Hart (2009) argue that the sheer number of households involved in this form of agriculture necessitates support.

Altman et al (2009: 17) emphasize that households that engage in subsistence agriculture are not necessarily more food secure as many households engage in subsistence farming as an additional livelihood strategy. Using the Labour Force Survey, Aliber (2009) shows a marked increase in the number of black households that practiced agriculture between 2001 and 2004. He finds that the increase in the number of households that do agriculture as an extra source of food has been at the expense of households that engage in agriculture as a main source of food perhaps because agriculture is being practiced less intensively in the wake of other cash generating activities. His analysis explains significant variations in the number of agriculturally active households by arguing that households treat agriculture as a residual activity to be engaged in when needed.

According to Altman et al (2009) women make up 61% of all individuals involved in agriculture. Although women are particularly active in semi-subsistence agriculture (as an extra source of food), black women are just as likely to be commercially orientated than black men. Aliber and Hart (2009) concludes that present agricultural support seem to benefit a small number of households with access to water and that support programs will have to be expanded to include activities conducted in diverse contexts; the promotion of

appropriate crops and livestock improving productivity while maintaining existing production capacity; and finally, to assist farmers to move into commercial and market orientated production as well.

Matshe (2009:488) identifies seven drivers of food insecurity for rural smallholder households. His list identifies the climate/environment as the most important driver, followed by poverty, property rights, human capital, market access and unemployment. Households face a diverse set of challenges which necessitate a variety of solutions. Informal markets involving a large number of small traders are common across South Africa and women comprise roughly two-thirds of the sellers. Although much of the produce is sourced from smallholders (Baiphethi and Jacobs, 2009:10), smallholders are unable to compete with large commercial ventures in terms of price and volume. When agriculture does not allow rural households a sufficient livelihood often due to poor market access and low productivity households start to engage in more than one livelihood production activity (Matshe, 2009: 492) often increasing their reliance on non-farm sources of income. Given all the challenges faced by rural households it is not surprising to learn that there has been a decline in the agricultural production in the former home lands (Aliber, 2009; Baiphethi and Jacobs, 2009:20). Policies need to improve sustainable access to these markets for smallholders. Providing input support to households has been shown to increase production and food security. The appropriate support will however depend upon the particular context within which smallholder households operate.

2.7 Effect of Irrigation on poverty reduction

Small scale irrigation has been identified as a vital part in reaching international goals on reducing hunger and poverty such as the United Nation's Millennium Development Goals (Polak and Yoder, 2006). Polak and Yoder highlight three characteristics of small scale irrigation, Firstly the affordability of small scale irrigation technology makes it accessible to poor farmers. Secondly the divisibility of small-scale irrigation increases the ability of small scale farmers to adopt the technology. The third important characteristic of small-scale irrigation technology is its expandability. Small low cost systems need to be available for entry level needs, but as a farmer's income increase, a portion of the additional revenues can be reinvested in additional equipment, expanding irrigation capacity.

These three characteristics make small-scale irrigation an important tool for increasing the productive capacity of small-scale poor farmers. Increasing farm output has been shown to have significant impacts on poverty reduction. The poverty reduction elasticity of farm output has been shown to be around 0.35 (Hussain, 2007). That is a one per cent increase in farm output leads to a 0.35 per cent reduction in poverty. Both direct and indirect benefits of irrigation contribute to the elasticity of poverty reduction for irrigation.

Irrigation in South and South east Asia has been shown to improve crop productivity, enables households to grow higher valued crops, lead to higher incomes and wage rates for family labour, benefit the poor and landless through increased food availability, and lower prices (Hussain & Hanjra, 2003). An empirical study by Tesfaye *et al.* (2008) found that access to small scale irrigation leads to increased and stable production, income and consumption in Ethiopia.

Despite major breakthroughs in agricultural technologies such as drip irrigation, agricultural households in many parts of the world societies still struggle to produce enough food to support them. Small scale irrigation is frequently cited as an innovation that can bolster rural livelihoods through climate adaptation, food security and poverty reduction (World Development Report, 2008). Empirical evidence suggests that irrigation projects have positive impacts on agricultural production and the reduction of poverty for farmers (Hussain & Hanjra 2004; Hussain, 2007; Lipton, Litchfield, & Faure's 2003; Smith, 2004). According to the World Development Report 2008, the overall economic rate of return for projects has also increased over the past 30 years. Large scale irrigation projects which were initiated from 1970 to 1974 in Sub-Saharan Africa had an average return of 10%, but returns have increased to 30% for projects initiated between 1995 and 1999. Only 4% of total cultivated area is under irrigation in Sub-Saharan Africa which suggests the potential that increased irrigation investments may have on agricultural productivity and poverty by expanding the number of total irrigated hectares. Using both biophysical and socioeconomic data to assess irrigation potential, You *et al.* (2010) also find substantial potential for irrigation on the continent, but caution that this potential is

highly dependent on biophysical potential, noting that two-thirds of irrigation in Africa is concentrated in five countries.

Irrigation projects have multiple micro and macro pathways through which irrigation investments may contribute to poverty reduction and increased economic growth. Irrigation investments increase agricultural production by increasing land productivity which changes relative prices and has distributional consequences. The effect of relative price changes on household welfare depends on whether the household was a net food producer or net food consumer and the distribution of land within the community (Lipton *et al.*, 2003). Increased agricultural production puts downward pressure on output prices which increases the welfare of landless laborers and net food consumers by increasing their food purchasing power.

For net food producers, the effect of lower output prices on welfare depends on the dominance of the price effect relative to the increased income of the output effect. Net food consumers, net food producers, and landless laborers all benefit from the increased indirect demand for nonfarm goods and services from increases in rural incomes. Despite these theoretical pathways at the household level, the profitability of rural irrigation investments and their effect on economic growth depends also on the sustainability of community level investments in maintenance and land quality which may erode due to inadequate drainage of plots or leeching of soils due to overuse of fertilizer or pesticides. Ultimately, the impact of irrigation projects in different production environments is an empirical issue for which both immediate impacts of a project's success and its long term sustainability should be quantified. The effect of irrigation on poverty reduction differs from country to country taking china for example. China has made remarkable progress in achieving rapid growth in grain and food production and increasing the standard of living in its rural areas since the onset of economic reform (Huang *et al.*, 1999; Lardy, 1983; Putterman, 1993; World Bank, 2001a, b).

By 2000, China's farmers were producing more than 3000 kcal per capita annually. China has been a net exporter of food since 1983 and since 2000 was increasingly a net grain exporter (Huang *et al.*, 2005). The total factor productivity (TFP) of grain increased steadily during the 1980s and 1990s (Jin *et al.*, 2002). From 1978 to 2000, more than 200 million people in rural areas have escaped from poverty. In accelerating production growth and poverty reduction, one type of investment that China's leaders have always relied on has been water control. China's success in achieving food self-sufficiency took place when China's government made massive investments in irrigation infrastructure in the 1960s and the 1970s, suggesting that irrigation has played a key role in rural development in the past (Liao, 2003).

Irrigation investment tends to be the most important form of agricultural investment in both rich and poor areas (Ministry of Water Resource, 2001; National Statistical Bureau of China, 2001a, b). Despite this record, it remains unclear that whether China's massive spending on water control, and the irrigation infrastructure that it has spawned, leads to either enhanced performance in the agricultural production or improvements in the livelihood of the poor. Likewise, it is unclear if more money should be spent in the future. Despite the common perception of the effectiveness of irrigation investment, many empirical studies fail to find a strong linkage between irrigation and production and incomes.

In China, Hu *et al.* (2000) found that irrigation (measured as the ratio of irrigated land to cultivated land) did not contribute to TFP growth of rice in China between 1980 and 1995.

Jin *et al.* (2002) extend the work to other crops and cannot find a link between irrigation and TFP growth of any major grain crop (rice, wheat or maize); using a provincial level data set.

For example, Fan *et al.* (2004) show that although levels of investment in water control exceed those of seven other investment categories, irrigation ranks only sixth in terms of marginal impact on poverty alleviation in India behind investments, such as, rural roads, agricultural research and education. Rosegrant and Evenson (1992) also find that irrigation does not have a significant impact on TFP in India. Investments in water for agriculture have made a positive contribution to rural livelihoods, food security and poverty reduction.

During the second half of the 20th century food production outpaced population growth, with some 78% of the production growth over the period 1961–1999 deriving from yield increases (Bruinsma, 2003) as opposed to agricultural land expansion. Higher yields have been achieved, in part, due to the expansion of irrigated areas and improvements in water management on irrigated lands. The area equipped with irrigation expanded from 139 million ha in 1961 to 277 million ha in 2003. Food prices – in absolute and real terms – have fallen over the past two decades, though recently prices have risen sharply, due partly to increasing demand for agricultural products in non-food uses. During the last 50 years, productivity gains have generated higher yields and incomes for food producers, while consumers have benefited through lower food prices. Throughout those years, irrigation development helped alleviate poverty by creating employment opportunities, lowering food prices, and increasing the stability of farm output (Lipton *et al.*, 2003; Hasnip *et al.*, 2001; Hussain, 2005).

Investments in irrigation have increased rural incomes, resulting in greater demands for nonfarm goods and services. Bhattarai *et al.* (2002) estimate this multiplier effect to be as high as 2.5–4. From a global perspective the benefits from investments in water have exceeded the costs, but the gains could have been more equitably distributed. In 2004, 850 million people were undernourished, most of whom live in rural areas in developing countries. Globally, agricultural productivity has increased during the past 50 years, but regional differences are considerable. For example, maize yields started rising before the 1940s in the US, in the 1960s in China, and in the 1970s and 1990s in Latin America.

While many investments in irrigation and agricultural management have improved productivity and enhanced livelihoods, some have been unsuccessful and some have generated notable external costs. Some poorly conceived or poorly implemented water management interventions have incurred high social and environmental costs, such as inequity in the allocation of benefits and undesirable impacts on natural resources. In some cases, common pool resources such as rivers and wetlands, that are important for poor fishers and resource gatherers, have been appropriated for other uses, resulting in a loss of livelihood opportunities (Gowing *et al.*, 2006). Some communities have been displaced,

especially in areas behind dams, without adequate compensation (World Commission on Dams, 2000).

Many of irrigation's negative environmental impacts arise from the diversion of water away from natural aquatic ecosystems, such as rivers, lakes, oases, and other groundwater-dependent wetlands. The direct and indirect negative impacts have been well documented, including salinization, channel erosion, declines in biodiversity, introduction of invasive alien species, reduction of water quality, genetic isolation through habitat fragmentation, and reduced production of floodplains and inland and coastal fisheries (Richter *et al.*, 1997; Revenga *et al.*, 2000; Bunn and Arthington, 2002; Pimentel *et al.*, 2004; MEA, 2005; Khan *et al.*, 2006; Falkenmark *et al.*, 2007).

One challenge in moving forward is to determine the best ways for improving agricultural productivity and enhancing livelihoods, while protecting natural resources and sustaining environmental amenities. This challenge might be described also as seeking the optimal balance between productivity gains and environmental costs. It is likely unhelpful to consider only one aspect of interventions in agricultural water management.

We must consider the farm-level and societal costs and benefits, and we must evaluate inevitable tradeoffs as we seek the optimal forms and levels of public intervention

2.8 Effect of irrigation on food security

Food crops production is affected by the vagaries of the weather but irrigation schemes which have been used since ancient times (Grove, 1989) has positively controlled the effects of floods and droughts on food crop yields. An effective irrigation scheme serves as reservoir during floods and a dependable source of water in drought. This enhances continuous farming all year round and boosts food availability and opportunities for employment and general well-being. Consequently governments are severally introducing citizens to irrigation worldwide. For instance, between 1970 and 1990, irrigated land had increased by 17% worldwide. However, the limiting factor in many developing countries is the high cost element in the construction of irrigation schemes and the necessary technical expertise to manage the scheme and the judicious use of the water available. In South Africa, there are sites designated as food basket zones and suitable for irrigation schemes

but the political will to invest in irrigation schemes is dwindling. However, there are non-governmental organizations in some rural areas in South Africa gradually introducing rural dwellers to food crops cultivation via small irrigation schemes.

According to GorCornist (1999) irrigation farming is a source of income for peri-urban dwellers and also source of income for disadvantaged rural people (Chazovachii, 2012). Irrigation farming has become a relief to the poor and disadvantaged especially in the developing countries. More so, irrigation is a welfare enhancing agent because it fosters the cultivation of early maturing vegetables for both household consumption and sale. According to Makumbe, (1996) cash earned from the sale of produce from the irrigation project in Mutambara (Zimbabwe) is used to meet some of the basic needs of the people. Consequently there is some level of improvement in rural infrastructure situation because of functional irrigation projects in some rural areas (Chazovachii, 2012) though the project might not be able to attract high industrialization. The development in the road and telephone networks, schools and health posts put the people in a position to initiate self-help and dependable projects via sustained source of income. These unravel the fact that irrigation schemes contribute to food security; people are able to afford food and access varied dietary requirements. It is in this direction that rural-urban migration is gradually reducing and many more youth are now willing to remain in rural areas to engage in irrigation farming.

Small and medium size community-managed irrigation schemes join together features ensuring food security, settlement success, and integration of cultural traditions. Tesfaye *et al.* (2008) and Gebregziabher *et al.* (2008) in Ethiopia and Connor *et al.* (2008) in the Senegal valley have demonstrated that small-holder, community managed irrigation schemes are key elements to guarantee food supply in sub-Saharan Africa. Ararso *et al.* (2008) concluded a widespread study on water management there with two relevant statements: it is impossible to feed the fast-growing population with improving living conditions in the region with the existing low level water management and agricultural trends and food security is achievable with the existing resources in 2025 if and only if implementation of proper water management measures is realized.

2.9 Sustainable Rural Livelihoods

Humanity has the ability to make development sustainable that is to ensure that it meets the needs of the present without comprising the ability of future generations to meet their own needs. It must go hand in hand with improved lifestyles for the least fortunate. Ellis (2000) postulates that livelihoods comprise of assets, activities and access to these that together determine the living gained by households or individuals. Rural people move regularly between rural areas and towns or cities to seek work, market their produce and buy manufactured goods. Rural families through livelihood diversification construct a diverse portfolio of activities and social support capabilities in their struggle for survival and in order to improve their standard of living of which small scale irrigation schemes is one of the options. The sustainable livelihoods framework is designed to help understand and analyse poor people's livelihoods. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future while not condemning the natural resource base. For sustainable livelihoods to be achieved the future of irrigation farming in alleviating rural poverty lies not only in people but calls for intervention of interested stakeholders in rural development. Irrigation farming is possibly one of the key drivers to enhancing rural livelihoods if necessary support is given to it. Chambers (1983) points out that participation should not refer to mere involvement but should mean that beneficiaries of development initiatives actively take part at all levels of development projects.

According to Hodder (2000), the active participation of women is critical to agricultural prosperity and policy designers should ensure that women are incorporated in all matters of life. According to Msingo (2007) Mujere, Chazovachii *et al.* (2010) irrigation farming has become a source of income for disadvantaged people in rural areas. This means that participation is no longer limited to the well-up but also extended to vulnerable groups for example widows and orphans. Makadho (1992) is of the assertion that access to information is limited among irrigation farmers. These tend to affect their competitiveness. There is need to increase access to information on irrigation farming. This implies that

agricultural workers in rural areas should work hand in hand with farmers and should offer training programs on how to improve productivity, quality and competitiveness.

The livelihood concept is a means of understanding the factors that influence people's lives and well-being, particularly those of the poor in the developing world (Bagchi *et al.*, 1998). In its general sense a livelihood refers to the means people use to make a living. Chambers and Conway (1992:6) define livelihood as comprising of the capabilities, assets and activities required for a means of living. In South Africa, the role of farming in the livelihoods of rural African people has changed substantially during the past century. In pre-colonial times, agriculture was central in the livelihoods of African households, mainly in the form of subsistence production (Thompson, 1990). At present, agriculture merely supplements the livelihoods of most rural African households (Carter and May, 1999; Fraser and Van Averbeke, 2003).

Political and economic changes played an important role in bringing about the historical shifts in the livelihoods of black South Africans. When livelihoods based on agriculture became stressed, many South African rural households adopted migration as a livelihood strategy. Migration of Black people in South Africa was organised in response to the demand for labour by white-owned enterprises, particularly in mining and farming. This became important from about 1900 onwards (Yawitch, 1982; Beinart, 2001). The drive by the mining and agricultural sectors to satisfy their labour needs was supported by state through legislation that forced black people to earn a living out off-farm for at least part of the year. This legislation included various forms of taxes creating a need among black people for cash income and also restrictions that prevented black people from accessing adequate land to continue to make a living from farming. Initially mainly African men migrated to the cities, leaving women and children at their rural homes. Male migration affected the traditional organisation of households in the African areas, as well as their productive capacity especially in agriculture.

2.10 Challenges faced by irrigation farmers

Capital: Irrigation farming like any other business requires financial capital. It also needs chemicals, seeds, fertilizers and in certain instances irrigation pipes and pivots maintenance. It is unfortunate that farmers do not have money to purchase agricultural implements. Resultantly they are forced to do away with such important inputs which negatively affect the quality of their crop. Makumire (1996) puts forward the idea that lack of inputs is a major setback. At the end these problems make irrigation farming a failure in uplifting rural people's livelihoods.

Transport: Food crops from irrigation farms are a problem for many rural people since they lack the transport to ferry their produce to the market. This tends to disadvantage communal farmers to participate in the recent boom in horticulture. Jackson *et al.* (1997) postulates that some small irrigation scheme faces problems of roads and transport facilities. Rural areas often have gravel roads which are long and winding, some poorly maintained and inaccessible. Transport operators are in most cases reluctant to reach such areas and some of the farmers fail to get their produce to the market in time. Given the perishability of their products farmers face the risk of running a loss.

Labour: According to Hodder (2000) irrigation farming is extremely labour intensive. A plot needs to be maintained and thus tend to make considerable demand on the time of members. Given the demographic characteristics of rural areas, it follows that women and young children attend mostly to the plots. Watering the plots is particularly the best challenge especially in times of water crisis.

Water: Msingo (2007, Mujere, Chazovachii *et al.*, (2010) postulated that unavailability of water affects crops. Kundlande (1994) showed that crop production in most areas is common in dark grey soils as well as brown thick soils which need large amounts of water to be saturated. In times of water crisis due to broken pipes this forces farmers to abandon their work. This possibly means that farmers will not be able to enjoy the fruits of irrigation farming and thus affecting their livelihoods at that time.

Dillon (2011) examined the effect of irrigation on poverty reduction, asset accumulation, and informal insurance in Northern Mali and noted that irrigation projects have multiple micro and macro pathways through which irrigation investments may contribute to poverty reduction and increased economic growth. Irrigation investments increase agricultural production by increasing land productivity which changes relative prices and has distributional consequences. The effect of relative price changes on household welfare depends on whether the household was a net food producer or net food consumer and the distribution of land within the community. Increased agricultural production puts downward pressure on output prices which increases the welfare of landless laborers and net food consumers by increasing their food purchasing power. For net food producers, the effect of lower output prices on welfare depends on the dominance of the price effect relative to the increased income of the output effect. Net food consumers, net food producers, and landless laborers all benefit from the increased indirect demand for nonfarm goods and services from increases in rural incomes. Despite these theoretical pathways at the household level, the profitability of rural irrigation investments and their effect on economic growth depends also on the sustainability of community level investments in maintenance and land quality which may erode. Small-scale irrigation projects can have significant impacts on household consumption and agricultural production in an environment such as northern Mali, where the Sahelian droughts have been severe and agro ecological conditions are not favorable to rain-fed agriculture.

Burney and Naylor (2011) Investigated Smallholder Irrigation as poverty alleviation tool in Sub-Saharan Africa and stated that promotion of smallholder irrigation is cited as a strategy for enhancing income generation and food security for sub-Saharan Africa's poor farmers, but what makes this technology a successful poverty alleviation tool.

In the short run, the technology should pave the way for increased consumption, asset accumulation, and reduced persistent poverty among users. Over the longer run, it should lead to institutional feedbacks that support sustained economic development and nutritional improvements. Small-scale irrigation projects in Africa and Asia suggests that the three

components of an irrigation system water access, water distribution, and water use play complementary roles and will not necessarily be adopted autonomously.

2.11 Chapter summary

This chapter reviewed literature on the history of irrigation schemes in South Africa, the impact of irrigation schemes on livelihood strategies and household food security status. The main focus was on the smallholder farmers and comparison was done with other results from other countries.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes research methodology used during data collection and analysis in this study. The chapter covers five sections the description of the study area, research design, sampling procedure and sample size, data collection tools and data analysis.

3.2 Study area

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. The rainfall pattern of the province occupies approximately 11% or 129 821km² of South Africa. The North West Province is mostly rural in nature with much of the area consisting of flat areas of scattered trees and grasslands. Thirty five percent of the population are in urban areas while sixty five percent in rural areas.

According to Stats SA (2007) there are approximately 911 120 households in the North West Province. Significant household and population growth has occurred in the Bojanala Platinum and Dr Kenneth Kaunda Districts. A slower growth rate is noted in the Ngaka Modiri Molema District while a decrease in households is evident in the Dr Ruth Segomotsi Mompati District. The North West Province produces a third of the country's maize and makes a contribution to the supply of other agricultural products such as tobacco, sunflower oil, cotton and wheat. Agriculture in the eastern parts of the mainly focuses on horticulture and livestock. The semi-arid central and western parts are more focused on livestock and game farming. The province has a well-developed commercial agricultural sector, while subsistence farming is a very prominent activity in the communal areas. The main economic sectors are agricultural, mining and tourism. Field crops and livestock are the foremost contributors towards gross farm income in all districts of the province. The contribution of horticulture to gross farm income is moderate in most districts in the province with the exception of the Bojanala Platinum, where it accounts for an estimated twenty six percent of gross farm income earned. In terms of the major field

3.4 Population of study

The research focused on smallholder farmers who practice irrigation farming in the North-West province. These include those farmers who are on irrigation scheme and areas adjacent to the schemes. A list of 285 farmers which represented population of the study was collected from the North-West provincial Department of Agriculture and Rural Development.

3.5 Sampling procedure and Sample size

A simple random sampling technique was used to select the respondents from a list of 285 irrigation farmers, a sample of 66 farmers were selected using the drawing from the hat method as interviewed from the list of farmers that was obtained from the extension workers. The target group was male farmers in the irrigation schemes and those who farm adjacent to the irrigation scheme. Sampling involves the determination of the sample size giving due cognizance to the fact that it should be representative enough to conduct reliable statistical and qualitative analysis. Sample size depends largely on the degree to which the sample population approximates the characteristics and qualities resident in the general population (Bazeley, 2004; Onwuegbuzie et al, 2003; Weisner, 2005; Tashakkori et al, 1998). Roberts (2000) defines a sample as a collection of sampling units drawn from the sampling frame. In other words, a sample is a finite part of a statistical population whose properties are studied to gain information about the whole. A statistically and qualitatively adequate sample is one that is of such size that the inferences drawn from the sample are accurate to a given level of confidence (Weisner, 2005). Representativeness means that the sample selected should have approximately the same characteristics as the population relevant to the research in question (Teddlie et al, 2003; Weisner, 2005).

A sample becomes inaccurate mainly due to human factor/bias and distortion due to the selection system. In the most general sense, the components of the sample are chosen from the population universe by a process known as randomization. According to Weisner (2005), randomization means selecting a part of the whole population in such a way that the characteristics of each of the units of the sample approximate the broad characteristics inherent in the total population.

3.6 Data collection techniques

The data collection tool was a structured questionnaire which was designed based on the objectives of the study and it was used to obtain data for the study. Section A of the questionnaire elicited household characteristics such as demographic information (Gender, age, level of education,), farm specific characteristics (number and class of livestock, crops grown, hectares and output), food and non-food expenditures, remittances, employment and income, agricultural activities. Section B focused on the contributions of irrigation on livelihoods. While Section C the focus was on household food security and poverty status. The questionnaire included a few open-ended and numerous close-ended questions. Face-to-face Interview method between the researcher and respondents was used to administer the questionnaires.

3.7 Data analysis

Data collected were coded and entered into Microsoft Excel and then transferred to Statistical Package for Social Scientists (SPSS). SPSS is a program which allows the researcher to analyse and describe data. In the SPSS, descriptive statistics such as frequency counts and percentages were used to describe the data which inferential statistics such as linear and probit regression models as well as FGT were used to analyze the impact of irrigation on livelihood strategies, household food security and poverty status among of smallholder irrigation farmers.

The objective on description of socio-economic profile of farmers was analysed through the use of frequencies and percentages. The objective of the impact of irrigation farming on livelihood was analysed through linear regression analysis.

The model specification is as follows:

$$Y = f(X_1, X_2, \dots, X_{11}) \dots \dots \dots 1$$

Y = Livelihood

X₁ = Age

X₂ = Marital status

X₃ = Number of dependants

X₄ = Number of household

X_5 = Educational level

X_6 = Labour source

X_7 = Nonfarm activity

X_8 = Type of irrigation

X_9 = Food security

X_{10} = Income

X_{11} = Expenditure

The objective of the impact of irrigation farming on household food security status among farmers was analysed through probit regression analysis.

The probit model is expressed as: $Y = B_0 + B_i X_i + e_i$

Where $Y=1$, if farmers are food secured, $Y=0$, if farmers are food insecure

B_0 = is the intercept

B_i is regression coefficient that explains the probability of household food security status,

e_i is the error term and X_i = independent variables ($i= 1, 2, 3, \dots, 13$) as defined below

The independent variables specified as factors affecting household food security status are identified below.

X_1 = Income

X_2 = Expenditure

X_3 = Age

X_4 = Number of household

X_5 = Labour source

X_6 = Nonfarm activity

X_7 = Access financial capital

X_8 = Access human capital

X_9 = Access physical capital

X_{10} = Land

X_{11} = Farm experience

X_{12} = Contact with extensions

X_{13} = Farmers group

The poverty status of the farmers was analysed through Foster Greer Thorbecke. For analysis concentration was on headcount rate (which an estimate of the poor in the sample) poverty gap (poverty rate looking as the poverty baseline) and poverty rate (percentage of the poor in the total sample) (Assa, 2012). Those three parameters are known as decomposable poverty measures (Makoka & Kaplan, 2005). This study used Foster-Greer-Thorbecke (FGT) the formulae for the model is as below:

$$P_{\alpha} = \sum_{i=1}^m \frac{(1 - \frac{Y_i}{x})^{\alpha}}{N} \quad \text{For } \alpha=0, 1, 2 \quad \alpha \text{ is a non-negative parameter.}$$

According to Makoka & Kaplan (2005) $\alpha=0$ reduces head count index , $\alpha=1$ becomes poverty gap index, $\alpha=2$ for severity, Y_i earned by each person in the household in the number of households that are below the poverty line, N is the number of persons in the sampling population and x poverty line.

3.8 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 1: Measurement of variables

Variable	Level of Measurement	Analysis
Age	Nominal	Frequency, percentages
Marital status	Nominal	Frequency, percentages, dummy in regression
Religion	Nominal	Frequency, percentages
Number of dependants	Interval	Frequency, percentages
Household size	Interval	Frequency, percentages
Total male in household	Interval	Frequency, percentages
Total female in household	Interval	Frequency, percentages
Educational level	Nominal	Frequency, percentages, dummy in regression
Farming experience	Interval	Frequency, percentages
Tenure status	Interval	Frequency, percentages
Farm size in Ha	Interval	Frequency, percentages
Member of farmers group	Nominal	Frequency, percentages, dummy in regression
Contact with extensions	Nominal	Frequency, percentages, dummy in regression
Access to financial capital	Nominal	Frequency, percentages, dummy in regression
Access to human capital	Nominal	Frequency, percentages, dummy in regression
Access to physical capital	Nominal	Frequency, percentages, dummy in regression
Non Farm activity	Nominal	Frequency, percentages, dummy in regression
Income	Interval	Frequency, percentages,
Expenditure	Interval	Frequency, percentages
Livelihood	Interval	Frequency, percentages, Dependent variable in regression
Food security status	Nominal	Frequency, percentages, Dependent variable in regression

3.9 Ethical considerations

In this study standardization and uniformity was adopted for the study procedure for all the respondents. Permission to enter the farms was obtained from the respective local departmental managers and extension officers from the Department of Agriculture and Rural Development in the province. The managers were consulted and informed about the objective of the study. Respondents' information was treated as confidential and the results were used for the research purpose. The respondents were treated with respect, dignity and the research objectives were outlined. Participation in the study was on a voluntary basis for the respondents and interviews were only focused on the issues related to the study. Ethics are described as a set of moral principles that...offer rules and behavioural expectations about the most correct conduct (Onwuegbuzie & Teddlie, 2003). Ethics provide a researcher with a guideline to moral conduct, to prevent scientific misconduct (Weisner, 2005:32). The ethical considerations and guidelines as proposed by these authors were addressed at each stage of the proposed research. In compliance with the regulations of the North-West University's.

3.10 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 66 farmers was interviewed from the list of farmers that was obtained from the extension workers. The target group was male farmers in the irrigation scheme and those who farm within the radius of the irrigation 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

This chapter discusses the results from the survey; the results that are discussed include demographics of the farmers ,farming enterprises, types of irrigation systems, sources of income, production expenses, personal expenses, sources of agricultural information, livelihood aspirations, competency and training needs, political, local, traditional authorities, household food security status, household poverty status, household coping strategies against poverty and community development.

4.2 Demographics of the farmers in the study area

Table 2 shows the personal characteristic of small-scale farmers using irrigation farming of the North West Province. The results showed that 66 of the respondents were males as shown in Table 1. This is because the focus of the study was only on one gender. The demographic data also showed that males with (9%) are less than 40 years old. Majority of the males (65%) are above the age of 50years. The result also showed that (3%) of the male respondents are divorced while (71.2%) are married. The results showed that (42.8%) of the male respondents interviewed have primary school educational level. This is because majority of the respondents are old and they were born during the apartheid era of South Africa that has forced many South Africans to leave schools at an early age.

Punnet (1982) gave an example of the Martha Fenai Pradesh scheme in India which has been successful. Under the scheme villagers grow two or three crops instead of one and new crops that have been introduced such as onions, bananas and higher yielding varieties are common. Irrigation farming is viewed as a cheap substitute for costly disaster relief by the governments.

Table2: Demographics of farmers in the study area

Variable	Frequency	Percentage
Age		
<40	6	9
40-50	18	26
Above 50	42	65
Marital status		
Single	15	22.7
Married	47	71.2
Widower	2	3
Divorce	2	3
Race		
African	66	100
Religion		
Christianity	55	83
Other	11	17
Number of dependants		
<5	46	70
Above 5	20	30
Household size		
<6	42	64
Above 6	24	36
Total male in household		
<5	44	82
Above 5	12	18
Total female in household		
<4	57	86
Above 4	9	14
Educational level		
Primary school	28	42.4
Secondary school	13	19.7
High school	13	19.7
College	1	1.5
University	5	7.6
No education	6	9.1
Farming experience		
<5	18	27
6-20	32	50
Above 20	16	23
Tenure status		
Rented	1	2
Allocated	65	98
Farm size in Ha		
1-10	63	95.4
11-20	3	4.5
Member of farmers group		

No	15	23
Yes	51	77
Contact with extension workers		
No	22	33
Yes	44	67
Frequency of contact		
Rarely	39	59
Occasional	23	35
Regularly	4	6
Organization of the extension		
Government	63	95.5
NGO	2	3
Parastatal	1	1.5
Number of workers		
<5	52	78.8
Above 5	14	21.2
Labour sources		
Self	51	77
Family	4	6
Hired	11	17
Number of years in the irrigation		
<10	30	46
12-20	20	31
Above 20	16	23
Non farming activities		
No	52	78.8
Yes	14	21.2
Sewing		
Tuck-shop owner	6	12.7
Livestock	50	87.3

4.3 Types of farming enterprises practiced by farmers on irrigation farming

Figure 1 shows different types of crops that are grown by farmers on irrigated land. The results indicated that about (56%) of the respondent's plant maize. Majority of the smallholder farmers that produce maize in the study area indicated that they use dry land and they depend on the amount of rainfall per season for better yields. The North West Province is ranked as the third producer of the country's maize production and makes a contribution to the supply of other agricultural products such as tobacco, sunflower oil, cotton and wheat. Agriculture in the eastern parts of the province is mainly focused on

horticulture and livestock. The semi-arid central and western parts are more focused on livestock and game farming. The province has a well-developed commercial agricultural sector, while subsistence farming is a very prominent activity in the communal areas (DAFF, 2010).

The results also indicated that (25.5%) of the farmers plant beetroot and (21.2%) cabbage respectively. According to Jackson et al (1997), a survey of horticultural production in Zimbabwe showed that irrigation farming enables the growing of green vegetables, wheat, tomatoes, cotton, maize and even sugar-cane among others. About (1.5%) of the respondents grow tomatoes, in the study area. This crop has the lowest average yields and this is attributed to difficulties of the weather conditions and expenses attached to storage since there is no ready or nearby market for the perishables in the area.

According to DAFF (2011) tomatoes are produced in all South Africa Provinces, with Limpopo province being the dominant producer. The province account for more than seventy five percent of the total area planted to tomatoes. The other main producing areas for the crop are Mpumalanga and Eastern Cape provinces. Maize which is the most important source of food in South Africa is only planted at less than one hectare by an average South African small-scale farmer. According to Dalelo (2003) a diversity of crops is grown by small-scale farmers of South Africa and the diverse crops grown by rural households, maize is the major crop produced.

Majority of the smallholder farmers that produce maize in the study area indicated that they use dry land and they depend on the amount of rainfall per season for better yields. The North West Province is ranked as the third producer of the country's maize production and makes a contribution to the supply of other agricultural products such as tobacco, sunflower oil, cotton and wheat. Agriculture in the eastern parts of the province is mainly focused on horticulture and livestock. The semi-arid central and western parts are more focused on livestock and game farming. The province has a well-developed commercial agricultural sector, while subsistence farming is a very prominent activity in the communal areas (DAFF, 2010).

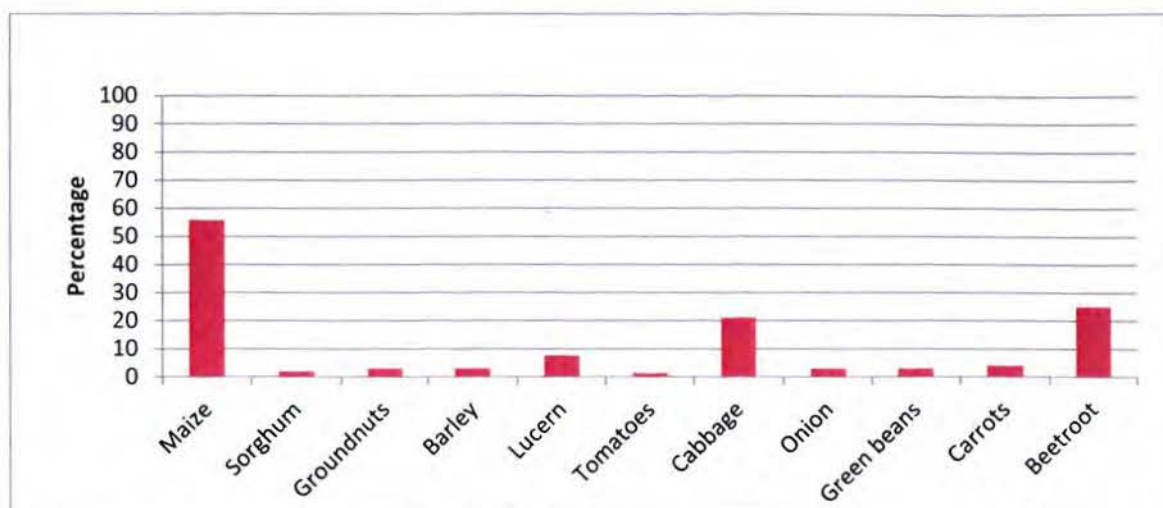


Fig1: Farming enterprises practiced by farmers

4.4 Different types of irrigation systems used by smallholder farmers on irrigation farming

Table 3 shows different types of irrigation systems that are practiced in the study area. The respondents indicated that only 7.6% of the irrigation land is privately owned and 92.4% belongs to the chief. About 59.1% of the respondents indicated that they use central pivots for irrigating and this type of irrigation method is commonly found in the Taung irrigation scheme. The Taung irrigation scheme was initially setup by government to assist farmers but due to changing policies through farming hence access to land and water is controlled by government and not by farmers. About 39.4% of the farmers use sprinkler irrigation system and this method is commonly found in the Brits area of the study. About 1.5% of the respondents use furrow irrigation and this type of irrigation found in the Zeerust of the study area.

Table 3: Different types of irrigation systems used by smallholder farmers

Different types of irrigation systems	
Central pivots irrigation systems	39(59.1)
Furrow irrigation systems	1(1.5)
Sprinkler irrigation systems	26(39.4)
Sources of water for the irrigation scheme	
Dam	60(90.9)
River	4(6.1)
Municipality	2(3)
Ownership of irrigation	
Private stakeholders	5(7.6)
Chief	61(92.4)

*Figures in parentheses are percentages

4.5 Sources of income to smallholder farmers

Figure 2 shows different sources of income to farmers. Majority of the farmers indicated they also obtain income from other sources such as salaries and businesses with (81%) of the respondents indicated that they can generate less than R30 000 per month, while (0.5%) can generate above R30 000 a month. The results also discovered that some of the farmers gain earnings from leasing their farm equipment with (81%) of the respondents indicated that they can generate less than R600 a month, while (0.5%) can generate above R2500. About (21%) of the respondents indicated that they depend on government grants. In South Africa men and women who are above sixty years old are supported by the government through a monthly government grant of about one thousand and two hundred and sixty rand, this amount increases on yearly basis and the aim of it is to help these elderly citizens to be able to meet some basic needs such as food. However some of the respondents on the grant category augment their grant with income from irrigation farming. Income is the consumption and savings opportunity gained by an entity within a specified time frame which is generally expressed in monetary terms. However households and individuals, income is the sum of all wages, salaries, profits, rents and other forms of earnings received in a given period of time.

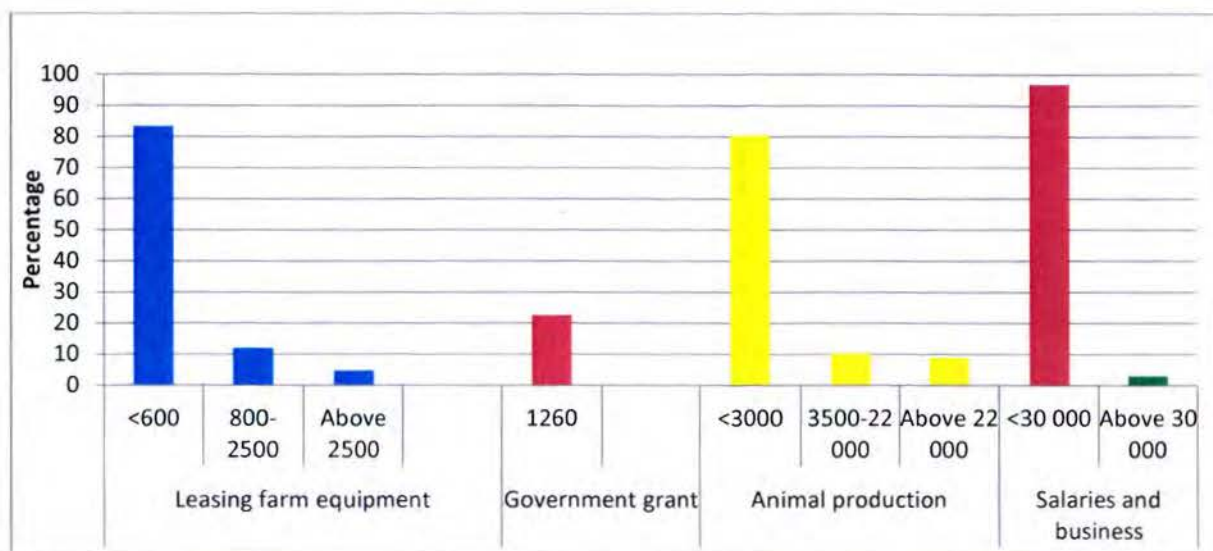


Fig 2: Farmers sources of income

4.6 Farmer's annual production expenditure

Figure 3 indicates annual farm production expenditure. This shows the fundamental outlining on inputs such as chemicals, seeds, fertilizers and in certain instances irrigation pipes and sprinklers. About (62%) of the farmers in the irrigation farming indicated that they spend more on water and electricity respectively. These expenditures vary seasonally and major cause for farmers to spend more on electricity is that pivots only operate on electricity. The water bill is always estimated by municipality, farmers have indicated that if water and electricity could be at reasonable prices they can improve their production and farm for profit. Farmers in Disaneng have indicated that they only depend on rain for irrigation as they produce maize using dry land farming system. About (70%) of the farmers spend more on transport since the markets are situated far from the farms, the only nearest and stable market is about 70 kilometers from the farm for farmers in Lehurutse, while for those in Taung is 240 kilometers. From the results the cost incurred by farmers is very high for the scale of production.

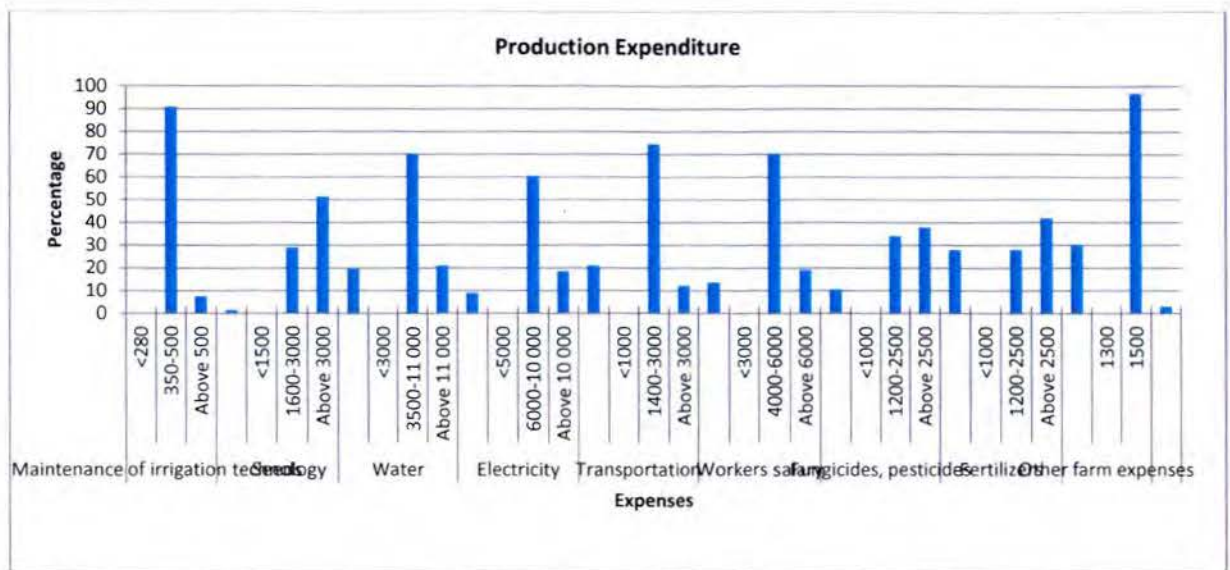


Fig 3: Annual production expenditure

4.7 Farmers personal expenses

Table 4 indicates farmers personal expenses, farmers indicated that the money they earn from farming they also use it for their personal expenses. They use money generated pay school fees (52%), transportation (45%), food (35%), and electricity (64%). According to Kundlande *et al* (1994), food production from irrigated farms is a major source of wealth creation to the extent that it is the basis for economic growth in a number of localities.

About (95.5%) of the farmers spend less than two hundred and fifty rand on entertainment, this could be because of the age, maturity level and the fact that majority have children that are still studying at both lower and higher educational levels. From the results farmers in the study area have indicated that a large portion of their income generated goes to household basic needs such as food with about (33%) of the farmers spending more one thousand and five hundred rand on monthly basis. While (64%) of the farmers spend approximately less than four hundred rand monthly on electricity and water respectively. The results also showed that only (4.5%) of the farmer put more than five hundred rand on their savings. This could be one of the prevailing saving attitudes. Moobi and Oladele (2012) reported farmers in the Ngaka Modiri Molema district of North West Province interact more with informal financial markets than formal financial market

Table 4: Personal expenses amongst smallholder farmers

Expenses	Rand	Frequency	Percentage
School fees	<500	35	52
	600-1000	21	33
	Above 1000	10	15
Transportation/Fuel	<700	19	29
	750-1000	30	45
	Above 1000	17	26
Food	<1000	21	32
	1100-1500	23	35
	Above 1500	21	33
Electricity	<400	45	64
	450-700	13	24
	Above 700	8	12
Water	<200	18	27.3
	250-400	38	57.6
	Above 400	10	15.1
Clothes	<300	25	31.9
	350-500	29	43.8
	Above 500	12	18.3
Entertainment	<250	63	95.5
	Above 250	3	4.5
Savings	<250	53	79.5
	300-500	10	15
	Above 500	3	4.5

4.8 Reasons for involvement in irrigation farming

Figure 4 indicates farmer's personal reasons for involvement in the irrigation farming. According to the farmers about (53%) are in the irrigation farming, only because the existing scheme is their only source of income. While about (47%) of the farmers are in the irrigation farming for personal interest. Data from previous case studies also revealed that irrigation farming has long term economic contribution on rural livelihoods.

Statistics South Africa (2002) reported that less than a quarter of households in South Africa are involved in agricultural activities, including practicing agriculture. Irrigation agriculture is an essential component of any strategy to increase global food supply. The benefits of irrigation have resulted in lower food prices, higher employment and a more rapid agricultural and economic development. Irrigation farming contributes significantly at the household in terms of income in rural areas. Having most of the rural household unemployed, most families, income levels are relatively low and possibly not enough to acquire basic commodities and services.

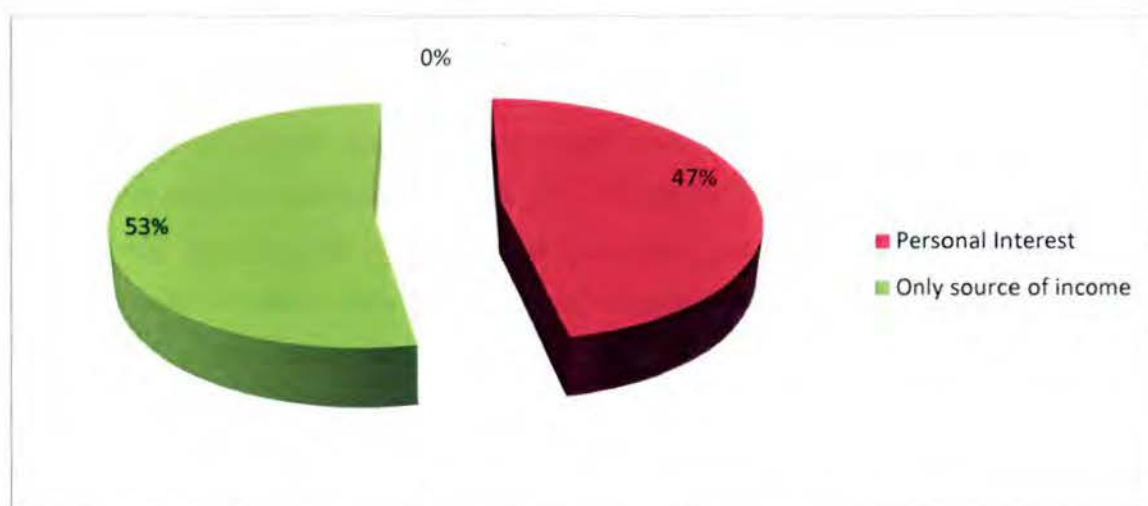


Fig 4: Farmer's personal reasons for involvement in the irrigation farming

4.9 Sources of information to farmers

Figure 5 analyses source of agricultural information for the farmers in the study area. About (93.6%) of the farmers indicated that they rely on television, radio (86.4%) and cell phones (90.9%) for agricultural information. Radio is one of the main communication tools that are mostly used in Africa this is because it can cover large audience at different languages.

The results also indicated that use of internet among smallholder farmers is very low with (90.9%) of the farmers not able to use internet. This could be due to low literacy level of among respondents. ICTs are believed to bring about social and economic development by creating an enabling environment. Almost every single activity in the modern world is becoming more dependent on the application of ICTs for one use or another. The benefits of ICTs reach even those who do not themselves have first-hand access to them. Through ICT an agricultural extension worker can learn new technologies, rainfall forecasts and commodity prices. With this information it can be used to advice farmers in rural villages. Global studies demonstrated the fact that information and communications technology (ICT) positively affect economic growth and productivity of production inputs.

According to (Christoplos and Kidd, 2000) knowledge and information have become the major drivers of social and economic transformation in the world. Knowledge and information are now as important, if not more, factors in development, and this trend is set to intensify. Agricultural education and extension can play a critical role in the transformation process to transfer technology, support learning, assist farmers in problem-solving and enable farmers to become more actively embedded in the agricultural knowledge and information system. However many farmers have complained about the unavailability of extension staff in their locality for consultation or advice. In Kenya, market information is provided through short message service (SMS) so that smallholders have access to daily agricultural commodity prices, extension messages and opportunities to sell or bid through text messages and or voicemail; there are other rural-based market information points which are linked through an electronic information system that allows farmers to link with buyers in different urban centres (Muriithi *et al.*, 2009; Davis and Addom, 2010). Pyramid Research (2010) also reported the importance and use of ICT's in Nigeria; the cassava growers receive market information through a new initiative called the

Integrated Cassava Project. Based on mobile phones and Internet and online marketplace Trade Net Africa, the project aims to disseminate market information using the Agri-Business Information Points (market information centres) and trade agents. These services include prices, demand volumes and offers, trade assistance and training.

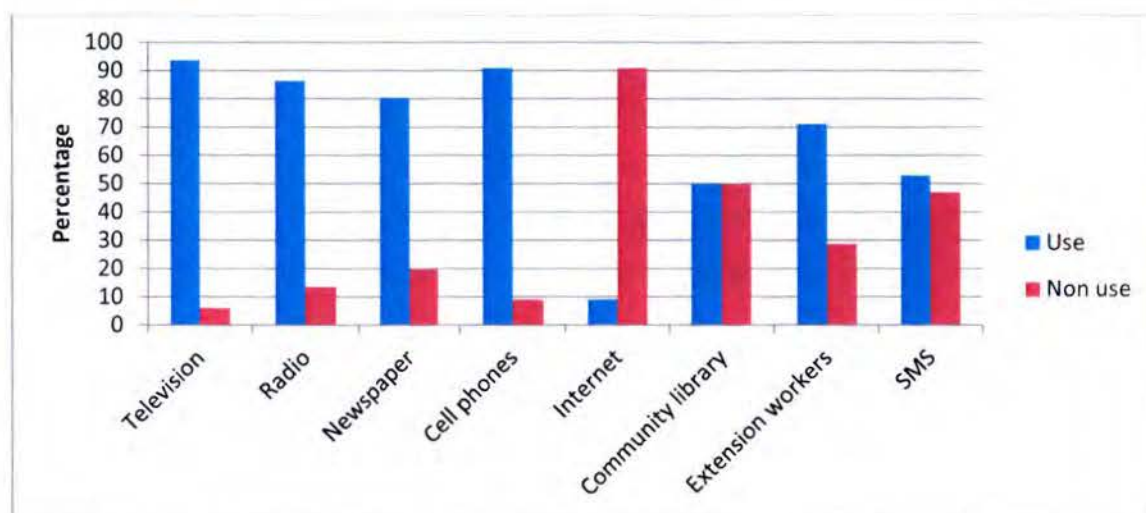


Fig 5: Sources of information to farmers.

4.10 Access to livelihood assets by irrigation farmers

4.10.1 Access to financial capital by smallholder irrigation farmers

Table 5 shows access to livelihood assets by farmers. From the list of 7 listed financial capital institutions (74.9%) of the farmers were not accessing credit from government subsidies or banks. In South Africa government has introduced programmes aimed at developing smallholder farmers through CASP and other programmes. These are the government initiatives aimed at supporting farmers in a form of grants for their farming development. Oladebo (2008) also found that smallholder farmers have relatively more access to informal and semiformal credit institutions than to formal credit institutions, in spite of the higher volume of credit at the disposal of formal institutions. In addition, the high repayment rate of loans recorded by informal and semiformal institutions could indicate that the loans are granted at affordable rates to the small-scale farmers and that

subsidization may not be necessary. Oruonye and Musa (2012) supported that access to agricultural credit constitutes a major challenge to small-scale farmers in Nigeria. This led the people in the area to evolve a local system of micro finance (bada kaka) to enable them overcome the challenges to access production loan from banks. However, the evolution of the local micro finance (bada kaka) as indicated by most farmers in Nigeria has failed to achieve the desired result due to the harsh and exploitative conditions associated with it. Consequently, most farmers have continued to operate at small scale due to lack of access to micro credit. The inability of the farmers to access alternative sources of farm credit has compelled them to endure the exploitative tendencies of the middlemen (traders) through the bada kaka micro credit scheme over the years. Even though farmers do not possess ownership deeds as a collateral to access financial institutions

4.10.2 Access to physical capital by smallholder farmers

From the listed 6 physical capital assets farmers were asked to indicate which assets are they easily accessible to them. Farmers indicated that they have more adequate access to storage (89.4%), market (81.8%) and electricity (50%). According to IFAD (2001) market access plays a remarkable role in ensuring better income and welfare for smallholder farmers through diverse channels. By raising income, markets increase purchasing power which in turn creates demand for consumer goods and enhancing farmer welfare. Market access can be improved with an increase in the flow of market information to the farmer, to broaden the information base of the farmer and reduce dependence on traders for price information. Without an institutional framework that facilitates information flow, access to information is dependent on social capital that is neighbours' friends and relations. Oduru *et al.* (2004) argued that age and gender have negative and positive effects on market participation respectively. Older people tend to have more dependents and more subsistence activities hence low market participation. While female-headed households and households with more female members, especially with respect to dairy products tend to be primarily involved in these production activities hence positively affect market participation. Infrastructure and services are important defining parameters of market proximity and therefore effective market participation (Holloway *et al.* 2000).

Farmers further indicated that access to transport (51.5%) is available to them. According to Goletti and Wolff (1998), transport generally marks the passage from one stage of the post-harvest system to the next. Therefore, if the roads are poorly developed, it becomes difficult to move products from one stage to another. From the results also farmers indicated that access to road (39.4%) is inadequate. Physical capital is essential to achieve livelihood goals and include access to basic services such as water, transport and electricity, as well as markets. The majority of villages in rural areas are served by an inadequate and poorly maintained road network. These roads are mainly gravel and are severely eroded. The poor conditions of roads, which are often impassable during the rainy season, have an adverse effect on the transportation of produce (Montshwe, 2006).

4.10.3 Access to natural capital by smallholder farmers

Natural capital refers to the land and natural resources to which households have access. The result showed that 98.5% of the farmers have permission to occupy land from the chief while 1.5% of the land is privately leased, because of the adaptation of the customary system of land allocation in rural areas of South Africa. There is no household that can claim formal ownership of the allocated piece of land. The land allocation and responsibility over it lie with the tribal authority, the Kgosi (chief). The average land size allocated to farmers in the irrigation schemes of the North West province is between 1.5ha and 20ha.

Table 5: Access to livelihood assets by farmers

Financial capital	Availability		Very adequate	Not adequate
Access to credit				
Banks	22(33.3)		4(6.1)	40(66.6)
Cooperatives	26(39.4)			40(60.6)
Money lenders	29(43.9)		2(3.0)	35(53)
Relatives	41(62.1)		2(3.0)	23(34.9)
Personal savings	43(65.2)		6(9.0)	17(25.8)
Contractors	25(37.9)		2(3.0)	39(59.1)
Government subsidies	5(7.6)		12(18.2)	49(74.3)
Human capital				
Training			44(66.6)	22(33.4)
Vocational training			32(48.5)	34(51.5)
Extension service	29(43.9)		18(27.3)	19(28.8)
Skills training				
Record keeping	34(51.5)		7(10.6)	25(37.9)
Water management	32(48.5)		13(19.7)	19(31.8)
Equipment handling	35(53.0)		14(21.2)	17(25.8)
Financial management	25(37.9)		12(18.2)	29(43.9)
Soil management	38(57.6)		8(12.1)	20(30.3)
Crop protection	43(65.2)		9(13.6)	14(21.2)
Physical capital				
Transport	34(51.5)		23(34.8)	9(13.6)
Water supply	20(30.2)		24(36.4)	21(33.4)
Markets	12(18.2)		54(81.8)	
Road accessibility	22(33.3)		18(27.3)	26(39.4)
Electricity	12(18.2)		33(50)	21(31.8)
Storage	7(10.6)		59(89.4)	
Natural capital	Yes	No		
Land	65(98.5)	1(1.5)		
Type of tenure				
Lease	1	1(1.5)		
Permission to occupy	2	65(98.5)		
Total size of land	Ha			
	1.5	21(31.8)		
	10	42(63.6)		
	15	1(1.5)		
	20	2(3.0)		

4.11 Smallholder farmer's competency skills and training needs

Table 6 shows competency skills and training needs among farmers. In relation to the prevailing/common agricultural enterprises among irrigation farmers, from a list of competencies in relation to agricultural enterprises of smallholder irrigation, farmers were asked to rate their competency levels on each of the skills regime for the identified enterprises. From 22 listed skills development farmers were highly competent in soil preparation for ploughing, determining intra row spacing and ability to determine seed depth (97%) respectively. From the results about (66.7%) of the farmers have indicated that they still lack skills and knowledge of negotiating for market contracts, while (63.6%) of the farmers have indicated that one of their major constraints is their low literacy level which disadvantages them in reading and interpreting market information. Ngemtu (2010) noted that in the Eastern Cape farmers know about the training services that are normal offered by extension workers, not all of them attend these sessions and group meetings. Some farmers argue that they cannot attend workshops because they are held far from their homes. Thus, it is important to find strategic areas to hold workshops in order to accommodate all the farmers. There are some farmers who indicated that they do not attend workshops because they are old, have knowledge on farming and are not willing to learn new things while others indicated that they only depend on extension workers for training and skills development.



Table 6: Competency and training needs required by smallholder farmers

Skills	Not competent	Competent	Very competent
Soil preparation for ploughing	2(3.0)	64(97.0)	
Determine inter and intra row spacing	2(3.0)	64(97.0)	
Determine seeds depth	2(3.0)	64(97.0)	
Selecting appropriate planting methods for various crops	8(12.1)	58(87.9)	
Evaluating farming land for soil and water conservation	23(34.8)	42(63.6)	1(1.5)
Recommending suitable soil and water conservation measures for specific farm lands	4(6.1)	62(93.9)	
Knowledge of crop rotation	4(6.1)	62(93.9)	
Calculating the amount of fertilizer to apply for various crops	21(31.8)	45(68.2)	
Appropriate application of herbicide and fungicide	11(16.7)	47(71.2)	8(12.1)
Calibrating planters and seeders for various crops	10(15.1)	44(66.7)	12(18.2)
Planning and carrying out harvesting appropriately for various crops	9(13.6)	53(80.3)	4(6.1)
Irrigation scheduling and frequency	9(13.6)	49(74.2)	8(12.1)
Knowledge on the amount of water to use	6(7.6)	52(78.8)	9(13.6)
Knowledge of the market for your produce	9(13.6)	48(72.7)	9(13.6)
Price determination for your produce	12(18.2)	38(57.6)	16(24.2)
Knowledge of reading and interpreting market information	42(63.6)	13(19.7)	11(16.7)
Knowledge of the marketing contracts	44(66.7)	22(33.3)	
Value adding	16(24.2)	36(54.5)	14(21.2)
Service provider for storage facilities	16(24.2)	50(75.8)	
Farm record keeping	20(30.3)	46(69.7)	
Financial management	17(25.7)	49(74.2)	
Packaging	20(30.3)	46(69.7)	

*Figures in parentheses are percentages

4.12 Influence of political, social, traditional institutions on farmers access to livelihood land and water

In terms of political interventions farmers stated that land reform of South Africa has not affected them defectively as majority of these farmers have indicated that access to land and water is very easy with (86.4%) of the respondents agreeing to that, although a large number of farmers were still complaining about high rates that they pay for water. The high payment rate of water is assumed to be because of the old pipes that are always broken as result water becomes wasted and the person that has to suffer the consequences is the farmer. One of the major reasons for easy access to land farmers is that rural laws and policies are well organised and transparent to everyone. It is known in the rural setup that by law the only person that holds the rights of ownership for land is the chief and has legal authority to control land.

About (72.2%) of the respondents indicated that in their society farming is one the main activities that is recognized and societal perceptions about farming are very good.. The acceptance of farming by the society is because historical farming either growing crops or breeding animals as an old practice has saved man and nations from hunger from the beginning of earth. In rural areas farming is very common as many families also rely on farming for survival and to meet their daily needs. Majority of the rural population depends on farming the Chief allocates land and each of the household has to produce food for survival.

Table 7: Political, local traditional authorities and cultural institutions

Political	Good	Fair	Bad
Land reform			
Access to land	57(86.4)	6(9.1)	3(4.5)
Land availability	59(89.4)	4(6.1)	3(4.5)
Land productivity	54(81.8)	8(12.1)	4(6.1)
Water reform			
access to water	57(86.4)	5(7.6)	4(6.1)
water availability	59(89.4)	3(4.5)	4(6.1)
water productivity	6(9.1)	58(87.9)	2(3.0)
Local and traditional authorities			
Access to land	58(87.9)	4(6.1)	4(6.1)
Land availability	61(92.4)	2(3.0)	3(4.5)
Productivity	49(74.2)	14(21.2)	3(4.5)
Water access	53(80.3)	10(15.2)	3(4.5)
Water productivity	23(34.8)	39(59.1)	4(6.1)
Available infrastructures	3(4.5)	36(54.5)	27(40.9)
Access to markets	34(51.5)	28(42.4)	4(6.1)
Social group	15(22.7)	31(47.0)	20((30.3)
Benefits of social group	17(25.8)	35(53.0)	14(21.2)
Water security	45(68.2)	15(22.7)	6(9.1)
Adjustment /changes in land reforms	6(9.1)	54(81.8)	6(9.1)
Adjustment /changes in water reforms	6 (9.1)	55(83.3)	5(7.6)
Adjustment /changes in income generating activities water reforms	57(86.4)	4(6.1)	5(7.6)
Coping strategies in terms of land reforms	60(90.9)	2(3.0)	4(6.1)
Coping strategies in terms of water reforms	39(59.1)	24(36.4)	3(4.5)
Coping strategies in terms of income generating activities water reforms	54(81.8)	9(13.6)	3(4.5)
Cultural Institutions			
Societal perceptions about your participation in farming	48(72.7)	14(21.2)	4(6.1)
Societal perceptions about your participation in your income generating activities	58(87.9)	4(6.1)	4(6.1)
Societal norms and values in perceptions about your income generating activities	41(62.1)	22(33.3)	3(4.5)

*Figures in parentheses are percentages

4.13 Household Food Security and Poverty Status

In this study farmers were asked to indicate their household food security status, this was measured in terms of number of meals per day among famers. The results indicated (83.3%) of the respondents have access to food at least three times a day, while (3%) of the respondents indicated that they only have one meal a day this could be because of low financial status of the household or the size of the household as it appears that many of the families are above ten heads in the house with only one bread winner or pensioner. Although the results indicated an easy access to food by farmers, the type of foods that they stated as their balanced diet does not have an adequate nutritious value. This clearly indicates that not all three pillars of food security are met by the respondents. While others also agreed that they cannot afford to buy quality and safe foods.

Food security exists at the individual, household, national, regional and global levels when all people at all times have physical, social, and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life(FAO, 2001).

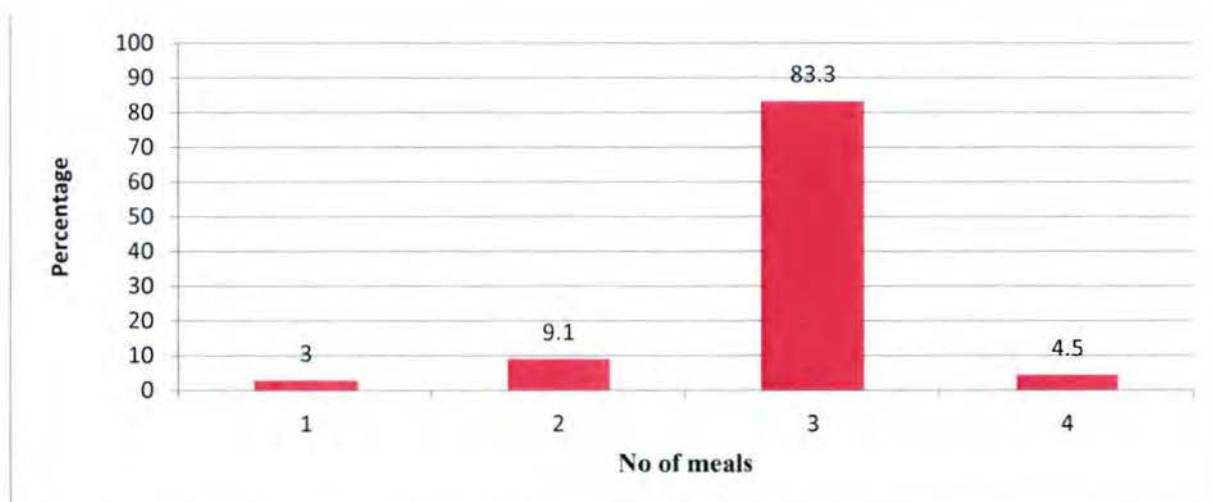


Fig 6: No of meals per day

Table 8 indicates household poverty status; this was measured in terms of perceptions from the list of three indicated perceptions farmers were asked to rank their household food security status. The results indicated that those farmers who are living below the stated poverty threshold about (77.3%) of them indicated they are very poor. About (15.2%) of the respondents indicated that their households poverty status is not poor. According to the Department of Agriculture (2002) Poverty and food insecurity in South Africa are some of the legacies of race-based socio-economic development practices that were enforced throughout history. The industrial development and resultant urbanization that took place during the 20th century devastated African farming and stripped households from agricultural and rural capital, wealth, and farming expertise. Stats SA (2005) National Food Consumption Survey found that 52% of households experienced hunger and that at least a third of households were at risk (Labadarios in Hart, 2009). South Africa is characterized by high levels of income poverty and inequality (Altman, Hart, Jacobs, 2009: 345) and poor households often suffer inadequate or unstable food supplies as well as poor nutrition. Department of Agriculture (2002: 19) also stated that households in South Africa are often characterized by high unemployment, inadequate safety nets, insufficient capital or access to land and meager purchasing power.

Table 8: Household poverty status

Status	Yes	No
Very poor	51(77.3)	15(22.7)
Averagely poor	58(87.9)	8(12.1)
Not poor	10(15.2)	56(84.8)

*Figures in parentheses are percentages

4.14 Reasons identified by household as causes of poverty

Table 9 shows reasons identified by household as causes of poverty. A list of 17 possible causes that could have led households to be in poverty in the study area was presented to respondents. Respondents indicated that drought and low prices of agricultural commodities (89.4%) respectively are the main challenges that could have led them to face poverty. While (87.9%) of the respondents indicated that prices of agricultural inputs are very high and with very low incomes (87.9). Baiphethi and Jacobs (2009:5) market purchases are becoming increasingly important for urban and rural households. The estimated number of households that purchase up to 90% of their food and that food expenditure could amount to 60-80% of the total household income for low-income households. Increases in the cost of food and energy will increasingly force poor households to spend a larger proportion of household expenditure on food, leading to less diverse, lower quality diets that are less likely to provide sufficient nutrients.

Since 1994 Government has attempted to address these challenges by increasing spending on a variety of social programs, including farmers support grant systems, school feeding schemes, free health services for children younger than 6 years, health services for pregnant and lactating women, and well-targeted cash transfers or social grants, but majority of households at ground level in South Africa are still stricken by poverty especially in rural and townships of the country (DoA, 2002:12). Hart (2009) reported that apartheid transformed livelihood systems in South Africa; causing households in rural and urban areas to rely on non-agricultural sources of income to purchase food as a result majority of those who could not find themselves in labor force are now facing the hit of high poverty.

Table 9: Reasons for the household to be in poverty

	Yes	No
Cannot afford/ lack of agricultural inputs(fertilizers, seeds)	58(87.9)	8(12.1)
Prices of inputs high	56(84.8)	10(15.2)
Unavailability of agricultural inputs	52(78.8)	14(21.2)
Late delivery of inputs by suppliers	44(66.7)	22(33.3)
Low agricultural production	49(74.2)	17(25.8)
Drought	59(89.4)	7(10.6)
Lack of adequate land	48(72.7)	18(27.3)
Prices of agricultural produce too low	59(89.4)	7(10.6)
Lack of buyers for agricultural produce	48(72.7)	18(27.3)
Lack of capital to start or expand agricultural business	49(74.2)	17(25.8)
Lack of credit to start agricultural production or buy inputs	52(78.8)	14(21.2)
Lack of employment opportunities	54(81.8)	12(18.2)
Prices of commodity too high	35(53.0)	31(47.0)
Salary/wage too low	58(87.9)	8(12.1)
Business not doing too well	50(75.8)	16(24.2)
Too much competition	58(87.9)	8(12.1)
Decline in the economy	13(19.7)	53(80.3)

*Figures in parentheses are percentages

4.15 Household coping strategies against poverty

Table 10 shows household coping strategies against poverty. A list of 14 possible coping strategies against poverty respondents were asked to indicate their coping strategies. About (54%) of the respondents indicated that they rely on government grants as one of the measures that help to cope with poverty. Social grants have been shown to benefit poor and vulnerable people and their broader households by inter alia elevating consumption, welfare and access to social services by improving the ability of households to deal with risk and insecurity (Stats SA, 2001). While (22.7%) revealed that they cope against poverty by looking for seasonal piece jobs. Other respondents about (19.7%) said that when they do grocery normally they reduce other household items such as (soaps, tissues) this also helps them to buy the most important items.

Table 10: Coping strategies against poverty

	Yes	No
Piece jobs	15(22.7)	51(77.3)
Relief food from the government	4(6.1)	62(93.9)
Substituting ordinary meals	3(4.5)	63(95.5)
Reducing the number of meals	9(13.6)	57(86.4)
Government grants	36(54.5)	30(45.5)
Reducing other household items (soap, tissues)	13(19.7)	53(80.3)
Informal borrowing from friends, neighbors	5(7.6)	61(92.4)
Formal borrowing in cash or kind	1(1.5)	65(98.5)
Pulling children out of school	1(1.5)	65(98.5)
Vending	1(1.5)	65(98.5)
Sales of assets	2(3.0)	64(97.0)
Begging from streets	6(9.1)	60(90.9)
Asking from friends, neighbors or relatives	8(12.1)	58(87.9)
Help from religious or charitable organization	6(9.1)	60(90.9)

*Figures in parentheses are percentages

4.16 Determinants of livelihood strategies on irrigation farming

The results of multiple regression analysis of relationship between irrigation farming and livelihood strategies among farmers were presented in Table 13. The independent variables were significantly related to livelihood strategies of the farmers with an F value of 8.067, $p < 0.05$ and R value of 0.788 showed that there was strong correlation between the independent variable and the household livelihood strategies. Significant determinants were marital status (2.43), number of household ($t= 5.41$), nonfarm activity ($t= 1.73$) and income ($t= 6.59$). This implies that the smaller the household and the higher the income from farming operations and nonfarm activities, farmers can meet their basic needs from irrigation farming and they can easily access as much as many livelihood strategies available to them.

Table 11: Determinants of livelihood strategies among farmers in the irrigation schemes

Model	B	Standard Error	Beta	t	Sig
Age	-1082.132	4273.636		-.253	.801
Marital status	169.558	69.535	.248	2.438	.018**
Number of dependents	1866.871	1258.553	.149	1.483	.144
Number of household	-1937.116	357.507	-.640	-5.418	.000***
Educational level	-712.863	457.429	-.155	-1.558	.125
Labor source	116.545	920.080	.012	.127	.900
Nonfarm activity	-3034.821	1747.310	-.176	-1.737	.088*
Type of irrigation	122.167	1360.175	.009	.090	.929
Livelihood	22.026	22.789	.087	.967	.338
Food security	1862.867	1430.381	.123	1.302	.198
Income	.171	.026	.631	6.590	.000***
Expenditure	-.017	.120	-.013	-.146	.885
F	8.067				
Sig	.000 ^b				
R	.788 ^a				
R Square	.622				

4.17 Determinants of food security on irrigation farming

Table 12 shows the result of the probit model. This was used to determine the influence of the dependent variable on household food security status. The autonomous level of food security is -1.574. The model has a good fit and it is significant at 10%. Two explanatory variables were significant while eleven variables were insignificant. The significant variables include Income and Land. The insignificant variables were Expenditure, Age, Number of household, Labour source, Nonfarm activity, Access financial capital, Access to human capital, Access to physical capital, Farm experience, Contact with extensions and Farmers group. The probit model was employed to determine factors influencing household food security status among farmers in the irrigation farming of the study area. The probit model seeks to explain the probability of household food security as a result of thirteen 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 probability of food security status among farmers. The sign of coefficient of the income did not comply with a priori expectation but is statistically

significant at 1 percent. The coefficient of land has a negative coefficient and is statistically significant at 5 percent. This indicates that there an indirect relationship between land and food security status of farmers. This indicates an increase in land size (that is more land acquired), will decrease probability of household to be food insecure.

Table 12: Determinants of household food security status among farmers in the irrigation farming

Parameter	Estimate	Standard Error	Z	Sig
Intercept	-1.574	.439	-3.587	.000
Income	.000	.000	2.094	.036**
Expenditure	.000	.000	-.921	.357
Age	.004	.007	.589	.556
Labour source	-.086	.082	-1.038	.299
Nonfarm activity	.170	.138	1.235	.217
Access financial capital	.012	.016	.747	.455
Access human capital	.002	.010	.163	.870
Access to physical capital	-.005	.016	-.290	.772
Land	-.314	.176	-1.784	.074*
Farm experience	-.003	.007	-.416	.677
Contact with extensions	-.106	.139	-.760	.447
Farmers group	.060	.153	.390	.696
Chi-square	90.969			
df ⁿ	52			
Sig	.001			

4.18 Forster Greer Thorbecke Analysis

Table 13 shows the results of Forster Greer Thorbecke analysis that was used to measure the poverty status of farmers in the irrigation farming. In this study household income is 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 $\alpha = 0$: 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 (1.5%) 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.

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 minimum threshold that was set at (R9.2). In most studies incidence, depth and severity is very low for farmers who are on irrigation farming since irrigation gives farmers a better crop and yields to sell easily in the markets.

Table 13: Forster Greer Thorbecke Analysis

Index	Estimated value	Estimated value	Estimate value
	Incidence value ($\alpha = 0$)	Depth($\alpha = 1$)	Severity($\alpha = 2$)
Farmers	0.01515	0.005	0.00165
Poverty line	9.2	9.2	9.2
EDGE	0	0.04599	0.37366

4.19 Chapter summary

The results of the study showed that 66 of the respondents were male data also showed that (9%) were less than 40 years old. The result also showed that (3%) of the respondents are divorced while 71.2% are married. The study showed (42.8%) of the respondents interviewed have primary school educational level. The results indicated that (56%) of the respondents produce maize, followed by beetroot with 25.2%. The results showed that only (7.6%) of the irrigation land is privately owned and (92.4%) belongs to the chief. About (54.5%) of respondents survive from government grants and (22.7%) from piece jobs to escape poverty. About (53%) of the farmers are in the irrigation farming, only because the existing scheme is their only source of income. While about (47%) of the farmers are in the irrigation farming for personal interest. Farmers indicated that they rely on television (93.6%), radio (86.4%) and cell phones (90.9%) for agricultural information. Significant determinants of livelihood strategies on irrigation farming were marital status (2.43), number of household ($t= 5.41$), nonfarm activity ($t= 1.73$) and income ($t= 6.59$). This implies that the smaller the household and the higher the income from farming operations and nonfarm activities, farmers can meet their basic needs from irrigation farming and they can easily access as much as many livelihood strategies available to them. The results of probit showed two explanatory variables were significant while eleven variables were insignificant. The results of Forster Greer Thorbecke showed that about (1.5%) of the respondents are living below the threshold of (R9.2) per day, while the per capita income of respondents that are below the poverty line needed to be increased by (0.5%) to meet the level of poverty line. The results also showed severity of (0.1%), this implied that the gap of respondents from the poverty line is very small.

CHAPTER FIVE

5.0 FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter concludes the study and it has an overview of summarized results and major findings. The chapter also covers an overall of the study and the recommendations for the future planning and possible influences of the policy and decision makers of the country. The study was designed to assess the impact of irrigation schemes on livelihood strategies and food security status of small-scale farmers in North West Province, South Africa. Sixty six males were randomly selected using simple random sampling techniques. Data were collected through the use of structured questionnaire that consisted of demographics, farming enterprises, types of irrigation systems, sources of income, production expenses, personal expenses, sources of agricultural information, livelihood aspirations, competency and training needs, political, local, traditional authorities, household food security status, household poverty status, household coping strategies against poverty and community development projects.

5.2 Summary

The study assessed the impact of irrigation farming on livelihood strategies and food security status of smallholder farmers in North West Province, South Africa. The objectives of the study were to describe the socio-economic profile of farmers on irrigation scheme, to analyse the impact of irrigation scheme on livelihood strategies of farmers and to analyse the impact of irrigation farming on household food security status of farmers. The population of the study included smallholder farmers who in the irrigation farming in the study area. The respondents were organised by the extension workers through their daily and weekly visits and the researcher was always accompanied by the extension workers.

Simple random sampling method was used for this study since it is a subset of individuals (sample) chosen from large set (population). The advantages of using this method is each individual is chosen randomly and entirely by chance, such that each individual has same

probability of being chosen at any stage during sampling process and each subset of individuals has the same probability of being chosen for the sample as any subset of individuals. The total sample size was hundred and fifty two farmers that included eighty six female and sixty six male respondents. The target group was male farmers in the irrigation schemes and those within the radius of the irrigations. A structured questionnaire based on the objectives of the study was used to collect data through interviews and group discussions. Interviews in a qualitative study as a key component of data collection allows the researchers to explore key issues of the study in depth on face to face encountered and they also add the benefit of personal involvement of the researcher in the study. The questionnaire consisted of three different sections based on the three objectives of the study. These sections consisted of the demographics, farming enterprises, types of irrigation systems, sources of income, production expenses, personal expenses, sources of agricultural information, livelihood aspirations, competency and training needs, political, local, traditional authorities, household food security status, household poverty status, household coping strategies against poverty and community development. Data collected were analyzed with statistical package for social science (SPSS) using frequencies and percentages, linear and probit regression analysis.

5.3 Major Findings

The results of multiple regression analysis of relationship between irrigation farming and livelihood strategies among farmers showed that. The independent variables were significantly related to livelihood strategies of the farmers and showed that there was strong correlation between the independent variable and the household livelihood strategies. Significant determinants were marital status, number of household, nonfarm activity and income. This implies that the smaller the household and the higher the income from farming operations and nonfarm activities, farmers can meet their basic needs from irrigation farming and they can easily access as much as many livelihood strategies available to them.

The results of the probit model were used to determine the influence of the dependent variable on household food security status. The model has a good fit and it is significant. Two explanatory variables were significant while eleven variables were insignificant. The significant variables include Income and Land.

The Forster Greer Thorbecke analysis was used to measure the poverty status of farmers in the irrigation farming. The results indicated that about (1.5%) of the respondents are living below the threshold of (R9.2) per day, while the per capita income of respondents that are below the poverty line needed to be increased by (0.5%) to meet the level of poverty line. The results also showed severity of (0.1%), this implied that the gap of respondents from the poverty line is very small.

5.4 Recommendations

The results of the study revealed challenges that affected the livelihood strategies and household food security status of the smallholder farmers in the irrigation farming. This section gives a series of options that can be considered in improving livelihoods and food security status of the smallholder farmers in irrigation farming of North West Province, South Africa. In an effort to help smallholder farmers to benefit from the irrigation farming so as to improve their livelihoods and meet all three pillars of food security.

Invest in nonfarm activities: Throughout the results farmers have stressed that they have insufficient inputs for farming, majority have indicated that they only depend on government grants. On the other hand farmers indicated that they cannot meet all the household needs from farm income generated. Farmers need to be encouraged to invest in other non farmer activities; this will enables them to meet other household needs such as food and fees for the children. If a farmer has another business apart from farming this could possibly help him to also buy other inputs for his farming operations.

Adequate land for farming: Throughout the results farmers have stressed that they have inadequate lands for farming majority have indicated that access to land from the chief is not a problem the only constraint is that the chief by law cannot allocate more hectors for individuals. On the other hand farmers are complaining about insufficient resources

especially tractors. The government through its programs aimed at developing small-scale farmers can ensure that whatever they give to a farmer they monitor and ensure is kept safe. If government can review its land reform policies especially land allocation in the rural area, farmers indicated that they can produce more if more land is available to them.

Improved incomes: Farmers in the study area emphasized a lot on income and they have indicated that their incomes from farming are relatively low. Farmers in Taung irrigation indicated that they have joint contracts with South African Breweries but the income that they receive seasonally is very small. It is recommended that government extensions when advising farmers to join in partnership with contractors they must clearly indicate the terms of the contract clearly to the farmers.

REFERENCES

ALIBER, M. & HART, T.G.B., (2009). *Should subsistence agriculture be supported as a strategy to address rural food insecurity?* *Agrekon* Vol. **48** (4): 321-34.

ALTMAN, T. G. B., & JACOBS P. T., (2009). *Household food security status in South Africa.* *Agrekon* Vol. **48**(4): 345-361.

ARARSO, G.S., SCHULTZ, B., HOLLANDERS, P., (2008). Planning water management for secure food production in sub-Saharan Africa. *Irrigation and Drainage*, doi: 10.1002/ird.444. Vol. **55**(5): 509-521.

ASSA, M. M (2012) Poultry production and rural poverty among small-scale farmers in Mzimba District of Malawi. *Livestock Research for Rural Development* **24**(177):112-118.

BACKEBERG G. (2006) Reform of user charges, market pricing and management of water: problem or opportunity for irrigated agriculture? *Irrigation and Drainage* **55**: 1-12.

BAGCHI, D.K., BLAKIE, P., CAMERON, J., CHATTOPADHY, M., GYAWALI, N. and SEDDON, D. (1998) Conceptual and methodological challenges in the study of livelihood trajectories: case studies in eastern India and western Nepal. *Journal of International Development* **10**:453-466

BAIPHETHI, M. N. & JACOBS, P. J (2009) *The contribution of subsistence farming to food security in South Africa* *Agrekon* Vol. **48**(4): 245-252

BANERJEE, A. V., & DUFLO, E. (2007). The economic lives of the poor. *The Journal of Economic Perspectives*, **21**(1):141- 152

BHATTARAI, M., SAKTHIVADIVEL, R., HUSSAIN, I (2002) Irrigation impacts on income inequality and poverty alleviation: policy issues and options for improved management of irrigation systems. Working Paper No. 39, International Water Management Institute. pp 101-118.

BEMBRIDGE TJ (2000). *Guidelines for rehabilitation of small-scale farmer irrigation schemes in South Africa.* WRC report No 891/1/00. Pretoria: Water Research Commission. pp 342-361.

BRUINSMA, J. (Ed.), (2003) World Agriculture: Towards 2015/2030, An FAO Perspective. Earthscan, London and Food and Agriculture Organization, Rome. p. 198-201.

BUNDERS, F. G. AND E. W. BROERSE (1991) *Appropriate biotechnology in small-scale agriculture: how to reorient research and development.* Wallington: CAB International. pp76-80.

BUNN, S.E., ARTHINGTON, A.H (2002) *Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity.* *Environ. Manage.* **30** (4), 492–507.

BURNEY AND NAYLOR (2012) Smallholder irrigation as a poverty alleviation tool in Sub-Saharan Africa **40**(1): 110-123.

CARTER, M. and MAY, J (1999) *Poverty, livelihoods and class in rural South Africa.* *World Development*, **27**(1): 1-18.

CHAZOVACHII B (2012) The impact of small scale irrigation schemes on rural livelihoods: the case of Panganai irrigation scheme Bikita District Zimbabwe. *Journal of Sustainable Development in Africa* (Volume 14, No.4, 2012)

CHRISTOPLOS, I.; KIDD, A (2000) Guide for Monitoring, Evaluation and Joint Analyses of Pluralistic Extension. Support. Neuchatel Group. pp123-134.

DALELO, A (2003) The church and socio-economic development. Addis Ababa: EKHC Literature Department. pp 18-23.

DAVIS, K. E. and B. K. ADDOM (2010) Sub-Saharan Africa. In R. Saravanan, Ed. ICTs for agricultural extension: Global experiments, innovations and experiences. New Delhi: New India Publishing Agency. pp 45-47.

DEMETRE L, YUL D, ZANDILE M (2009) *The assessment of food insecurity in South Africa*, [Online] Available at www.hsrc.ac.za [Accessed: 2013-09-01] Food Security in South Africa: a review of national survey. pp155.

DEPARTMENT OF AGRICULTURE FORESTRY AND FISHERIES. *The integrated Food Security Strategy for South Africa (2002)*, [online] Accessed from www.daff.gov.za [Accessed: 2013-09-05]. Report on Household Food Security 2006, pp.65.

DEPARTMENT OF AGRICULTURE (2007) National Issues: Food Security. Pretoria: *The National Agricultural Directory* 2007, pp 53.

DEPARTMENT OF AGRICULTURE FORESTRY AND FISHERIES; Directorate: Food Security, *Strategic outlook (2010 – 2015)*. Quarterly Report on Household Food Security pp.115.

DEPARTMENT OF AGRICULTURE FORESTRY AND FISHERIES, (2010): *2010 Abstract of agricultural statistics*. Available online: www.daff.gov.za. Abstract 2010, pp 250.

De SATGE, R. (2002) *Learning about livelihoods: Insights from Southern Africa*. Cape Town: Periperi. pp 155- 252.

DIAO, X., P. HAZELL, D. RESNICK and J. THURLOW (2007) *The role of agriculture in development: implications for Sub-Saharan Africa*. IFPRI Report 153. Washington: IFPRI. pp 185-221.

DILLION, A (2011): The effect of irrigation on poverty reduction, asset accumulation, and informal insurance: Evidence from Northern Mali. *World Development* Vol.39 (12): 2165-2175.

ECONOMIC COMMISSION FOR AFRICA (2005) Emerging issues in science and technology for Africa's development: science, technology and innovation for meeting key MDGs. Addis Ababa: ECA Sustainable Development Division. *Transforming African agriculture and rural economy on sustainable development: Overview of the Africa report*. pp105-115.

ELLIS, F (2000) *Rural Livelihoods and Poverty Reduction Policies*: London, Rout ledge pp 201-214.

FAN, S., ZHANG, L., ZHANG, X (2004) *Reforms, investment, and poverty in rural China. Economic Development and Cultural Change* **52** (2), 395–421.

FAO (1997a) Small-scale irrigation for arid zones: Principles and options. Food and Agricultural Organisation, Rome. Climate change, water and food security. Food and Agriculture water report. p48-110.

FAO (1997b) Assessment of the socio-economic impact of smallholder irrigation development on smallholder farmers in Zimbabwe. A report prepared by R. Dhlohlho for Food and Agricultural Organisation. pp 87-115.

FOOD and AGRICULTURAL ORGANISATION (FAO) (2001).*FAO's State of Food Insecurity 2001*. Rome: FAO. p. 55-61.

FRASER, G., MONDE, N., and VAN AVERBEKE, W (2003) Food security in South Africa: a case study of rural livelihoods in Eastern Cape. Institutional constraints to small farmer development in Southern Africa. pp115-205.

GOR CORNIST (1999) *Peri Urban Irrigation in Kumasi*, FAO. Water Quality and Peri-Urban Irrigation, p. 110-125.

GOLETTI, F. & WOLFF, C (1998) *The impact of post-harvest research*. MSSD Discussion Paper 29. International Food Policy Research Institute, Washington DC.p. 128-135.

GOWING, J.W., TUONG, T.P., HOANH, C.T (2006) Land and water management in coastal zones: dealing with agriculture-aquaculture-fishery conflicts. In: Environmental Livelihoods in Tropical Coastal Zones: Managing Agriculture-Fishery-Aquaculture Conflicts, CABI Publishing, London. Land and water management in coastal zones. Dealing with agriculture-aquaculture-fishery conflict. pp. 28-63.

GROVE, A.T. (1989) *The Changing Geography of Africa*: Wadsworth, Belmont. Sustainable Development in Africa. Vol **14**(4): 217-231

HART, T (2009) *Food security definitions, measurements and recent initiatives in South Africa and Southern Africa*. HSRC: Pretoria. Food Security in South Africa pp 53-84.

HASNIP, N., MANDAL, S., MORRISON, J., PRADHAN, P., SMITH, L.E.D (2001) Contribution of Irrigation to Sustaining Rural Livelihoods. HR Wallingford, Wallingford, UK. Contribution of Irrigation to Sustainable Rural Livelihoods pp 189.

HODDER, A. C (2000) *The Elements of Research in Agriculture*, Fourth Edition, New York pp101.

HOLLOWAY GJ, CHARLES N, CHRISTOPHER D, STEVEN S, SIMON E 2000. Agro-industrialization through institutional innovation: *Transaction costs, cooperative and milk market development in East African Highlands. Agricultural Economics Journal*, **23**: 279-288.

HU, R., HUANG, J., JIN, S., ROZELLE, S (2000) *Assessing the contribution of research system and CG genetic materials to the total factor productivity of rice in China. Journal of Rural Development* **23**(1): 33–79.

HUANG, Q., DAWE, D., HUANG, J., ROZELLE, S., Wang, J (2005) Irrigation, poverty and inequality in rural China. *The Australian Journal of Agricultural and Resource Economics* **49** (2): 159–175.

HUSSAIN, I., & HANJRA, M. A (2004) Irrigation and poverty alleviation: Review of the empirical evidence. *Irrigation and Drainage*, **53** 1–15.

HUSSAIN, I. (2007a) Direct and indirect benefits and potential disbenefits of irrigation: Evidence and lessons. *Irrigation and Drainage*, **56**, 179–194.

HUSSAIN, I (2007b) Poverty reducing impacts of irrigation: Evidence and lessons. *Irrigation and Drainage*, **56**, 147–216.

IFAD (2003). Promoting Market Access for Rural Poor in Order to Achieve the Millennium Development Goals. *Paper presented in Seminar on the 25th Anniversary Session of Governing Council, Rome, Italy, April 16 to 18, 2003.* Promoting Market Access for Rural Poor in Order to Achieve the Millennium Development Goals. pp 162-170.

INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT (IFAD). (2001). Rural poverty report 2001: the challenge of ending rural poverty. Oxford: Oxford University Press.

INTERNATIONAL PROGRAMMES FOR TECHNOLOGY AND RESEARCH IN IRRIGATION AND DRAINAGE (1999) Poverty reduction and irrigated agriculture. pp 14-18.

JACKSON AND STEENHUIS, T (1997) *Environmental Issues*. Small Hotters Sectors, University of Zimbabwe. Impact of Small-scale Irrigation Schemes on Livelihoods. pp 10-35.

JIN, S., HUANG, J., HU, R., ROZELLE, S., (2002) The creation and spread of technology and total factor productivity in China's agriculture. *American Journal of Agricultural Economics* **84** (4): 916–930. Kennedy, P., 1998. *A Guide to Econometrics*. The MIT Press, Cambridge, MA.

KADZOMBE, E.D. and MANZUNGU, E. (1973) *Land and Peoples of Central Africa*. Harlow. Longman, pp 85-93.

KHAN, S., TARIQ, R., YUANLAI, C., Blackwell, J., (2006). Can irrigation be sustainable? *Agric. Water Manage.* 80 (1–3): 87–99.

KUNDHANDE, G.M, GROENEWALD, D.C. BAIPHETHI, M.N And VILJOEN, M.F (1994) *Environmental Systems* (Certificate Course) Bulawayo ,Tyrocrafters Press, pp 18-45.

LEWIS, R. A, (2002). *CRC dictionary of agricultural sciences*. London: CRC Press, pp68.

LIAO, Y., (2003). Irrigation water balance and food security in China. Ph.D. Dissertation, The Chinese Academy of Agricultural Science, pp 11-91.

LIPTON, M., LITCHFIELD, J., FAURE' s, J.M., (2003). The effects of irrigation on poverty: *a framework for analysis*. *Water Policy* 5 (5-6): 413-42.

LYNE MC, HENDRICKS SL, CHITJA JM (2009). Agricultural growth and food security. In: S L Hendricks and M C Lyne (ed), *Does food security improve when smallholders access a niche market? Lessons from the Embo Community in South Africa*. The African Centre for Food Security, University of KwaZulu-Natal, South Africa, pp 18-54.

MANZUNGU, E., MABIZA, C., (2004). Status of water governance in urban areas in Zimbabwe: some preliminary observations from the city of Harare. *Physics and Chemistry of the Earth* 29, 1167-1172

MAKADHO J.M, (1994). An Analysis of Water Management Performance in Small holder Irrigation Schemes in Zimbabwe. A dissertation submitted to the Department of Soil Science and Agricultural Engineering in partial fulfillment of the requirements for the degree of Doctor of Philosophy. University of Zimbabwe, pp 32-45.

MAKADHO, L. (1997). *Water and Agriculture in Zimbabwe Policy and Management Options For The Smallholders*: Mount Pleasant, Harare. University of Zimbabwe.p.14-65.

MAKOKA, D and KAPLAN, M. (2005). Poverty and vulnerability. Center for development research. University of Bonn. Ecological Sustainability: Understanding complex issues, pp 323-467.

MAKUMBE P. (1996). *The Role of Popular Participation in Programmes of Social Development*. Journal of Social Development in Africa, Oxfam. Assessment of Smallholder Irrigation Schemes on Household Food Security. Vol 3(4): 317-326.

MATSHE, I. (2009). Boosting smallholder production for food security: some approaches and evidence from studies in sub-Saharan Africa. *Agrekon*, 48(4): 483-511.

MINISTRY OF WATER RESOURCE, (2001). China Water Resource Yearbook. China Water-Hydropower Publishing House, Beijing. Irrigation and Drainage. Vol 56(2-3): 247-259.

MONTSHWE, B.D., (2006). Factors affecting participation in mainstream cattle markets by small-scale cattle farmers in South Africa. Unpublished master's thesis. University of Free State, Bloemfontein, pp 522-528.

MOOBI M. N. and O. I. OLADELE (2012) Factors Influencing Small Scale Farmers' Attitude and Participation in Formal Financial Markets in Mahikeng Municipality, South Africa. *J Hum Ecol*, 39(1): 11-1.

MUJERE, N., CHAZOVACHII, B., CHIFODYA, G and MUSHUKU, A (2010). *Evaluating Factors Influencing The Variation Of Irrigated Wheat Yields. A Case Study Of*

Chinyamatumwa Irrigation Scheme In Zimbabwe. Journal Of Sustainable Development In Africa 2011, Vol 13, No.4.

MUNAMATI, M., MHIZA, A., SITHOLE, P., (2005). Cultivating livelihoods: an assessment of water allocation and management practices in small-scale irrigation schemes – case studies in Mzingwane Catchment. In: Abstract Volume, Sixth Water Net-WARFSA-GWP Symposium, Swaziland, November, pp 120.

MUTSVANGWA T and DORANALLI, K (2006). Agriculture And Sustainable Development, Netherlands ,The Hague University Press. *Journal of Sustainable Development in Africa.* **14**(3): 217-231.

MURIITHI, A. G., E. BETT, and S. A. OGALEH (2009). Information Technology for Agriculture and Rural Development in Africa: Experiences from Kenya. A paper presented at Conference on International Research on Food Security, Natural Resource Management and Rural Development, University of Hamburg. *Journal of Agriculture Economics and Rural Development.* **1**(1): 1-7.

NEVES, D., SAMSON, M., Van Niekerk, I., HLATSHWAYO, S., Du Toit, A (2009). *The use and effectiveness of social grants in South Africa.* Cape Town: PLAAS and EPRI.Unpublished Thesis.

OBADIRE OS., ONI SA., and MALIWICHI LL, (2010). *Socio-economic factors affecting smallholder farming and Household Food Security: A case of Thulamela local municipality in Vhembe district of Limpopo province, South Africa.* *Africa. J. Agric. Res.* **5**(17): 199-637

ODURO AD, OSAI-AKOTO I, ACQUAYE I (2004). *Poverty in a Localizing World. The Role of Rural Institutions.* Tokyo: FASID. Analysis of Market Participation and Rural Poverty among Farmers in Northern Part of Taraba State, Nigeria. *Journal of Economics.* **2**(1): 23-36.

OLADEEBOO J. O. and O.E. OLADEEBO. (2008). Determinants of loan repayment among smallholder farmers in Ogbomoso Agricultural Zone of Oyo State, Nigeria. *J. Soc. Sci.* **17** (1): 59–62.

ORUONYE E. D. and MUSA Y. N (2012). Challenges of small scale farmers access to micro credit (*Bada Kaka*) in Gassol LGA, Taraba State, Nigeria. *Journal of Agricultural Economics and Development.* **1**(3): 62-68.

PERRET S (2002). *Water policies and smallholding irrigation schemes in South Africa: A history and new institutional changes.* *Water Policy.* **4**(3): 283-300.

PERRET S., GEYSER M. (2007) The cost of irrigation: adapting existing guidelines to assess the full financial costs of irrigation services. The case of smallholder schemes in South Africa, *Water SA.* **33**: 67-78.

POLAK, P., & YODER, R. (2006) Creating wealth from groundwater for dollar-a-day farmers: Where the silent revolution and the four revolutions to end rural poverty meet. *Hydrogeology Journal.* **14**(3): 424–432.

PYRAMID RESEARCH (2010) The Impact of Mobile Services in Nigeria: How mobile technologies are transforming economic and social activities. <http://www.pyramidresearch.com/documents/IMPACTofMobileServicesInNIGERIA.pdf>,

Accessed June 07, 2013.

PUNNET, W. (1982) *Man, Land and Resources*; Yew York. Macmillan. pp 217-224.

REVENGA, C., BRUNNER, J., HENNIGER, N., KASSEM, K., PAYNER, R., (2000). Pilot Analysis of Global Ecosystems. Freshwater Systems. World Resources Institute, Washington, DC. Pilot Analysis of Global Ecosystems. pp 115-142.

RICHTER, B.D., Braun, D.P., MENDELSON, M.A., Master, L.L., (1997). Threats to imperiled freshwater fauna. *Conservation Biology* **11** (5): 1081–1093.

ROSEGRANT, M., EVENSON, R., (1992). Agricultural productivity and sources of growth in South Asia. *American Journal of Agricultural Economics* **74** (1): 757–761.

RUKUNI M, EICHER C.K & BLACKIE (Eds). (2006). *Zimbabwe's Agricultural Revolution, Revisited*, University of Zimbabwe Publications, Harare. *Academic Journal* **.5(7)**: 399-409.

SAMAKANDE, I., SENZANJE, A., MANZUNGU, E., (2004). Sustainable water management in smallholder irrigation schemes: understanding the impact of field water management on maize productivity on two irrigation schemes in Zimbabwe. *Physics and Chemistry of the Earth* **29**, 1075–1081.

STATS SA (2004). Gross Domestic Product. Statistical Release P0441. Pretoria. Third quarter report review, 2003-2012. pp 2-72.

STATISTICS SOUTH AFRICA (2011). *General Household Survey 2011*. Pretoria: Statistics South Africa. Report, P0318. pp 5-60.

TESFAYE, A., BOGALE, A., NAMARA, R.E., BACHA, D., (2008). The impact of small-scale irrigation on household food security: the case of Filtino and Godino irrigation schemes in Ethiopia. *Irrigation and Drainage Systems* 22, 145–158.

UNITED NATIONS DEVELOPMENT PROGRAMME, (2005). Investing in development: a practical plan to achieve the Millennium Development Goals. London: Earth scan. pp 11-50.

WORLD COMMISSION ON DAMS, (2000). *Dams and developments: A new framework for decision-making*. London, UK: Earth scans Publishers. The Report of the World Commission on Dams. pp 152-185.

WORLD BANK. 2006b. Africa development indicators: 2006. Washington: World Bank .pp 29.

YOU, L., RINGLER, C., NELSON, G., WOOD-SICHTA, U., ROBERTSON, R., WOOD, S. (2010). What is the irrigation potential of Africa? Washington, DC: International Food Policy Research Institute Discussion Paper 993.
<<http://www.ifpri.org/sites/default/files/publications/ifpridp00993.pdf>> Accessed February 10, 2013.

APPENDIX

QUESTIONNAIRE ON EMPOWERMENT OF MALE FARMERS IN RURAL AREAS THROUGH WATER USE SECURITY AND AGRICULTURAL SKILLS TRAINING FOR GENDER EQUITY POVERTY REDUCTION IN THE NORTH WEST PROVINCE

Dear Respondents

This questionnaire is for data collection on research on EMPOWERMENT OF WOMEN IN RURAL AREAS THROUGH WATER USE SECURITY AND AGRICULTURAL SKILLS TRAINING FOR GENDER EQUITY 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: Government Non-governmental NGO Parastatals
 (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	
	Use	Non use
Television		
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			

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 about 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?

.....

Food security

How many meals do you and your household eat 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		