

PROBLEMS FACED BY SMALL-SCALE FARMERS IN TAUNG IRRIGATION
SCHEME IN THE NORTH WEST PROVINCE, SOUTH AFRICA

By

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DECLARATION BY CANDIDATE

I, GABRIEL EKOBI ACHA, do hereby declare that this dissertation is my original work and that it has never been submitted before for examination to any other university or for another qualification. Works of other people used in this dissertation have been correctly acknowledged as such.

Signature

A handwritten signature in black ink, appearing to be 'Gabriel', written over a horizontal dotted line.

Dated this 05 day of 10 2015

DEDICATION

This dissertation is dedicated to my sister, Vivian Nwatiagbo, my beloved mother, Emilia Mokosso, Emmanuel Okobi and Lovelyne Mboh.

ABSTRACT

The main objective of this study was to investigate the challenges facing Small scale farmers in Taung Irrigation Scheme. Furthermore, the study investigated how these challenges affected Small scale farmer's livelihoods and food security in the area. Irrigation farming has been identified as the backbone of rural development in the world in general and South Africa in particular. Irrigated agriculture is seen as an important mechanism for creating jobs, poverty reduction and most particularly, to improve livelihoods and food security. In order to achieve the above objective, the study used both quantitative and qualitative research methods in gathering data from the main specific objective formulated which was to identify the factors hindering the effectiveness of Small scale farmers working on Taung Irrigation Scheme.

The result of the study shows that Small scale farmers are plagued with major challenges on the scheme which has hindered food security and livelihoods in Taung. These challenges include the following; lack of market, institutional structure (organization and management), lack of capital, water pricing, lack of transport and theft of crops. Other challenges raised are the high presence of European contracts farmers on the scheme, low level of education among extension officers, lack of ownership of land by Small scale farmers and lack of proper sanitation (clean water, sewerage and toilets) to farm houses.

The study concludes by recommending that the establishment of cooperative will enable Small scale farmers to have access to market and capital. This will also enable them to have powers to influence the decision making process of the scheme to solve the problem of institutional structure. Furthermore, it was recommended that a well-fenced project on the scheme and a self-managed and sustainable security system supported by the government (Department of Agriculture) and other stakeholders would minimize theft of crops on the scheme.

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LIST OF ACRONYMS

DAFF: Department of Agriculture Fisheries and Forestry

DoA: Department of Agriculture

DWAFF: Department of Water Affairs and Forestry

BFAP: Bureau for Food and Agricultural Policy

DrRSMDM: Dr Ruth Segomotsi Mompati District Municipality

FSU: Farmers Support Unit

FIVIMS: Food Insecurity and Vulnerability Information and Mapping Systems

FAO: Food Agricultural Organization

FANR: Food Agriculture and Natural Research Directorate

GTLM: Greater Taung Local Municipality

IPCC: Intergovernmental Panel on Climate Change

EU: European Union

IFAD: International Fund for Agricultural Development

HSRC: Human Sciences Research Council

IFPRI: International Food Policy Research Institutes

IAASTD: International Assessment of Agricultural Knowledge, Science and Technology for Development

GDP: Gross Domestic Product

WB: World Bank

UN: United Nations

PASW: Predictive Analytic Software

NPDLE: Northern Province Department of Agriculture, Land and Environment

STATSA: Statistics South Africa

USDA: United States Department of Agriculture

SAB: South African Brewery

MEC: Members of Executive Committee

NDA: National Department of Agriculture

NWPG: North West Provincial Government

WFP: World Food Programme

WCD: World Commission on Dams

SADC: Southern Africa Development Community

USAID: United States Agency for International Development

NVACs: National Vulnerability Assessment Committees

MDG: Millennium Development Goal

GCIS: Government Communication Information System

UNICEF: United Nations Children's Fund

UDESAs: United Nations Department of Economics and Social Affairs

UNDP: United Nations Development Programme

OECD: Organization for Economic Co-operation and Development

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

Irrigation has been identified as a cornerstone of agriculture, food security and poverty reduction since it is an important tool to stimulate economic growth and rural development in a country (Hagos, Makombe, Regassa & Awulachew, 2009: 9; UNDP, 2009: 4). Irrigation plays a crucial part in making water available for food production in rural areas, most particularly in semi-arid and arid regions in the world (Chazovachii, 2012: 219). The current world population of about seven billion people are sustained through irrigated agriculture. About 40 percent of the total world food crops produced are through irrigation undertaken on only 20 percent of the total agricultural land in the world (FAO, 2009: 9; FAO, 2012: 12). Irrigated land has been far more productive than rain fed land over the past four decades; irrigation has undoubtedly contributed to an increase in global crop yield, allowing global food production to keep pace with population growth (Shah, 2008: 106; FAO, 2009: 9). Irrigation ensures the capability of sufficient domestic food production in the event of a global supply disruption. High dependence on foreign food producers makes a country vulnerable in the event of war, blockade or embargo. Irrigation ensures the availability of food at all times in a country and lessens any risk of supply shock that may occur (Tekana & Oladele, 2011: 70).

Irrigation farming has contributed significantly to life at the household level in rural areas in terms of employment and wages. Qiuqiong (2004: 64) posit that, irrigation has been tremendously effective in generating a variety of benefits such as improvements in productivity, employment, wages, incomes and consumption expenditures which directly have effect in reducing poverty in irrigation areas. Hussain & Hanjra (2003: 6) concur and point out that labour employment and wage rates are higher in irrigated areas than rain-fed areas. They highlight that the annual labour work per hectare in the Ganges-Kobadak irrigation system of Bangladesh was around 100 days more than that in nearby non irrigated areas. This additional labour demand created better full time employment opportunities for family members involved in agriculture and also create employment opportunities for hired labour. Moreover, they indicted that hired labour used in irrigated settings was double in comparison to that of nearby non-irrigated areas.

Wage rates earned for irrigation farmers were 15 percent more than those labourers working in industrial sites (Hussein & Hanjra, 2003: 6).

Mutsvangwa (2006: 221) argued that irrigation also empowers women and emancipates them socially. Women tend to play a leading role in irrigation farming and this ensures their participation in development initiatives and poverty alleviation in rural areas. Manzungu (in Moll, 2004: 220) concurs and points out that irrigation farming has enabled women in rural areas to generate income which has enabled them to influence changes in the balance of power within their households. This has increased women's confidence in community decision making and debates. From the educational perspective, irrigation farming also has enabled agricultural households to generate income to educate their children. Education is very important since it implies more opportunities of generating income, as well as better understanding of new and improved farming technologies. This has enabled children to be self-reliant (Chazovachii, 2012: 227).

According to Haile (2008: 67), there are four interrelated mechanisms by which irrigated agriculture can reduce poverty and improve livelihood: (i) increasing production and income, and reduction of food prices, helping very poor households to meet the basic needs associated with improvements in household overall economic wellbeing, (ii) protecting against risks of crop loss due to erratic, unreliable or insufficient rainwater supplies, (iii) promoting greater use of yield enhancing farm inputs and (iv) the creation of additional employment, which together enables people to move out of the poverty cycle. Sinyolo, Mudhara & Wale (2013: 42) further corroborate and state that irrigation has improved livelihoods and stimulated broader development in many parts of the world. Irrigation farming makes a long term economic contribution to rural livelihood. Kundlande *et al.* (in Chazovachii, 2012: 220) argued that 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 including Africa.

In Africa, irrigation is seen to make up for the extreme variability in rainfall, long dry seasons, recurrent droughts, floods and dry spells which pose a key challenge to agriculture and food production. Most of the countries in Africa depend highly on rain fed farming which has been a major cause of low food productivity, food shortages, undernourishment and famine in the region (FAO, 2012: 10). Irrigation farming was introduced as an important tool to stimulate

growth, food security, employment and most particularly, development in rural areas where rainfall is unreliable. Hagos *et al.* (2009: 92) posit that irrigation contributed approximately 5.7 and 2.5 percent to agricultural Gross Domestic Product (GDP) and the overall GDP, respectively, during the 2005/2006 cropping season in Ethiopia. During the year 2009/2010, the contribution of irrigation to agricultural GDP and overall GDP was estimated to be approximately nine (9) and 3.7 percent, respectively (Hagos *et al.*, 2009: 221). This means irrigation led to an increase in food security and employment in the country, thus livelihoods.

According to FAO (2012: 13), in Southern Africa, irrigation development became paramount due to the erratic nature of rains in the region to promote agricultural development in order to avoid food poverty. Chazovachii (2012: 215) echoed that most governments of the region advocated for irrigation agriculture to meet the following objectives, to ensure crop production during winter and summer, increase crop yields and crop intensity, provide food and employment for the rural people, generate incomes and raise the level of economic activities. Irrigation development in Zimbabwe for example, led to the increase of crops such as vegetables, tomatoes, beans that broaden the people's nutritional requirement leading to better health and an increase in life expectancy (Chazovachii, 2012: 227).

In South Africa, irrigation schemes that cover about 1.3 million hectares of land were mainly found in the rural areas of the former homeland areas where poverty levels are very high, with only a few located close to towns. The role of establishing these smallholder irrigation schemes in such areas was to try and help rural farmers to improve their livelihoods and, hopefully, escape the vicious circle of poverty that has been so severe in South Africa (Aliber, 2003: 473). Poverty alleviation, employment and ensuring household food security in rural areas are major objectives for the establishment of smallholder irrigation schemes in South Africa (Vink & Van Rooyen, 2009: 34).

World Bank (2007: 28) and Cousins (2012: 10), point out that irrigation development was introduced due to the unreliability of rainfall in the country making crop production very difficult and risky. Irrigation was seen as a vehicle in reducing or eliminating water deficit in crop production in order to promote food security and rural development. Irrigated agriculture contributes directly and indirectly to poverty reduction and food security in South Africa. Most importantly it supports access by providing poor people with income and employment

opportunities. It promotes and supports economic growth, creates jobs and ensures that there is enough food for all South Africans (DAFF, 2012: 16).

Irrigation increases crop yields where plant-available soil water is a yield-limiting factor during parts or all of the growing season (van Auerbeke, Denison & Mnkeni, 2011: 145). Van Auerbeke *et al.* (2011: 145) argue that smallholder irrigation has the potential to create employment in these underdeveloped rural areas, both directly and indirectly through forward and backward linkages. The National Planning Commission (2011: 10) further points out that one million new jobs can be created in agriculture over the next two decades, mostly through labour-intensive forms of small-scale farming in communal areas and on redistributed land if irrigated agriculture is encouraged.

Oni, Maliwichi & Obadire (2011: 34) acknowledged that in Vhembe district of Limpopo Province, a proportion of food secured households was higher among farmers who were on the irrigation projects (86.3%) compared to dry-land farmers (53.0%). From the analysis, irrigation and per capita aggregate production were found to have a positive influence on the probability of households being food secure. This means that the likelihood of food security increases when farmers increase agricultural output and have access to a piece of land on the irrigation project. Irrigated agriculture contributes about 30 percent of the country's GDP undertaken by only 10 percent arable land in South Africa (Fanadzo, Chiduza, Mnkeni, Van der Stoep & Stevens, 2010: 2; Tekana & Oladele, 2011: 76).

Hussain, Madhusudan & Sakthivadivel (2004: 41) argue that access to consistent irrigation land and water has enabled farmers to adopt irrigation technologies which facilitate the intensity of cultivation that leads to an increase in agricultural productivity and greater returns from farming. The development of irrigation opens up new employment opportunities in a country and increases the efficiency of labour and land. This improves farm income, food security and livelihood which help in poverty alleviation (Hussain *et al.*, 2004: 41). However, improved access to irrigated land and water is only one aspect of poverty alleviation, poverty can only be alleviated if other support mechanisms such as technical, financial and organisational support are provided in a coordinated manner (Van Koppen, Parthasarathy & Safilou, 2002: 65). Hussain & Hanjra (2004: 7) concur and point out that access to reliable irrigation water and improved

infrastructures such as roads, clinics and market contribute to improved socio-economic status of rural communities and alleviate poverty.

About 64 000 people (1.7% of North West population) depend on irrigated agriculture for their livelihoods out of the population of 3.9 million people (NWPG, 2009: 5; Statistics South Africa, 2011: 13). In addition, 60 percent of this population live in rural areas and depend on agriculture for their survival (NWPG, 2009: 10). According to Tekana & Oladele (2011: 70), the North West Province is known as the “bread basket” of South Africa. Though the province has a semi-arid and arid climatic condition, agriculture plays an important role employing about 60 percent of the population and providing food for the population. Apart from mining, agriculture is the only sector in which North West Province has a comparative advantage over other provinces in South Africa (Tekana & Oladele, 2011: 70). The agricultural sector provides 13 percent of the provincial GDP and provides jobs for 18 percent of the labour force in the province. Sunflower, groundnut, maize, wheat, and cattle production are the main activities in the province (NWPG, 2009: 12).

The North West Province is one of the poorest provinces in South Africa. The provincial gross geographic product (GGP) of R 3 964 per person is well below the national average of R 6 498 (Tekana & Oladele, 2011: 70). The Gini coefficient, a measure of income inequality, is above 0.6 in the province, placing the province among the most unequal regions in the world. Only 27 percent of households in the province have access to safe drinking water (National Planning Commission, 2011: 8). The estimated unemployment rate is 39 percent, slightly higher than the national average in South Africa. Food access problems are the most serious in North West Province where about 34 percent of households had inadequate or severely inadequate food access (National Planning Commission, 2011: 15). Thus, an irrigation scheme is believed to be very essential to meet the need of the predominant livelihoods in the area. However, irrigation development is limited to few areas in North West Province, these include: Molopo, Brits and Taung (DoA, 2013: 13). This poor development of irrigation development, like the case of Taung Irrigation Scheme in the area, has contributed to food poverty.

Taung Irrigation Scheme has been implemented since 1939 as a means of ensuring food security and in improving the standard of living of the rural people of Taung (Tekana & Oladele, 2011: 70). Taung Irrigation Scheme irrigates about 3 698 hectares of land and is funded by the South

African government as part of the Vaal-Hartz scheme (DoA, 2013: 12). It was introduced in order to promote economic development during the independent homeland era (Van Averbeké & Mohamed, 2006: 65). According to Tekana & Oladele (2011: 71), the scheme was originally developed as 1.7 hectares plots per farmer that were irrigated by floods. Almost 200 farmers used the plots for subsistence, growing maize and pumpkin by preference. About 2 500 hectares of the scheme are under the centre pivot system and about 1000 hectares are irrigated by conventional sprinkler system.

The objective for the establishment of the scheme was to provide for continued improvement of livelihoods for all stakeholders in Taung through the creation of jobs, improvement of food production of rural households and the efficient utilization of resources through sustainable economic farming and agribusiness enterprises (Tekana & Oladele, 2011: 72; DoA, 2013: 13). The project was put in place to provide the Taung community with better lives through better water management, which will help to increase food security that is believed to lead to improved livelihoods and development in the area. Taung Irrigation Scheme was believed to impact the lives of the people in the area positively, for instance, studies conducted by Tekana & Oladele (2011: 75), show that 88 percent of the farmers revealed that they received training in water management. This is vital because improved knowledge of methods of water management enhance agricultural productivity and hence food security.

In order to facilitate irrigation development, the South African government has enacted a number of legal and policy frameworks. These include the following:

The Constitution of South Africa (ACT 108 OF 1996)-The Constitution of South Africa allocates functional areas to local government which include potable water supply and domestic waste water disposable systems. In terms of section 152(1)(b) of the Constitution, Local government has the power to ensure the provision of services such as potable water to irrigation farms in a sustainable way so as to promote development (GCIS, 2008: 2; Davids, Theron & Maphuye, 2005: 35).

National Water Act (Act 36 of 1998) This Act ensures that the nation's water resources are managed in ways that take into account the basic human needs of present and future generations, promoting equitable access to water, redressing past racial and gender discrimination, facilitating

social and economic development, and protecting aquatic and associated systems (DWAFF, 2012: 15).

Water User Associations of 2005 (WUA)-These were created by the Department of Water and Forestry and replaced the Irrigation Board. The aim was to provide technical and management training to irrigation farmers, to assess state of irrigation technologies, to identify their suitability and sustainability for smallholder farmers and to ensure active farmer participation in the re-planning of existing and future smallholder irrigation projects (Van Averbeké & Mohamed, 2007: 41; DWAFF, 2012: 7).

National Extension Recovery Implementation Plan of 2006- The recovery plan was introduced by the Department of Agriculture to assist farmers in the irrigation scheme through the use of an extension officer. It was aimed at providing and facilitating access to agricultural information for improved planning and decision making; provision and facilitation of advice on a sustainable agricultural production, skills development and technology and strengthen institutional arrangements on irrigation schemes (DoA, 2012: 8).

Micro-Agricultural Financial Institution of South Africa (MAFISA of 2005)- This is a newly established state-owned scheme created by the Department of Agriculture to provide micro and retail agricultural financial services on a large, accessible, cost effective and sustainable basis in the rural areas. The scheme provides capital to support agricultural activities in the communal land areas as well as other small-scale agriculture involved in irrigation farming (NDA, 2006: 8).

North West Water Sector Forum of 2004- This forum was established by DWAFF to coordinate and operate the structure of all water sector activities in the province including the irrigation scheme. The NWWSF has subcommittees that deal with sanitation coordination, transfers and institutional support, water resources and infrastructure planning and development (DWAFF, 2012: 21).

The Provincial Growth and Development Strategy of the North West province of 2004- This is a collective effort by government and its social partners to address the challenges of growth and development in the province and to help improve the quality of people's lives through irrigation development. The strategy identified Taung irrigation as a cornerstone for growth and rural development in the province. It was created to meet the following objectives:

building an enduring partnership through the promotion of a shared vision of South Africa's growth and economic development strategy, job creation, improved efficiency and productivity in irrigation schemes, greater social equity, and a fairer distribution of economic opportunities and rewards, while undertaking serious social dialogue within broad policy frameworks (NWPG, 2009: 8).

These policy instruments and legislative frameworks were introduced to provide support and smooth running of irrigation schemes in the country and Taung in particular, so as to promote food security and livelihoods.

However, in spite of the above, irrigation schemes like the case of Taung Irrigation Scheme appear to be facing challenges and causing a continuous increase in food prices and poverty in the area. More so, these are making the schemes to operate below their full potentials thereby, compromising Small-scale farmers' livelihoods. Irrigation schemes, and Taung irrigation in particular, form the centre of this discussion not only because it constitutes approximately 20 percent of the world's total cultivated farm land, but mainly because it is responsible for 40 percent of the food and fibre production in the world (Fanadzo *et al.*, 2010: 70; FAO, 2012: 6). This study identifies the impact of irrigated agriculture on Small-scale farmers' livelihoods in general, South Africa, North West Province and most particularly, the challenges facing small scale farmers in the Taung Irrigation Scheme. An extensive use of literature on irrigation impact and challenges is explored in order to strengthen our argument. Reference is also made to the theoretical framework relating to the topic (actor-oriented approach) to bring out the roles and responsibilities of actors involved in the irrigation system. A research on problems faced by Small-scale farmers in Taung irrigation scheme will produce some relevant results which may be beneficial to stakeholders involved in irrigation development.

1.2 STATEMENT OF THE PROBLEM

Despite the introduction of the above legislative and policy frameworks to promote irrigation development in the country as a whole and Taung Irrigation Scheme in particular, studies on irrigation schemes in South Africa indicate that the development objectives of irrigation schemes remain largely unfulfilled in the country causing food inflation (Fanadzo *et al.*, 2010: 70). It

appears that problems of access to capital (human, physical, natural and financial), institutional structures, marketing, transportation and water pricing continue to plague small-scale farmers working on irrigation schemes most particularly Taung Irrigation Scheme to an extent that food shortages and hunger continue to persist in the area thereby, compromising livelihoods (Golder Associates, 2004: 34; BFAP, 2008: 12; Tekana & Oladele, 2011: 73; DoA, 2013: 13). More so, the irrigation schemes were introduced in South Africa in general and that of the North West Province in particular to improve the livelihoods of the poor group (BFAP, 2008: 13). However, it looks as if this is far from becoming a reality as poverty among the Small-scale farmers in irrigation schemes continues to be a serious problem in Taung (Golder Associates, 2004: 15).

The above indicates that a lot of challenges are plaguing Small scale farmers working in irrigation schemes most especially Taung Irrigation Scheme. Therefore, it is necessary to make an assessment of how the problems are affecting Small-scale farmers on Taung Irrigation Scheme making it difficult to contribute to livelihoods in Taung area. A study of this nature will unravel the problems and provide solutions which might help in improving the effectiveness of Taung irrigation scheme.

1.3 SIGNIFICANCE OF THE STUDY

The primary objective of this study is to investigate the challenges plaguing Small scale farmers in Taung irrigation scheme and to provide militating factors that will help in providing a smooth operation of irrigation schemes.

The study will enable the government to understand the constraints of farmers involved in the Taung Irrigation Scheme and in trying possible solutions. More so, the contribution of the study will also provide a way forward on those irrigation schemes in South Africa in general, and Taung in particular, currently having problems. Ignoring such problems may lead to the continued failure and collapse of irrigation projects in South Africa (Golder Associates, 2004: 35).

Very few studies seem to have been done on the problems facing Small scale farmers in irrigation schemes in the North West Province, hence, a study of this nature should contribute to

a better understanding of the operation of irrigation schemes in the country in general and Taung irrigation scheme in particular. Therefore, the findings of the study may be very vital to other countries facing similar challenges with irrigation schemes.

The study will contribute in planning irrigation policies for development practitioners and also help decision makers such as the government (Department of Agriculture, Department Water and Forestry, Department of Rural Development and Land Reforms) to adopt measures and intervention methods that would improve irrigation management not only for the Taung Irrigation Scheme but the country as a whole.

Furthermore, the study will contribute to academic studies in the sense that research findings on challenges faced by Small scale farmers in Taung irrigation scheme and food security for the promotion of farmer's livelihoods will add value to the existing body of research done on food security and irrigation systems. Hence, other researchers will gain an insight and make recommendations for further research.

1.4 RESEARCH QUESTIONS

The following research questions were formulated from the above problem statement:

- What are the contributions of Taung Irrigation Scheme in promoting the livelihoods and food security among Small-scale farmers in the area?
- Has Taung Irrigation Scheme addressed the food security problem in the area?
- What are the contributions of stakeholders in the management of Taung Irrigation Scheme in order to ensure sustainability?
- What are the major challenges facing the effective operation of Taung Irrigation Scheme?

1.5 AIM OF THE STUDY

The main aim of this study was to appraise the challenges encountered by Small scale farmers of the Taung Irrigation Scheme, and discuss how these challenges affect Small scale farmers in addressing livelihoods and food security in the area.

1.5.1 Specific objectives

The specific objectives were as follows;

- To assess the role played by various stakeholders in the management of Taung Irrigation Scheme in order to ensure sustainability;
- To determine the extent to which livelihoods and food security have been addressed through the project;
- To identify factors hindering the effectiveness of Taung Irrigation Scheme, and
- To make recommendation to improve the effectiveness of Taung Irrigation Scheme.

1.6 RESEARCH METHODOLOGY

Specification of methodology is at the heart of any research study. It consists of complete description of the methods and procedure used in the study in obtaining information. These procedures include study design, sampling and sample size, data collection and data analysis.

Babbie (2013: 4) echoed that methodology is the science of finding out procedures for scientific investigation. The aim for research methodology is to enable the researcher to gain familiarity with a phenomenon or to achieve new insights in to the study or to portray accurately the characteristics of a particular individual, situation or group (Kothari, 2006: 67; Salkind, 2012: 171).

The study uses both quantitative and qualitative research methods. These methods are considered appropriate for this study in view of their importance to the objective of the study. The study utilised more of qualitative data to obtain an in-depth understanding of Small scale farmer's experiences on the scheme. Both Quantitative and qualitative methods were used to provide clearer and more precise responses comprising open and closed-ended questions. Quantitative research method quantifies the problem and how prevalent it is since it is more conclusive in its purpose and it also allows one to describe and interpret data statistically. Qualitative research method enables one to clarify the situation when necessary and to give an in-depth understanding of the research objective. According to Kumar (2011: 89), it is important to use quantitative

method because it is an approach in the social sciences that is rooted in rationalism and follows a structure, predetermined methodology and believes in having a narrow focus, emphasizes greater sample size, aims to quantify the variation in a phenomenon and tries to make generalizations to the total population.

On the other hand, qualitative method is based upon the philosophy of empiricism, follows an unstructured, flexible and open approach to enquiry, aims to describe rather than measure, believes in in-depth understanding and small samples, and explores perceptions and feelings more than facts and figures (Kumar, 2011: 89). Babbie (2013: 309) asserts that qualitative research is the non-numerical examination and interpretation of observation, for the purpose of discovering underlying meanings and pattern relationships.

1.7 POPULATION AND SAMPLING

The population for this study is defined as the total number of people who are involved and have knowledge about the scheme. They include Small-scale farmers, Irrigation Manager, extension officer from the Department of Agriculture, Traditional Authority and development agents from Department of Water Affairs and Forestry and the relevant organisation (SAB). Bless, Higson-Smith & Kagee (2006: 184) describe population as the complete set of events, people or things to which the findings are to be applied. Furthermore, sampling is defined as a technique for collecting data on a part of the population to reveal the characteristics of the entire population (Bless *et al.*, 2006: 176; Creswell, 2012: 167).

According to DoA (2013: 12) and an interview conducted with the Tribal Authority of Taung (Chief Mankuraone), 412 Small scale farmers are benefitting from Taung Irrigation Scheme. Out of this number, 100 respondents were drawn from the small-scale farmers who are involved in the scheme. In order to obtain additional data to support the challenges facing Small scale farmers in Taung Irrigation Scheme, the Department of Agriculture, Department of Water Affairs and Forestry, the relevant organisation (SAB) and the Tribal Authority were also included.

The study was conducted in Taung Irrigation Scheme and, during the survey; each head of every Small-scale farmer's household who is benefitting from Taung Irrigation Scheme was selected

for the study. In cases where the head of the household was absent, a member of that part of the household was selected. To summarise, the following were considered when selecting the samples:

- All Small-scale farmers who are involved in the scheme and also those who have leased their lands to other farmers were part of the study.
- Every head of the households be it male or female farmers was part of the study.
- Extension officer, Irrigation Manager and development agent from the Departments and also the relevant organization and the Traditional Authority were also part of the study.

1.8 SAMPLE SIZE

Sample size is defined as the number of population from whom the researcher obtains the required information (Bless *et al.*, 2006: 89; De Vos, 2005: 66). The sample was selected using a Non probability sampling method (Wayne and Melville, 2001: 56; Bless *et al.*, 2006: 184; Kumar, 2011: 75). According to Kumar (2011: 306) and Babbie (2013: 406), Non probability sampling is a technique in which samples are selected in such a way not suggested by probability theory. Examples include the reliance on availability as well as purposive (judgmental) sampling. During the survey, only Small scale farmers considered convenient to the researcher (convenience Sampling) were considered. The reason was that data that contained all the Small scale farmers were unavailable despite the fact that they are part of the scheme. In a situation where the total number of respondents was not well known, it was difficult to decide on the sampling interval so that each selected sample could be reached for data collection. As a result of the above, the researcher used non-probability sampling based on convenience (convenience sampling) to select respondents for the study. A better result is often achieved when non-probability sampling is well administered than probability sampling (Kumar, 2011: 78).

An attempt was made to ensure that the sample size drawn reflected the entire population. Both males and females (Small scale farmers), educated or not with different ages were selected purposively for the quantitative study. For qualitative study, purposive sampling was also used to select Small scale farmers (males or females) with more experience on the scheme for the study. Sample size was drawn only from Small scale farmers working on Taung Irrigation Scheme.

Hesse-Biber (2010: 50) considers quantitative sample selection as numerical and ensuring sample size to be relative enough to produce a better representation of the population under study. Qualitative is non-numerical and has the goal of looking at a process or subjective understanding of the feelings of the respondents. It is important to use quantitative and qualitative methods in drawing samples in the sense that quantitative data can be useful for establishing generalizability of qualitative results. In addition, using both methods by the researcher gives a more robust understanding of qualitative results by integrating quantitative findings (Hesse-Biber, 2010: 50).

A sample of 105 respondents was drawn for the study since it was difficult to sample the entire population. One hundred (100) Small scale farmers from the Taung Irrigation Scheme and five (5) respondents from the Departments (Agriculture, Water affairs and Forestry), the relevant organization (South African Breweries) and Traditional Authority were selected for the study. Seventy five (75) respondents participated in the completion of the closed-ended self-administered questionnaire. Thirty (30) Small scale farmers consisting of 19 men and 11 women were selected to take part in focus group interviews which comprised open-ended questions. Five (5) respondents from the Departments (Agriculture and Water Affairs and Forestry), relevant organization (South African Breweries) and Tribal Authority participated in a self-administered questionnaire consisting of unstructured questions.

Both female and male Small-scale farmers were selected from the study area. During the survey 40 women and 65 men were selected for the study. The study used more men since they are in the majority in the scheme. It is important to include female farmers in the study in the sense that studies have shown that women provide most of the food in the area they live in.

1.9 DATA COLLECTION PROCEDURES AND INSTRUMENTS

According to Bless *et al.* (2006: 75) and De Vos *et al.* (2005: 44), data collection demonstrates the construction of tools necessary to collect data and the way the information should be recorded. Data collection is the direct interaction with individuals on one-to-one basis or direct interaction with individuals in a group setting (Kothari, 2006: 56; Kumar, 2011: 302). Data collection approach is very important since this allows the researcher to collect data that would

meet the objectives of the study. The study utilised the following methods to collect data: questionnaire, focus group interview and secondary data.

1.9.1 Questionnaires

During the survey three types of questionnaire (individual, focus and quantitative) were utilised. A self-administering questionnaire consisting of structured questions was used to conduct the interviews from individual farmers. It comprised close-ended questions. The survey was face-to-face interaction with the respondents in Taung. Face-to-face interview is important since it enables the researcher to make a follow-up on questions. Structured questionnaire was used to collect quantitative data. These are primary data relating to Taung Irrigation Scheme livelihoods and food security. Small scale farmers were contacted in their homes and farms and taken to a quiet environment where there were no other farmers or family members. This was done in order to avoid interference. The farmers were contacted between 10:00 am and 4:00 pm. A translator was also part of the study since the majority of the population were Tswana speaking. The questionnaire was used because it saves time and cost, it is also easier to analyse statistically. The Irrigation Manager and the extension officer from the Department of Agriculture, Traditional Authority and development agents from the relevant organizations and Department of Water Affairs and Forestry were interviewed using a self-administered questionnaire consisting of unstructured questions. This was conducted in their offices in Taung. The questions comprised two sections, namely, demographic section and questions of opinion of respondents' views.

1.9.2 Focus group interview

According to Kumar (2011: 57), focus group is a form of strategy in qualitative research in which attitudes, opinions or perceptions towards an issue, product, service or programme are explored through a free and open discussion between members of a group and the researcher. The benefit of using focus groups in this study includes gaining insights into people's shared understandings of everyday life. The main purpose of focus group research is to draw upon respondents' attitudes, feelings, beliefs, experiences and reactions in a way in which would not be feasible using other methods, for example, observation, one-to-one interviewing, or

questionnaire surveys. Focus group seeks to gather information that is beyond the scope of quantitative research (Bless *et al.*, 2006: 62; Kumar, 2011: 55).

Qualitative data was obtained through focus group using a semi-structured questionnaire. The focus groups consisted of three groups of 10 members each. Each focus group was made up of males and females, educated or not. This was done to collect relevant opinions and experiences from Small scale farmers about Taung Irrigation Scheme. In the focus group interview, only the researcher had the questionnaire. The interview was conducted in their farms in Taung. The focus group interviews were conducted by the researcher in order to get an in-depth understanding of the challenges that Small scale farmers involved in the Taung Irrigation Scheme are experiencing. Also, this method of data collection is of considerable advantage in generating first-hand information on a subject such as this in social science research. A focus group also generates rich data in a less intensive manner than one-to-one interview.

1.9.3 Secondary data

Secondary data is defined as “second-hand” analysis, it is the analysis of data or information gathered by someone else, for instance, researchers, institutions and other Non-Governmental Organizations, or for some other purpose than the one currently being considered, or often a combination of the two (Kumar, 2011: 56).

Secondary data was collected from a number of sources including reports, documents, books, memoranda, journals and minutes from relevant organizations which are involved in the Taung Irrigation Scheme. Furthermore, information was obtained from the internet and unpublished sources to bring out irrigation challenges and their impact on livelihood and food security.

The sources of such literature were obtained from the Department of Agriculture, Statistics South Africa, Department of Water Affairs and Forestry, North West Provincial Government, Mafikeng Municipal Council and Greater Taung Local Municipalities. A letter permitting the researcher was obtained from the school in order to get the information from the above.

1.10 DATA ANALYSIS AND INTERPRETATION

Data analysis describes steps taken to check the validity of both the quantitative data (descriptive and inferential numeric analysis) and the accuracy of qualitative findings (description and thematic text) of a research (Creswell. 2012: 219).

Data obtained from the quantitative interview, focus group discussions and content analysis from other stakeholders (DoA, DWAFF, SAB and Traditional Authority) were reviewed and then analysed to generate findings. For this study, quantitative data was analysed using the Predictive Analytic Software (PASW) version 18 software, also referred to as SPSS 18.0. Each questionnaire was numbered to ensure reliability and validity. Quantitative responses from the questionnaire were displayed using frequency, charts and tables. The qualitative data for focus groups and other partners who are part of the scheme was analysed using Taylor-Powell & Renner's (2003: 87) and Bless *et al.* (2006; 77) approaches.

- Identification of themes and sub themes was done in relation to the objectives. Sub themes like ideas, concepts, behaviours, interactions, incidents, terminology were brought out. The themes and sub themes were identified and summarized in order to bring meaning to the text.
- Categorisation of meaning reduces interview to the meaning of collected data. In this perspective, the study provides for reasonable explanation of support by data about the research objectives that deal with problems faced by the Small scale farmers in Taung Irrigation Scheme.
- Making deeper interpretation of specific statements from the data collection method is another method. The emphasis was on the opinion and experience reported by participants during the interviews. The study worked out deeper meaning gathered from participants' responses.

Bless *et al.* (2006: 163) indicate that once data collection and checking have been completed, the process of analysing data should begin. This analysis is conducted so that the researcher can detect consistent patterns within the data, such as the consistent co-variance of two or more variables.

1.11 ETHICAL CONSIDERATION

Ethics is conforming to the rule of conduct of a given profession or groups aimed at causing no harm and providing, if possible, benefits (Salkind, 2012: 171; Babbie, 2013: 63). Most researchers may have good intention when undertaking a study, however, there is always the possibility for the rights of research participants to be violated either knowingly or unknowingly (Bless *et al.*, 2006: 139; Salkind, 2012: 171). Participants' rights should be respected in order to protect them from any physical and psychological harm which may hamper the research activity. During the survey, the following were taken into consideration, informed consent, confidentiality and anonymity and voluntary participation to avoid the consequences and after-effect of the findings (NWU Research Ethics Committee, 2010: 48; Babbie, 2013: 63).

With regard to informed consent, the researcher explained the nature of the study to participants, in order to obtain permission. Cover letters from the university accompanied the questionnaires explaining the purpose and nature of the research. The letters were taken to the Irrigation Manager (Department of agriculture) to have access to documents and reports concerning the study area.

Voluntary consent was assured during the study when participants were told that they were free to leave at any time, and they were not forced to participate in the study. Confidentiality and anonymity of respondents participating in this research were protected in the report by making it impossible to link any specific data to a specific respondent. Confidentiality was further assured when participants were told that data collected and analysed would be used solely for the purpose of the study and that data obtained would not be traced to participants. Participants' identity, names and other features were withheld to ensure anonymity.

1.12 LIMITATIONS OF THE STUDY

Despite the fact that the study offers relevant findings, however, some limitations were realised during the study. They include:

A covering letter from the university explaining the purpose and nature of the research was taken to the Department of Agriculture and South African Breweries for the researcher to have access to information concerning the Taung Irrigation Scheme. This information was not made available by the Department of Agriculture and SAB. Failure to have access to that information

limited the study in the sense that crucial information which would have been of great importance was denied.

The use of a translator also limited the study because information from the questionnaires was not equivalently translated to the Small scale farmers. As a result of this, some vital information was lost during data collection.

1.13 SCOPE OF THE STUDY

The study contains five chapters. They are as follows;

Chapter One describes the introduction, problem statement in relation to the topic, research questions, significance, aim, specific objectives and research methodology of the study as well as the scope of the study.

Chapter Two presents the definition of key concepts and the review of literature related to the topic, including the relevant legislative and policy frameworks in the North West Provincial Government and South Africa Government. The chapter further outlined the theoretical framework of the study.

Chapter Three focuses on the description and socio-economic background of the study area where the Taung Irrigation Scheme is located. The chapter also provides organisational structure of the Taung Irrigation Scheme.

Chapter Four deals with the demographics of the Small scale farmers in the Taung Irrigation Scheme as well as the analysis of the findings on the challenges facing Small scale farmers in the scheme.

Chapter Five provides a summary of the findings, conclusion and recommendations of the study.

1.14 SUMMARY

This chapter provided the introduction and background to the study and statement on the research problem in relation to the challenges of irrigation schemes as well as the research methodology applied in the study of the impact and challenges of Taung Irrigation Scheme. The chapter also covered the main aim of the study which was to appraise the challenges that small scale farmers are encountering and more specifically to assess how this is affecting Small scale farmers in addressing livelihoods and food security in the area. The chapter further covered the significance of the study by bringing out the relevance of the study to development processes in general and Taung in particular. The chapter also provided the research methodology used in the study as well as study limitation, ethics and scope of the study.

CHAPTER TWO

DEFINITION OF KEY CONCEPTS AND LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents the definition of key concepts and a review of the existing literature on the influence of irrigation on livelihood, poverty and irrigation schemes. An attempt is made to cover not only literature specific to South Africa but also literature from other African and Asian countries. Furthermore, policies, legislatures and programmes to facilitate irrigation schemes, livelihoods and food security in South Africa in general and Taung in particular are reviewed. The last part of this chapter presents a theoretical framework which is the actor oriented approach used in the study to bring out the roles and responsibilities of all actors involved in irrigation schemes.

2.2. DEFINITION OF KEY CONCEPTS

2.2.1 DEVELOPMENT

The definition of development is contested theoretically carries with it layers of meaning. Very few other words offer such definitional difficulties as Development

According to Todaro & Smith (2006: 810), development is a practice of improving the value of all social lives in three important characteristics. These include (i) Nurturing peoples' in as far as earnings and consumption, therapeutic services, levels of food, education among others (ii) Generating situations beneficial to the growth of peoples' self-confidence through the instituting of social, political and economic systems with the aim of upholding human dignity and respect, and (iii) Increasing human rights among the populous by broadening their required varieties of properties and facilities. On the same note, Burke (1993: 48) definition of development entailed and included changes associated with cognizance, inspiration and performance of individuals relative to others within society. As such, development is imposed from outside it should come from within individuals and groups

On the other hand, Seers (1969: 3) defined development in a contemporary way in which aspect of elimination of poverty among the people through balanced equality in the area of economic

dimension such as unemployment leverage in a growing economy. He further articulated that activities behind poverty, unemployment and inequality associated with human activities are severe, they do affect people's well-being which translate into positive gains or losses. That aspect defines development in any concerned community or country. However, if one of these indicators behave reciprocally to each other, they do interact negatively to each other.

In social classical aspect, Korten (quoted in Davids *et al.*, 2009: 160) enlightened development as a process in which the society increase in resources in order to not only produce but also distribute equitably on the human quality of life in as consistent as possible in their daily aspirations. From the perspective of human well-being, development is defined as "participation of the people towards reaching self-reliance and participation in their evolving (well-being) with freedom and ability in a manner they determined" (Davids *et al.*, 2009: 163). The general purpose of development is to increase the level of human well-being and the basic ideal of providing people with better life. Pieterse (2010: 3) defines development as the organized intervention in collective affairs according to a standard of improvement.

According to Human Development Report (2007: 23), defined development as wellbeing as a means of extending people's preferences, competences and autonomies in order for them to live longer and healthy and having the likelihood of accessing knowledge, standard of living as they interact with others within their community(s). The scholar further posits that development is not dependent on mean incomes growth alone, but it ascertains on the environments for populous make choices, capabilities and freedoms. Furthermore, aspect of wellbeing defines diverse environments such as natural, man-made, social cluster, which interact within the cultural context which in the long term been perceived as a state of health or sufficiency in all aspects of human dignity. From the above, wellbeing is influenced by intrinsic values of biodiversity and ecosystems. There are five major dimensions associated with wellbeing and these are minimal materials among the people to support their well-being, good social relationships, security, freedom and choice (UNDP, 2007: 23).

On the other hand, Sen (1999), development is perceived from context of capabilities aimed at awarding freedom to persons to exercise choice while functioning in order to achieve optimal attainment of utility at either a micro or macro-economic context and this is spurred using

income as a catalyst of change. Further to this, Sen (1999) advocated functioning's associated with development as a precursor that a person have that result in spurring competence to participate in economic growth of the people.

UNDP (2007: 12) defined development as "a process of broadening people's choices by expanding human operatives and competences in a way to advance their livelihood I which directly or indirectly provide freedom among them of being capable to live with an opportunity forgone of different social choices. This human development approach is based on people-centeredness perspective in which the focus target at enhancement of diverse factors influencing the well-being of the society and their relationships among themselves. All in all, this aspect of development, focuses on fundamental aspect of freedoms that provides an enabling environment for people have longevity of life, to acquisition of knowledge, and be able to benefit from a decent standard of living that support their well-being as a result of such developmental milestones (UNDP, 2007: 12). Thus, human development entails people-centeredness approach aimed at support every aspect affecting their environmental well-being. However, this is attained through, appropriation of equity, efficiency, efficacy and sustainability of issues affecting human life among others key principles in general (UNDP, 2007: 12).

According to United Nations (2009: 1), development is defined as a means in which pledges associated with upholding the philosophies of human self-respect, equality and equity, and free the world from risky insufficiency. This aspects highlight a set of goals associated with human dignity in all spectrum of human life and had a time span 15 years from 2000 to 2015 which was defined based on 1990 as a base year. According to Desai and Potter (2008: 34; UN, 2009: 1) such goals were defined as:

"Halve the proportion of people living in extreme poverty and hunger", "Halve the proportion of people without access to safe drinking water (with sanitation added at the World Summit on Sustainable Development, 2002)", "Achieve universal primary education", "Empower women and promote equity between women and men", "Reduce under-five mortality by two-thirds", "Reduce maternal mortality by three-quarters", "Reverse the spread of killer diseases- especially HIV/AIDS and malaria", "Ensure

environmental sustainability”, and “Develop a global partnership for development, with targets for aid, trade and debt relief”. (Dessai & Potter, 2008: 34).

As such, based on the study, development is to be viewed from the context of increasing the capacity of a community to achieve the objectives they have set for themselves in order to achieve a better living conditions, adopted from Sen, (1999: 87), Davids *et al.*, (2009), and Todaro and Smith (2006: 17).

2.2.2 FOOD SECURITY

Food security is been used over the past decades and was adopted since 1970's. From that time, to present, the concept has received numerous attention and renewed effort in its context. (FAO, 2010).As such, the subject could mean differently to different class of people.

The United Nations (1975: 10) defined food security as: “accessibility at all times of sufficient supplies of basic food-items”. According to United States Department of Agriculture (1995: 4), food security is defined from the aspect where people have either physical or economic enablement to access sufficient food dietary items to support their productive and healthy well-being. Such definitions, entails and includes all aspect associated with food availability, accessibility and consumption. In this context, food availability being achieved when sufficient quantities are existent and accessible to all individuals at either household levels while the surplus is directed to commercial markets, in order to complement its productivity (USDA, 1995: 4).

Hendriks & Msaki (2009: 7) classically looked at food security as a state whereby societies experience social, economic, political and technological capability to have sufficient, nutritive food items at all instances of their well-being. In another literature, Wenhold *et al.* (2007: 1) pointed out and defined food security as a mechanism in which people are what to consume in order to support their nutritional wellness.'

In South Africa, department responsible for food availability among the people looked and defined food security as food self- sufficiency in that people should be able to have some things

to eat in order to support their human well-being regardless of their age and race. (DoA, 2012:15).

2.2.2.1 FOOD SECURITY COMPONENTS

Food security is a multi-dimensional having interrelationships with susceptibility correlate which cannot be captured from either a single or a specific indicator alone. As such, the understanding of the fundamentals associated with food security in terms of availability, accessibility and use have to have to be understood. These fourth components associated with Food security include:

2.2.2.1.1 Access

This defines the process of acquisition of any food items by an individual in order to adequate support his/her nutritional requirement for a considerable period of time. Prerogatives are defined as a set of product bundles a person establish command at a legal, political, economic and social aspects in which he or she lives not excluding traditional rights. For example, access to resources that ensure proper access to food regardless of the time of the year with the aim of making sure that people are able to have the item in order to for them to support their economic, cultural, and technological and political development of the country including their provinces. Food access is essentially determined by the capability of families and individuals to acquire food from either their own production or purchases from other sources among them being gifts and aids (Maxwell & Slatter, 2003: 22; WFP, 2009: 23). Better irrigation development enables a community to have access to food.

2.2.2.1.2 Availability

This refers to the availability of sufficient capacities of food with suitable qualities from either national production or importations not excluding food aid. These food availability contexts include livestock and aquaculture products (Maxwell & Slatter, 2003: 22). The World Food Programme (2009: 170) defined availability as, a food that is existent at a country levels to support domestic use of the items either from national and external sources (WFP, 2009: 170).

2.2.2.1.3 Utilization

This is related to use of food items to reach a state of nutritional well-being for which all biological requirements are met. The absence of proper sanitation and inadequate safety net structures in a country results in poor health compromising the individual's digestion and undermining nutrient intake (World Bank, 2007: 22; FAO, 2012: 12).

2.2.2.1.4 Stability

It involves the continuation of a country's food supply and access to food (Frayne *et al.*, 2012: 22). At individual and household to attain food sufficiency, factors that affect food stability include change during its seasons of supply include climate variations, price instabilities and political and economic stress (Frayne *et al.*, 2012: 22). This aspect of stability relates to both availability and access in as far as food self-sufficiency is concerned (Maxwell & Frankenberger, 1992: 67).

For the purpose of this study food security entails acquiring safe and nutritious foods at all time in order to meet the dietary and food preferences for an active and healthy life without resorting to emergency food supplies, scavenging and stealing (FAO, 1996: 9; DoA, 2002: 15).

2.2.3 IRRIGATION

Mutsvangwa *et al.* (2006: 6) define irrigation as the artificial application of water to the land to ensure double cropping as well as steady supply of water in areas where rainfall is unreliable. On the other hand, Nigussie (2002: 16) defines irrigation as a case of agricultural development in which technology intervenes to provide control for the soil moisture regimes in the crop root zone in order to achieve a high standard of continuous cropping. Irrigation's primary objectives are to supply essential moisture for plant growth, which includes transport of essential nutrients, and to leach or dilute salts in the soil. Irrigation also provides a number of side benefits, such as cooling the soil and atmosphere to create more favourable environment for crop growth (Shirsath, 2009: 34).

Uphoff (1986: 13) sees irrigation to be widely defined, "as the practice of applying water to the soil to supplement the natural rainfall and provide moisture for plant growth". Shanan (1987:

115) also defines irrigation as the application of water to the land for the purpose of supplying moisture essential to plant growth. In the process, irrigation projects transform the land in two ways: (i) by direct modifications of the land surface that occur when canal networks are constructed and land is cleared, shaped and levelled for irrigation, (ii) by indirect in-depth transformations that take place when the water and salt balances in the region are changed following the import of additional quantities of water and salt into the area.

FAO (1997: 6) defines irrigation as the supply of water to agricultural crops by artificial means, designed to permit farming in arid regions and to offset the effect of drought in semi-arid regions. Even in areas where total seasonal rainfall is adequate on average, it may be poorly distributed during the year and variable from year to year. Where traditional rain-fed farming is a high-risk enterprise, irrigation can help to ensure stable agricultural production (FAO, 1997: 6).

On the other hand, Small & Svesdsen (1992: 285) define irrigation as a "human intervention to modify the spatial or temporal distribution of water and to manipulate all or part of this water for the production of agricultural crops". Chamber (1988: 102) suggests a similar view from a farmer's perspective, good irrigation service involves the delivery of "an adequate, convenient, predictable and timely water supply for preferred farming practices."

Uphoff (1986: 121) conceptualizes irrigation systems as socio-technical because both human and physical aspects interact continually and profoundly. The physical side refers to technical aspects relating to dams, channels, control structures and soils. While the human or social dimension refers to behavioral aspects relating to the activities and attitudes of both water users and agency personnel. Because irrigation systems bring together different people, due to large resource requirements, an effective organizational framework for co-ordination is necessary.

For the purpose of this study, irrigation is defined as the adequate application of water to land and human intervention to modify the spatial or temporal distribution of water to manipulate all part of this water for the production of agricultural crops (FAO, 1997: 6; Small & Svesdsen 1992: 285).

2.2.4 LIVELIHOODS

The concept of livelihoods has gained prominence and traction in recent years through debates about rural development, poverty reduction and social protection. Defining livelihoods is not straight forward since it means different things to different people.

Vincent (2001: 10) defines livelihood “as the outcomes of how and why people organise to transform the environment to meet their needs through technology, labour, power, knowledge, and social relations”. Lipton (cited in May, 1996: 1), defines livelihood quantitatively, as consisting of approximately 200 days per year of work (the means), receiving a reward that is at least sufficient to prevent household poverty (the outcomes). This particular definition of livelihood is directly connected to poverty.

Chambers & Conway (1992: 6) define livelihood to comprise the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain and 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 and in short and long term. Similarly WFP (2009: 3) defines livelihoods to comprise the capabilities, assets (including both material and social resources) and activities required for a means of living linked to survival and future well-being. The importance of capturing multidimensionality is also evident in DFID’s (2002: 41) framing of sustainable livelihoods, which posits that people’s livelihoods will improve if they have:

- a policy and institutional environment that supports multiple livelihood strategies and promotes equitable access to competitive markets for all
- a secure access to, and better management of, natural resources
- a better access to basic and facilitating infrastructure and financial resources
- an access to basic rights established through international conventions and access to high quality education, information, technologies and training, and better nutrition and health
- a supportive and cohesive social environment

On the other hand, Long (2001: 241) defines livelihoods as “practices by which individuals and groups strive to make a living, meet their consumption necessities, cope with adversities and uncertainties, engage with new opportunities, protect existing or pursue new lifestyles and cultural identifications, and fulfil their social obligations”. UNDP (2004: 5) defines livelihoods as a result from people's capacity to make a living by surviving shocks and stress and improve their material condition without endangering the livelihood options of other people either now or in the future. This requires reliance on both capabilities and assets, that is, stores, resources, claims and accesses for a means of living.

Ellis (2000: 12) sees livelihood as attempts to capture not what people do in order to make a living, but, the resources that provide them with the capability to build a satisfactory living in managing their resources, and the institutional and policy context that either helps or hinders them in their pursuit of a variable or improving living. This implies that to secure the livelihood condition, enabling resources have vital importance.

On the other hand, DFID (2002: 23) conceptualizes livelihoods as being comprised of five capitals: human, natural, financial, physical and social. Ellis (2000: 13) points out that social capital describes the social networks and associations in which people participate, and from which they can derive support that contributes to livelihoods. Physical capital, on the other hand, refers to assets brought into existence by economic production processes. Farm tools, machines, and land improvement practices like irrigation canals can be taken as a good example. He further reveals that natural capital refers to the natural resource base like land and water that yield products for the utilization of human beings for their survival. Human capital refers to the education level and health status of individuals and populations or the community. Financial capitals mainly focus on stocks of cash or credit that can be accessed in order to purchase production, inputs or consumption goods (Ellis, 2000: 13).

Babulo et al (2008: 45) say that rural livelihood diversification out of farming is increasingly recognized. IFAD (2005: 12) report further elaborates that farmer managed irrigation contributes usefully to food security through enhanced crop production and farmer incomes. Irrigation schemes bring a significant effect on improving rural livelihoods if properly adhered to with appropriate technologies. For the purpose of this study, livelihood refers to the ways and means

people use to overcome stress and shock in order to make a living in a particular community or region (UNDP, 2004: 5).

2.2.5 POVERTY

Poverty is said to be multidimensional and has been given various meanings from a range of different perspectives. Defining poverty is not only a political but also economic, social, and cultural activity.

According to UN (2009: 12), poverty is a denial of choices and opportunities, a violation of human dignity. It means lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go to. Furthermore, it means not having the land on which to grow one's food or a job to earn one's living, not having access to credit. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence, and it often implies living on marginal or fragile environments, without access to clean water or sanitation. Dinitto & Dye (1983: 23) explain poverty in terms of deprivation, that is, insufficiency in basic human needs such as food, housing, clothing, education, medical care and other items required to maintain a decent living standard.

On the other hand, the World Bank (2010: 11) defines poverty as an income level below some minimum level necessary to meet basic needs. This minimum level is usually called the "poverty line". What is necessary to satisfy basic needs varies across time and societies. Therefore, poverty lines vary in time and place, and each country uses lines which are appropriate to its level of development, societal norms and values. Wilson & Ramphela (1989: 14) think poverty is not knowing where your next meal is going to come from, and always wondering when the council is going to put your furniture out and always praying that your husband must not lose his job.

On the other hand, Commission for Africa (2005, 110) defines poverty to mean hunger, thirst, and living without decent shelter. It means not being able to read. It means chronic sickness. Poverty means not finding any opportunities for you or your children. It is about being pushed

around by those who are more powerful. It is about having little control over your own life. And it can mean living with the constant threat of personal violence.

Singh (1980: 56) suggests that it is difficult to convey the true meaning of poverty because the people affected may not have anything in common other than a lack of resources to meet their basic needs. Owing to the complex nature of poverty, it is not really possible to give uniform account of the circumstances in which people become poor. From a sociological perspective, poverty is viewed within the social context of the family, community and society, not just the individual. Most sociologists explain poverty in terms of inadequacy of the welfare state, not its generosity (Haralombos & Holborn, 1991: 126). Poverty does not explain certain kinds of characteristics which people do or do not have. It is used to describe a group or a large number of conditions.

Poverty is not only about lack of money, but also more centrally about the scarcity of favourable occasions which allow people to build decent lives for themselves. A number of definitions have been given to the term 'poverty'. There are disagreements and controversies that exist as to stating the precise nature of poverty. To define the concept of poverty formally, Frye (2005: 23) suggests two ways, namely, absolute and relative terms.

2.2.5.1 Absolute Poverty

The concept of absolute poverty rests on the idea that it is possible to define a minimum standard for physical survival, and that the needs of the poor do not change through time (Buckingham, 1991: 9). This is the condition in which everything revolves around the worst scenario. It posits a situation where the mortality rate is high, malnutrition is chronic, housing is of sub-human standards and employable skills are extremely rudimentary due to weak or absent entrepreneurship (Singh, 1980: 56; Aliber, 2001: 160).

Todaro & Smith (2006: 805) think absolute poverty "is a situation where a population or section of population is, at most, able to meet only its bare subsistence essentials of food, clothing and shelter to maintain minimum levels of living". To understand poverty in absolute terms, Frye (2005) proposes that reference be made to a "certain quantitative measure" which is used to distinguish the poor from the non-poor. Therefore, the ability to purchase the minimal quantity of

basic goods and services required for human survival should be used to distinguish the poverty status of different individuals in absolute terms (Frye, 2005: 25). The fact that absolute poverty is defined by measuring individuals' purchasing power means that income is a strong factor to be considered when ranking the absolute poverty status of people. Anyone whose income is below a certain level or threshold is regarded as poor. According to Davids *et al.* (2005: 45), one weakness with income perspective for measuring poverty is that the very poor tend to depend on non-income sources of support, that is, the support of the extended family.

2.2.5.2 Relative poverty

Relative poverty is defined in relation to the economic status of other members of society. According to Iceland (2005: 79) poverty compares whether people comparatively lack a certain level of income, consumption, material possessions, good quality housing and clothing. Relative poverty depends on the overall distribution of income, consumption, or any of the above-mentioned material possessions in a given area. Buckingham (1991: 101) thinks poverty is relative and implies that poverty is about being poor in comparison to the standard of living of others, and about being unable to do things that are generally accepted. Singh (1980: 58) elaborates by saying that relative poverty defines poverty in terms of its relation to the standards, which exist elsewhere in society. This can be understood primarily in terms of inequality, namely where goods and services are less than available to most members of the community struggling to maintain the prevalent norm of living (Frye, 2005: 29).

For the purpose of this study, poverty is defined as lack of access to basic necessities such as shelter, clothing and food. It means absence of food production resources like land, water, inputs, labour and market. Poverty also means not able to influence decision making process of a community or region (UN, 2009: 12).

2.3 THE ROLE OF IRRIGATION SCHEMES IN DEVELOPMENT PROCESS

Different countries have acknowledged the role of irrigation schemes in the development process by creating employment, income and livelihoods. A lot of studies have shown that irrigation schemes play a major role in promoting economic growth, poverty alleviation and most particularly food security and livelihoods. Ali & Pernia (2003: 76) concur and point out that

“empirical evidence from Australia shows that a dollar worth of output generated in irrigated agriculture generates more than five dollars’ worth of value to the regional economy”. Irrigation development has a strong multiplier effect on other sectors of the economy by promoting livelihoods.

Irrigation development enabled global cereal production to increase and help in the reduction of malnutrition in developing countries. Schoengold & Zilberman (2000: 4) concur with this when they assert that, “a report by IFPRI shows that between 1967 and 1997, global cereal production increased by 84 percent at a time when population increased by 67 percent and that malnutrition among children under the age of five in developing countries declined from an aggregate rate of over 45 percent to 31 percent during that period”.

Irrigation farming serves as an instrument for promoting food security and alleviating poverty among farmers which is a major item in promoting the MDGs. IFAD (2005: 15) concurs and points out that in developing countries like Ethiopia, “the construction of Small scale irrigation schemes resulted in an increase in food production, income and diet diversification in the Oromia and Southern Nation and Nationalities People (SNNP) regions”. The study further revealed that, the cash generated from selling vegetables and other produce was commonly used to buy food to cover the household food demand during the food deficit months. Hagos *et al.* (2009: 21) further state that irrigation farming in Ethiopia generates an average net gross margin of about US\$323/hectare. This is in comparison with the calculated average net gross margin for rain fed which is US\$147/hectare. This indicates that after accounting for annual investment replacement costs, the net gross margin from irrigation is 219.7% higher than the gross margin from rain fed agriculture. This is above the UN recommendation of US \$1.00 per day per person.

Woldeab (2003: 71) also found that, in Tigray region in Ethiopia irrigated agriculture has benefited some households by providing an opportunity to increase agricultural production through double cropping and by taking advantage of modern technologies and high yielding crops that called for intensive farming. He further reported that irrigation development led to the increase in the diversification of crops across the schemes and the shift from cereal livestock system to cereal-vegetable-livestock system and thus improve the diversity of household nutrition through making vegetables part of the daily diet (Woldeab, 2003: 71).

Irrigation farming was instrumental in promoting economic empowerment in Zimbabwe. According to Chazovachii (2012: 228), income generated from irrigated farming in Zimbabwe enabled farmers to acquire assets such as scotch carts, wheelbarrows and livestock. Scotch carts have enabled farmers to carry produce from the plots to their homes thus ensuring that transportation of their produce is easier. The livestock in form of cattle are used by farmers for draughts power and can be sold so that they get income to cover for their basic needs. More so, respondents who had acquired assets such as livestock also reiterated that they could meet some dietary requirements from meat and milk from their livestock. Makumba (1996: 70) further concurs and states that “cash earned from the sale of food was used to cover household needs like cooking oil, paraffin and others. It also enables members to meet educational needs of their children such as exercise books and tuition fees”. Data from previous case studies also revealed that irrigation farming has long term economic contribution to rural livelihoods (Makumba, 1996: 70).

In South Africa, irrigation is considered as one of the best technologies for ensuring household food security and for sustainable rural development. Irrigation farming helps in generating employment and household food security in the country. Research has shown that eighty four percent of respondents in Taung Irrigation Scheme acknowledged that the scheme contributes to food security in the area (Tekana & Oladele, 2011: 76).

FAO (2006: 12) further concurs and states that most smallholder schemes in South Africa are not only dominated by women, but by women who also do not have much formal education. These women and the few men who remain at home to farm usually start farming when they are still very young (below the age of 35). Denison & Manona (2007: 151) also concur with the above statement and point out “that 65.15 percent of households in Tugela ferry irrigation scheme in Kwa Zulu Natal were headed by women”. Irrigation farming has helped in generating employment in the country most particular among women and this has resulted in improved livelihoods.

Irrigation farming has also enabled households to reduce the incidence of poverty in irrigated areas though limited. A study conducted by Sinyolo *et al.* (2013: 152) states that poverty gap

index for non-irrigators in Tugela ferry irrigation scheme was 31 percent as compared to 16 percent for irrigators. The current consumption level of poor non-irrigators and irrigators would have to increase by an average of 31 percent and 16 percent respectively, to lift them out of poverty. The squared poverty gap index indicates that inequality among the poor is higher for non-irrigators than it is for irrigators. They further indicate that although poverty is prevalent for both groups it is more pronounced among non-irrigators than irrigators.

Sinyolo *et al.* (2013: 150) equally point out that irrigation facilitates the holdings of small land size as compared to non-irrigation areas due to the intensive nature of irrigation farming. Irrigators operate in less land, while non-irrigators need to put more land under cultivation to cater for the extensive and risky nature of dry-land farming. Compared to non-irrigators, the irrigators can achieve a given welfare level from a smaller land area as irrigation access enhances land productivity. Non-irrigators spend much of their income on food, with food expenses contributing an average of 87% of total consumption expenditure.

Irrigated agriculture has played a major role in the lives of some farmers in smallholder irrigation schemes through income despite the fact that it is little. NPDALE (1999: 4) reveals that 75 percent of households in a rural scheme in the Northern Province in South Africa earned income from cropping. However, the income generated only amounted to just 5.8 percent of their total household income. This has made these households to intensify their pursuit of other sources of income and food besides their farm produce and formal sector jobs in order to enhance their livelihood status. This statement is corroborated by Shah *et al.* (1992: 165) who state that “households depend on other sources of income such as formal sector wages and social grants to supplement their agricultural income”.

Monde *et al.* (2005: 42) concur and point out that the farmers in the scheme in Zanyokwe get about 29 percent of their total household income from external sources. Van Averbeké & Mohamed (2006: 6) further point out that though the irrigation scheme helps in creating jobs in areas where they are located, nevertheless, most of the rural households are unemployed and most families' income levels are relatively low and possibly not enough to acquire basic commodities and services. Eicher (1994: 21) further points out that though irrigated agriculture is believed to be the key to poverty reduction and getting agriculture moving, most irrigators have

actually been relying more on other sources of income than they have on agriculture. There is hardly a household that entirely depends on its produce for its livelihoods.

2.3.1 Evolution of world irrigation development

Irrigation is an age-old art practised for thousands of years in the Nile Valley. In 1800, an estimated eight million hectares of land were irrigated worldwide. During the early 1950s, the irrigated area in the world increased to about 94 million hectares (Wolff & Huebener, 1996: 34). A century later, this area had increased by about 40 million hectares and in 2008 irrigated areas in the world increased to 304 million partially as a result of new irrigation technology (Wolff & Huebener, 1996: 34; Shirsath, 2009: 6; FAO, 2012: 12). Since World War Two, irrigated agriculture has been a vehicle for agricultural development (Vincent, 1994: 309). Historically, civilizations have been dependent on development of irrigated agriculture to provide jobs, income and to enhance food security to the people (Vincent, 1994: 309).

Zewdie *et al.* (2007: 201) believe that irrigation has been practised for thousands of years in the Nile Valley. Egypt claims to have the world's oldest dam built about 5000 years ago to supply drinking water and for irrigation in order to promote agricultural development. At that time, basin irrigation was introduced and still plays a significant role in Egyptian agriculture. Irrigation has been practised in Egypt, China, India and other parts of Asia for a long period of time. India and Far East have been using irrigation to grow rice for nearly 5000 years. The Nile valley in Egypt, the plain of Euphrates and Tigris in Iraq were under irrigation for 4000 years (Schilfgaard, 1994: 68). Irrigation is the foundation of civilization in numerous regions. Egyptians have loading for irrigation continuously for a long period of time on a large scale. The land between the Euphrates and Tigris, Mesopotamia, was the breadbasket for the Sumerian Empire and the civilization developed from centrally controlled irrigation system (Schilfgaard, 1994: 68; Shirsath, 2009: 6).

According to Shirsath (2009: 3), the Indus Valley Civilization in Pakistan and North India from 2600 BC also had an early canal irrigation system. Large scale agriculture was practised and an extensive network of canals was used for the purpose of irrigation. Sophisticated irrigation and storage systems were developed including the reservoirs built at Girnar in 3000 BC. Evidence also shows that irrigation in China began about 4000 years ago. There were reservoirs in Sri

Lanka more than 2000 years old (Shanan, 1987: 67). As far back as 2300 BC, the Babylonian Code of Khammurabi provided that, “If anyone opens his irrigation canals to let in water, but is careless and the water floods the fields of his neighbour, he shall measure out grain to the latter in proportion to the yield of the neighbouring field” (Wolff & Huebener, 1996: 34). Another indicator for irrigation development is found in the stony-gravel limestone desert of the Negev area in Israel. According to Shanan (1987: 67), the remains of these ancient irrigation systems date back from the Israelite period (about 1000 BC) and from the Nabattee- Roman-Byzantine era (300 BC to 600 AD). In the absence of permanent water sources, the ancient farmers developed 'runoff' farm systems that used sporadic flash floods for irrigating (Shanan, 1987: 67).

In Southern Africa, like the case of Zimbabwe, Smallholder irrigation schemes date back to 1913 as a subsequent means to settle black farmers displaced from designated areas for white commercial farmers and also for famine relief (Makumba, 1996: 60). In 1928, the colonial government introduced a programme to provide services to existing smallholder schemes and to assist in developing new schemes (Makumba, 1996: 60). Small scale irrigation was introduced in South Africa soon after the arrival of the European settlers, although irrigation really developed from 1912 onward. In the Native areas, minor irrigation occurred in 1950 following the report of the Tomlinson Commission on the socio-economic development of Bantustans (Bembridge, 2000: 11). Irrigation potentials during the Bantustans were 54 000 hectares, sufficient to settle 36 000 families. After their independence, Bantustans encouraged the central government to withdraw and homeland administration took over the schemes. In 1999, Small scale irrigation consisted of 46000 to 475000 hectares as compared to 1.3 million hectares in 2010 (Bembridge, 2000: 4; National Development Plan, 2012: 23). It is estimated that two thirds of Small scale irrigation schemes are dedicated to food plots, and almost half are located in the Northern Cape (National Development Plan, 2012: 23).

2.3.2 Legal and policy framework to promote irrigation, food security and livelihoods in South Africa

The South African government is aware of the important role that can be played by irrigation schemes in promoting food security and livelihoods. In this regard the government of South

Africa and the North West Province have developed some policy and legislative instruments to facilitate irrigation, livelihoods and food security in the country.

2.3.2.1 The Constitution of the Republic of South Africa

The Constitution of the Republic of South Africa, 1996 Chapter one (Act 108 of 1996) is the supreme law of the Republic of South Africa and provides among others, how the three branches of Government, namely the Legislature (Parliament, Provincial Legislatures and the Municipal councils), the Executive Authority and the Judicial Authority should carry out the affairs of the country (GCIS, 2008: 2). The importance of the Constitution to the Greater Taung Local Municipality, is to ensure a smooth running of Chapter 2 which gives South African citizens fundamental socio-economic rights which the state must protect. These rights, enshrined in the Bill of Rights of the Constitution, extend beyond political, social, economic and environmental rights. Everyone has the right:

- The right of access to housing, health care, food, water and social security;
- The right of children to basic nutrition, shelter, basic health care and social security;
- The right to basic education, including adult education;
- To an environment that is not harmful to their health or well-being;
- To have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that-
- Prevent pollution and ecological degradation;
- Promote conservation and
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development (David *et al.*, 2005: 35).

2.3.2.2 Strategic Framework for Water Services of 2003

The Strategic Framework for Water Services, approved by Cabinet in September 2003, was a comprehensive approach in respect of water services provision in South Africa. It serves as a

policy framework for international, national and local/community water services sectors. The strategic framework sets out the sector's vision for the next ten years. It covers institutional, planning, financial, regulatory, monitoring and support mechanisms that are required to achieve the goal of sustainable water services for all South Africans. The SFWS contains targets for the water services sector, and provides a challenge to all the water services stakeholders, to individually and collectively meet the targets (DWAF, 2007: 6)

2.3.2.3 Masibambane Water Services Sector Support Programme of 1999

In order to facilitate sustainable water services delivery to communities, DWAFF together with the Department of Provincial and Local Government and SALGA, embarked on a multi-faceted water services sector programme called Masibambane Water Services Sector Support Programme. DWAF assumed the overall coordination of this programme which began in 2000. In its first three years, the focus was on three provinces, Limpopo, Eastern Cape and Kwazulu Natal. The programme has since been extended to cover all the nine provinces in South Africa since 2003 including the North West Province. Funding is provided by the Government of South Africa and various donors, the principal donor being the EU Commission (DWAF, 2007: 8).

2.3.2.4 Water Research Commission (WRC)

The WRC was introduced in terms of the Water Research Act (Act No 34 of 1971) by DWAFF. The WRC plays a pivotal role in water research by establishing needs and priorities, stimulating and funding research, promoting the transfer of information and technology, and enhancing knowledge and capacity-building in the water sector. The commission provides support to the water sector and all its relevant institutions and partners. Over the medium term, it focuses on water resources management, water-linked ecosystems, water use and waste management, and water use in agriculture (DWAFF, 2012: 5).

2.3.2.5 The Comprehensive Agricultural Support Programme (CASP) of 2005

The initiative called CASP involves a range of government departments and incorporates the Household Food Production programme, which was targeted at those households that fail to access surplus food. The programme spent R22 million of the R30 million budgeted for the

2005-6 financial year on 273 projects with just over 17 000 beneficiaries receiving surplus food aid. CASP also focused on skills and knowledge transfer and financial and marketing advice with the aim to promote wealth through agriculture and improve national and household food security, amongst others (DAFF, 2012: 6; National Treasury, 2003: 7; Koch, 2011: 6).

2.3.2.6 Special Programme for Food Security (SPFS)

According to National Treasury (2003: 5), this involves land reform and a rural land and farm tax. The Department of Agriculture in collaboration with the Department of Agriculture in the North West Province developed a Special Programme for Food Security with the support of the Food and Agricultural Organization. The SPFS provides a framework for focusing on increasing production in areas of food shortage, improving supplies and creating rural employment. The programme aims at increasing food production among small-scale farmers by means of the development of a low-cost irrigation and water management system. The main strategy is to rehabilitate existing irrigation schemes and improve soil and water conservation to increase agricultural production. The programme also involved the rehabilitation of Taung irrigation scheme to support small-scale farmers to improve food security in order to improve household livelihoods in Taung community (FAO, 2012: 14; Koch, 2011: 5).

2.3.2.7 Land Care Programme

According to Aliber (2003: 23), Land Care Programme is the birth child of the National Department of Agriculture (NDA). The vision for the programme is to have communities and individuals adopt an ecologically sustainable approach to the management of South Africa's environment and natural resources, while improving the quality of life of the population. This means that people use the soil, water and vegetation resources in such a manner that their own quality of life is improved and that future generations will also be able to use them to satisfy their needs. This implies that cultivation, livestock grazing and harvesting of natural resources should be managed in such a manner that degradation (such as soil erosion, nutrient loss, loss of components of the vegetation, increased runoff of water) is curtailed. In order to achieve this, the National Department of Agriculture gives support for natural resource management through the National Land Care Programme. Through this programme community groups are encouraged to responsibly manage and conserve the land, vegetation, water and biological diversity in their

local area. Furthermore, the National Department of Agriculture seeks to promote its National policy on Agricultural Land and Resource Management (DAFF, 2012: 7).

2.3.2.8 Social Grants Programme

According to Statistics South Africa (2012: 10), the Social assistance grant programme was also initiated as a safety net approach to fight against poverty. These include disability grant, child support grant, war veteran, foster children grant and old age grant. These programmes provide both poverty reduction and poverty prevention strategies, and are part of the government's largest poverty reduction programme (Statistics South Africa, 2007: 11). This programme has focused on the most poverty stricken peoples in rural communities and therefore aims to promote rural development through the provision of a basic financial means to support local economic development. However, recent poverty statistics have not been analysed due to the lack of capacity within the Department of Social Development, and hence progress in reducing the number of people living in poverty has not been able to be accurately assessed (Statistics South Africa, 2012: 10).

2.3.2.9 Taung Agricultural College Amendment Act, No 16 of 1994

The institution was established in 1965 by the Department of Agriculture. It aimed for the provision of excellent education and training respondent to the development and socio economic needs of a dynamic agricultural sector, the provision of good quality education and training at all times, for qualified, competent and committed staff, ensuring the accessibility to instructional programmes, the admission of committed learners as well as the provision of a conducive learning and training environment. The Agricultural College is also a place where the Agricultural College staff and Extension officers are trained to provide a dedicated and focused training programme to all smallholder irrigation schemes that are undergoing the revitalization programme. In a bid to create a pool of irrigation expertise for the Dr Ruth Segomotsi Momphati district, the Taung Agricultural College has introduced a special irrigation course for which the first batch of students will enroll next year. The special course came after the provincial agriculture department established that farming in this region was mostly done under irrigation, hence the need for trained people (Golder Associates, 2004: 59).

2.3.2.10 Sedibeng Water

Sedibeng Water was established on 1 June 1979 by DWAFF. It serviced the Free State Goldfields and parts of the former Western Transvaal. In 1996, Sedibeng Water extended its operational area to the North West Province. The organization currently services an operational area spanning more than 86 000 square kilometres across three (3) provinces: Free State, North West and Northern Cape. Sedibeng Water is unwaveringly committed to the uninterrupted supply of water to municipalities, farms, mines and other industries in the North West Province. Sedibeng water focuses on the following: The appropriate treatment of wastewater and supply of potable water; Ensuring viability and sustainability; creating an environment that is conducive to the growth and retention of skills; providing effective and efficient communications; and ensuring compliance (DWAFF, 2007: 8).

2.3.3 IRRIGATION DEVELOPMENT IN SOUTH AFRICA, HISTORY AND CURRENT STATUS

In South Africa, several eras of irrigation development have been identified. They include: peasant and mission diversion scheme era, homeland era, the smallholder canal scheme era, and the irrigation management transfer (IMT) and revitalization era (van Averbek, 2008: 24; Fenadzo *et al.*, 2010: 16).

2.3.3.1 The peasant and mission diversion scheme era

Smallholder irrigation development that occurred early during the 19th century in the Cape Colony was as the result of technology transfer from the colonial power to the local people (van Averbek, 2008: 24). This era saw the emergence of African peasantry with the association of missionary's activity in the Eastern Cape. The technology used (river diversion) during this period in the smallholder irrigation schemes was similar and through private initiatives. Situated within the broad history of irrigation development in South Africa, the peasant and mission diversion scheme era coincided with the early part of the individual diversion scheme era identified by Backeberg & Groenewald (1995: 3). In terms of area brought under irrigation, the peasant and mission diversion era was not very important and much of what was developed had ceased to function by the end of the 19th century (Van Averbek, 2008: 24; Fenadzo *et al.*, 2010: 16).

2.3.3.2 The smallholder canal scheme era

This was the second era of the development of canal irrigation schemes that lasted from about 1930 until about 1960. During this period, the schemes were initiated in order to provide African families residing in the “Native or Bantu Areas” with a full livelihood based on farming (Fenadzo *et al.*, 2010: 11). According to van Averbeké (2008: 25), at least 18 200 hectares (37%) of the existing small irrigation schemes were developed during the smallholder canal scheme era. Irrigation schemes established during this era obtained water from a river by means of concrete weir diversion but schemes using storage dams were also built. The plot size on these schemes was considerably smaller than the 8-20 hectares that were allocated to white settler farmers during the same period. ; Backeberg & Groenewald (1995: 3) state that the difference between the plot size allocated to white and African farmers suggests that irrigation farming proceeded under the assumption that African families required less land (and income) to attain a full livelihood than white farmers did. Trust tenure was imposed on these farmers, and they held their plots by means of permission to occupy. Trust tenure provided the state with the necessary powers to prescribe land use and to expel and replace farmers whose practices did not comply with these prescriptions. In some cases, the state effectively used these powers to enforce the overall objectives of the scheme by evicting poorly performing families (van Averbeké, 2008: 25; Fenadzo *et al.*, 2010: 11; Backeberg & Groenewald (1995: 3).

2.3.3.3 The homeland era

This was the third era which lasted from about 1960 until about 1990. It was an integral part of the economic development of the homelands, which were all islands of underdevelopment and poverty (Beinart, 2001: 6; van Averbeké, 2008: 25). New irrigation schemes were established with funding from the South African government. The number of existing schemes that date back to this period is probably higher than 64, because much of the 15 897 ha of existing irrigation land that could not be dated was probably developed during this era (Van Averbeké, 2008: 25). Irrigation development during the homeland era was characterized by modernization, functional diversification and centralization of scheme management (Fenadzo *et al.*, 2010: 11). For instance, large schemes of less than 400 hectares developed during this era were found mainly in the Eastern Cape (Backeberg & Groenewald, 1995: 3). According to Van Averbeké (2008: 12), Qamata in the Eastern Cape was the only scheme that used canals. The irrigation and

farming technology that was implemented in these large schemes was often the most technologically developed and available at that time. Even on the smaller schemes established during this era, pressurized overhead irrigation systems were used instead of surface irrigation (Beinart, 2001: 6).

On the large schemes, economic viability was pursued by means of a strategy of functional diversity. The schemes were operated as estates with a central unit, commercial smallholder function in the form of medium sized plots, also called mini-farms (5-12 ha), and a subsistence function in the form of food plots, ranging from 0.1 to 0.25 ha in size (Fenadzo *et al.*, 2010: 25). The functional diversity provided rural homesteads with different options to benefit from irrigated agriculture, depending on the structure of their existing livelihood. For example, the mini-farms catered specifically for homesteads that sought full land-based livelihoods. The food plots provided homesteads that derived their livelihood from external sources, such as old-age pensions, while the estate component offered opportunities to members of rural homesteads who were searching for employment and monetary income close to home (van Auerbeke, 2008: 13). The management of these large schemes was centralized in the hands of specialized parastatals (Lahiff, 2000: 17).

According to Van Auerbeke *et al.* (2008: 13), the establishments of large schemes during the independent homeland era were very complex and proved very costly to maintain. Conflict and social unrest during the late 1980's and early 1990's further affected their sustainability. Following the democratization of South Africa in 1994, provincial governments decided to dismantle the agricultural homeland parastatals they had inherited. This decision particularly affected the large schemes. This was because they were the most complex and had been centrally managed from inception, resulting in exceptionally high levels of dependency among farmers (van Auerbeke *et al.*, 1998: 13). Partial or total collapse of production followed this decision almost immediately (Bembridge, 2000: 13).

2.3.3.4 The irrigation management transfer and revitalization era

This is the most recent or current era in South African smallholder irrigation development and can be referred to as the irrigation management transfer (IMT) and revitalization era. According to Van Auerbeke (2008: 13), IMT refers to the transfer of the responsibility of managing,

operating and maintaining irrigation schemes from the government to the farmers. The process of IMT includes government withdrawal, formation of water users associations, development of local management institutions, and transfer of ownership and management (Fenadzo *et al.*, 2010: 25). Denison & Manona (2007: 14) believe that revitalization is a holistic development philosophy that aims for socially uplifting, profitable agribusiness on existing irrigation schemes and in the communities surrounding the schemes. It is characterized by whole enterprise planning, human capital development, access to information, and is underpinned by a financially sustainable development strategy alongside repair and re-design of existing infrastructure (Denison & Manona, 2007: 14). South Africa has just cautiously initiated IMT in government SIS in the former homelands, and most transfer operations are still unsure how to design and implement the process (Bembridge, 2000: 13).

2.3.4 METHODS OF IRRIGATION SYSTEMS

Methods of irrigation are ways of how to obtain water for irrigation purpose in order to facilitate agricultural production or to supplement water supply. Methods of irrigation depend highly on several factors such as the plant cultivated, land tenure systems, the growing season, rain and water regimes, topography, and water resources (Dupriez & De Leener, 2002: 61).

2.3.4.1 Drip or trickle irrigation

According to Ayele (2011: 45), Drip or Trickle irrigation involves slow application of water to the root zone. The drip irrigation systems consist of the head, main line and sub lines, lateral lines and drip nozzles. The head consists of a pump to lift water and produce the desired pressure (about 2.5 atmospheres) and to distribute water through nozzles. Mains and sub mains are normally of flexible material such as black PVC pipes. Laterals or drip lines are small diameter flexible lines (usually 1 to 1.25 cm diameter black PVC tubes) taking off from the mains or sub mains (Denison & Manona, 2007: 14). Laterals are normally laid parallel to each other. Lateral lines can be up to about 50 meters long and are usually 1.2 cm diameter black plastic tubing. There is usually one lateral line for each crop row. By laying the main line along the centre line of the field, it is possible to irrigate either side of the field alternately by shifting the laterals. A pressure drop of 10 percent is permitted between the ends of lateral. Drip nozzles are also known as emitters or valves and are fixed at regular intervals in the laterals. These PVC valves allow

water to flow at the extremely slow rates, ranging from 2 to 11 liters per hour and they are of different shapes and design (Denison & Manona, 2007: 14).

According to Ayele (2011: 45), the aim of drip irrigation is to wet dry ground with small amounts of water just where the plants can absorb it. Drip irrigation is mostly practised in dry, arid regions where water is scarce, and it must be used sparingly. Water is delivered to the points through a set of plastic lateral tubes laid along the ground or buried at a depth of 15-30. These tubes are left in place throughout the irrigation season (Ayele, 2011: 45). Drip irrigation can save water by reducing the portion of the soil surface that is wetted thus, decreasing the amount of direct evaporation. The initial cost of the drip irrigation for large-scale irrigation is its main limitation. One problem with drip irrigation is that the cost of the unit per hectare depends mainly on the spacing of the crop. For widely spaced crops like fruit trees, the system may be even more economical than sprinkler (Dupriez & De Leener, 2002:45).

2.3.4.2 Sprinkler or overhead irrigation systems

This method of irrigation resembles rainfall. In this method of irrigation the water is broken in to fine droplets created by expelling water under pressure from an orifice (Dupriez & De Leener, 2002: 61). According to Ayele (2011: 46), sprinkler irrigation is designed to deliver water to the field without depending on the soil surface for water conveyance or distribution. Also in order to prevent surface runoff and ponding, sprinkler irrigation is designed and arranged to apply water at a rate that does not exceed the soil infiltration. One weakness of sprinkler irrigation, the water application efficiency, is usually strongly affected by wind especially during the day time, when the air is warm and dry. The droplets are also small and making the application rate low (Dupriez & De Leener, 2002: 46).

2.3.4.3 Surface irrigation systems

According to FAO (2012: 5) surface irrigation is a broad class of irrigation systems where water is distributed over the field surface by gravity flow. Surface irrigation is the oldest and most common method of applying water to croplands. It is also referred to as “flood irrigation”, the essential feature of this irrigation system is that water is applied at a specific location and allowed to flow freely over the field surface and thereby apply and distribute the necessary water to refill the crop root zone (ibid). It is classified in to the following methods such as flooding,

furrow irrigation, basin irrigation, and sub-surface or sub-irrigation (Denison & Manona, 2007: 14).

2.3.4.4 Flooding

According to Dupriez & De Leener (2002: 46: 46), flooding consists of opening a water channel in a plot or field so that water can flow freely in all directions and cover the surface of the land in a continuous sheet. They usually have slopes from 0.1 percent to 0.2 percent, include small 'border checks' (or small levies) 6-20" high, which confine water to an area from 10 to 100 feet wide so that water moves down the field. The advantage of this method is that it is inexpensive, both in terms of system costs and energy costs (Putnam, 2003: 9). This is the most inefficient method of irrigation as only about 20 percent of the water is actually used by plants, since the rest of the water is lost as a runoff seepage and evaporation. Water distribution is very uneven and crop growth is not uniform. It is suitable for uneven land where the cost of levelling is high and where a cheap and abundant supply of water is available. It is unsuitable for crops that are sensitive to water logging. The method is suitable where broadcast crops, particularly pastures, alfalfa, peas and small grains are the produce. Its performance depends strongly on soil properties such as the infiltration rate (Putnam, 2003: 9; Ayele, 2011: 43).

2.3.4.5 Furrow irrigation

In furrow irrigation, the water is guided to pass in a furrow or channels that pass through the whole field (Denison & Manona, 2007: 14). In this method the water covers only part of the soil surface, so it results in less evaporation. The furrows are separated with ridges. At each ridge, water is conveyed into furrows that can be perceived as narrow basins or borders. Furrowing is applied on steep slopes where the furrows are made along contours. The length of furrow is determined mostly by soil permeability. Row crops such as potatoes, cotton, sugarcane and vegetables can be irrigated by furrow method. Water is allowed to flow in furrow opened in crop rows (Ayele, 2011: 42).

2.3.4.6 Basin irrigation

This method is suitable for orchids and other high value crops where the size of the plot to be irrigated is very small (Dupriez & De Leener 2002: 46: 46). According to Shah *et al.* (2002:

174), basin irrigation is suitable for many field crops such as paddy rice. It is also efficient in the use of water but its initial cost is high. In this method the field is divided into compartments or checks wholly surrounded by levees. The water is contained at the upper end and completely fills the compartments until it over flows at the lowest point of the levees. The basin may be square, rectangular or circular shape. A variation in this method, viz. ring and basin, is commonly used for irrigating fruit trees (Putnam, 2003: 10). A small bund of 15 to 22 cm high is formed around the stump of the tree at a distance of about 30 to 60 cm to keep soil dry. Basin irrigation is generally not suited to crops, which cannot stand in wet or waterlogged conditions for periods longer than 24 hours (Ayele, 2011: 42; Denison & Manona, 2007: 14; Shah *et al.*, 2002: 174). Basin irrigation is easier to construct on a flatter land surface. On flat land only minor levelling maybe required to obtain level basins. It is possible also to construct basins irrigation even when the slope is quite steep, and on sloping land. Level basins can be constructed like the steps of a staircase; these are called terraces (Shah *et al.*, 2002: 174).

2.3.4.7 Sub-Surface irrigation or sub-irrigation

According to Dupriez & De Leener (2002: 62), subsurface irrigation or sub-irrigation may be natural or artificial. Natural sub surface irrigation is possible where an impervious layer exists below the root zone. Water is allowed into series of ditches dug up to the impervious layer, which then moves laterally and wets root zone, whereas in artificial sub surface irrigation, perforated or porous pipes are laid out underground below the root zone and water is led into the pipes by suitable means. In either case, the idea is to raise the water by capillary movement. The method involves initial high cost, but to maintain is very cheap. There is a risk of soil getting saline or alkaline and neighbouring land damaged due to heavy seepage (Ayele, 2011: 42).

2.3.5 COST OF IRRIGATION SCHEMES

Though irrigation systems help in promoting livelihoods and food security in the development process in general and South Africa in particular, there have been many negative impacts of water projects such as financial, environmental, and social costs of developing water systems. There have also been environmental problems, such as habitat destruction and a decrease in water quality. Humans also suffer when an irrigation system is constructed. The construction of water projects has resulted in the displacement of native populations, and also resulted to waterborne diseases that affect the population (Schoengold & Zilberman, 2000: 13; WCD, 2000: 39).

2.3.5.1 Capital Costs

According to WCD (2000: 39) and Schoengold & Zilberman (2000: 13), the costs of constructing a dam and conveyance system for irrigation are often many millions of dollars. The costs of constructing irrigation projects in West Africa have averaged over three times more per hectare irrigated than projects in Asia. Generally, the capital costs of constructing water projects have been consistently underestimated by many countries in the world. A recent study of 81 large dams by the World Commission on Dams found that the average cost overrun was 56 percent. These overrun costs result in decreased net benefits of a water project, in comparison to the ex-ante predictions (Schoengold & Zilberman, 2000: 13; WCD, 2000: 39). The Schoengold & Zilberman (2000: 13) study found that the internal rate of return to most water projects at assessment is well below the expected rate of return when the project was approved, although most of the return rates are still positive. As mentioned earlier, costs and benefits vary by location (Schoengold & Zilberman, 2000: 13; WCD, 2000: 39; FAO, 2006: 10).

2.3.5.2 Environmental Costs

2.3.5.2.1 Habitat destruction

According to WCD (2000: 39), the construction of a large dam causes changes in a river ecosystem such as, the changes in stream flow, water temperature, and water quality. These changes turn to affect the flora and fauna living in a river basin area. These changes can lead to permanent ecological changes, leaving native species without a viable habitat. Fish species that live in warmer waters might not survive the cold waters below a dam site, or species that thrive in flowing waters might have a difficult time surviving in the still water of a reservoir (Schoengold & Zilberman, 2000: 13; Ayele, 2011: 42).

2.3.5.2.2 Blocking migration of native species

Many river systems are used by species of migratory fish, such as salmon. Salmon species often are born in an upstream area, travel down river during their lifetime, and return upstream to mate and reproduce (FAO, 2006: 11). The construction of large dams can block the routes used by these fish, and affect their reproductive behaviour. This affects both the sustainability of the fish

species and those whose livelihood depends on the fishery (Schoengold & Zilberman, 2000: 14). One example of this occurred on the Porto Primavera Dam in Brazil. Construction of this dam obstructed the migration of native fish species, and led to an 80 percent decrease in upstream fish catch (WCD, 2000: 41). Decreases like this not only affect the health of the species but also the social health of people who depend on the fish species for survival (Shah *et al*, 2002: 174).

2.3.5.2.3 Dynamic cost on water resources

Irrigation development projects had allowed crop production on otherwise arid and semi-arid lands. This is very vital since it helps in expanding output and increasing land values. Nevertheless, there are environmental problems that have occurred over time as the amount of land being irrigated has expanded. These costs include increased salinity levels in fresh water sources, and water logging and salinization of soil. Salinization happens when water that formerly ran into a freshwater lake is diverted, diminishing the freshwater replenishment of the lake, or when water withdrawals from a river are too great. The level of a lake will decrease due to less fresh water available, when this happens water evaporates then salt content of the lake will increase. When water withdrawals are too great, the salt water from the sea can regress into the river basin. Over time this can lead to severe changes in the ecological balance of the lake and the species that it supports [say more and provide more sources (WCD, 2000: 4; Schoengold & Zilberman, 2000: 14)].

2.3.5.2.4 Contamination of water supplies

Pesticides, chemicals and fertilizers used in agriculture through the use of irrigation systems contaminate fresh water supply. Water that has been contaminated with animal waste, pesticides and fertilizers can cause diseases such as *diarrhea*, hepatitis, or typhoid fever (FAO, 2006: 12). Schoengold & Zilberman (2000: 14) state that “more than one-third of the world’s population lacks access to basic sanitation, and most of these people live in developing countries. They further point out that over half of China’s population consumes water that exceeds the maximum permissible limits on human and animal waste, and an estimated 80 percent of the diseases and one-third of deaths in developing countries are caused by consumption of contaminated water”.

2.3.6 CHALLENGES OF IRRIGATION SCHEMES

2.3.6.1 Institutional and organizational problem

Institutional organisation and management problems are seen to be a more common constraints to the success and exploitation of irrigation schemes in the world and South Africa in particular (Woldeab, 2003: 229). Institutional and organisational decline has its most profound impact on routine maintenance of the water distribution system, which includes cleaning and minor repairs (Van Averbeke, 2008: 71). Woldeab (2003: 229) argues that “inadequate routine maintenance of an irrigation scheme reduces water delivery and shortens the life-span of the water distribution system, posing a threat to the sustainability of irrigated farming”. Shah *et al* (2002: 45) further point out that inadequate routine maintenance as one of the important factors that contributed to the downward ratchet that characterised smallholder irrigation schemes in South Africa. He further states that in South Africa, for instance, the ARDC and its predecessors have, for over 30 years, managed smallholder irrigation schemes through an elaborate top-down command and support system, which has eventually proved to be unsustainable, under a version of contract farming system.

Bembridge (2000: 11) also concurs and point out that Scheme managers have been attempting to ‘manage’ farmers rather than encouraging entrepreneurial development. The situation was similar in other African countries”. Tekana & Oladele (2011: 75), paid considerable attention to the building of social capital among irrigator communities in their guidelines for trainers and development facilitators, but evidence suggests that capacity on its own might not be enough (Van Averbeke, 2008: 71). Assessments of smallholder irrigation schemes invariably identified the institution of land tenure to be an important factor for irrigation development. Tenure restrictions prevented the development of a land-exchange market among farmers (Bembridge, 2000: 11). Poorly functioning land-exchange markets prevented plot-holders to adapt the size of their farm enterprises to their capacity to produce, resulting in the coexistence of demand for land and land surplus (Van Averbeke, 2008: 71).

2.3.6.2 Markets

Food crops from irrigation farms are either sold in local or urban markets. However, ready market is seen as challenge plaguing irrigation farmers. Kundlande *et al.* (1994: 102) postulate

that in Mutare, Manicaland Province in Zimbabwe only hotels and schools are targeted as markets for irrigation farmers. While established ones like Dewure have had contracts for tomato production with Pizza and Chicken Inn in Mutare. Makumbe (1996: 34) however, showed that producers prefer selling to local markets in small quantities than in bulk. The reason for this is that, rural people could not meet commercial quantities and qualities. Markets are unreliable especially during the rainy seasons when people are self-sufficient and reliant. In such times Makumbe (1996: 68) argues that produce are bought at very low prices thus affecting producer's income. Lack of proper market information has also prevented irrigation farmers from selling their products. Woldeab (2003: 71) corroborates with the statement and point out that, market information is limited to smallholder farmers and this has hamper marketing of their agricultural products.

2.3.6.3 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 agricultural boom. Jackson & Steenhuis (1997: 23) postulate that some small irrigation schemes face problems of roads and transport facilities. Wodeab (2003: 79) further concurs that at a local level in Ethiopia, for example in the rural areas of the AoI, product flow is more difficult as roads connecting remotely situated Small scale irrigation farmers to different markets are often unpaved and transport services are scarce. 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 perishable nature of their products farmers face the risk of running at a loss (Chazovachii, 2012: 231).

2.3.6.4 Capital

Irrigation farming, like any other business, requires financial capital to ease production. Inadequate financial capital limits irrigation farmer's ability to pay for water, electricity, costs of operating and maintaining the irrigation system. Inadequate finance also prevents households from investing in new methods of crop production and irrigation. In addition, many households are risk averse because they have limited financial abilities to respond to unexpected shortfall in

income. Financial capital is needed to buy farm inputs such as fertilizers, chemicals and pesticides (FAO, 2012: 15). Machete *et al.* (2004: 23) argue that one of the most critical problems threatening the viability of smallholder irrigation is the absence of credit. Access to physical and natural capital leads to sustainability of an irrigation project. Farmers need chemicals, seeds, fertilizers and in certain instances irrigation pipes and sprinklers to facilitate production. Most irrigation farmers do not have finance to purchase agricultural implements due to the absence of credit from financial institution as a result of this; farmers are forced to do away with such important inputs which negatively affect the quality of their crop. Tekana & Oladele (2011: 75) put 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.

2.3.6.5 Water pricing

According to Han & Zheng (2004: 2), water pricing definitely provides an incentive to stimulate water users to increase water savings in irrigation systems. However, soaring charges of water for irrigation farmers have been identified as a challenge of irrigation farmers. Han & Zheng (2004: 2) argues that water pricing hike methods have threatened the viability and sustainability of irrigation projects in China. de Fraiture & Perry (2002: 2) concur and point out that "increase of water prices for irrigation will reduce farmers' incomes, especially those whose income largely come from crops". According to Chazovachii (2011: 4), unavailability of water affects crops. Kundlande (1994: 23) is of the opinion 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, the water table goes down forcing 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 (Kundlande, 1994: 23).

2.3.6.6 Land tenure

Secure land tenure is considered to be a highly significant factor in determining the productivity of irrigation farmers. Providing security of tenure is often seen as a pre-condition for intensifying agricultural production and is increasingly stressed as a prerequisite for better natural resource management and sustainable development (Chazovachii, 2012: 34). The literature suggests that increased security of land tenure in productive resources enhances sustainable agricultural

production. Bembridge (2000: 65) indicates that insecure land tenure limits farmers' incentives in making long-term development investments on their land. In principle, farmlands are communally owned. Rukuni (2006: 43) also suggests that "communal ownership of land would promote productivity only if communal ownership were secure. Land tenure is a major institutional issue which will have a bearing on irrigation management institutions".

2.3.6.7 Thieves and Animals

According to Chazovachii (2012: 229) and Manzungu (2004: 221), protecting crops from destruction by dangerous animals especially during the dry season when forage is scarce is a major problem to irrigation farming. Existing fences are at times destroyed and it is quite expensive to repair them (Chazovachii, 2012: 229). It is not only animals that destroy farmers' crops but human beings also steal farm produce. Chazovachii (2012: 221) argues that "crops are targeted by thieves who do not just steal part of the fence but occasionally raid the place for the crops and this tends to draw back irrigation farming. Irrigation schemes can also be failures or be affected by internal and external, human and physical threats to their survival". This can also lead to the dysfunctioning or stoppage of the scheme. More so, this has resulted in some schemes not effectively addressing their intended problems like reducing peasant and communal poverty (Mazungu, 2004: 221).

2.3.7 IRRIGATION MANAGEMENT AND ORGANIZATION

According to Mollinga (2003: 21) and Golder Associates (2004: 24), irrigation management activities have both technical and social dimensions. These include control structure activities such as design, construction, operation and maintenance, water use activities (acquisition, allocation, distribution and drainage), and organizational activities (decision making, resource mobilization, communication and conflict management). Mollinga (2003: 35) classifies irrigation management functions into four types that include planning, organizing, leading and controlling. These tasks and activities should be properly coordinated and managed in irrigation systems. In irrigation management, water control is crucial for agriculture and food production. It refers to the managerial control of water distribution and organizational processes in the irrigation system (Mollinga, 2003: 35). According to Mollinga (2003: 35), "effective water control in irrigation management is a function of several factors including physical, technical, socioeconomic,

organizational, political, cultural and complex institutional factors”. These components of irrigation systems inter act in irrigation management (Golder Associates, 2004: 28). Political factors such as irrigation laws and policy can enable or constrain irrigation management. Gyasi *et al.* (2006: 52) posit that lack of transparency, accountability and incidences of rent-seeking reduce trust and confidence in leadership, and undermine management efficiency impeded irrigation management in Ghana. Leaders perceived to be corrupt lose their moral authority to enforce rules and regulations.

Mollinga (2003: 38) argues that socio-economic differentiation among farmers impeded the emergence of effective water user’s organizations in India and Bangladesh. Inequity among water users makes it difficult to achieve social control. FAO (2001: 15) further posits that where the issues of organization and management of irrigation are not well considered problems may arise in such areas as:

- Existence of indefinite regulations or instructions about the share of responsibilities.
- Lack of coordination between different work groups, and
- Absence of common meeting point for discussion and setting difference.

2.4 OVERVIEW OF FOOD SECURITY

2.4.1.1 Global overview of food security

In November 1996, heads of states and government representatives gathered in Rome, Italy, in World Food Summit to reaffirm the right of all to have access to safe and nutritious food. This was consistent with the right to adequate food and the fundamental right for everyone to be free from hunger (FAO, 1996: 5). The delegates committed themselves to achieving for all the ongoing efforts to reduce hunger in all countries, with an immediate view to reducing halve the number of food-insecure people by 2015 (FAO, 1996: 9). Despite the efforts of governments, international organizations, Non- Governmental Organizations and Community-Based Organizations, food security is still a global problem with an estimated one billion people in the world suffering from

hunger in 2009 (FAO, 2012: 7), though this figure fell during the early 1990s and stood at just over 800 million around the mid-1990s. Over the last decade, the total has been increasing again, especially following the sudden sharp increase in food prices all around the world in 2007 and 2008 and following the subsequent economic crisis of 2008–2009 (FAO, 2012: 2).

According to USDA (2012: 12; Shapouri *et al.*, 2010: 7), the number of food-insecure people decreased from about one billion in 2009 to 882 million. This figure includes 15 million in developed countries, Near East and North Africa 42 million, Latin America and Caribbean countries, Asia and the Pacific 643 million and in Sub-Saharan Africa 215 million. In terms of regions, the largest share of the total number of food-insecure is found in Asia and the Pacific with about 60 percent, followed by Sub-Saharan Africa with 25 percent. According to FAO (2012: 2), the percentage of the population that is undernourished varies between the different developing country regions. The highest incidence of food-insecure people was detected in Sub-Saharan Africa, where about 357 people were found to be food-insecure. In terms of percentage, the figure is far above the 16 percent of Asia and the Pacific, and the 10 percent of that estimated for both Latin America and the Caribbean, and the Near East and North America (FAO, 2012: 2).

According to Wiebe (2003: 23), the world's population reached three billion in 1960 with a third being chronically undernourished. Forty years later the world's population has doubled to six billion, and food production has grown even faster. The number of people who are chronically undernourished has fallen (FAO, 2006: 6). Despite these achievements, challenges however remained as more than 800 million people most of whom live in Asia and Africa are still chronically undernourished (Wiebe, 2003: 23). The FAO estimates that one out of every five people in the world suffers from chronic malnutrition. The World Bank estimates that, about 400 million suffer from severe food deficiency and an additional 350 million cannot afford even the minimum diet necessary for good health (WB, 2002: 5). According to FAO (2012: 4; Shapouri, *et al.*, 2010: 8), food insecurity is still a major global concern as about one billion people are suffering from starvation and malnutrition, and the Food and Agriculture Organization of the United Nations (FAO) has concluded that we are still far from reaching the millennium development goal (MDG) number one: to halve extreme poverty and hunger by 2015 (FAO, 2012: 4; USDA, 2012: 12).

Food prices are rising, supplies are very tight and already some countries have experience some intense food protests that have led to destruction of property and lives. When people do not have enough to eat, they tend to become very desperate, and unfortunately it looks like the global food situation is not going to improve much any time soon. Right now the world is really struggling to feed itself, and with each passing day there are even more mouths to feed. It is being projected that the population of the world will reach nine billion people by the year 2050. According to WFP (2013: 2), a total of 842 million people in 2011–13, or around one in eight people in the world, were estimated to be suffering from chronic hunger, regularly not getting enough food to conduct an active life. This figure is lower than one billion reported with 2010–12 representing almost 16 percent of the population of developing countries (WFP, 2013: 2). The vast majority of hungry people of about 827 million live in developing regions, where the prevalence of undernourishment is now estimated at 14.3 percent in 2011–13 (WFP, 2013: 3).

Despite the fact that the rate of undernourishment falls from 20 million in 1992-93 in developed regions to 16 million in 2011-13 and that of developing countries increased from 173 in 1992-93 to 223 million people in 2011-13 (WFP, 2013: 12), there are already way too many people starving to death around the globe, and unfortunately starvation is only going to become more rampant as food supplies get even tighter (USDA, 2012: 14). Some provinces that are producing food in China are facing their worst drought in 200 years. Flooding has absolutely devastated agricultural production in Australia and Brazil this winter. Russia is still trying to recover from the horrific drought of last summer. Global weather patterns have gone haywire over the past 12 months, and this is putting immense pressure on the global food system that is already on the verge of a major breakdown (FAO, 2012: 7).

2.4.1.2 Food security situation in Sub-Saharan Africa

Sub-Saharan Africa remains the world's most food insecure region in the world. In 2010, the World Food Programme and FAO declared that 269 million people were food insecure, and on the verge of starvation in sub-Saharan Africa as compared to 357 million people in 2012 (Shapouri *et al.*, 2010: 11; FAO, 2012: 12). But that is hardly out of the ordinary as large portions of rural and urban populations in the region suffer from inadequate diets and experience

lack of food as a daily challenge (WFP, 2010; 8; FAO, 2012: 14). There was a 4.3 percent decline of food insecure people in Sub-Saharan Africa in 2011. Food distribution gap is estimated to decline 1.8 percent. The region's grain output in 2011 fell below the bumper crop of 2010 as several countries including Angola, Burkina Faso, Chad, Madagascar, Mali, Niger, and Sudan saw below average production in 2011. The improvements estimated for 2012 are driven by an estimated recovery in production (USDA, 2012: 4). However, the number of food insecure people in Sub-Saharan Africa is expected to increase 15.1 percent over the next decade, reaching 411 million in 2022. This projected increase is compared to a projected 28 percent rise in population for SSA countries, such that the share of food insecure people is projected to fall from 42 percent in 2012 to 38 percent in 2022 (USDA, 2012: 11). However, the region's distribution gap (the amount of food needed to raise consumption in each food deficit income group to the nutritional target of roughly 2,100 calories per person per day) is projected to rise nearly 19 percent over the next decade, reaching 12.4 million tons in 2022.

In Madagascar, severe drought hit the country in 2008 and led to poor harvest. About 720, 000 inhabitants (about 40 percent of the population) suffered from starvation (FAO, 2012: 11). Fifty three districts in Madagascar were declared food insecure areas in 2010 as compared to 31 districts in 2008 and 45 in 2009 (FAO, 2012: 11). According to UNICEF (2011: 7), about 7000 children (most particularly) south of the country that had below 350 mm rainfall, suffered from malnutrition, some eventually died. Cases of tuberculosis and women mortality during delivery also increased due to poor food intake (UNICEF, 2011: 7). According to FAO (2012: 8), in the Horn Africa (Ethiopia, Somalia and Kenya) around 12 million people are suffering starvation. The areas were hit by severe drought and in July 2011 and about 10 million people needed food assistance, and these required food aid cost of about 1.14 billion U.S dollars. In Kenya in 2010, about 50 children had been treated due to malnutrition but by 2011 the number increased to 700 (FAO, 2012: 8). Drought in Kenya led to an increase in the price of staple food. The price of rice rose from 60-80 shillings (0.64) per kilogram in three months, while the price of sugar doubled (FAO, 2012: 9).

According to FAO (2012: 9, in 2011, UNO declared that famine existed in two regions in Somalia. These include, Southern Bakool and lower Shabelle. About 30 percent of children in

those areas suffer from acute malnutrition; mortality rate reaches two adults or four children per day per 1000 people (FAO, 2012: 9). In Somalia, about four million people are food insecure for which about three million are from the south (Oxfam, 2012: 13). Relief agency such as Oxfam has been urging donors to provide the 800 million US dollars desperately needed to help 10 million hungry people in the Horn of Africa (FAO, 2012: 9).

Across Chad, Burkina Faso, Mali, Mauritania, Niger, and northern Senegal, malnutrition rates hover around 10 to 15 percent, while in some areas, rates have risen beyond the emergency threshold level of 15 percent. Over one million children are estimated to be at risk of severe acute malnutrition (Oxfam, 2012: 15) and the escalation of armed conflict in northern Mali in April 2012 has resulted in a large displacement of people and serious disruption in commodity movements, worsening food security in Mali.

2.4.1.3 Food security situations in Southern Africa

Southern Africa, as a sub-region, is particularly vulnerable to food insecurity, largely due to climatic conditions such as the general scarcity of water and recurring droughts in most countries in the region, but also because of the recent civil conflicts in Angola and the Democratic Republic of the Congo (DRC) and the political and economic crisis that took place in Zimbabwe. The sub-region has the highest prevalence of HIV and AIDS in the world, and this poses a serious long-term threat to food security in the region, as do tuberculosis, cholera outbreaks and frequent bouts of diarrhoea and endemic malaria (SADC FANR, 2006: 10). Drimie *et al* (2008: 67) argue that much of the food insecurity in these countries can be considered chronic; there are areas in which transitory food insecurity occurs on a frequent or seasonal basis like the case of Horn of Africa. The gravity of the situation and the widespread erosion of the region's resilience to shocks are largely due to the deterioration of livelihoods and assets (Drimie *et al*, 2008: 67). According to National Vulnerability Assessment Committees (NVACs) about six million people in the region are at the risk of food insecurity in 2012/13 consumption period (NVACs, 2012: 6). The number of food insecurity households has increased drastically in 2012 due to severity of crop failures in many more countries than has been the case in the past three to four years. Estimates conducted in Angola in 2012 to show the severity on crop production resulted in a 40 percent drop as compared to last year (NVACs, 2012: 7). Food and Agricultural Organization

revealed that 10 percent of the population of five countries in Southern Africa (Angola, Lesotho, Malawi, Swaziland and Zimbabwe) are food insecure ranging from the period three to eight months (FAO, 2012: 4; NVACs, 2012: 7).

According to NVACs (2012: 8), in Malawi, a total of 15 districts in the south and central region are facing harvest failures, estimates of about two million people have been assessed to be food insecure. Due to the devaluation of the country's currency, food prices and basic commodities increased significantly throughout the country. In Mozambique, a total of about 255, 000 people require food assistance including food distribution. Maize production deficits continue to cause food insecurity in the country (NVACs, 2012: 8). According to USAID (2012: 4), about two million people are affected by the food insecurity situation in Zimbabwe, 80 percent households the districts were facing food insecurity. In 2012 cereal production fell by 33 percent and coupled with this, the country's inflation food prices soared (USAID, 2012: 5).

According to NVACs (2012: 6), in Swaziland, the current cereal production estimates indicate a 10 percent decrease in maize production from 89,000 tons in 2011 to 76,000 tons in 2012. In recent years, maize production in the country has remained relatively low, mostly in the range of 60,000 tonnes to 80,000 tonnes, as opposed to above 100,000 tons in 1999 and 2000 (NVACs, 2012: 6). This is mainly due to frequent droughts in the country. Food security situation for the 2012/13 marketing year is expected to remain tight, with expected price rises of both food and inputs. The 2012/13 marketing year cereal deficit/import requirement is currently assessed at 91,000 tonnes, which is higher than last marketing year's deficit of 67,000 tonnes. Maize deficit alone is estimated at 42,000 tonnes, while deficits for wheat and rice are estimated at 31,000 tonnes and 19,000 tons respectively (NVACs, 2012: 7). Vulnerability assessment conducted in May 2012 indicates that some 116,000 people may require food and non-food humanitarian assistance during the 2012/13 marketing year (FAO, 2012: 5). The country may find it difficult to deal with the food security problems without external assistance due to the economic challenges the country is facing at the moment.

According to FAO (2012: 6), in Zambia, there was a five percent reduction of cereal production from 3.35 million tons in 2011 to 3.19 million tons in 2012. However, the current production

figure is 37 percent above the past five-year average production of 2.32 million tonnes, which is an indication of the general upward trend in production in recent years. Maize production at 2.85 million tonnes is six percent down from last year's harvest of 3.02 million tons, while sorghum/millet is down 20 percent to 45, 000 tones (FAO, 2012: 6). Production of wheat and rice are, however, up from 237,000 tons and 32,700 tons to 254,000 tonnes and 34,000 tons respectively. According to WFP (2013: 8), cereal production, especially maize, was negatively affected by dry spells and flash floods which occurred in some parts of the country. In spite of the slightly reduced cereal production compared to 2011, the food security situation is expected to remain stable, with current 2012/13 marketing year's assessment indicating a cereal surplus of 1.11 million tonnes which is, however, slightly lower than the 1.74 million tons in 2011/12 marketing year (WFP, 2013: 8). The cereal surplus is made up of surpluses in maize and wheat of 1.04 million tonnes and 96,000 tons respectively, less a deficit in rice of 24,000 tones. Recent vulnerability assessment indicates that about 63,000 people may require humanitarian assistance during the 2012/13 marketing year, as a result of poor rains and other calamities such as floods in some parts of the country (WFP, 2013: 9).

2.4.1.4 Food security in South Africa

After 1994, food security received much attention in South Africa. The right to access sufficient food was embedded in Section 26 and 27 of the South African Constitutional law of 1996. The constitution indicates that every South African citizen has a right to sufficient food and water; and social security (DAFF, 2011: 5). According to FAO (2006: 12), South Africa is a major player in the Southern African region and its food security is vital to the stability of the region. South Africa has also been a contributor to food security at the regional level. The 196 000 tons brought in by the World Food Programme in the region in 2007 was recorded, and 150, 000 tons of that was from South Africa (WFP, 2010: 11). According to WFP (2010: 11), South Africa has a role to play in helping to stabilize the food security in the region as well as domestic food security. Food security is said to have two components. Firstly, the availability of food and the ability to be self-sufficient in food production through one's own production and secondly, having accessibility to markets and the ability to purchase food items (WFP, 2010: 11).

According to Department of Agriculture (2002: 5) and (Hendriks & Msaki (2009: 7), South Africa is food secure at the national level. It produces the main staple food and exports surplus

food. It can also import what is required to meet food needs. National food security indicators reveal that South Africa has been meeting the food needs of the population from domestic sources for the last 20 years (FAO, 2012: 6). Indicators in 2002 suggested that South Africa met the needs for the main staple, maize, by over 100 percent. It also met the requirements for wheat, the second most important food product, by up to 95 percent (FAO, 2012: 6). Imports of livestock and dairy products from the EU and SADC regions filled any production gaps. Despite the fact that South Africa is a very successful food security country at the national level, very few households are food secured in South Africa. The food security of the urban and rural poor is under threat (Statistics South Africa, 2007: 15; Wenhold *et al*, 2007: 1).

According to National Planning Commission (2011: 13), South Africa has ranked 40th out of 105 countries in a Global Food Security Index which has the US in the top spot and the Democratic Republic of Congo at the bottom. An estimated 22 percent of South African households had inadequate or severely inadequate access to food. Food access problems were the most serious in North West where about 34 households had inadequate or severely inadequate food access. Food access problems in KwaZulu-Natal stands at (26.9%), Northern Cape (26%), Free State (23.6%), Limpopo (20.6%), Eastern Cape (20.3%) (NPC, 2011: 13). Human Sciences Research Council (2008: 6) acknowledges that South Africa's food inflation rate hit a new high in 2008. From July 2007 to July 2008, the year on year increase in the Consumer Price Index for Food was 17.8 percent. South African's earning less than US\$200 per month spend more than 30 percent of their income on food. The cost of almost all essential food items (bread, milk and meat) increased by more than six percent in 2008 (HSRC, 2008: 6).

Despite being a maize producing nation in the world, South Africa now imports wheat and sunflower oil. The urban poor are the worst affected as they do not have access to food, unlike the rural poor, who have access to land to grow food to support themselves and their families but are face with water problems (Labadarios, 2009: 12; DoA, 2012: 9). In May 2005, the cost of maize was less than R600 per ton. By December 2007, the maize price had risen to R1806 per ton. The price of sunflower seed increased from R850 per ton to R4600 per ton. Such increases make the cost of staples infinitely more expensive for the rural poor. The South African Constitution states that every citizen has the right to have access to sufficient food and water (Labadarios, 2009: 13; Statistics South Africa, 2011: 15).

In 1994, the government identified food security as a top priority and increased its spending on social programmes which was seen as a way to solving food problems in the country (DoA, 2002: 5). Feeding schemes, child support grants, free health services for children up to six years and for pregnant and lactating women, pension funds, provincial public works programmes, community food garden initiatives, and the rehabilitation of irrigation schemes were all introduced as ways to improve household food security (DoA, 2002: 5; Statistics South Africa, 2007: 7). However, most of these programmes had unsatisfactory results and in 2000, a National Food Security Strategy was formulated (DoA, 2012: 10). Some of the key challenges to achieving food security in South Africa are highlighted by the Department of Health in the Integrated Food Security Strategy (IFSS). These challenges include: ensuring enough food is available now and in the future; matching income to prices in order to ensure access to sufficient food for all; empowering citizens to make optimal choices for nutritious and safe food and ensuring adequate social safety nets and food emergency systems (DoA, 2012: 10).

According to DoA (2012: 11), 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. One of the main dimensions of the IFSS is to eradicate widespread inequalities and grinding poverty amongst the majority of households. Poverty is manifested by inadequate and unstable food supplies, lack of purchasing power, weak institutional support networks, poor nutrition, inadequate safety nets, weak food management systems, poor performance of irrigation systems and unemployment (DoA, 2012: 11). According to the Department of Agriculture (DoA, 2006: 6; Omotesho *et al*, 2010: 17), in 2002, 35 percent of the population, 14.3 million people, was vulnerable to food insecurity. Women, children and the elderly are the most vulnerable to food insecurity. In 1996, one third of all households spent less than R1000 per month on food and only 18 percent spent over R3500 per month. The highly unequal nature of income distribution in South Africa means that there is a large, poor, food insecure population (DoA, 2006: 6).

According to DoA (2006: 6), poverty is spread throughout the provinces. Gauteng and the Western Cape have less than 12 percent poor households. The Free State, Eastern Cape, Northern Province and the North West Province have the worst poverty levels, largely related to the incorporation of very poor homelands into these provinces after 1994. Nearly one third of all

South African households are female headed. These households are amongst the poorest of the poor and spend less than R1000 per month on food (FAO, 2012: 12). In 1996, 73 percent of households earned less than R2500 per month, 39 percent of the population did not meet the daily energy requirement of 2000 kcal/day (HSRC, 2004: 5; FAO, 2012: 12). In South Africa, the cause of hunger and malnutrition is not due to shortage of food but rather inadequate access to food. Stats SA (2007: 15; Oni *et al.* 2007: 1) show that food insecurity is not an exceptional, short term event but is rather a continuous threat for more than a third of the population. Factors which influence household food security include “access to land; livestock ownership; food garden availability; safe, accessible water supply; stable climatic conditions; access to food shops; access to alternative food suppliers and income to buy food. Since the mid-1970s, the African continent has been the only region that has been unable to feed its own population (FAO, 2012: 6). South Africa could face a plight similar to other sub-Saharan African countries. Currently there are approximately 14 million people in South Africa who are vulnerable to food insecurity and 1.5 million children under the age of six years who are stunted by chronic malnutrition (Presidency 2012: 14; National Planning Commission, 2012: 7; Earl, 2011: 13; FAO, 2012: 10). It is unlikely that the country will be able to produce sufficient food in the future unless radical new policies change current practices.

2.4.2 CAUSES OF FOOD INSECURITY IN SOUTH AFRICA

The root causes of food insecurity at the regional and household level is quite complex. It is a combination of both natural factors and man-made processes. The underlying factors in general can be grouped under three main types as natural causes, socio-economic factors, and policy failures.

2.4.2.1 Socio-economic factors

Social factors such as population pressure, traditional farming system and practices, and economic limitations like poor infrastructural services, shortage of farm land and other productive assets are also factors responsible for the households' food insecurity in the region. One of the main socio-economic problems in the region is population pressure. High rate of population growth causes without the improvement of infrastructure results to food self-

insufficiency. Lakew (2006: 72) argues that the region with rapid population growth coupled with a stagnation of agricultural technology over the past two decades makes it difficult for agricultural production to keep pace with the rising demand for food. POST (2006: 6) further states that the demographic pressure is putting pressure on the existing services. Rural population growth raises concerns about the slow pace of rural-urban transition in the region and the consequent lack of dynamism in non-farm sub-sectors in rural areas. Poor infrastructural services are the main constraint to food security. Infrastructural services such as marketing, rural transport communications are essential to achieve household food security in particular or for poverty alleviation in general (POST, 2006: 4).

2.4.2.2 Natural disasters

FIVIMS (2003: 12) postulates that, traditional practices are also contributing negatively to the efforts made in addressing the problems of food insecurity. Despite there are good and beneficial traditional practices there are traditional values that do not encourage innovations and innovative that have significant impact on households' food security. Celebrating many days in a month as "non-working religious days" and big memorial feasts are among others, the prominent traditional practices among rural households. Hail storm, landslides and animal diseases are other natural factors that distort food security. Lakew (2006: 67) concurs and states that "hail storm in Enebe Sar Midir Ethiopia, food production was severe that people depended on relief aid". People attempt to prevent it with some traditional ways such as by abstaining from work for some days and by having a traditional prayer that would pray to prevent hail storm from coming. Shortage of farmland and other productive assets is also an important limiting factor for farmers in the region.

Landholding size is crucial for farmers 'food security situation in particular or for their livelihood security in general. FAO (2012: 11) and Lakew (2006: 67) revealed that data from Bureau of Finance and Economic Development shows that the per capita arable landholding size in Ethiopia is diminishing from 0.31ha in 1997 to 0.19ha in 2006 mainly due to increasing population size and inability of then on-farm sector to provide employment. This per capita land holding is far below the minimum area required to produce for households with the current average productivity of cereals. Combining short-term and long-term causal factors can explain the trends towards the increasing food insecure caseload. Long-term factors, such as the

interaction between environment, high population growth, and diminishing land-holdings led to significant decline in productivity per household. These trends have combined to cause the repeated effects of drought over the years, to substantially erode the productive assets of communities and households (Lakew, 2006: 67).

2.4.2.3 Government policy failures

According to POST (2006: 7; Gebrehiwot, 2008: 31), inappropriate governmental policies and institutional weakness are the main responsible factors for the recurrence of food shortage or poverty and underdevelopment in general. Whenever food shortage or famine occurs in a given country, the government is responsible for either causing the crisis or failing to prevent it. Glantz (1987: 34) corroborates the statement by pointing out that the government has frequently followed inappropriate food policies, given agricultural research low priority, as in Northern Ethiopia, used crop failure as a military weapon. In Sub-Saharan Africa, circumstances like lack of appropriate development policies and strategies constitute one of the main factors which result in the vulnerability to disaster. Lack of democratic governments which are responsive to the needs of all their citizens and making food security a high priority, and welcoming community participation were the main causes for the exacerbating condition of food insecurity in the region. Gebrehiwot (2008: 31) argues that there were little or no programs in Sub-Saharan Africa like Ehoipia aimed at fostering broad-based agricultural and rural development that should have been implemented within appropriate policy context. This includes good governance, the rule of law, transparency, sound public administration, democratic and inclusive decision making, and respect for human rights. The poor and food insecure people in the region were deprived of their political voice and organizations that are accountable to them and capable of articulating their interests to policymakers and other power holders (Gebrehiwot, 2008: 31).

2.4.3 FOOD SECURITY AND CLIMATE CHANGE

Climate change is one of the major challenges plaguing food security and it is a serious challenge to poverty since it can destabilise development done for over decades (UNEP, 2010: 1). Agricultural productions depend greatly on weather conditions even in the most highly mechanized systems. Agricultural growth and developmental processes are temperature related,

and show temperature and precipitation threshold responses that can significantly affect yields (IPCC, 2007: 9; IAASTD 2008: 9). IPCC (2007) argued that an increase in temperature and humidity contributes to the deterioration of crop growth, loss of water from soil, and directly damage plant cells, all of which tend to reduce yields (Todaro & Smith, 2006: 73). Schmidhuber & Tubeillo (2007: 2) further argue that climate change affects all four dimension of food security which includes availability, access, utilisation and stability. They further state that as climate affects food security negatively this will affects the poor greatly. However, availability of sufficient water and nitrogen, and proper weather conditions, additional carbon dioxide (CO₂) can increase plant growth. Higher carbon dioxide (CO₂) concentrations also improve the water use efficiency of most crops, which would be beneficial in semi-arid regions (IAASTD, 2008: 8). Crops such as rice, wheat, and soybean which are known as C3 crops are much more sensitive to CO₂ fertilization than C4 crops (maize, sugarcane, and sorghum), which regularly show no response to elevated CO₂ (FAO, 2012: 12).

The magnitude of CO₂ fertilization will likely be enough to counteract the effects of roughly 2 °C warming on global food supply. An increase in temperature above 2 °C will require major improvement in agricultural technologies, non-farm incomes, and social safety nets to avoid pushing tens of millions of people into chronic under nutrition (IPCC. 2007: 11).

Beyond the primary effects of higher temperatures and carbon dioxide (CO₂), food production processes and patterns could be affected through:

- Changes in the timing, location, and amounts of rain and snow, and increases in the frequency, intensity, and length of dry spells and droughts;
- Increases in the frequency, intensity, and length of heat waves;
- Changes in the frequency and intensity of extreme weather events, including storm surges, windstorms, and floods;
- Increasing weather variability;
- Earlier starts to the growing season, and
- Sea level rise, with salt water intrusions (IPCC, 2007: 12)

In addition to effects on food quantity, climate change could alter the nutritional quality of major grains. Recent studies suggest that protein and micronutrient levels are reduced when crops are

grown at higher CO₂ concentrations, although the severity of these effects and the potential to ameliorate them with management changes are unclear (Kundzewicz *et al*, 2007: 32; FAO, 2012: 6). A critical issue is water availability. Uneven spatial and temporal distribution of fresh water means that only 15 percent of the world population currently lives with relative water abundance, with the majority experiencing moderate to severe water stress (IPCC, 2007: 10). Generally, the precarious negative impacts of climate change on freshwater systems are projected by some scholars to surpass its benefits in all regions in the world, with great consequences for water availability for crop production.

2.4.4 FOOD SECURITY CHALLENGES IN SOUTH AFRICA

South Africa faces a wide range of food security challenges, ranging from national-level to household issues. These challenges undermine South Africa's ability to achieve food security at the local and national level.

2.4.4.1 Inadequate safety nets

According to the DoA (2002: 6), 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. Earl (2011: 34) argues that in South Africa, rural households are 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 of the government is to create the enabling economic conditions that favour poor and households that are experiencing food insecurity. This means introducing changes that will encourage the participation of all most especially the poor in the mainstream economy, and thereby minimizing poor households' dependency on government assistance (Gebrehiwot, 2008: 33). In other words, social safety nets should be seen 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.

2.4.4.2 Inadequate and Unstable Household Food Production

According to DoA (2002) and Statistics South Africa (2007: 15), 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's 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 (Hwenha, 2013: 45).

2.4.4.3 Lack of purchasing power

According to Hwenha (2013: 34), 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 25 percent, despite other decent economic indicators (Statistics South Africa, 2011: 15). Black households in South Africa have the lowest standards of living due to lack of purchasing power and resulting to food insecurity and poverty. Brown (2004: 68) concurs that the ability to earn cash income is an especially important determinant of urban food security. Simon (2003: 45) further adds that "because rural dwellers must rely on income in order to survive, rural poverty tends not to be primarily the result of lack of work but the lack of well-paying, steady jobs". Although food insecurity is highest among Africans, it also affects a significant number of Coloured and Indian households. There are also some communicable diseases that have further undermined food-insecure households (Hwenha (2013: 34).

2.4.4.4 Poor Nutritional Status

About 1.5 million children in South Africa suffer from chronic malnutrition which retards their physical and mental development (Hwenha, 2013: 34). Brown (2004: 68) believes that women with poor nutrition are more likely to produce low birth weight infants who are at increased risk of birth injury, illness and early death, and often grow up to be stunted due to chronic malnutrition than well fed women. The effects of malnutrition may not be apparent immediately

but it has significant effects on mortality, morbidity, educability and productivity (Brown, 2004: 68). In populations where under nutrition is a chronic problem, a cycle of malnutrition exists and undermines the development of a healthy productive population. The three provinces that Food insecurity and malnutrition are highest are Eastern Cape, KwaZulu-Natal and Northern Province. Northern Province (34.2%), the Eastern Cape (28.8%) and the Free State (28.7%). An estimated 60 percent of all stunted children and two thirds of poor people live in these three provinces (DoA, 2002: 27; Brown, 2004: 68; Hwenha, 2013: 34).

2.4.4.5 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 (Hwenha 2013: 34). 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 (DoA, 2002: 27; Brown, 2004: 68).

2.4.5 FOOD SECURITY AND LAND REFORMS IN SOUTH AFRICA

According to DoA (2002: 25) and Aliber (2003: 26), land reform presents a unique opportunity to alleviate poverty in South Africa. In rural areas, people continue to depend on access to land for their economic and social survival. Control of the land is the strongest force in shaping economic, social and political structures of a country. In South Africa, land reform was a key promise made by the African National Congress (ANC) when it gained power in 1994 (Chawatama, 2008: 1). Land redistribution is one of the components of government's land reform programme. The other components are land restitution, which involves the restoration of land or other compensation to victims of forced removals, and tenure reform, which seeks to improve the clarity and robustness of tenure rights, mainly for residents of former homeland areas and Coloured Reserves (Aliber, 2003: 89; Lahiff & Cousins, 2005: 67). By comparison,

land redistribution is that part of land reform whereby people apply for financial and other assistance with which to acquire land for farming, and sometimes settlement purposes. Whereas tenure reform is mainly effected through legislation and associated processes, and the explicit function of restitution is to provide for restorative justice, land redistribution is project-based and has overt economic objectives, namely to reduce poverty and promote opportunities for economic advancement through agriculture in order to promote food security (DoA, 2002: 26: DLA, 2009: 8).

According to DAFF (2012: 14), the main intention of this promise was to reimburse the victims of apartheid oppression. In South Africa, land reform policies are aimed at facilitating the poor and disadvantaged in gaining access to land for residential purpose and most particularly food production. The South African government also introduced policies that protect the rights of farm workers and their families living on the farms (DoA, 2002: 16). Tekana & Oladele (2011: 78) argued that access to land is part of a multiple-livelihood strategy that is particularly important for poorer households. Moreover, even where agriculture contributes only a modest share of overall household income, it plays an important security role, not least in making households less reliant on purchased food, which can vary greatly in price. Implementation of the land reform process has been hindered in South Africa by a lack of funds available to the government to purchase land. Land reform in South Africa has no focus on the enhancement of food security. As a result, agricultural production of beneficiaries is still not sufficient to raise them out of poverty (Aliber, 2003: 89; Lahiff & Cousins, 2005: 68).

2.4.6 FOOD SECURITY AND IRRIGATION

According to UNDESA (2009: 11), irrigation is only a modest part of agricultural water consumption but it accounts for more than 40 percent of the world's production on less than 20 percent of the cultivated land. However, concerns about food insecurity are growing across the globe and more water will be needed to meet increasing demands for food. Withdrawals for agriculture tend to decrease with increasing levels of development (FAO, 2012: 13). According to FAO (2012: 21), in many countries, water availability for agriculture is already limited and uncertain, and is set to worsen. Agricultural water withdrawal accounts for 44 percent of total water withdrawal in OECD countries, but for more than 60 percent within the eight OECD

countries that rely heavily on irrigated agriculture. In the BRIC countries which include Brazil, Russia, South Africa, India and China, agriculture accounts for 74 percent of water withdrawals. In the least developed countries (LDCs), the figure is more than 90 percent (FAO, 2012: 21).

FAO (2012: 21) argued that globally, irrigated crop yields are 2.7 times those of rain fed farming. This means irrigation is playing an important role in food production. The area equipped for irrigation increased from 170 million ha in 1970 to 304 million ha in 2008. There is still potential for expansion, particularly in Sub-Saharan Africa and South America, in places where sufficient water is available. Although there is still potential to increase the cropped area, some five to seven million hectares (0.6%) of agricultural land are lost annually because of accelerating land degradation and urbanization (FAO, 2012: 21). This reduces the number of farms in the rural areas as more people move to the cities to seek better livelihoods (UNDESA, 2009: 9). Population increase means that the amount of cultivated land per person is also declining sharply: from 0.4 ha in 1961 to 0.2 ha in 2005. The world population is predicted to grow from 6.9 billion in 2010 to 8.3 billion in 2030 and to 9.1 billion in 2050 (UNDESA, 2009: 10). With expected increases in population, by 2030, food demand is predicted to increase by 50 percent (70% by 2050) (Bruinsma, 2009: 81). Food security and irrigation are interrelated and increasing agricultural output, for example, will substantially increase water consumption, leading to increased competition for water between water-using sectors such as irrigation systems who depend heavily on water (FAO, 2012: 21).

2.4.7 WATER AND AGRICULTURE

Water is a basic need for human beings and animals. It is essential for their metabolic processes (Dupriez & De Leener, 2002: 6). According to Dupriez & De Leener (2002: 6), agriculture and livestock water requirements are mainly provided by direct water intake and partly by the moisture content of their forage. Livestock production requires large quantities of forage. The production of forage requires substantial amounts of water. Water, soil, air and sunshine are the four main determinants for plant growth. Therefore, water is essential to plant-growth and crop-production (Widtose, 2001: 34). All sectors of the economy of a country depend on water. Water plays an important role in agriculture, household consumption, industry, hydropower, navigation, fisheries, recreation, and ecosystems. When water is absence there would be no food production

hence hunger and poverty. Crops grow best and produce most when there is abundant supply of water.

According to Dupriez & De Leener (2002: 37), the sources of water for crop production are rainfall and irrigation water. The two types of agriculture seen from the perspective of water management are: irrigated cultivation is agricultural production using irrigation water in addition to rainfall. Irrigated crops benefit from man-made watering with the help of water pipes, canals, reservoirs and pumps. The source of irrigation water is surface water or groundwater. Surface water is obtained in ponds, lakes, rivers and seas whereas groundwater is obtained underground in liquid or vapour state (Dupriez & De Leener, 2002: 38). According to Widtose (2001:10), rain fed cultivation is agricultural production of crop depending entirely on the rain. It relies on the rainfall timing and distribution. Rain fed farming is characterized by plateau cultivation and dry land cropping. Rain fed farming is mostly practiced during one growing season, unimodal, but in some areas two growing seasons (bimodal production) are possible.

2.5 LIVELIHOODS AND POLICY RELATIONSHIPS

It is important to understand the relationships between policy and livelihood since policy is believed to be the fundamental factor in shaping livelihoods, most particularly among the poor. According to Aliber (2003: 67), agriculture-based livelihoods in Africa, including South Africa, have changed tremendously over years and policy changes have been identified as a major cause. Though the exact ways in which policy affects livelihoods are not yet well understood (Blaikie & Soussan, 2003:1), but there is no doubt that livelihoods are shaped by policies, institutions and processes at all levels, from domestic to international, since they determine access to the various types of properties. The prevailing institutional environment policies are proved to be the main catalyst associated with vulnerability for people's standard of living. This aspect makes get selection biases in far as implementing agricultural livelihood strategies is concerned (Blaikie & Soussan, 2003: 1).

Studies conducted by Rukuni (2006: 45) in Zimbabwe show that policy can positively impact on rural livelihoods to the rise of smallholder agriculture in Zimbabwe during the 1980s and early 1990s. This rise was made possible by the comprehensive smallholder development policy that

was adopted by the government of Zimbabwe after democratization. These smallholder policy measures included land reform and resettlement, making available relevant and affordable technology, creating reliable markets and establishing effective services and facilities in rural areas, and pursuing a pricing policy that favoured farmers. Poor understanding of people's existing livelihood strategies leads to policy formulation that fails to influence livelihoods, or worse, that has adverse effects (Rukuni, 2006: 45). Conducting a study of the challenges facing Small scale farmers in Taung irrigation scheme will contribute to knowledge and understanding of irrigation development. Also, the study will add value to the future development of irrigation policy in South Africa and the rest of the world.

2.5.1 Rural livelihoods in South Africa

In pre-colonial times, agriculture was central in the livelihoods of most South African households, mainly in the form of subsistence production (DAFF, 2012: 17). According to (DAFF, 2012: 19), the role of farming in the livelihoods of rural African people in South Africa has changed substantially over the past century. Presently, farming only contribute positively to the livelihoods of the majority people which are the rural residence (DAFF, 2012: 19). However, these people are heavily affected by the changes in economic, political, social and technological aspect which make people to have challenges in making sustainable agricultural choices which include natural resource among others (Muhammed, 2006: 56).

On the same note, it is postulated that the people's livelihoods is usually stressed as such majority adopted migration as a livelihood strategy. Migration of black people in South Africa was organized in response to the demand for labour by white-owned enterprises, predominantly in mining and farming. This significantly was noted from the 1900's to the present onwards (Yawitch, 1982: 5; Beinart, 2001:27-35). In addition, mining and agricultural sectors play o significant role to satisfy their populous labour needs and this was supported by the government through ACT of parliament. This ACT of parliament enabled people more especially the black community earned their living using this off-the-farm income earning strategy for years on end (Bundy, 1988: 45). 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 (Van Muhammed, 2006: 56).

On the same note, Yawitch (1982: 6), initiated that men that moved from their place of origin to place such as cities leaving their spouse and children behind in search for better social economic livelihood. Such male migration oftentimes are influenced by traditional organization within the communities which in turn impact their productivity potentials. Agricultural sectors being the most affected in this case (Mollinga et al., 2003). Complimentary to this belief, Yawitch (1982:6) postulates that when male migrants reverted back to their homes their level of participation in agricultural practices receded below the capacity, a situation which affects food security safety at their household. As the 20th century progressed, the livelihoods of rural African households became increasingly reliant on non-farm sources of income.

According to Sperber (1997: 70-84), in the 1970s, remittances from migrant workers were the dominant source of off-farm income for many rural homesteads. Thereafter, other forms of off-farm income became increasingly important, including local employment in the civil service of the homelands and public welfare grants. Claiming against the state, initially mainly in the form of old age pensions, and more recently also in the form of child support grants, has developed into the principal off-farm source of income of rural homesteads in South Africa (Van Muhammed 2006e, 2006: 44 ; Statistics South Africa, 2007: 15). The growth in the importance of state transfers in the livelihoods of rural African households has been due to policy that increased the real value of these grants, particularly old age pensions paid out to black people (Van Muhammed, 2006: 44) and policy change that broadened access to child support grants. Another reason is that access to public welfare grants enabled people to remain resident in rural areas. Van Muhammed (2006: 45) concur and points out that homesteads without one or more members who are either in employment or eligible to claim a welfare grant, are relatively rare in rural settlements, because typically such homesteads migrate to urban areas.

In 2009, an estimated 13 million people in South Africa were receiving social assistance grant as compared to six (6) million in 2003. Out of that number nine (9) million are children (Statistics South Africa, 2011: 16). This number corresponds to one of seven South Africans, or more than one in four adult South Africans and a higher proportion of households (Statistics South Africa, 2011: 16). During the period 2008 to 2009, the national budget allocation to social grants

increased from R124 million to R624 million, an increase of 25 percent per annum (Statistics South Africa, 2011: 16; National Development Plan, 2012: 13). This increase is due to annual increases in the value of the grants and due to an increase in the number of eligible beneficiaries. For many, 22 per cent of households, social grants are the main source of income to promote livelihoods (National Development Plan, 2012: 13). In 2009, the monetary value of social assistance grants represented about five (5) percent of the GDP of South Africa, which is nearly two thirds the contribution primary agriculture makes to the GDP (Nattrass, 2006: 1; Statistics South Africa, 2011: 15). Despite the contribution of social assistance and the declining role of agriculture in rural African livelihoods in South Africa, most rural households still engage in agriculture as part of their livelihood strategy (National Development Plan, 2012: 14).

2.6 THEORETICAL FRAMEWORK OF THE STUDY

The theoretical background for the analysis in this study draws upon an actor-oriented approach in irrigation systems.

2.6.1 Actor Oriented Approach

This study used the actor-oriented approach to explain the role and the responsibilities of actors involved in an irrigation system. Long (2001: 240; Woldeab, 2003: 35) argued that the actor oriented approach in an irrigation system encourages a look at the whole range of actors, with respect to their roles, involved in a system. Though the relations among the actors in irrigation systems are complex and with varying interests, they all have contribution in generating, revealing, and diffusion of technical and institutional knowledge which enable irrigation systems to be sustainable. Woldeab (2003: 35) further argued that the involved actors in an irrigation system are considered as complementary to each other in managing the water resource in the system. Furthermore, the need to focus on actor linkages is because of the increasing realization of importance and contribution of different actors in an irrigation system. The actors in irrigation systems are always under continuous interaction.

According to Long (2001: 240), actor oriented approach is concerned with the relationships and flow of information among the different actors in the irrigation system. If there is exchange of experience, flow of information and good partnership and coalition among the actors, socio-

technical knowledge of all the actors can be effectively used (Kidane, 2009: 70). Also using this approach makes it possible to examine the decision-making of central actors involved in an irrigation system. Furthermore, this approach constitutes a counter-approach to more conventional structural analyses used in development (Long, 2001: 240). According to Long (2001: 240) the focus on external forces in structural analysis does not leave sufficient room for considering how affected groups or internal actors in irrigation systems interpret, mediate and transform intervention. In an actor-oriented approach more attention is given to the fact that different actors perceive the same situation in different ways and the differences in behaviour is the result of actively knowing and feeling subjects, not the differential impact of broad social forces (Long, 2001: 241).

According to Long (2001: 240-241), using an actor-oriented approach in an irrigation system like the case of Taung Irrigation Scheme entails the identification and analysis of social actors that interact with each other in the context of a planned intervention. Planned intervention in the context of this study would mean implementation of specific government policies, funding's and organization of workshops to train farmers in the irrigation system. The involvement of companies such South Africa Brewery Malting and cotton South Africa and the role of the tribal authority to resolve conflicts in the scheme. The combined effects of both government through the Department of Agriculture, Water Affairs and Forestry, farmers and tribal authority leads to better intervention strategies that would propel irrigation management.

A social actor is defined as a social entity that has agency, meaning the knowledge and capabilities to interpret or assess a problem or situation as well as producing a certain response or action. This is central to decision-making by households and its consequences, which is often based on the careful consideration of costs and benefits. The response can impact upon the actor's own and other actors' actions and interpretations. Social actors encompass (and agency can thus be attributed to) individual persons, informal groups, interpersonal networks, organizations, as well as national governments or international organizations. Moreover, agency can be attributed to objects and ideas that can influence actors' perceptions and capability for action (Long, 2001: 240-241).

2.8 SUMMARY

This chapter discussed the definition of key concepts and literature review in relation to the study in order to show their relevance to the study. The chapter also outlined the role irrigation plays in development process in general and South Africa in particular in promoting food security, livelihoods, employment and poverty. The chapter further provided legal policy framework introduced by the government of South Africa and the North West Province in order to enhance irrigation development, food security and livelihoods. Evolution of irrigation development in the world, methods of irrigation systems and most particularly the challenges irrigation schemes are facing in the world at large and South Africa in particular were also provided in this chapter. The chapter outlined that irrigation is facing challenges such as market, capital and institutional (organisation and management) which is hindering food security and livelihoods in the world in general and South Africa specifically. The chapter also outlined the state of food security situation globally and regionally and the causes of food insecurity. It was further highlighted that food security is hampered by challenges which are very detrimental to the economy of the country. Finally, the Actor-oriented approach which was a theoretical framework for the study was also discussed to provide its relevance to the study.

CHAPTER THREE

SOCIO-ECONOMIC BACKGROUND AND ORGANISATION OF THE TAUNG IRRIGATION SCHEME

3.1 INTRODUCTION

This chapter examines the socio-economic background of the study area as well as its climatic and environmental conditions. The chapter also looks at organization and management of the Taung Irrigation Scheme.

3.2 GEOGRAPHICAL LOCATION OF THE STUDY AREA

The Taung Irrigation Scheme is located in Greater Taung Local Municipality of Dr Ruth Segomotsi Mompati District Municipality, in the North West province of South Africa. The North West province is located between 22 and 28 degrees longitude east of the Greenwich Meridian and between 25 and 28 latitude south of the equator (Cowley, 1985: 5). The North West province is situated in the north of South Africa on the Botswana border, fringed by the Kalahari Desert in the west, Gauteng province to the east, and the Free State to the south (NWPG, 2009: 10). It is also known as the Platinum Province for the wealth of metal it has underground. The Province has a population of 3.9 million people and about 65 percent live in rural areas (Statistics South Africa, 2011: 3). It occupies 106 512 area sq. km. Most economic activity is concentrated in the southern region between Potchefstroom and Klerksdorp, as well as Rustenburg and the eastern region, where more than 80 percent of the province's economic activity takes place (NWPG, 2009: 1).

Dr Ruth Segomotsi Mompathi District Muinicipality in which the Greater Taung Local Municipality is located ,covers an area of 43 699 sq km and has a population of 463,815, which constitutes 13 percent of the total population of the North West Province (Statistics South Africa, 2011: 5 ; DrRSMDM, 2013: 3). Greater Taung Local Municipality with a population of 177 642 people is one of five Local Municipalities that constitute the Dr Ruth Segomotsi Mompati District Municipality in the North West Province. Greater Taung Local Municipality covers an area of approximately 563 955 hectares which is 11.88 percent of the Dr Ruth Segomotsi Mompati District. Greater Taung is also located 75km south of Vruburg, 25km from Hartwater and 175km from Kimberley. About 98 percent of the population is Tswana speaking and Taung

is the headquarter of Greater Taung Local Municipality (GTLM, 2012: 2). Greater Taung was the area where the Taung Child was discovered and identified as the Australopthecus Africanus a predecessor of human. The area is the wettest area of western region of the North West Province (GTLM, 2012: 2). Greater Taung is an area that always experiences series of floods causing damages not only to property but also food production (GTLM, 2012: 5).

Greater Taung Local Municipality is a typical rural municipality with 106 villages which are mostly concentrated adjacent to the N18 and the Dry-Harts River. The settlement pattern in Greater Taung Local Municipality is fragmentary, with small, low-intensity urban areas scattered throughout, and surrounded by vast rural areas (GTLM, 2012: 6). Most of the population live in small, low-intensity settlements consisting of mostly informal housing that are scattered throughout the eastern parts of the municipal area and has the highest population density within the Dr Ruth S Mompati District Municipality (DrRSDM, 2013: 8). It has a population density of between 33 and 35 per km people. Nearly 60 percent of the population in Greater Taung local municipality reside within the Bathlaping Ba Ga Phuduhutswana main-place. The overwhelming majority of the population within the Greater Taung Local Municipality reside within the rural areas represented by 93 percent and only seven (7) percent live in urban areas (Statistics South Africa, 2011: 2).

3.3 Population size and distribution

Table 3.1 Population size and distribution

Population Group	Percentage
Black Africa	98.2%
Coloured	1%
Asian/Indian	0.2%
White	0.4%
Other	0.1%
Total	100%

Source: Stats SA (2011: 2)

Greater Taung Local Municipality has large households sizes with an average of 4.4 person per household. It has 42 953 number of households in the area which constitutes 42.92 percent (GTLM, 2011: 20, Statistics South Africa, 2011: 4). Majority 52.8 percent of households are headed by men as compared to 48.2 percent for females in 2010. With referenceto education, a large proportion of the population 75 percent have completed at least some secondary school education. Currently only 31 percent have completed school and only 13 percent have tertiary education. These low percentages is hampering human development capacity in the area (Statistics south africa, 2011: 15).

3.4 Economic activity

According to Statiatics South Africa (2011: 4), agriculture is the main economic activity in the area consisting of cattle farming in the largest parts of the municipality and intensive agriculture (irrigation) in the Great Hartz River Valley. Agricultural households in GTLM stand at 18, 255, livestock contributes 38.1 percent of the economy, poultry 41.9 percent, vegetables stand at 6.0 percent and other crops 4.3 percent. Animals only contribute 81.3 percent, mixed farming at 12.4 percent, other crops 3.2 percent and crops only 3.1 percent (Statistics South africa, 2011: 4). Majority of the population constitutes the historical disadvantaged groups, and poverty level in the area stands 49.8 percent. Most of the households in area have also been noted to rely on external economic activities, especially state grants (Statistics South Africa, 2011: 4). For instance, studies conducted by Tekana & Oladele (2011: 74) show that pension which is 33 percent is the greatest contributor of the economy in the area.

Table 3.2 Agricultural Households

Type of specific activity	Numbers	Percentage
Livestock production	10,441	38.2%
Poultry production	11,462	41.9%
Vegetable production	1,649	6.0%
Production of other crops	1,168	4.3%
Other	2,614	9.6%
Total	27,334	100

Source: Stats SA (2011: 2)

According to Statistics South Africa (2011: 11), Only 40 percent of the population in the area, are formally employed. There are currently 164 males and 84 females, 66 percent of employees are male and 34 percent of employees are females. Greater Taung Local Municipality also have four (4) employees with a disability thus 1.6 percent. Ninety three percent (93%) of employees are African, three (3) percent are Coloured and four (4) percent are White. This also indicates that overall 96 percent of employees are black and 4 percent are white. According to (Statistics South Africa, 2011: 11) the working age group (15-64) in the area is 56,3 percent. However, though unemployment rate stood at 49,8 percent, youth unemployment rate in the area constitutes 61,7 percent in 2010. About 24 percent of the population in Greater Taung Local Municipality are looking for work but could not find one. This forms part of the unemployed population. About 48,3 percent of the population is not economically active. About two thirds (63%) of the households travel mainly by taxi and highly depend on public transport.

Table 3.3 Employment status (15-64)

Employment Status	Percentage
Employed	16.5%
Unemployed	16,3%
Discouraged Work Seeker	12,7%
Not Economically Active	54,4%
Total	100

Source: Stats SA (2011: 3)

Concerning income level, 26 percent of the households fall within the R9 601- R19 600 bracket. People with no income stands at 20.5 percent. The average income of the households is very low with almost none of the households reaching one top four income bracket (Statistics South Africa, 2011: 9)

Table 3.4 Poverty levels

None income	20,5%
R1 - R4,800	6,2%
R4,801 - R9,600	10,3%
R9,601 - R19,600	25,4%
R19,601 – R38,200	21,6%
R38,201 – R76,400	8.1,%
R76,401 – R153,800	4,1%
R153,801 +	4.2%

Source: Stats SA (2011: 4)

3.5 Level of service provision

The table below shows the breakdown of service provision such as housing, electricity, refused removal and water.

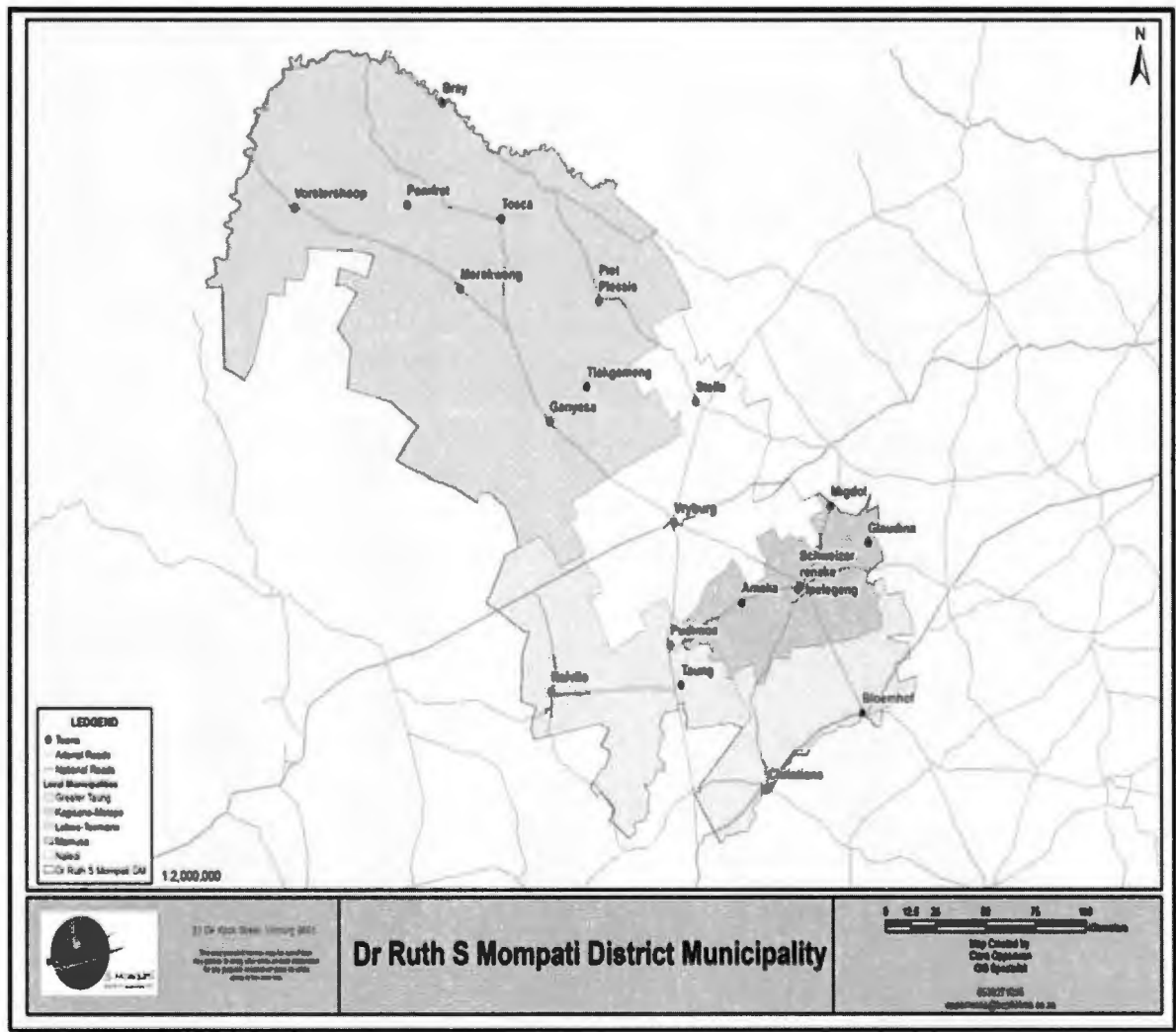
Table 3.5 Service provision

Service	2001	2011
Housing		
• Housing (Formal dwelling)	83,5%	88.5%
• Housing owned/paying off	70,9%	70%
Electricity		
• Lighting	49,4%	88.5%
• Heating	33.4%	40.3%
• Cooking	46.6%	73%
Water (inside dwelling)	5,3%	10%
Water (community stand less than 200m)	27.4%	51.2%
Water (travel between 200 and 500m)	19.4%	18%
Water (travel more than 500m)	11.3%	8.3%
Weekly refuse removal by municipality	5.9%	7.4%
Toilet (connected to sewerage)	7.4%	9%
Toilet (with ventilation)	13.6%	29%
Toilet (without ventilation)	57.7%	49%

Source: Statsa SA (2011: 5)

People living in formal houses in GTLM increased from 83.5 percent in 2001 to 88.5 percent in 2011 census. Access to electricity for cooking increased from 46.6 percent in 2001 to 73 percent in 2011, and for heating 33.4 percent to 40.3 percent. Water inside dwelling improved from 5.3 percent to 10 percent while distance between 200m and 500m from dwelling stands at 19.4 percent and 18 percent respectively. This shows that GTLM is still unable to provide the people with clean water. Only 7.4 percent of refuse are removed by the local municipality once every week (Statistics South Africa, 2011: 11).

Figure 3.1: Dr Ruth Segomotso Mompoti District Municipality



Source: DrRSDM (2013: 9)

3.6 ORGANIZATIONAL STRUCTURE OF TAUNG IRRIGATION SCHEME

3.6.1 Introduction

The Taung Irrigation Scheme was established in 1939 by the South African government as part of the Vaal-Hartz scheme. During the 1970’s, political and administrative independence of the Bantustan or native area was encouraged, resulting in the central government’s withdrawal and homeland administration taking over. This prompted the incorporation of the Taung Scheme into the Bophuthatswana homeland during the independent homeland era which lasted from 1970

until 1990's and was an integral part of the economic development of the homelands (Tekana & Oladele, 2011: 69). Taung irrigation scheme was an effort to expand the welfare of small-scale farmers socially and economically through jobs creation so as to promote rural development in the area. Institutions such as South African Breweries and Cotton South Africa (cotton), Department of Agriculture and Department of Water Affairs and Forestry were brought together for better management of the scheme (Golder Associates, 2004: 35; DoA, 2013: 12).

Small scale farmers are selected by the Taung Traditional Authority (Chief Mankuraone) with the help of the Department of agriculture. In the communities that people live those who were living in abject poverty are identified. When this is done the Department of Agriculture then involve them in farming with the support of an irrigation system. The irrigation system provides Small scale farmers with water throughout the year for cultivation (DoA, 2013: 14).

According to Golder Associates (2004: 25; DoA, 2013: 12), the sustainability of Taung Irrigation Scheme depends on the establishment of appropriate institutional structures which involves the formation of farmers groups (FSU's) and a management committee.

3.6.2 Farmers Support Units (FSU)

Farmers Support Units represent Small scale farmers in five areas of the scheme in the management committee. The Small scale farmers groups are the selection of an appropriate legal entity for the ownership and self-management of the scheme by the farmers (Golder associates, 2004: 28; DoA, 2013: 14).

3.6.3 Management Committee

The scheme is run by a management committee. The management committee manages the scheme in terms of a constitution which has been adopted by all the scheme members and key stakeholders. Management committee comprises of the chairman, Vice-Chair, Secretary, Treasurer and additional members (Golder Associates, 2004: 28; DoA, 2013: 15). The management committee oversees the following:

- To make sure Farmers Support Units (FSU) has a grass-roots representation.
- The FSU must be represented on an umbrella management committee.

- Management committee should have an executive comprises of chairman, vice-chair, secretary and additional members and a number of portfolios of responsibility for the range of scheme management requirement.
- The operation of the elements of the structure must be implemented in terms of a constitution drawn up with full involvement of the farmers and other key stakeholders for this purpose.
- Appointment of a paid manager and administrative assistant for the scheme as soon as the scheme can afford such a support structure. Affordability will in turn be dependent on consistent, profitability crop production and regular payments of a levy from all farmers to their legal entity (DoA, 2013: 14).

However, at present the Taung Irrigation Scheme does not have a Management Committee to formally represent all the farmers. The absence of this has resulted in the farmers not having proper and communicable channels through which they can raise their concerns, needs and problems with the strategic partners. Also, this has led to poor relation with other stakeholders hence poor management of the scheme (Golder associates, 2004: 29; BFAP, 2008: 24; DoA, 2013: 10).

3.6.4 Strategic partners

The scheme is operated as a public-private partnership that involves Small scale farmers, Department of Agriculture, Department of Water affairs and Forestry, traditional authority and South African Breweries (SAB). The pivots of the irrigation project are maintained by the Department of Agriculture, water for the scheme is made available by Department of Water Affairs and Forestry through the Water User Associations. The Traditional Authority provides land for the irrigation scheme. Farmers are responsible for minor repairs and the replacement of electrical cable in the case of cable theft. SAB/SABM provides off-take contracts to the farmers for both the barley and maize, thereby providing the farmers with a secure and stable market in for their produce, as long as they are able to produce acceptable quality of, and quantities of, barley and maize (Golder Associates, 2004: 32 BFAP, 2008: 23; DoA, 2013: 10).

3.7 DESCRIPTION OF SCHEME INFRASTRUCTURE

The Taung Irrigation Scheme forms part of the Vaalhartz Water Users Associations. Taung Irrigation Scheme irrigates 3 698 hectares of land by means of centre pivot, flood and sprinkler irrigation. (DoA, 2013: 17). Three methods of irrigation are practiced at Taung Irrigation Scheme. Centre pivot irrigation is the largest area (2 490) and the gravity fed sprinkler irrigation irrigates 967 hectares. There are also 24 farmers using flood irrigation on 41 hectares. About 412 Small scale farmers are presently working on the scheme (DoA, 2013: 17). However, about 175 individuals farmers were excluded from the irrigation scheme when it was converted in to centre pivot scheme and have been waiting since for restitution if and when the scheme is eventually expanded (Tekana & Oladele, 2011: 70; DWAFF, 2012: 14; DoA, 2013: 17).

Below is the breakdown of areas under irrigation for the diferent systems and the numbers of Small scale farmers involved in each irrigation system.

Table 3.6: Area under irrigation for the three types of irrigation at Taung irrigation scheme

Method of irrigation	Area (ha)	Farmers
Pivot		
52 × 40 ha	2080	208
2 × 30 ha	60	6
16 × 20 ha	320	32
3 × 10 ha	30	3
Sub total pivot irrigation	2490	249
Sprinkler		
Farmers	967	137
Reserch station	20	1
Flood irrigation	41	24
Agrriculture college	180	1
Total	3 698	412

Source: DoA (2013: 14)

The table below illustrates five sections of Taung irrigation scheme, each headed by a Farmer Support Unit (FSU)

Table 3.7: Number of farmers per FSU and irrigation area of 2011

FSU	Water Source	Area under irrigation (ha)	No. of Farmers
Bosele	Dam 1	940	94
Rethuseng	Dam 1	987	138
Tshidiso	Dam 6	560	56
Ipelengeng	Dam 6	391	59
Areageng	Dam 7	640	64
Agric College	Canal	180	1
Total		3 698	412

Source: (Golder associates, 2004: 12; DWAFF, 2012: 15; DoA, 2013: 17)

Taung Irrigation Scheme allows farmers to irrigate two or three crops per year. Variety of crops are grown on the scheme and most often it is rotational (BFAP, 2008: 13; DoA, 2013: 18).

Table 3.8: Crops planted on the scheme and peroid in a year

Crops	Times in a year
Potatoes	Autumn
Groundnuts	Winter
Lucerne	Winter/ Summer
Maize	Summer
Millet	Summer
Onions	Winter
Wheat	Summer
Barley	Winter

Source: (BFAP 2008: 13; DoA, 2013: 17)

Table 3.9 below summarises selected crops in tons and gross income make in Taung irrigation scheme using pivot and sprinkler irrigation systemes. These crops comprises of Lucerne, barley, groundnuts and wheat produced in Taung irrigation scheme in 2012 (DoA, 2013: 10).

Table 3.9: Seleted crops yield and gross income of 2012

Crops	Pivot		Gross income	Sprinkler		Gross income
	t/ha	R/ha		t/ha	R/ha	
Lucerne	21,0	2,617	49,723	18,6	2,248	40,464
Barley	6,8	1,239	7,434	6,2	1,501	7,505
Groundnuts	3,8	1,533	6,132	3,3	1,473	4,419
Wheat	5,6	1,043	6,258	5,5	1,269	7,614
Average long-term margin			2,064			2,065
Total	37,2	6,432	69,673	33,6	6,491	60,002

Source: (DoA, 2013: 10)

Table 3.9 above gives an estimated return for the period of five (5) years. As indicated in the table Lurcerne production is higher than that of other crops. Centre pivot irrigation system yields more production than sprinkler irrigation system.

3.8 TEMPERATURE

Taung normally receives about 322 mm of rain per year, with most rainfall occurring mainly during summer. It receives the lowest rainfall (0mm) in June and the highest (65mm) in February. The midday temperatures for Taung range from 18.7°C in June to 32.5°C in January. The region is the coldest during July when the mercury drops to 0.7°C on average during the

night. Taung as a semi-arid area also experienced occasional hail and frost. The area receives variable rain with scattered thunder storms and flooding. During hot summers there is high evaporation and elevated temperature (Tekana & Oladele, 2011: 70; GTLM, 2011: 5).

3.9 SOIL COMPOSITION

According to DWAFF (2007: 7), the soils are characterised mainly by calcareous types in the central to western parts and eutrophic soils in the northern and north-western parts zone. Glenrosa and Miapah land types dominate the area (comprises approximately 60% of the total area). According to GTLM (2011: 11), soils in Greater Taung Local Municipality are predominantly shallow and rocky with outcrops, however deep red soils also occur in the area. The rocky and shallow outcrop areas are too shallow for irrigation production and are mostly utilises as natural veld. The deep red soils areas are suitable for dry land farming and irrigation purposes. The north-western part of Taung is characterised by red-yellow apedal soils (remaining 40% of the area). According to DWAFF (2007: 7) and DrRSMDM (2013: 8), these types of soil are very sensitive to wind erosion and due to the low erratic rainfall are not cultivated and mostly utilised as natural veld. This implies that the soils are suitable for maize and groundnuts under special cultivation practices and the soils are irrigable where enough water is available.

3.10 SUMMARY

In this chapter the location and description of the socio-economic background of the study area was discussed. Institutional organisation which involved Farmers Support Units and management committee were also outlined to point out how the Taung Irrigation Scheme is arranged and functions to enable sustainability. Equally discussed in this chapter was the composition of Small scale farmers belonging to each irrigation system and the quantity produced on the scheme. The chapter further provided the soil composition and temperature of the study area in order to point out its relevance to farming in the area.

CHAPTER FOUR

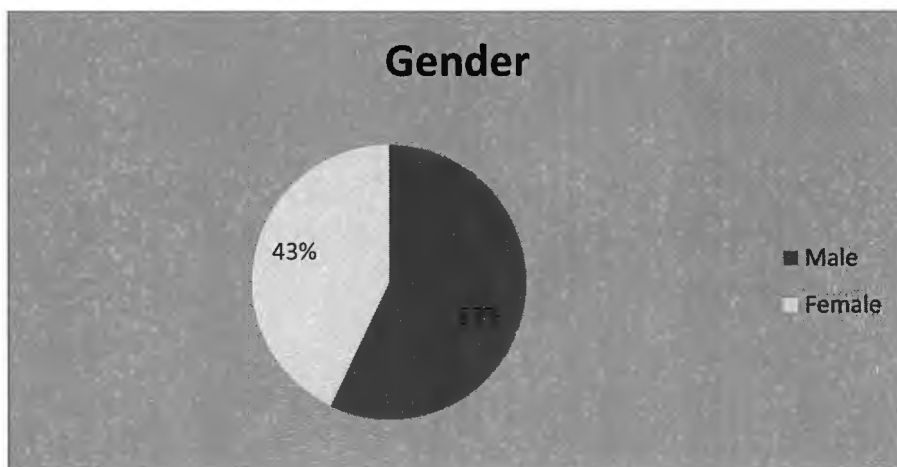
PRESENTATION AND ANALYSIS OF THE RESEARCH FINDINGS

4.1 INTRODUCTION

This chapter presents the results of the problems faced by Small scale farmers in the Taung Irrigation Scheme. The chapter also provides data from other stakeholders such as Irrigation Manager, extension officers, Traditional Authority and development agents from Department of Water Affairs and South African Breweries (SAB) who are part of the irrigation scheme.

4.2 DEMOGRAPHICS OF RESPONDENTS

Figure 4.1: Gender of respondents



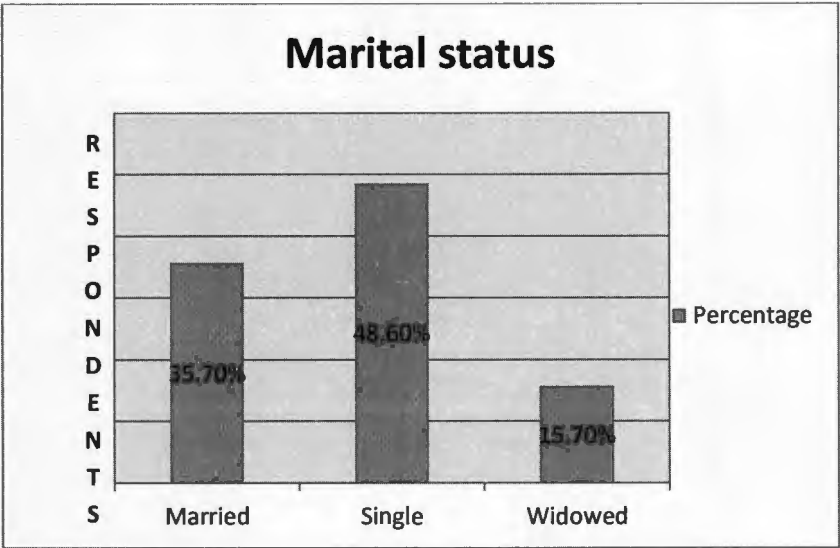
Majority of respondents (57%) are males as compared to females (43%) which reflects that males play key role in the irrigation systems. This is not in line with most studies conducted in irrigation systems in Africa stating that women in rural areas run most small scale irrigation systems (FAO, 2006: 6).

Table 4.1: Age distribution of respondents

Age group	Frequency	Percent
19 - 24 years	1	1.4%
25 – 30 years	1	1.4%
31 -36 years	4	5.7%
37 -42 years	16	22.9%
42+	48	68.6%
Total	70	100%

The information in Table 4.1 shows majority (69%) of respondents who participated for the study fell under the age groups of 42 years or more. It is also interesting to note that Table 4.1 revealed 22% for the age group 37–42 years. On the other side only 8% of respondents are below the 36 years or younger.

Figure 4.2: Marital status of respondents.



Information in Figure 4.2 indicates that 48% of respondents were single (48%). It is interesting to note that 36% are married whilst 16% are widowed.

Table: 4.2: Educational level of respondents

Educational Level	Frequency	Percent
Illiterate	12	17.1%
Literate (Read and Write only)	14	20.0%
Grade 1 - 4	20	28.6%
Grade 5 - 8	11	15.7%
Grade 9 - 12	10	14.3%
Tertiary	3	4.3%
Total	70	100%

The data in Table 4.2, shows that 45% of respondents had completed Grade four (4) and above. Only 14% had completed Grade 9–12. It is interesting to note that four (4%) had obtained tertiary qualification as their highest level of education. On the other hand, 17% did not have any formal education whilst 20% could read and write only.

4.3: Monthly income levels of respondents

Income Level	Frequency	Percent
Less than R800	45	64.3%
R900 - 1600	16	22.9%
R1700 – R2200	3	4.3%
R2200+	6	8.6%
Total	70	100%

Data in Table 4.3 indicates that majority (64%) of respondents earned less than R800 per month. The table further revealed that 23% receive between R900-1600 per month. It is worth to note that four (4%) of respondents obtained R1700-R2200 per month whilst 9% of respondents revealed that they received R2200 and above.

Figure 4.3: Household heads of respondents

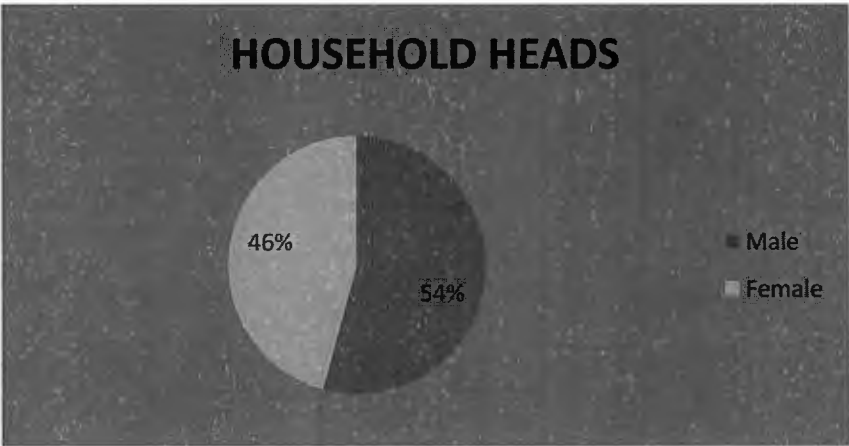


Figure 4.3 indicates that majority (54%) of respondents’ households are headed by males. The figure further revealed that 46% of respondent’s household heads are females.

Table 4.4: Respondents size of household

Size of household	Frequency	Percent
1 - 2	8	11.4%
3 - 4	17	23.7%
5+	45	64.7%
Total	70	100%

Information in Table 4.4 reveals that majority (65%) of respondents’ households consist of more than five (5) people living in it. It further indicates that 24% of respondents’ households had 3–4 people, while household size of respondents with 1-2 people constitute 11%.

4.3 RESPONSES FROM RESPONDENTS

4.3.1 MANAGEMENT OF THE SCHEME IN ORDER TO ENSURE SUSTAINABILITY

Figure 4.4: Respondents role as farmers

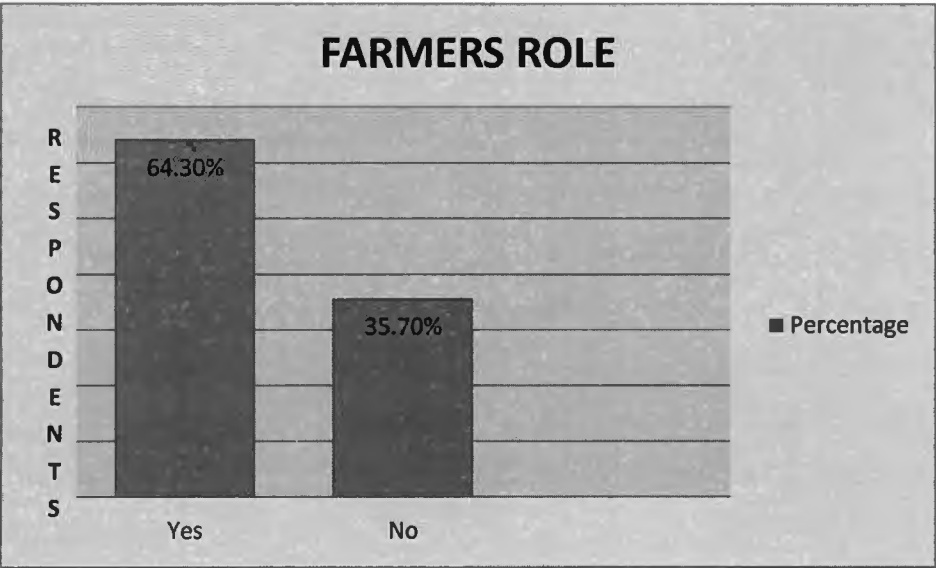


Figure 4.4 above indicates that the majority of respondents (64%) reported that they played a role in the management of the scheme and 36% of respondents indicated that they were not allowed to play any role in the scheme.

During focus group discussion majority of participants indicated that they played a role which includes the following:

- To chase away stray animals that usually destroy food crops;
- To make sure the irrigation scheme infrastructure such as pipes are in good order;
- To give inputs (suggestions) for the way forward of the scheme, and
- Produce quality crops that must meet the contractual requirement of the partnership

Participants indicated that they contributed positively to better management of the scheme, in the sense that, they are allowed by the Department of Agriculture to give inputs concerning their wellbeing. Participants stated that by making sure that the irrigation pipes were in good order to enable the scheme to function properly. This has also enabled them to acquire skills from the scheme leading to self-reliance. However, a small proportion of participants reported that they do

not take part in the management of the scheme. These participants are of the view that they are not allowed by the Department of Agriculture to make decisions that involve them thereby reducing Small scale farmer’s participation on the scheme. One male Small scale farmer aged 37 said that their inputs are not considered during decision making of the scheme; hence this is a major problem plaguing the scheme.

Table 4.5: Other stakeholder role respondents (DOA, DWAFF, SAB and traditional authority)

Stakeholders role	Frequency	Percent
Yes	62	88.6%
No	8	11.4%
Total	70	100%

Table 4.5 above indicates that majority of respondents (89%) agreed that other stakeholders played a positive role in managing the scheme. These roles have enabled the scheme to be functional for the past decades thereby meeting the objectives it was created for. However, 11% of respondents were not of the opinion that other stakeholder’s play any meaningful role in the management of the scheme.

During focus group discussions, participants and other stakeholders (Irrigation Manager and extension officer, development officials, Traditional Authority (Chief Mamkuraone) pointed out the roles performed by other stakeholders. These include the following:

DEPARTMENT OF AGRICULTURE

- Introduce programmes and policies that facilitate food security at Taung Irrigation Scheme and in the surrounding area.
- Provide farm inputs such as seeds, pesticides and fertilizers to Small scale farmers in the scheme.

- Organize training workshops for Small scale farmers in the scheme so as to improve their farming skills.
- Provide machinery such as tractors ploughs and planting equipment, to facilitate production, and
- Provide and arrange financial assistance for Small scale farmers on the scheme.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY

- To make sure that water is available and used efficiently on the irrigation scheme through Water User Associations (WUAs).
- To train small scale farmers on how to use the irrigation system, and
- Provide irrigation infrastructure and equipment for the scheme.

SOUTH AFRICAN BREWERIES (SAB)

- Provide a market for Small scale farmers on the scheme.
- To provide Small scale farmers with farming inputs such as fertilizers, seeds and pesticides.
- Provide off-take contract to Small scale farmers in the scheme.

TRADITIONAL AUTHORITY

- To identify individuals from deprived communities in the Greater Taung Local Municipality in order for them to participate in the irrigation scheme.
- Provide land for the irrigation scheme, and
- To manage conflicts that arise among Small scale farmers in the scheme.

Table 4.6: Other stakeholders (Better management) respondents

Stakeholders (Better management)	Frequency	Percent
Yes	53	75.7%
No	17	24.3%
Total	70	100%

Table 4.6 indicates that majority of respondents (76%) acknowledged that stakeholders' roles played enabled sustainability of the scheme through better management. On the other side 24% of the respondents reported that the roles played by the identified stakeholders did not contribute to better management of the scheme. In fact, the respondents were of the view that the involvement of stakeholders such as South African Breweries presence on the scheme has led to exploitation of Small scale farmers through marketing of their produce.

During Focus group discussion majority of participants indicated that other stakeholders' roles contributed immensely to the better management of the scheme. One of the participant- man aged 42- said the contribution of DoA, DWAFF, SAB and Traditional authority has helped in generating, revealing, and diffusion of technical and institutional knowledge on the scheme. The above indicates that the actor-oriented approach is an important factor in irrigation development.

4.3.2 FOOD SECURITY AND INCOME

Table 4.7: Types of crops respondents

Types of crops	Frequency	Percent
Barley	13	18.6%
Potatoes	3	4.3%
Groundnuts	6	8.6%
Lucerne	45	64.3%
Millet	1	1.4%
Onions	2	2.9%
Total	70	100%

Table 4.7 indicates that majority of respondents (64%) prefer growing Lucerne because it is more profitable than other crops. Fewer proportion produced onions which constitute three percent (3%). Only one (1%) preferred growing millet whilst seven (7%) indicated growing groundnuts. However, (19%) reported that it is important to grow barley since South African Breweries is ready to buy it. The respondents that prefer to grow potatoes constitute four percent (4%).

In the focus group discussion, majority of participant said they were satisfied with the types of crops grown on the scheme. According to the participants, Lucerne is cheaper to grow and yields average high output since the prices are good. The participants went on to explain that they prefer producing barley and Lucerne as there is a ready market for the produce. Growing Lucerne helps in preventing Parasites and diseases which affect crops. Also, cultivating Lucerne enabled them to cover losses of other crops due to fluctuation in prices and climate change. However, some participants reported that growing more than one crop throughout the year is more profitable. Nevertheless, a small number of participant pointed out that there was a guaranteed market for barley and Lucerne in the scheme. The participants indicated that they were not happy as it is used for feeding animals. According to them growing onions, potatoes and groundnuts provide them not only with income but food security.

Figure 4.5: Enough food produce of respondents

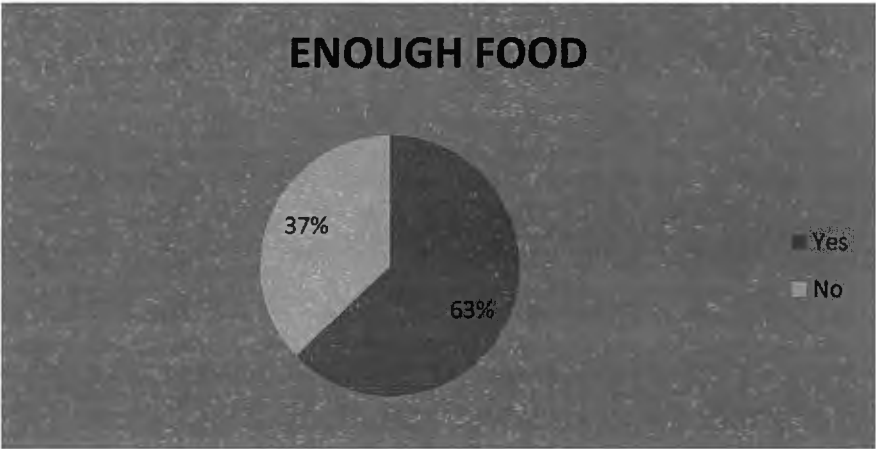


Figure 4.5 show that 63% of respondents indicated that they produce enough food for their household and 37% indicated that they do not produce food for their households.

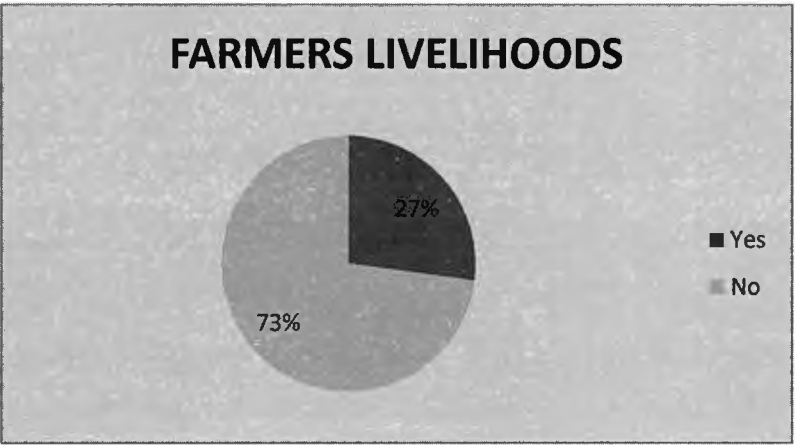
During focus group discussion, majority of participants, the Irrigation Manager, and extension officer, development agent (SAB) and Traditional Authority reported that they managed to produce enough food to support their households. They were able to generate some income after selling some of the food locally. They also explained that some of the food produced is consumed by them for nutritional gain since working on the scheme requires a lot of energy. According to the participants, the scheme has met their expectation by providing them not only with food but also, an income. However, a number of participants indicated that the food produced on the scheme was not enough for their households. They were on the opinion that the cost of inputs such as fertilizers, chemicals, seed, pesticides and lack of proper farming skills hindered food production.

Table 4.8: Make profits respondents

Make profits	Frequency	Percent
Yes	41	58.6%
No	29	41.4%
Total	70	100%

Data in Table 4.8 indicates that 59% of respondents reported that they made profit from selling their produce. However, a small proportion of respondents (41%) indicated that they did not make any profit from the scheme. They were of the opinion that the levy paid on electricity and water is too high for them thus making it impossible for them to make any profit.

Figure 4.6: Contribution to farmer’s livelihoods respondents



Information in figure 4.6 indicates that majority of respondents (73%) reported that participating in Taung irrigation has not improved their livelihoods as compared to 27% who reported that their livelihoods have improved.

During focus group discussion, majority of participants, Irrigation Manager and extension officer and development agents stated why their livelihood had not improved. They said the lack of capital such as finance and machinery (tractors) prevents them from carrying out food production in large quantity. The lack of finance made it difficult for them to hire labour to increase

production. Furthermore, the high presence of contract farmers (Europeans farmers) in the scheme reduced the livelihoods of the small scale farmer. This contract farmers cajoled Small scale farmer's to lease or rent their land by giving them a minimal amount of money (R10 000) for the whole planting season.

Also, the high cost of inputs and levy paid for tractors used in cultivating plots of land constituted another factor reducing Small scale farmer's livelihoods. It is important to note the above is the reason for high dependence on social grants such as, old aged pension, disability grant, child support and care dependency grant in Taung. According to, participants, state grants provide them with steady income which enables them to improve their livelihoods.

Table 4.9: Food shortages respondents

Food shortages	Frequency	Percent
Yes	50	71.4%
No	20	28.6%
Total	70	100%

Data in Table 4.9 indicates that majority of respondents 71% reported that they have experienced food shortages in their households. Only 29% of the respondents indicated that they have never experienced food shortages on the scheme.

During focus group discussion majority of participants with Irrigation Manager and extension officer (DoA), development agents (DWAFF and SAB) and the Traditional Authority inclusive stated why Small scale farmers experience food shortages in their households. They reported that winter prevents them from carrying out food production. During winter only few crops such as groundnuts are grown. They further reported that due to the cold weather, they are forced to abandon production because they tend to fall sick. As a result the average yield during winter is very low. They also indicated that the contractual agreement between Small scale farmers and South African Breweries is causing food shortages in households.

4.3.3 PROBLEMS FACING SMALL SCALE FARMERS ON THE SCHEME

Figure 4.7: Types of credits respondents

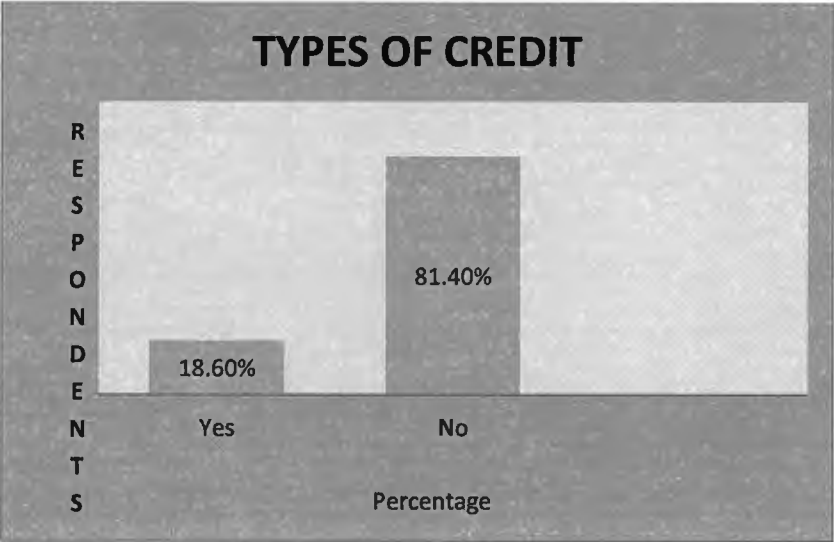


Figure 4.7 indicates that majority of respondents (81%) have not received any financial support to enable them to increase food production. Only 19% of the respondents reported they received credits from an institution in the forms of seeds, fertilizers, chemicals and pesticides from South African Brewery to ease food production.

Table 4.10: Major problems encountered

Problems encountered	Frequency	Percent
Institutional structure (Management and organization) of the scheme	16	22.9%
Marketing	19	27.1%
Lack of capital	18	25.7%
Theft of crops	5	7.1%
Transport	5	7.1%
Water pricing	7	10.0%
Total	70	100%

Major problems highlighted facing the Taung Irrigation Scheme include lack of capital, institutional structure, water pricing, marketing, transport and theft of crops. From Table 4.10, 27% of the respondents indicated they have problem marketing their produce. According to the respondents only one buyer (White commercial farmer) was allowed to purchase their produce and sell to neighboring countries. This buyer was arranged by the Department of Agriculture and South African Brewery. The buyer pays a minimal amount for their produce and this affects their income level negatively.

About 23% of respondents reported that they had problems with the institutional structure, that is, the organisation and management of the scheme. Respondents complained that they were never part of the decision making body of the scheme. The Farmers Support Unit that was supposed to represent small scale farmers at the management committee is non-existent. According to respondents, the above have made them to resort to vandalizing the office of the scheme in order for the Department of Agriculture to meet their demand.

About 26% of respondents reported that they had a problem in securing capital to buy inputs such as fertilizers, seeds, pesticides. This has made Small scale farmers to use unspecified organic fertilizers or just plant without resulting to low productivity. It is important to note that seven (7%) of respondents complained that theft of their crops was another problem plaguing the scheme. This compelled the Department of Agriculture to contract Expanded Public Work Programme to fence the irrigation scheme so as to reduce theft of crops. Respondents who constitute 10% indicated that the price of water charged by Department of Water Affairs and Forestry (Water User Associations) was too high. Small scale farmers were supposed to be charged in accordance with the number of plots they owned, instead they were charged at a higher rate (R154 per hectares for a year). This has contributed towards accumulating large amount of debts. As a result, Small scale farmers were forced to temporarily abandoned cultivation of their plots and instead resorted to increasingly leasing or renting their plots of land.

Only seven (7%) of the respondents indicated that transportation was a major problems. They said the scheme did not have available vehicles to transport their produce to the market, since they were the people taking their produce to the market. Coupled with the above, roads leading

to farms are inaccessible. Respondents explained that due to the above challenges their livelihoods are not improving since they do not make enough profits from the scheme. As a result they are getting poorer thus hindering development in Taung area. In addition, other problems, such as poor fencing, winter, contract farmers (European farmers), absence of title deeds and ownerships of land by farmers, extension officers low level of education, levy paid on electricity and tractors, the constant changing of Ministry (MEC) and lack of proper sanitation (Clean water and sewerage) to farm houses were reported during focus group discussion and content analysis from the other stakeholders (Irrigation Manager and extension officer, development agents and Traditional Authority).

4.9 SUMMARY

The chapter outlined the findings of demographics and respondents' views in the study during data analysis. This chapter further discussed the findings of the study in response to the main objective of the study which was to investigate the challenges encountered by the Taung Irrigation Scheme. It also discussed how these challenges are affecting Small scale farmers' livelihoods and food security in the area. Respondents and participants acknowledged that they played a role in the Taung Irrigation Scheme given to them by the Department of Agriculture to enable the scheme to be sustainable. However, in spite the fact that the scheme has facilitated enough food to be produced in some Small scale farmers households, nevertheless, it has not improved the livelihoods of Small scale farmers due to challenges such as lack of market, capital, transport, theft of crops, poor fencing, winter, European contract farmers, low level of education among extension officers and water pricing that the scheme is facing.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter summarises the findings of the study and also provides a conclusion and recommendations based on the objectives of the study.

5.2 SUMMARY OF FINDINGS

The following were cited as challenges facing Small scale farmers in Taung Irrigation Scheme.

5.2.1 Marketing

As illustrated in Table 4.10, majority of the Small scale farmers (27%) indicated that marketing was a major challenge hindering production in the scheme. Small scale farmers do not have the freedom to market their produce and as a result they sell their produce at a very low rate. They also reported that lack of proper market information is another major factor plaguing Small scale farmers in the scheme. The lack of market and information has hampered their livelihoods in the scheme since they are unable to exploit other options of markets. The above statement is confirmed in Figure 4.6 where majority (73%) of Small scale farmers reported that their livelihood has not improved since using the scheme due to challenges such as marketing. The issue of marketing and information problem is a very serious threat to Small scale farmers in generating income from the Taung Irrigation Scheme. This in line with studies conducted by Kundlande *et al.* (1994: 102) which indicate that in Mutare, Manicaland Province in Zimbabwe, only hotels and schools were targeted as markets for irrigation farmers. Woldeab (2003: 71) also corroborates with the statement and points out that, market information is limited to small scale farmers involved in irrigation system in North of Ethiopia and this has hampered marketing of their agricultural products.

5.2.2 Institutional structure

Institutional structure (organisation and management) is seen as the best platform to improve communication among farmers and other stakeholders involved in irrigation schemes in general and South Africa in particular in order to ensure sustainability. However, this was a major

challenge plaguing the scheme. As indicated in Table 4.10 majority (23%) of Small scale farmers reported that they had problems with the institutional structure. Small scale farmers complained that they are never part of the decision making body of the scheme hence their opinion regarding of the scheme is not considered. This has led to poor contractual agreement between the Small scale farmers, Department of Agriculture and South Africa Brewery due to lack of proper communication channels. This assertion is confirmed in Table 4.9 where 71% of Small scale farmers reported that they experienced food shortages in their households due to contractual agreement with South Africa Brewery. This has made many households in Taung to be food insecure. According to FAO (2001: 15) where the issues of organization and management of irrigation are not well considered problems may arise in such areas as, (i) existence of indefinite regulations or instructions about the share of responsibilities, (ii) lack of coordination between different work groups, (iii) absence of common meeting point for discussion and setting difference.

5.2.3 Lack of capital

As illustrated in table 4.10, majority of the Small scale farmers (26%) reported that they had problem securing capital such as finance to ease production in the scheme. Coupled with the above, Figure 4.7 indicated that majority of Small scale farmers (81%) reported that they were unable to receive any financial support from any institution. This is a serious threat to the Small scale farmers in the scheme since finance is needed to pay for water and also to buy farm inputs like chemicals, pesticides, tractors and fertilisers to ease production. This has compromised food security and livelihoods in Taung. The above explains the reason for the high food price in Taung in particular and South Africa in general. According to Machete *et al.* (2004: 23) one of the most critical problems threatening the viability of smallholder irrigation is the absence of credit. Access to financial, physical and natural capital leads to sustainability of an irrigation project. Farmers need chemicals, seeds, fertilizers and, in certain instances, irrigation pipes and sprinklers to facilitates production. Most irrigation farmers do not have the finance to purchase agricultural implements due to the absence of credit from financial institutions and as a result of this farmers are forced to do away with such important inputs which negatively affect the quality of their crops.

5.2.4 Water pricing

Water is seen as an important factor in facilitating farming in semi and arid region like the case of Taung. Water enables crop production to be carried out throughout the year to avoid food insecurity. However, water pricing is seen as a challenge facing most irrigation farming in the world, South Africa and Taung Irrigation Scheme in particular. As illustrated in Table 4.10, Small scale farmers (10%) reported that the high rate of water charged by the Department of Water Affairs and Forestry through Water User Association hindered food security and livelihoods in the area. As a result of the high water rate charged, Small scale farmers have accumulated large amount of debts in the scheme. According to (Han & Zheng 2004: 2), water pricing hike methods have threatened the viability and sustainability of irrigation projects in China. This has made some irrigation schemes in China to collapse thus causing food insecurity in the area. de Fraiture & Perry (2002: 2) concur and point out that increase in water prices for irrigation reduces farmers' incomes, especially those whose income largely comes from crops.

5.2.5 Transportation

As illustrated in Table 4.10, Small scale farmers (7%) reported lack of transport facilities such as vehicles to take their produce to the market and poor roads leading to farms were another problem plaguing Small scale farmers on the scheme. In addition, Small scale farmers were responsible for taking their products to the buyer or market. This tends to disadvantage Small scale farmers to take produce of high quality to the market. As a result any profit made from the scheme is low thereby reducing Small scale farmer income and food security hence livelihoods. According to Wodeab (2003: 79), at the local level in Ethiopia, for example, in the rural areas of the AoI, product flow is more difficult as roads connecting remotely situated Small scale irrigation farmers to different markets are often unpaved and transport services are scarce. Rural areas often have gravel roads which are long and winding, some poorly maintained and inaccessible to farms and/or market.

5.2.6 Theft of crops

As Table 4.10 indicated seven percent (7%) of Small scale farmers reported that theft of farm crops had been a threat to the survival of the scheme as this reduces productivity. Due to poor fencing and the absence of an organised security system in the scheme, thieves are able to find

their way to the farms not just stealing crops but parts of the irrigation systems. This has resulted in continued poverty and food insecurity in households in the area. High rate of theft can lead to dysfunctioning or collapse of irrigation systems if not properly handled. According to Chazovachii (2012: 221), irrigation farms are targeted by thieves who do not just steal crops or parts of the fence but occasionally raid the place for the crops and this tends to draw back irrigation farming.

In addition, content analysis from Irrigation Manager and extension officer (DoA), Development Agents (DWAFF and SAB), Traditional Authority (Chief Mankuraone) and focus group participants indicates other factors as a challenge facing Small scale farmers in the scheme. Majority of the Small scale farmers do not have proper sanitation (Clean water and sewerage) to their farm houses. The absence of proper sanitation has resulted in diseases and many deaths in the area. The other reason cited was the high presence of European contract farmers who cajoled Small scale farmers to lease or rent their plot of land to them giving them R10 000 for the whole planting season. The appointment of extension officers with low level education and training was another problem facing the scheme. As a result of this, extension officers lack the knowledge of irrigation development. Lack of title deeds and ownership of land by Small scale farmers was another reason plaguing Small scale farmers in the scheme. This has made the farmers to be afraid to increase production due to doubt and suspicion. Another problem is the continuous changing of Ministry (MEC) which affects the effectiveness of the Taung Irrigation Scheme. This is because legal policy put in place to improve the effectiveness of the scheme is often disrupted. The last major issue raised is the absence of proper fencing of the scheme, levy paid on electricity which is too high and the sprinkler irrigation system used on the farms. Sprinkler irrigation system is difficult to use and requires huge labour. Winter was cited as another challenge plaguing the scheme.

The suggested solutions provided by the Irrigation Manager and extension officer, Development Agents and Traditional Authority to address the challenges facing the scheme include: Greater Taung Local Municipality should be part of the scheme as this will enable them to provide farm houses with clean water and sewerage. Also, the Department of Agriculture should not encourage or support contract European farmers on the scheme as this will reduce exploitation of

Small scale farmers. The other partners (DoA, DWAFF, SAB and Traditional Authority) should assist the Small scale farmers with fencing and a well-organized security systems to prevent thieves and animals from invading the farms. Taung Agricultural College must be involved to assist extension officers with training and education in irrigation schemes development. To appoint an MEC who has the interest of the scheme at heart will lead to sustainability. More importantly, the Department of Agriculture should replace the sprinkler irrigation system used on farms to that of Musharraf irrigation mega Dam system. Musharraf mega dam irrigation system was seen as the best method of irrigation since it is easier to use and requires less labour.

5.3 CONCLUSION

Taung Irrigation Scheme was a mechanism introduced to improve the lives of the people in Taung through income, job creation and most specifically to provide food security and livelihoods in Taung. Stakeholders like South Africa Brewery, Department of Water Affairs and Forestry and Traditional Authority are all part of the scheme. Small scale farmers and other stakeholders all play a role in the scheme which has enabled the scheme to be sustainable using actor-oriented approach as an important factor to ensure irrigation sustainability (Long, 2001: 240-241). The scheme enabled some Small scale farmers to produce more food which has helped in improving household nutritional levels. The scheme has also enabled Small scale farmers to make profit. Some Small scale farmers are able to acquire assets such as livestock and farming tools with profit made from the scheme although limited. However, the profit made has not been able to address food security and livelihoods among Small scale farmers in Taung due to challenges. These challenges include; lack of proper markets, institutional problems, lack of capital such as finance to purchase inputs, low level of education of extension officers, high presence of European contract farmers, high water rate charged, transport and theft of crops which hindered production to be done on a large scale.

Some recommendations were made to help address the challenges that the scheme is facing. Cooperatives should be established by Small scale farmers as this will enable them to solve the problem of institutional organisation of the scheme. Cooperative establishment will also enable Small scale farmers to have access to markets and even capital. The Department of Agriculture and GTLM should ensure that there are good roads and cheap transport to enable Small scale

farmers to take their produce to the market. Subsidization of water by DWAF (WUA) will help solve the problem of water pricing. Greater Taung Local Municipality should be part of the scheme and they must understand that it is their responsibility to provide farm houses with clean water and sewerage. It is also recommended that further research should be conducted on challenges facing Taung irrigation scheme and other irrigation schemes in South Africa as this will provide a way forward for irrigation development in the country.

5.4 RECOMMENDATIONS

The following recommendations are based on the finding of this study. It is anticipated that these recommendations may be used as guidelines for the government (Department of Agriculture) and other stakeholders involved in irrigation development to mitigate the challenges facing Small scale farmers in the Taung Irrigation Scheme in particular and South Africa at large.

5.4.1 Marketing support

From this study, it is evident that small scale farmers are struggling to market their produce. Therefore, the study recommends that the Department of Agriculture and Rural Development and the municipality must assist Small scale farmers in marketing their produce. This can be done by holding market fairs and agricultural trade exhibitions. Also they can assist Small scale farmers by using media platforms to advertise their produce. The one buyer system of marketing introduced by the Department of Agriculture and South Africa Brewery must be addressed so that Small scale farmers would be able to market their produce with freedom. With access to market information, the Department of Agriculture, South Africa Brewery, private and governmental organizations must constantly supply market information to Small scale farmers. Department of Agriculture and GTLM must organise workshops to educate the farmers on how to use the market information. Also Small scale farmers must establish cooperatives as this will enable them to acquire power to influence the market

5.4.2 Institutional structure

Institutional structure plays a very vital role for the success or failure of any irrigation system. Without a good institutional structure in an irrigation scheme, the failure of the scheme is high. The study revealed that institutional structure was a problem plaguing Taung Irrigation Scheme

leading to discontent between Small scale Farmers and the Department of Agriculture. The study therefore, recommends that Small scale farmers must establish cooperatives to enable them to have more powers to influence the decision making process of the scheme. Also cooperatives would enable Small scale farmers to afford legal representatives to negotiate contractual agreement between South Brewery, Department of Agriculture and Small scale farmers to avoid being exploited. Secondly, Small scale farmers and other partners (DoA, DWAFF, SAB, Traditional Authority) should form a Management Committee with Small scale farmers having a better representation. Formation of Management Committee will provide a smooth platform for communication among the members of the scheme. Lastly, Small scale farmers' inputs concerning the scheme should be highly considered since this is their project.

5.4.3 Capital support

The study shows that capital was a serious challenge facing Small scale farmers in Taung Irrigation Scheme. In this regard, it is recommended that community based bank must be introduced to meet the financial needs of the Small scale farmers in the scheme. The North West Provincial Government through the bank must provide capital in the form of inputs such as fertilisers, seeds, chemicals and pesticides up to 60 percent then the community can provide the rest. The rate of percentage of lending money must be below the cost of operation of the scheme. Secondly, cooperatives must be established by the Small scale farmers as this would enable them to obtain loans from banks involved in agricultural development since they would be able to pull their resources together. Thirdly, the Department of Agriculture must organise workshop to educate Small scale farmers on how to acquire loans from banks and the importance of repaying the loans. Lastly, the Department of Agriculture must encourage banks involved in agricultural development to assist farmers in the irrigation scheme.

5.4.4 Transport support

Transportation of produce to the market is seen as another challenge facing Small scale farmers in Taung Irrigation Scheme. It is recommended in this study that the government (Department of Agriculture) and other partners SAB, DWAFF and Traditional Authority involved in Taung Irrigation Scheme must assist the Small scale farmers with cheaper transport. Also, the Department of Agriculture and South Africa Brewery must encourage the commercial buyer to

make transport available to Small scale farmers. Most importantly the Greater Taung Local Municipality should be part of the scheme and must assist the Small scale farmers with roads leading to the farms since this is the responsibility of the municipality.

5.4.5 Water pricing

Water plays an important role in promoting agriculture development. However, water pricing is a challenge facing Small scale farmers in the scheme. This study recommends that the Department of Water Affairs and Forestry through Water User Association must subsidise the use of water in the scheme as this will help reduce water debts owed by the Small scale farmers. Subsidization of water will help expand production and will also enable the Small scale farmers to be self-reliant. Furthermore, Small scale farmers must be charged in accordance with the cubic litres of water used in the scheme rather than hectares of land owned.

5.4.6 Theft of crops

Theft of crops and parts of the scheme infrastructure is a challenge plaguing Small scale farmers in the scheme. The study therefore, recommends that a well-fenced project must be introduced by those involved on the scheme (DoA, DWAFF, SAB, Traditional Authority). Furthermore, a self-managed and sustainable security system must also be introduced as this will not only minimise theft of crops but also stray animals invading the farms.

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