Training needs Analysis of women in Irrigation Farming in the North West Province, South Africa

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DECLARATION

I, Seleke Christopher Tshwene hereby declare that the thesis titled "Training Needs Analysis of Women in Irrigation Farming in the North West Province, South Africa" submitted for the fulfilment of the requirements for the degree of Doctor of Philosophy in Agricultural Extension in the Faculty of Natural and Agricultural Sciences, School of Agricultural Sciences is my own work. I further declare that this thesis has not been previously submitted to any institution or any other University in partial or entirely for the award of any degree and that, as required by rules and conduct, I have fully acknowledged all material and results that are not original in this work. All the information in this document has been obtained and presented in line with academic rules and ethical conduct.

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Date: .....

DEDICATION

This thesis is dedicated to the Almighty God, the author, creator, maker, redeemer and sustainer of my life. He indeed is the source of all wisdom and sovereign God over all. I dedicate this study to my mother, Ms Gladys Tshwene, my brothers, Keorapetse and Modise, my sister, Martha and her husband, Leonard Dikhudu as well as my mother in-law, Mrs Rose Pilane. A special dedication goes to my late grandparents, Mr Christopher and Mrs Goitsemodimo Molosiwa as well as my late father in-law, Mr Sello Pilane. I hope my studies make you even more proud of me!

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LIST OF ACRONYMS

AOAD: Arab Organization for Agricultural Development

C: Competent

DACERD: Department of Agriculture, Conservation, Environment and Rural Development

DAFF: Department of Agriculture, Forestry, and Fisheries

DS: Discrepancy Score

FAO: Food Agriculture Organisation

FGDs: Focus Group Discussions

GFRAS: Global Forum for Rural Advisory Services

GTLM*:* Greater Taung Local Municipality

I: Important

IATE: International Association for Tourism Economics

ICT: Information Communication Technologies

IFPRI: International Food Policy Research Institute

IPM: Integrated Pest Management

LGA: Local Government Area

MDG: Millennium Development Goals

MWDS: Mean Weight Discrepancy Score

NC: Not Competent

NGO: Non-Governmental Organisation

NI: Not-Important

NWPG North West Provincial Government

OECD: Organisation for Economic Co-operation and Development

OLS: Ordinary Least Square

PADEE: Project for Agricultural Development and Economic Empowerment

READ: Rural Environment and Agricultural Development

RESIS Revitalization of Smallholder Irrigation Schemes

SACAU: Statement by the Southern African Confederation of Agricultural Unions

SA: South Africa

SD: Standard Deviation

SSA: South of the Sahara

SPSS: Statistical Package for Social Science

TCRA: Tanzania Communications Regulatory Authority

TNA: Training Needs Analysis

UN: United Nations

UNEP: United Nations Environment Programme

UNDP: United Nations Development Programme

UNICEF: United Nations International Children's Emergency Fund

VC: Very-Competent

VI: Very-Important

WDS: Weight Discrepancy Score

WRC: Water Research Commission

WS: Weight score

WUA: Water User Association

$\bar{x}$: Mean

ABSTRACT

Training is one of the requirements that lead to productivity in farming. Gaining of skills and knowledge of farming activities enhances developments and adoption of innovations. This study examines the training needs of women in irrigation farming in the districts of Ngaka Modiri Molema and Dr Ruth Segomotsi Mompati, North West Province, South Africa. The target group was female farmers involved in irrigation farming and those who farm within the range of the irrigation scheme. A purposive stratified random sampling method was used to select a sample of the respondents. A sample of 83 female farmers was selected to obtain a representative sample from participating farmers. A semi structured questionnaire with open and closed-ended questions was used to collect socio-economic information, competence and important training needs from farmers. Data was analysed using the Statistical Package for the Social Sciences (SPSS).

Descriptive statistics such as frequency distribution, percentages, mean and standard deviation were used to describe demographic characteristics of farmers. Linear multiple regression analysis was used to determine the relationship between eighteen socio-economic characteristics and competency. The main objective of the study was to analyse the training needs among women involved in irrigation farming in the North West Province. The irrigation sites were selected for this study due to the functionality of the schemes and high concentration of women farmers. Data were obtained from a primary survey of women farmers involved in irrigation farming. In this study, a questionnaire with open and close-ended items was used; a focus group discussions and cross-sectional survey were also employed.

A stratified random sampling method was employed, using a Raosoft's sample size calculator with a confidence interval of 95% and 5% error; accordingly, 83 women were selected from the 120 women from the total population involved in the scheme. The result revealed that the majority of women (62.7%) are above 50 years of age. The result also revealed that a greater

proportion (42.2%) of farmers in the schemes were married. It was further indicated that 34.9% of respondents interviewed had a primary school education, 24.1% had high school education, and 10.8% had no formal schooling while only 2.4% had college and tertiary education. Furthermore, the majority of women in the irrigation schemes (44.6%) indicated that they have more than 30 years in irrigation scheme. This clearly suggests that most farmers have been working on the irrigation schemes for a long period.

The result revealed that all 10 tasks had a mean score less than 2 indicating that respondents are not competent in pre and post planting tasks identified. The perceived level of competence of women on irrigation management was all below the cut-off point of 2, indicating a low level of competency. When it came to the marketing tasks, respondents were found to be incompetent in all nine farming tasks identified. The importance of the farming task, high importance of irrigation management, and the importance of marketing tasks were found to be 2, indicating a high importance as a mean of 2 and greater denoted high importance of the farming tasks. It was then recommended, based on the findings of the study that the government of the day should also introduce training courses and facilities especially related to marketing and irrigation, as all the respondents from both focus groups indicated that that was the main challenge they face.

Keywords: Competence level, Irrigation farming, Irrigation importance, Livelihood enterprise

CHAPTER ONE

INTRODUCTION

1.0 Background study

In South Africa, the term 'smallholder irrigation scheme' is commonly used to refer to irrigation schemes in which the land is held by Black people (Machete *et al.*, 2004). According to Vander Stoep (2011), smallholder irrigation schemes are of secondary importance in terms of land area and farmers' contribution. In 2010, smallholder irrigation schemes covered 47 667 hectares compared to the 1 675 822 hectares of registered irrigation land in 2008, with 1 399 221 hectares irrigated per annum.

The importance of smallholder irrigation schemes arises primarily from their location in former homelands, which continues to be poverty nodes (Vink & Van Rooyen, 2009). Irrigated farming in such areas has the capacity to contribute positively to food security and income of the participating homesteads (Bembridge, 2000). Black irrigators farmed on about 100 000 hectares and half of this irrigated area was located in smallholder irrigation schemes (Bembridge, 1997) as part of their residential sites. International Food Policy and Research Institute (IFPRI) (2017) states that 5% of cultivated land in Africa, South of the Sahara (SSA) is irrigated and high proportion of labour supply for agriculture in Africa are from women in farming households.

The importance of the role of women farmers in agricultural production is constructed on their contribution to household's food security. In most developing countries, women are leading in the agricultural labour force supply ranging from 30-60% (Food and Agricultural Organization (FAO), 2011). Most societies outline women according to their roles and capability to look after their families and raise children. According to FAO (2011), in developing countries, there

are about 43% of women working in agriculture, however they face more challenges in agriculture than men with very low access to resources and opportunities for production resources (FAO, 2011). Access to productive resources such as land, modern inputs, technology, education and financial services is a critical determinant of agricultural productivity.

Women have low entree to agricultural inputs such as land, knowledge, fertilizers and better-quality seeds as equalled to men (Sheahan and Barrett, 2014). According to FAO (2011), women have less training and less access to education, which makes it even more difficult to gain access and use some of the resources. Women are farmers and entrepreneurs but most of the time, they face greater challenges than men in accessing productive resources, markets and services. Furthermore, women are less likely than men to own land or livestock, adopt new technologies, use credit or other financial services, or receive education or extension advice. In some cases, women within agricultural households do not even control the use of their own time.

The disparity in access and control of productive resources among men and women farmers is often referred to in development parlance as the 'gender gap'. The gender gap in terms of assets and access to extension services affects the enhancement of women and minimises their likelihoods of reaching higher targets that may contribute undoubtedly in the agricultural sector. This gap hinders optimum productivity and overall contribution of women to the sector (FAO, 2011). While the size of the gender gap differs according to resources and location, the underlying causes for the gender asset gap are repeated across regions as social norms systematically limit the options available to women.

Regardless of the cause or magnitude, the gender asset gap reduces the agricultural productivity of women and thus, involves broader economic and social costs (FAO, 2010). If this gap is closed, more produce would be supplied to the market and livelihoods of women farmers would be secured. Yields would increase by 20-30% if this gap is addressed, reducing numbers of the hungry in developing countries by 12-17% (FAO, 2011). In South Africa, the agriculture industry contributes 2.2% to the gross domestic product (GDP) and 5.2% to employment. The agriculture population consists of 12% male and 11% female-headed agricultural households. Furthermore, households involved in agriculture also tend to have limited access to basic services compared to the rest of the population (STAT SA, 2013).

A major approach to reducing and eliminating the gender gap has been through the development of human capital (through provision of training). Training plays a pivotal role in the advancement of human performance in a given situation. Training provides a systematic improvement of knowledge and skills, which in turn, helps trainees to function effectively and in their given tasks on completion of the training. It is further regarded as a process of acquisition of new skills, attitude and knowledge within the context of preparing an individual for entry into one's productivity in an organisation or enterprise. According to Lyton and Pareek (1990), training comprises of well-organised opportunities for farmers as participants to acquire necessary skills and understanding. Training of farmers is directed towards improving their job efficiency in farming. The type of training offered to farmers is education that is, more often, outside formal learning institutions. It differs from the one in schools because it is directed towards adult learning. Knowles *et al*. (2005) and Barbarzett (2006) state that the approach to adult learning is mainly through the route of situation but not of subject and that for training to be conducted successfully, the trainer must determine who, what, where and what training should be done.

Training needs assessment is one of the crucial steps towards identifying the area of farmers' interest and development of curriculum that can best suit the existing and real condition of farmers. It is regarded as a process that assists in determining the priority of changes in knowledge, attitude and behaviour of that will provide positive results in achieving famers' goals. Most successful farmers, whether in small or large-scale farming enterprises, depend on their skills which makes them farm entrepreneurs. According to Eskola and Gasperini (2010), skill development is crucial in improving rural productivity, income earning opportunities, money making schemes, enhancing food security, promoting environmental awareness and promoting sustainable rural development as well as livelihoods. Training needs analysis for women on irrigation schemes underscores the need for sustainable water management.

1.1 Problem statement

CTA (1993), identified absence of training as part of the factors contributing to low women farmers' efficiency and effectiveness. The need to fortify the intellectual competencies of women in their enterprises is important so as to expand their capacities to contribute to household and national development with a purview that such mediation should be based on knowledge of the situation to be meaningful. The Organisation for Economic Co-operation and Development (OECD) (2001) argues that farming systems become more prolific and beneficial when human capital increases, particularly in the form of capacitating farmers to inventions and to adapt their farming systems. Inadequate information towards farmers and the necessary skills to manage diverse farming systems could be a major hurdle towards acceptance of technology in farming (Pretty and Ward, 2001).

Fruitful and result-oriented farming requires satisfactory skills and knowledge, which can only be accomplished through suitable training. The realisation of training need shows that there is lack of something, which if present would make a better condition to individuals or group of individuals. The gap between how the job is being done currently and how it should be performed highlights the need for training. The World Bank (1992) reported that training and diffusion of information to women farmers as critical input for the modernizing of farm production and home management in rural areas

The United Nations International Children's Emergency Fund (UNICEF) (2015) mentions that training farmers for growth is one of the several activities that need to be carried out to sustain production of food and to enhance self-sufficiency in food production in the developing world. Training is commonly directed at refining the ability of an individual to perform more effectively and efficiently. It encompasses securing information and developing capabilities or attitudes, which will result in greater competence in the performance of a work). Nischithaa and Rao Narasimha, (2014) emphasised that the contributions of training to agricultural development is in providing farmers with the basic skills, improving rationality and increasing desire for knowledge and thereby improving receptivity for new ideas, opportunities and methods and changing values and aspirations and strengthening the willingness to economize and facilitate the adoption of new techniques.

Training plays an important role in the advancement of human performance in a given situation. Training provides a methodical development of knowledge and skills which in turn helps the trainees to function effectively and efficiently in their given task on completion of the training. It is a process of acquisition of new skills, attitude and knowledge in the context of preparing for entry into a vocation or improving one's productivity in an organization or enterprise. Effective training entails a clear representation of how the trainees will need to use information

they benefitted from training in place of local practices and what they had adopted before in their situation.

Training has been defined as skill, knowledge and attitude an individual requires in order to overcome problem Owona *et al*. (2015); and training need as difference between what is and what ought to be, which exist anytime an actual condition differs from a desirable condition in the human or people aspect of organizational performances or more specifically when a change in present knowledge, skill and attitude can bring out the desired performance (Ajibola & Onwu 2017). Very few literatures exist if any specifically on the competency level of women farmers involved in irrigation farming in North West Province, this study aims at filling this gap. There have been various degrees of support given to smallholder women farmers on irrigation schemes in the pre and post-apartheid periods in the North West Province by South African governments; however, women farmers still require training to optimise the support effectively. Identification of training needs of the women farmers in irrigation farming is a crucial element in actualising the potentials of women farmers to harness the irrigation resources to enhancing household food security. The needs assessment for training is the basis for extension process and its activities. All interventions that do not take these needs into consideration tend to be wasting valuable resources. This study attempts to provide adequate answers to the following questions:

1.2 Research questions

The study was guided by the following research questions:

i. What are the demographic characteristics of women involved in irrigation farming?
ii. What are the training needs required by women in irrigation farming?
iii. What is the competence level of skills of women farmers?
iv. What is the importance associated with required skills for livelihood enterprises?

1.3 Aim and objectives of the study

The aim of the study was to establish was to analyse the training needs among women involved in irrigation farming in the North West Province.

1.4 Specific objectives

The specific objectives were to:

i. Determine the demographic profiles of women on irrigation schemes;
ii. Determine the training needs of women involved in irrigation farming;
iii. Assess the competence level of skills for women involved in irrigation farming; and
iv. Identify the importance of skills required for livelihood enterprises.

1.5 Hypothesis

H_1 There is a significant relationship between respondent's socio-economic characteristics and their competence level in irrigation farming

H_o There is no significant relationship between respondent's socio-economic characteristics and their competence level in irrigation farming.

1.6 Significance / rationale for the study

The focus of this study was to identify and analyse the training needs of women involved in irrigation farming in the North West Province, South Africa. It also involved an identification of required skills, areas of interaction and skills development towards irrigation among women. Understanding these changes will, therefore, improve their competence and traditional ways of farming and consequently, reduce risks of food insecurity and improve their living standards. Also, this study will help programme planners, trainers or extension agents to improve their strategies of planning, delivery and evaluation of training programmes for women farmers. This is because most policies and programmes tend to be run by men and often these do not take the specific needs of women farmers into account. Furthermore, the results of this study

will assist government to adjust training programmes and relate them to identified training needs of women farmers involved in irrigation schemes.

It will also serve as a focal point for intervention activities in areas of need for policy makers to explore. The findings of this study will pinpoint the needs for training of women towards sustaining their livelihoods through tailor-made training. The study might also be useful in terms of developing an approach for farmers' needs for agricultural extension and training in other irrigation schemes in the country.

The success of woman farmers is a significant source of knowledge and development promotion. Rural economic empowerment programmes should help woman acquire more skills, increase their produce, earn more and give their families a better education and healthier food. Women will generally benefit meaningfully from improving the position of women in their respective communities. Women farmers will provide assurance that there is the reduction of rural poverty and food security among women headed households because they will contribute to their entrepreneurial economy at large and have the ability to create employment.

1.7 Limitation of the study

This study is constrained by a number of factors including the dependence on the respondent's ability to remember certain information requested. The absence of farm records and the unfortunate record keeping behavior of farmers might have a negative impact on the data. The study focused on the training needs of women participating in irrigation farming, which is both input and output relationship requiring data to reach an acceptable conclusion. The study relied on data by farmers such as number of years involved in the irrigation scheme. In some instances, approximations had to be prepared in order to reach a given data set. Furthermore, some respondents were not present during data collection due to personal commitments and others were not interested in participating in the study as participation was not paid for. The

study focus is on women farmers on irrigation schemes in North West Province. The training needs analysis of women farmers in irrigation scheme in relation to their farming activities are the boundaries for analysis of this study.

1.8 Outline of the study

The study is divided into five chapters. Chapter 1 presents the introduction, research problem, aim of the study, objectives and hypothesis. Chapter 2 is the literature review which identifies the research issues related to training and its processes on the topic under discussion. Chapter 3 outlines the methodology, a detailed discussion and explanation of the method(s) that were used for data collection and analysis. Chapter 4 presents the results and discussions using descriptive statistics such as percentages, frequencies, tables, graphs and the models used for analysis. Chapter 5 gives the summary, conclusion, and recommendations based on the findings of the study.

1.9 Definition of terms

1.9.1 Training needs

A training need is a shortage of skills or abilities, which could be reduced or eliminated by means of training and development. Lack of training needs hinder employees in the fulfilment of their job responsibilities or prevent an organisation from achieving its objectives. They may be caused by lack of skills, knowledge or understanding, or arise from a change in the workplace **(**Garavan, *et al*, 2003).

1.9.2 Training needs analysis

Training needs analysis identifies training needs at employee, departmental or organisational levels in order to help the organisation perform effectively. The aim of training needs analysis is to ensure that training addresses existing problems, tailored to organisational objectives, and delivered in an effective and cost-efficient manner (Francis and Bee, 2003).

1.9.3 Irrigation

Irrigation is the artificial means or actions of applying water to land in order to supply crops and other plants with necessary water. Fertilizers and pesticides may be applied through irrigation as well (Chait, 2013).

1.9.4 Competence

The term competence is regarded as "the adequacy of knowledge and skills that permit a person to perform in a wide variety of circumstances". It is, therefore, the ability to do proficiently and excellently with the aim of being successful (Davis, 2015).

1.9.5 Needs assessment

According to Altschuld and Lepicki (2010), needs assessment is a formal process to obtain information on the two states, the current versus desired, comparing them, identifying the gap and arriving at the needs-based priorities for organisational actions.

1.9.6 Education

Education is a social foundation and the process of accomplishing knowledge and skills that people are projected to have in any society. It develops the critical thought of an individual and promotes the process of learning accepted facts. Education inspires one to be competent and encourages intellectual inquisitiveness which will lead to lifetime learning (Türkkahraman, 2012).

1.9.7 Knowledge

Knowledge is the result of an interaction between intelligence (capacity to learn) and situation (chance to learn). It includes theories and concepts gained as a result of experience of performing certain tasks (Winterton *et al.*, 2006).

1.9.8 Water User Association

Water User Association (WUA) is a co-operative association of individual water users who desire to take on water-related undertakings for their mutual profit. It is generally established in response to the ambitions of its members (Zhang *et al*., 2013).

1.9.9 Training programme

A training programme is the sequence of educational activities planned in order to achieve particular defined objectives. In the agricultural field, the training programme can be informal or formal educational activities, long-term or short-term and can be designed to meet individual or a group of farmers (Gwivaha, 2015).

1.9.10 Agricultural extension

According to Kyaruzi *et al*. (2010), agricultural extension is described as a linkage between farmers and agricultural institutions whereby knowledge is exchanged with the aim of assisting farmers to develop skills needed to solve their problem. While extension advisors are the ones who assist farmers to apply the knowledge or new technologies using various techniques of teaching and learning adults. Their compulsory work is to transfer agricultural technology to farmers in order to use innovations to their potential.

1.9.11 Food security

Food security is the capability of accessing enough food for an active, healthy life for all people at all times (Nord *et al*., 2010).

1.10 Chapter summary

This chapter introduced the training needs analysis of women farmers in irrigation farming in North West Province, South Africa, giving a comprehensive background of women farmers in connection with their training needs. The problem statement was systematically presented

highlighting the need for training on women farmers in order for them to become better farmers. This led to the depiction of the four research questions that the study tried to deliver answers to through four expanded objectives and one hypothesis. The significance and rationale of the study were well articulated in the chapter and it is expected that the study will offer policymakers and the administration of department of agriculture with information on concepts and approaches to implement policies and guidelines that will address the training needs for women in irrigation farming for them to become successful woman farmers in agricultural entrepreneurship.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter provides a review and critical analysis of the literature and identifies the research issues related to training and its processes. The literature review covers training, types of training; the concept of training needs assessment; and common models and theories of Training Needs Analysis (TNA).

2.1 Background on training needs

There is little information recorded on smallholder irrigation schemes in Africa. Many of the views expressed about women in irrigation were based on small, intensive, sociological studies that have often focused on women's economic status. Chancellor (1996) stated that the disadvantaged status of rural women was widely discussed during the Women in Development Decade where the importance of women's participation in irrigation as social determinants is well recognized. Women's projects were favored during that period in recognition of their needs. However, the importance of women to successful and sustainable irrigated production has only recently been recognized. This is true despite that women make up most of the human effort that contributes to day-to-day irrigated production. Furthermore, the number of women in sub-Saharan countries leading rural households appears to be increasing.

In a given situation, training plays an important role in advancing human performance. Sajeev *et al*. (2012) stated that training provides a systematic enhancement of knowledge and skills, which in turn helps trainees to function effectively and efficiently in their particular task of completing the training. Training is a process of acquiring new skills, attitudes and knowledge in preparation for entry into a vocation or improving the productivity of an organization or business. Farmers ' training is aimed at improving their farming work efficiency. Sajeev *et al*. (2012) further emphasized that the training of farmers is education that occurs most often

outside formal learning institutions. Training needs assessment is one of the key steps to identify the area of interest for farmers, and designing a curriculum that will best suits farmers current real conditions.

Training farmers for development is, according to Alarima (2011), one of the numerous activities needed to sustain food production and enhance self-sufficiency in developing world food production. Training is mainly aimed at improving an individual's ability to do his or her vocation more efficiently and effectively (Fashola *et al*., 2006). It generally involves the acquisition of information and the development of skills or attitudes, resulting in increased skills in the performance of a job. Bari (1987) highlighted the contributions of training to agricultural development as providing basic skills to farmers, improving rationality and increasing inquisitively, thereby enhancing receptivity to new ideas, opportunities and methods and changing values and aspirations, and strengthening the willingness to economize and facilitate the adoption of new techniques.

According to Dossah *et al.* (2003), existing irrigation projects have quite considerable potential with the use of suitable management strategies for their sustainable and effective use. However, it is not possible to achieve improved and effective management without training and retraining those categories of people directly or indirectly involved in the management of irrigation schemes. It is worth noting that the development and training of manpower is an essential facet of irrigated agriculture. Training should be viewed as a continuous process as knowledge development is not static and new systems and techniques are evolving continuously. In terms of manpower development and training, irrigation schemes need to be sufficiently elevated to achieve sustainable management of schemes.

Proctor and Thornton (1961) as well as Owona Ndongo *et al*. (2010) all defined training needs as an individual's ability, knowledge and attitude to overcome problems and avoid creating a problem situation. It is clear from the above definition that training is an essential resource that directs knowledge and skills to production (Adesoji *et al*., 2006). Outside training operators often remain responsible for identifying training needs. Therefore, it is characterized by their situation analysis and the goals they pursue. Thus, it is decided from the outside, what is good for the farmers, what is necessary, and later it is deplored by the lack of enthusiasm of the farmers to follow the sessions organized for them (Mercoiret & Mercoiret, 2003).

Training needs assessment is a tool used in human resource management literature to determine and measure ' the existence of a gap between what a person needs to perform his or her duties competently and what they actually know as a basis for initiating corrective measures and/or remedial education [and] a method that bridges the gap between the performance required and the actual performer. Training needs assessment is important in farmers training because it "provides clear guidelines as to which skill deficiencies need to be remedied and what the profile of future farmers should be. Training needs come from underdeveloped skills, insufficient knowledge or inappropriate attitudes of the worker" (Ferreira & Abbad, 2012). Furthermore, Cekada (2010) indicates that the evaluation of training needs is intended to determine whether training is a solution to the problem.

2.2 Training

Training is considered as a skills empowerment process in which acquisition of new skills or gathering of knowledge is intended to improve an individual's abilities towards work or tasks assigned to complete (Chan and Lim 2003). Most researchers consider training as a systematic process aimed at conveying knowledge, skills and changing the attitude of people towards learning. Buckley and Caple (2007) emphasised that training is the systematic development of the attitude and skills behaviour patterns required by people in order to perform adequately

when given tasks. Training is deliberately designed to change the behaviour of anyone who is working; it is meant to arouse efficiency and higher performance standards.

Sahu *et al*. (2011) stated that a well-planned training aimed at disseminating information on knowledge gap and training needs will help improve the capacity of farmers. Alkinani (2013) defines training as a structured procedure concerned with the acquisition of the capability or the maintenance of existing capabilities. Noe (2010) emphasises that training is one of the most crucial fundamentals for the prosperity of any organisation. Saaed (2010) argues that training has four stages which include assessment; design and development; delivery and follow-up; and evaluation. Training is a process of attaining new skills, attitude and knowledge in the context of preparing for entry into an occupation or improving one's productivity in an institute or activity.

Effective training requires a clear picture of how the trainees will need to use information after training in place of local practices and what they have adopted before in their situation. Training has an essential role in the progress of human performance because it provides systematic improvements of knowledge and skills, and these improvements are helpful in the working efficiency of trainees (Sajeev, 2010). Training provides a well-planned opportunity for the contributors to get important knowledge and skills. The basic objective of farmer's trainings is to improve the farming operations in field. The purpose of training is not for knowing more but its objective is to lead to behaving differently (Lynton & Pareek, 1990). Training is an organized activity designed to enhance the knowledge, skill and competencies to a person for improving his/her performance, and this might be helpful for attaining the required level of knowledge and skill (Shibu & George, 2013).

2.3 Types of training

According to several definitions ascribed to training, some training provides individuals with the skills they need in order to relate to other people (Scheer *et al*., 2011). Other forms of training provide a wide-range of competencies and values that are obligatory in a profession in line with Christoplos (2010). Table 1 shows the different types of training.

Table 1: Classification of types of training

Types of training	Definition
Business function training	Training perceived to develop knowledge and skills related to different business functions.
Technical skill training	Training targeted at developing skills that are compulsory to do a specific job.
Performance,management training	Training that assists individual personnel to advance work performance by upgrading the skills that can permit them do valuable tasks and reduce wastage.
Interpersonal skills	Training that is engaged to progress leadership skills, coaching competence and communication skills.
Problem-solving/decision-making training	Training that empowers an individual systematically to solve his or her difficulties by learning how to define problems.
Mandatory training	Training is commenced in areas that are mandatory as per the provision of the law.
Personal training	Subjective training that enables an individual to manage life and profession in a better fashion.

Source: Ghuman (2010)

2.4 The Concept of Training Needs Assessment and Training Need Analysis

According to Ferreira and Abbad (2013), training needs assessment is a process that has a strategic role because it provides clear guidelines as to which professional skill deficiencies must be remedied and what the profile of future trainees should be. Training needs come from underdeveloped skills, insufficient knowledge or inappropriate work attitudes. Clarke (2003) defines training needs as the organisational process of collecting and analysing data that supports decision-making about when training is the best option (or not) to improve performances of individuals, define who should be trained and exactly what content should be taught in order to yield positive results or reach goals and targets that are being set.

Dahiya and Jha (2011) state that a needs assessment should be designed to identify and prioritise needs, while a needs analysis should break and identify needs into components and determine solution requirements. Gould *et al*. (2004) consider training needs analysis as the initial step in a cyclical process, which contributes to the overall training and educational strategy of staff in an organisation or a professional group. The cycle commences with a systematic consultation to identify the learning needs of the population considered, followed by course planning, delivery and evaluation. Miller *et al*. (2002) posit that the assessment begins with a "need" which can be identified in several ways, but is commonly described as a gap between what is currently in place and what is needed, now and in the future.

The purpose of a training needs assessment is to identify performance requirements or needs within an organisation or an enterprise in order to help direct resources to the areas of greatest need, those that closely relate to fulfilling targeted goals and objectives, enlightening productivity and providing quality products and services. According to Erasmus *et al*. (2000),

the aim of training needs analysis is to establish what needs exist, whether they are of great importance, how the need becomes apparent, how they were identified, how best they can be addressed and what are the priorities. In irrigation farming the different skills are required for several crops that are produced. The specific requirements for each of the crops and water management emphasise the need for definite skills and competencies to enhance the efficiency of farmers using irrigation schemes. The analysis of gaps in the level of skill and competencies will help to provide the level of competence and the areas of need.

Training need analysis is a systematic approach, meaning that the training process has different phases. It is usually depicted in a sequence of needs analysis, designing and developing an appropriate training solutions, delivering the training and evaluating on the training programs effectiveness whether the objectives have been achieved. The sequence is also often referred to as the "training cycle" and many training researches agree these steps are necessary to ensure training effectiveness (Reed & Vokala, 2006). Reed and Vokala (2006) define the term 'training needs analysis' as "a process of gathering, assessing and analyzing data to determine the training needs for and organization."

Chiu (1997) described TNA as "an ongoing process of gathering data to determine what training needs exist so that training can be developed to help the organization accomplish its objectives". Bucalo, (1984) states that the internal factors that initiate training needs include new or revised organizational strategic objectives, installing new machine or equipment, implementing new processes, hiring of new employees, new job created or because of gap in performance; while external factors are customer requirements, technological changes, ISO compliance, government legislation among others.

Approaches in Training Needs Analysis have been categorised into reactive and proactive depending on whether the focus of TNA is based on current performance gap problem in individuals within an organisation or the determination of the knowledge, skills and attitude needed to realize the necessary changes. The reactive approach is often described as the traditional and common ways of looking at training needs by focusing on a performance gap between current performance and expected performance such that the training is applied as the solution only when there is a gap in meeting current standards of performance.

However, due to rapidly changing performance environment, reacting only when performance gaps grow or focusing only on present needs is no longer suitable in a rapidly changing business environment as future needs and requirements are important to maintain survival, relevance and competitiveness (Anderson, 1994). Anderson (1994) further explains that training must be perceived as a proactive process which anticipates trends and future changes. According to Anderson (1994), "a proactive approach unlike the deficit models, will actively seek out ways to help people further develop existing strengths and encourage them to improve both the quality of their contribution to the organization and their life at work."

2.5 COMMON MODELS AND THEORIES OF TRAINING NEEDS ANALYSIS (TNA)

There are a couple of terms that can be used to refer to the training needs identification process. Training Needs Analysis (TNA) is the most common term. Reed and Vokala (2006) define the term needs analysis of training as a process of collecting, evaluating and analyzing data to determine an organization's training needs. A more detailed meaning of TNA explained by Chiu *et al*. (1997) as "an ongoing data collection process to determine what training needs exist to help the organization achieve its goal." In fact, TNA refers to an effort in which data are collected systematically by evaluating potential training activities to analyse and solve performance-related issues (Bucalo, 1984; Bin Arshad *et al*., 2015). Research shows that all

performances cannot be treated solely by training. Knowledge and skills that are needed are not the only reasons that concern employee inability to perform well, but are due to non-training problems. However, Chiu *et al*. (1999) insist that only training can solve performance issues related to lack of knowledge and important skills (Goldstoin & Buxton, 2014). Training can solve the performance issue of employees only if the problem is due to the lack of knowledge and skills of the employee as highlighted by Chiu *et al*. (1999).

Bin Arshad *et al*. (2015) argue that it is not an easy task to train staff effectively. Conger (2015) states that Training Needs Analysis (TNA) is the prerequisite for initially making training effective and accessible. It also includes a careful consideration of the accuracy and fulfillment of the recognized "need." If, while using the right process, these "needs" are correctly recognized, then the probability of training success is high. To enjoy the benefits of training investment, training must be approached systematically. An organization needs to manage certain steps during the training process. The steps begin with identifying the need for training, designing and also developing the appropriate training solution, implementing this training and evaluating the effectiveness of the training programs if the original needs have been met. These steps are popularly referred to as the "training cycle," and many types of research in training have agreed that these steps are needed to ensure effective training (Leat & Lovell, 1997). Among the training steps, the cycle is to identify training needs. The most important step in ensuring the effectiveness of the overall training process can be considered as the Training Need Analysis (TNA). There are various models and theories designed and applied to the TNA. Some of these theories and models are discussed and examined below. These include the Latham Model, the Kissack and Callahan model, the Borich model, the Analysis Model for Training Needs, and the theory of human capital.

2.5.1 Latham Model

Latham (1988) states that needs assessment involves four steps in the process of identifying training needs that include demographic analysis, organizational analysis, task analysis, and analysis of individuals. The author further argues that the analysis identifies an organization's need for different staff groups. It highlights the requirements of this step by mentioning an organization's recent demographic changes that affect training. Such variations include minority increases, mature employees and new staff in a workplace with few basic skills and poor levels of literacy for which special training programmes may be needed.

Brown (2002) indicates that the organizational analysis examines where training is needed in the organization and the conditions under which the training will be carried out. It identifies the knowledge, skills and abilities that employees will need for the future as they evolve or change the organization and their jobs. Brown (2002) states that task analysis starts with job requirements and compares knowledge and skills of employees to determine training needs. Examining job descriptions and specifications provides the necessary information about expected performance and the skills that employees need to do their job. Any gaps between the requirements of performance and work indicate a requirement for task training. Individual analysis targets individual employees and their job performance. According to Locke (1997), the performance resulting from these efforts affects the level of satisfaction experienced, which can lead to other forms of action (e.g. job and work avoidance, deviance, adjustment) along with organizational commitment. The figure1 shows framework of Latham model for training need Analysis.

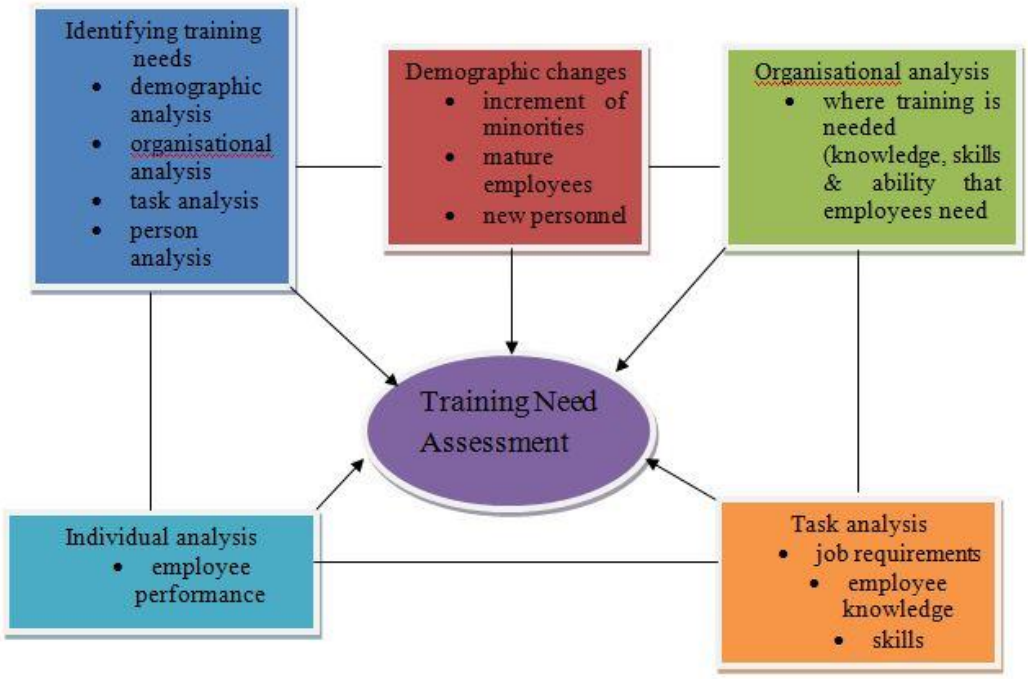

Figure 1 Conceptual framework of Latham model for training need Analysis

Source: Latham (1988)

2.5.2 The Kissack and Callahan model

In the 1970s, the concept of organizational culture began to receive attention as the view of organizations where employees were seen as mechanistic pieces of a larger systemwas originated. This was to realize how human factors affect organizational processes and progress (Hawkins, 1997). Organizational culture has since been studied, researched, and conceptualized in a variety of ways. Culture is generally identified as a set of shared values, assumptions, artifacts, language and rituals that guide an organization's interaction and functioning (Jones *et al*., 1997; Hatch, 1993; Hawkins, 1997; Ngwenyama & Nielsen, 2003; Nutt, 2005; Schein, 1983). The overarching theme of most organizational literature on culture is the notion of manipulating and changing culture in alignment with strategic institutional plans (Smircich, 1983). This is an effort that can be supported through training and development activities (Sirianni & Frey, 2001; Zhao, 2005).

Kissack and Callahan (2010) have introduced cultural analysis in training needs analysis so that inclusion in needs assessment generates awareness among trainers and organizations about the failures between the program and the organization that may limit and destabilize training success. The analysis of culture involves evaluating the strategic directions of an organization, reviewing the training resources required, thus supporting managers and subordinates. This technique alerts trainers to various issues that have not been addressed and also provides information that can be used to determine the training's success or failure.

A culture analysis in the needs assessment phase creates awareness of potential problems and inconsistencies which can inhibit and undermine the program's success between the program and the organization for trainers and organizations alike. A needs assessment is performed in a training program's analysis step. This phase determines whether or not training is required through three separate analyses which are man analysis, task or operational analysis, and analysis of organization (McGehee & Thayer, 1961). An organization will generally notice growing demands or problem areas and may seek training to address these issues. However, Kissack and Callahan (2010) felt that since training is not always the best course of action, a needs assessment is being conducted to determine whether training will be useful in solving the concerns of the organization.

However, it is suggested that training and development programs should include a cultural analysis as part of the program planning process–particularly within, or during, the portion of the organizational analysis of a needs evaluation. Kissack and Callahan (2010) concludes that organizational culture awareness helps trainers manage their program in a variety of ways; namely, conducting their programs in a way that suits the organizational culture. In addition, the decision to include management and employees in the definition of training culture is due to the fact that cultural analyses in managerial literature are usually carried out exclusively

from a managerial perspective, whereas culture is located in the mental programs of all the organization members (Hofstede, 1998).

As Aguinis and Kraiger (2009) have stated, the benefits of training are detectable at various levels and are stratified and interconnected. In fact, training promotes individual performance, enables employees and management to update their knowledge and skills, supports problem-solving within the organization, and helps new employees to focus on the organizational context (Dolan *et al.,* 1999). Training culture at the individual level is concerned with all those aspects related to the benefits of individual training, such as the usefulness of training in maintaining the job, acquiring new knowledge, increasing opportunities to be promoted and achieving career success (Noe, 1986; Tziner *et al*., 2007). Federica, Cervai and Jussi (2018) conclude that understanding the culture of training is important to shed light on the role that training plays in cultural terms within the organization: meaning, values, practice, attitudes and behaviors.

2.5.3 The Borich Model

Mckim (2013) and Wingenbach, (2013) maintain that Borich's needs assessment model is a 'self-evaluation procedure predominantly based on the trainee's ruling on the significance and competence of certain areas of knowledge in these areas.' Borich Model measures competence by comparing the features of those receiving a service with others, who are not. If others display the same features, they are said to be in need. An important feature of the Borich Model is that when asked to do so openly, individuals "can be adjudicated on their own expertise and can make an objective finding" (Borich, 1980). Borich's model defines training needs as a discrepancy between educational goals and trainee performance in relation to goals and suggests that 'training programmes could use this model by using the two extreme positions

(what are farmers' measured behaviours, skills and competencies and what should be the goals of a training programme.'

Competencies are the application of knowledge, technical skills and personal characteristics, resulting in exceptional performance (Boltes, 1997). Competency models such as the needs assessment model of Borich are designed around the skills of individuals or groups that need to be effective in the future and used to make human resource verdicts. The advantage of this model is its ability to lock the type and quality of the received data. It attempts to gather additional information about their current knowledge of the topic from respondents and the ability to apply information. In this case, the model tries to determine the congruence between what women farmers should be able to do in irrigation and what they can do. Many studies were presented to determine the agricultural sector's training needs in both formal (Peake & Duncan, 2007) and non-formal settings (Gregg & Irani, 2004).

By calculating the mean weight discrepancy score, many of these studies identified the use of Borich's model as the ideal in identifying needs for training in needs assessment. Garton and Chung (1997) and Oladele (2015) state that the type discrepancy of Borich has two common types as stated in the agricultural literature and these types are the "significance, ability or what is and what should be." The Borich model is considered by Bar-rick and Doerfert (1989) as one that provides defensible data in identifying important topics where respondents need further training. Waters and Haskens (1989) add that the Borich model "seems to add legitimacy to the progress of measuring respondents' perceptions of the importance of educational programme needs."

Christensen *et al*. (2009) and Elhamoly (2014) state that in order to calculate the mean weight discrepancy score (MWDS) and describe the overall ranking of identified competencies, statistical steps need to be followed. These steps are as follows: discrepancy score (DS)

calculation for each competency by taking the important ranking minus ability (competency) rating; the weight discrepancy score (WDS) which calculates individuals' competencies by multiplying the discrepancy score by the main importance rating; a MWDS which calculates the competencies by taking the sum of the weighted; and the discrepancy scores divided by the number of observations. According to Borich (1980), using the MWDS, the importance of rating for each task is represented by (I), Competency rating for each task is symbolized by (C), while $\bar{X}I$ means the importance and lastly, the Number of observations is represented by (N).

2.5.4 Training Need Analysis Model

McGehe and Thayer (1961) and Goldstein (1998) wrote one of the earliest and most classical works to influence TNA and the field of training and development. McGehe and Thayer (1961) introduced the TNA model's tripartite level and this model played a major role in other subsequent TNA models. The three levels are organizational analysis; analysis of operations; and analysis of individuals.

According to Noe *et al.* (2009), organization analysis involves the consideration of organization strategic direction such as analysing the organization mission, vision and values and then determining relevant training needs to support those statements. Daniel (2003) refers to operation analysis also as job or task analysis. According to Noe *et al*. (2009), task analysis is a process of identifying the job knowledge, skills and attitude that need to be emphasized in training while person analysis helps identify who needs training based on performance deficiencies that result from lack of knowledge, skills or attitude.

2.5.4.1 Organizational Analysis

Organizational analysis involves determining where emphasis could and should be placed within the organization's training (Ling *et al*., 2014; McGehe & Thayer, 1961). Furthermore,

Noe *et al.* (2009) explains that the analysis of the organization involves considering the strategic direction of the organization such as analyzing the mission, vision and values of the organization and then identifying relevant training needs to support these statements.

2.5.4.2 Operational Analysis

According to McGehe and Thayer (1961), operational analysis involves the process of determining the training content for an employee to effectively and efficiently perform a task or job (Ferreira *et al*., 2015). Operational analysis was referred to by Daniel (2003) as a job or task analysis. Noe *et al.* (2009) therefore explained task analysis as a process of identifying the job knowledge, skills and attitudes that need to be emphasized in training.

2.5.4.3 Individual Analysis

Individual analyses are also known as analysis of individuals. Noe *et al*. (2008) explain that analysis of individuals helps identify who needs training based on performance deficiencies resulting from lack of knowledge, skills or attitude (Martin, 2014). Furthermore, Leat and Lovell (1997) state strongly that the process of personal analysis should not only consider current training needs but should also identify training and development strategies that will help individuals achieve expected performance standards that are important for organizational goals. For example, Daniels (2003) believe that team workers need different training needs compared to individual work alone.

2.5.5 Human Capital Theory

The theory of human capital is based on education and economic fields and claims that the higher the education, the higher the economic returns to society (Sweetland, 1996). The research focuses on the skills and knowledge of current workforce and dislocated workers laid off in past recessions in the knowledge-based economy. Mincer (1958) maintained in his study that both formally and informally, training and skills affect the personal income of an individual. For decades, human capital theory has been important to scholars and its analytical

framework supports economic approaches used to inform and support educational policymakers (Sweetland, 1996). Ulrich and Lake (1991) note that the uniqueness of the skills and abilities of an employee is critical to gaining competitive advantage.

In order to gain future productivity by developing the skills and knowledge of employees, human capital places emphasis on labour costs relative to return on investment. Employees own their human capital while firms are working hard to protect these skills and knowledge, so they are not being transferred to other firms. Houghton and Sheenan (2000) state that "a knowledge economy has been described as a network hierarchy driven by the acceleration of change and the rate of learning where opportunities and the ability to combine knowledge-intensive and learning-intensive knowledge related to the determination of individuals' social economic position in a firm"

2.5.6 Synthesis of the Models

In this study, the models covered were reviewed in order to determine the indicators and approach for the conceptual analysis of the training needs concept. The views and models as well as theories have indicated the different dimensions of the need for training and areas that should be covered in the analytical framework and to exploit the views of various schools of thought as existing in literature. This means that women farmers in irrigation schemes and adjacent areas, whether in an association or an organization or not, could be x-rayed in terms of their knowledge of the skills required and the tasks to be performed in order to increase their productivity, which could lead to food safety in return for investment in their training by the Department of Agriculture and other agencies working together.

The human capital model briefly captures the essence of this study within the agricultural setting by seeking to determine the competence and skill gaps between women farmers in order to be able to raise their levels of production. Efficient use and management of human capital

in agriculture are some of the fundamental conditions for the sector's successful functioning and for ensuring the country's food security in general. This is because human capital is not only a set of specific human and business skills, but also the main resource for investment (Grishnova, 2014). According to Odusola (1998), the concept of the formation of human capital refers to a conscious and continuous process of acquiring and increasing the number of people with the necessary knowledge, education, skills and experience that are crucial to a country's economic and political development.

This concept is theoretically modelled on the hypothesis that human knowledge and skills directly increase productivity and enhance the ability of an economy to develop and adopt new technologies (de la Fuente, 2013). Through education and training, as well as through various forms of informal learning, knowledge is embedded in people. In agriculture, through various educational systems, the workforce acquires knowledge. These are summarized by Rivera (1998) as the formal education provided by mainstream educational institutions, non-formal agricultural and extension education systems, and mass media.

Wouterse (2015) distinguishes the cognitive and non-cognitive effects of agricultural education. The former refers to the development of general literacy, numeracy, and specific knowledge transfer skills. This can lead to improved allocation efficiency, thus allowing farmers to follow written instructions for chemical inputs and to calculate accurate dosages. Non-cognitive effects can lead to changes in attitudes and preferences of individuals. However, regardless of form, education significantly improves productivity (Rivera, 1998; ILO, 2008).

2.6 Lessons on Women Competency/Training Needs in Irrigation Farming Globally

Globally, as indicated by Moyo *et al*. (2017), smallholder irrigation systems are seen as critical common property resources needed to increase the supply of crop water and sustain living conditions in semi-arid regions (FAO & WWC, 2015). Improving agriculture and increasing

productivity through irrigation of smallholder farmers is one of the key strategies for alleviating poverty and improving rural communities' livelihoods as the majority of the poor are directly or indirectly dependent on agriculture (Mutiro & Lautze, 2015).

Tselaesele *et al*. (2018) point out that training is a way to address the outcomes of respondents ' needs. Training involves acquiring cognitive, abstract knowledge that includes theory and concepts, as well as tacit knowledge acquired through the experience of performing certain tasks (Nischithaa & Rao Narasimha, 2014; Winterton, Le Deist & Stringfellow, 2005). It also implies refreshing the existing skills to meet the expectations of the job at hand. Skills are attributed at the right time to perform or perform the right technique.

2.6.1 South Africa

Mudhara and Oladele (2016) stated that female farmers, particularly in the areas where water projects are located in Taung, expressed the need and interest in household food production as well as the income generated from the products. As soon as the project is established, there is interest in empowering other women. Due to large-scale irrigation farming, as well as other water demand activities in the area, such as mining, water security could be a challenge to sustain small-scale farming. To reduce water wastage and maintain moisture, an innovative floppy irrigation system is used, considering the area is very humid.

In addition, Mudhara and Oladele (2016) noted that farmers in Molatedi indicated that as a result of the high volatility in the community, the majority of farmers have migrated from vegetable farming to tobacco farming, where water safety is of great concern because many activities use water from the same source. This is the reason they indicated that they need training in the water aspect

With regard to the farm in Nyetse-Zeerust, as a result of their success, women farmers were very skilled and had a great source of water and also presented a large percentage of farm 74 owners as well as community influencers. A Nchapeo-Brits respondent merely indicated that although she has a high level of competence in her farming practice, she still needs to be trained in external marketing and hopefully international markets. Individuals from Dinokana in Zeerust indicated that although they appear to be fine and competent in their farming activities, they still need water safety training. Because of the current irrigation system –furrows where plots are serviced using a cyclic rotation, they believe that water safety could prove to be a problem to sustain small-scale farming. The farm has the potential to provide and improve the community's livelihoods when the irrigation system is revised.

Similarly, farmers in Khanya-Brits indicated that they enjoy high production skills and have been able to attract markets from neighboring towns and villages, and the irrigation farming project attracts water from a dam about 50 km from the irrigation farm due to the unreliability of rainfall in the area. In addition to irrigation water, groundwater is used. The farmers are very active and the 5 ha are fully used with a variety of vegetables being grown. Farmers in Mabogo/ dinku-Lethlabile indicated that although there is predominantly good access to water every season, training in groundwater use and extension service delivery will still be required to improve their production level. Likewise, women from Mayiyeyene-Mafikeng indicated that they require water safety training as this was a major obstacle to small-scale farming as a result of the granite rock in the area. Lastly, Disaneng-Mafikeng irrigators also highlighted that they have been able to secure a good market for their products, especially with Fruits and Veg City, as a result of the level of their production competence, but they still require irrigation system training and market potential.

2.6.2 Lesotho

Irrigation has been instrumental in food production (FAO, 1986). Not only does it increase the yields of specific crops, it also extends the effective crop-growing season by allowing multiple crops (two or three crops per year). However, with irrigation security, additional inputs are required to further intensify production (disease and pest control, fertilizer management, improved varieties, and adequate preparation of seedbeds). Stevens and Ntai (2011) state that the role of expansion in developing smallholder irrigation includes not only transferring technical knowledge, but also supporting farmers in mobilizing farmers' groups and networking with all players involved in the Lesotho agricultural innovation system. It was also pointed out that although the farmers were competent in irrigation farming, they still needed irrigation engineering training.

In the study conducted by Stevens and Ntai (2011), extension service delivery was rated highly competent in Lesotho, but some perceived irrigation challenges identified included access to financial support and an inappropriate land tenure system. Many farmers reported renting land on the basis of very informal landlord contracts as a challenge. Extension staffs also believe that most smallholder irrigation farmers rely heavily on government and donor subsidies. These constraints, together with the fact that only 5 percent farmers and 3 percent extensionists have been trained in irrigation management aspects, contribute to a situation where many smallholders produce far below the potential of the respective Lesotho irrigation areas. 75 percent of respondents believe that the efficiency of irrigation and water use will improve if these issues can be addressed.

2.6.3 Zimbabwe

Moyo *et al*. (2017) point out that about 80 percent of agricultural land in Zimbabwe lies in arid or semi-arid regions. Rainfall is too erratic and unreliable for dryland farming in the arid and semi-arid regions, making additional irrigation necessary for successful farming. Therefore, irrigation acts as a mitigating measure against droughts and dry spells in the mid-season, allowing irrigators to grow crops year-round and intensify production. Zimbabwe's irrigation development goal is to ensure food safety by increasing crop production (Chazovachii, 2012; Jacobs *et al*., 2013). Smallholder irrigation schemes in Southern Africa, including Zimbabwe, have largely failed in their goal of improving rural livelihoods and sustainable crop production for food security and alleviation of poverty (Mutiro & Lautze, 2015). Similarly, there are numerous challenges to smallholder irrigation in Zimbabwe, with more failures reported than successes (Jacobs *et al.,* 2013). In most developing countries, the underperformance of smallholder irrigation schemes is largely due to complex interrelated factors such as low technical capacity, poor institutional arrangements and uncoordinated market connections (Crosby *et al*., 2000; Jacobs *et al*., 2013; Mujere *et al*., 2011). Productivity barriers in Zimbabwe include inadequate inputs; inaccessible markets; unreliable and inadequate water supply due to weak water governance institutions; weak market integration; significant degradation and abandonment of irrigated land, including inadequate infrastructure; and land tenure policies that do not support an environment conducive to successful operations.

FAO (2000) and Moyo *et al*. (2017) all found that irrigation farmers in Zimbabwe need to assess markets as this was a major constraint as well as training on the use of mobile phones as a means of market information dissemination. This study found that irrigators in the schemes have limited market access, particularly at Silalatshani, although due to the subsistence nature of production they also have little need for market access. It would, however, provide incentives for irrigators to increase production if better market access were available. There is

no coordinated product marketing at any scheme. In addition, land tenure is likely to be unclear to irrigators, especially since the post-2000 state-driven land redistribution. As a result, irrigators in Mkoba and Silalatshani were unclear as to whether the land belonged to the community or to the government.

Furthermore, the weakness of the extension service delivery is a major concern because if there is no connection between the producer and the market, the farmers can continue their business and thus produce what the market really does not want. Irrigators trust local AGRITEX extension officers, but also seek advice from local farmer groups to a lesser extent. Moyo *et al*. (2017) state that the Agricultural Marketing Authority, a statutory body with a broad mandate to regulate participation in the production, purchase and processing of agricultural products in Zimbabwe has no awareness of smallholder irrigators. The duties of the Authority include promoting agricultural production of strategic crops (tobacco, cotton, sugar, soybeans, barley); food security crops (maize, wheat, sorghum); livestock (beef, dairy, piggy, poultry, small stock); borrowing and loans for agricultural production and marketing; and promoting contract farming by encouraging private sector participation;

2.6.4 Nigeria

According to Okeowo (2015), occupational analysis was conducted to analyse the skills and training needs of agricultural extension staff. The result shows that although the link between extension agents and farmers was important and strong, they still indicated the need for occupational training to further improve job satisfaction and service delivery to the farmers. Training in any form is inherent in the effectiveness and efficiency of the organization. Two major types of training programs were identified by Ovwigho and Ifie (2009), on-the-job training and pre-employment training. They stated that on-the-job training is the type of

training given to an individual who is employed gainfully but requires certain knowledge and skills in order to improve his efficiency.

Agricultural extension staff plays an important role in disseminating and disseminating new agricultural technologies and training should therefore be given priority. This would allow the farmer to benefit from using new technology packages properly (Abamu, 2006). The training of agricultural extension workers is an integral part of the overall process of agricultural production, according to Ovwigho and Ifie (2009). Agricultural extension agents have a duty to reach farmers scattered throughout the country with useful and practical information to increase agricultural production. Okeowo (2015) stated that farmers ranked the need to train extension officers as they are the link between the research laboratory and the grassroots in order to more effectively discharge their duties. Moreover, the result shows that the operation and maintenance of agricultural machinery was perceived by respondents as a very important training need.

2.6.5 Iraq

Rice is the most significant summer crop in Iraq. It comes third in terms of area planted and production for 2015 after wheat and barley. The area under rice cultivation was 27608 hectares, producing 109209 tons of paddy, with an average yield of 3.96 Mt.ha-$^{1.}$ Its cultivation concentrated in the provinces of the Middle Euphrates, in particular AL-Qadisiyah, first in terms of plant area (16094 hectares) and production (56563 tons) (SCO, 2016). Rice productivity in Iraq is 3.96 Mt.ha-^{1}, very low compared to Egypt (9.5 Mt.ha-^{1}), Morocco (7.5 Mt.ha-^{1}), (AOAD, 2015), China (6.7 Mt.ha-^{1}), the USA (8.3 Mt.ha-^{1}), (Mundhe, 2015) and Uruguay (8 Mt.ha-^{1}), (Tarlera *et al*., 2016). The low yield is mainly due to a number of reasons, and the most important is rice farmers' mismanagement of their farms.

Improving rice farmers ' skills in managing their farms is through training aimed at giving them the skills they need. Training plays an important role in the development of human resources. Agricultural education and training are generally assumed to have a major role in creating capacity and providing the human resources needed to increase agricultural productivity and farming systems sustainability (Gina & Madsen, 2013). Training is primarily aimed at improving individuals ' ability to do their vocation more efficiently and effectively. In general, it involves the acquisition of information, knowledge and the development of skills or attitudes, resulting in increased skills in a work performance (Tsado *et al*., 2014). In order to make any training meaningful and effective, it is imperative on the part of the training organizers to identify farmers' training needs on the basis of which a suitable training module can be developed in order to provide appropriate training and to achieve a higher degree of productivity and profitability (Chawang & Jha, 2010). Evaluation of training needs is the first step to be taken in the design of education and training programs and extension of agriculture, and the process has its own principles and specific methods to achieve it (Ansari, 2006).

Understanding the training needs of rice farmers helps design appropriate policies and extension programs that can help improve rice farmers ' skills and expertise and increase productivity. Many studies have been carried out for this purpose in various regions of the world, for example in India (Bajpai *et al*., 2007; Chawang & Jah, 2010; Nath & Chowdhury, 2010; Devarani, 2013), in Nigeria (Tologbonse *et al*., 2008; Alarima *et al*., 2011; Tsado *et al*., 2014), in Sri Lanka (Nahfees, 2013), and in Iran , (Goli *et al*., 2013). Kshash (2016) identified farmers ' training needs in Iraq. They include plant protection measures, fertilizer management, loan and intercultural operation, winnowing, threshing, insect and disease management, water management, weed management, land preparation, sowing and transplantation, harvesting and storage, surface leveling and smoothening, nursery management, selection of high yielding varieties, selection of healthy seeds and marketing.

2.6.6 Cambodia

As part of the Agricultural Development and Economic Empowerment Project (PADEE) in the provinces of Takeo, Kandal, Prey Veng, Svay Rieng and Kampot, Rio *et al*. (2013) assessed the training needs of members of Improved Group Revolving Funds (IGRF). The agricultural extension system in Cambodia is generally weak and provides farmers with limited services of varying quality. Rio *et al*. (2013) conducted a survey that revealed numerous agricultural production topics that farmers needed to be trained on. The study showed that farmers indicated the need for training in livestock and crop production, followed by vegetable production, while fishing and fruit farming were the least indicators requiring training from farmers. They also identified training needs in pest and disease control, input selection and purchase, fertilizer use, and planting methods among others. Livestock farming respondents indicated that they need some training in disease management, animal feeding, housing, and flood / disaster management.

2.7 The Role of Training and Its Impact in Agriculture

In less developing countries, agriculture is the main source of livelihood and its development depends directly on the development of agriculture. Agriculturists and other scientists have suggested a wide range of technologies / measures for agricultural development. This includes the use of enhanced seeds, chemical fertilizers, modern machinery, integrated pest management, and extension agent contacts. These technologies have been introduced and used over the past three decades, but despite all this, most developing counties have failed to meet the desired development goals.

Farmers' training has been demonstrated to yield a variety of results. In their study on small farmers in Bangladesh, Murshed-E-Jahan and Pemsl (2011) concluded that building farmers' capacity through training is more valuable than providing financial support to increase

production and income. Similarly, a study conducted by Tripp and Hiroshimil (2005) confirmed that the importance of training can contribute to improving farmers ' skills in agricultural works. Studies on the effectiveness of farmers ' training have shown that not all programmers are successful as most program failures in developing countries have been attributed to the tendency to focus excessively on a particular technology transfer rather than a wider spectrum of farmers' empowerment including knowledge dissemination (Oreszczyn & Carr, 2010; Yang *et al*., 2008). However, by carefully revising and designing the training to address the needs, these gaps could be overcome. It was also reported that some success stories were related to the use of non-formal education, focusing on the approach of learning-discovery, and filling the gaps in the misconceptions of farmers' knowledge.

Zikhali (2017) states that in order to boost agricultural productivity, training and development have become the necessary components. From their study, Sharma *et al*. (2017) indicated that the impact of training also enabled farmers to do their jobs much more quickly and easily and that they were highly motivated and satisfied with new knowledge and skills. Therefore, what emerged from the research showed that the impact of training has been positive and effective on the majority of farmers. Todaro and Smith (2009) argue that training of staff has been strongly recognized as contributing to the development of agriculture. Extension staff training, for example, remained a key component in the agricultural sector in Nigeria. It currently accounts for 40.0% of GDP and 70.0% of the active population is employed in the agricultural sector.

One aspect of this training, according to the FAO (1985), is to provide the extension officers with the technical or scientific knowledge needed to be passed on to the farmer. It is not enough to be armed with this scientific knowledge, but the extension officers need to know how to communicate the information to the farming community. Therefore, there is a strong relationship between training activities and how they benefit the community. Studies have

shown that training efforts have improved the quality of labour-power, which in turn has contributed to national economic growth. Employee development training activities have the potential to yield some benefits such as a country's inclusion in powerful economic blocks.

As Zikhali (2017) indicates, it can be noted that farmers ' training and development is increasing the availability of local food and improving productivity. It provides sufficient food to local markets, increases farmers 'income, and also enhances farming practices' sustainability. This addresses hunger and poverty issues by directly increasing the availability of local food. Increasing the sustainability of farming practices ensures future food security. It ensures motivation and efficiency for employees, resulting in lower turnover for employees.

2.8 Factors Influencing Training of Farmers

There is a positive correlation between education, economic growth and profit, according to Pont (2003). Food security and economic challenges can be faced with the advent of globalization and the massive influx of migrants from neighboring countries, the South African food and agricultural sector. To address these challenges, South African industries need to have a well-qualified and technologically-competent workforce in all economic spheres. It is, therefore, necessary to identify and develop new technologies, accompanied by rigorous systems and niche markets (Fete, 2010). Among other things, these require the use of trained and productive staff. If these aspects are not included in the agricultural workers ' development agenda, farming in South Africa will lag behind best practices and trends in international farming. Complementing the above, Blunch and Castro (2005) acknowledged that human capital development is integral to economic growth. According to Yu and Wang (2014), some of the major factors identified to be influencing farmers' training are their socio-economic characteristics, which include age, family or size, and years of education. They also identified age as the most important factor, family-scale or size being of secondary importance, and the third being years of education.

2.9 The model of training need assessment to be utilized in this study

The model of training needs assessment to be used in this study to assess the training and competency needs of women farmers is Borich Needs Assessment Model. Conklin *et al*. (2002) state that the Borich model is a complete model that is used to assess the training needs. Need assessment, as stated by Borich (1980), is the gap between the desired performances of participants and what is currently existing. This idea gives the awareness of the existing circumstances of women farmers' competence and the ultimate situation (Borich, 1980). The identified gaps are labelled as discrepancies. The model utilises self-assessment of professional verdict of woman famers to evaluate their ability by relying on their aspects of importance. The model has a complex accuracy of assessing the competency levels and needs of woman farmers and permits the participants to express their training needs. The areas where they need training is normally achieved through statistical or mathematical calculations by carrying out the discrepancy analysis using the mean weighted discrepancy score (Borich, 1980; Adel *al.*, 2014). This calculation comprises of comparisons between the level of importance rating of woman farmers (relevance of each competency task) and the ability to accomplish (level of accomplishment of each competency).

Several studies have been successfully conducted to assess the needs for farmers, extension agents and extension education in various countries in order to determine their competency level and training needs using borich need assessment model. Hashemi (2009) utilized the Borich model to assess the farmers' competence and training needs on pest management practices in Karaj, Iran. The farmers' level of competence on pest management practices were identified and the needs for pest management training. Also, Sajeev, Singha and Venkatasubramanian (2012) made the use of borich to assess the training needs of farmers and rural youth: an analysis of Manipur state, India. The authors suggested that farmers there required extreme trainings on integrated farming systems, integrated pest and disease

management and technologies for soil and water conservation. Furthermore, Daudu *et al*. (2017) used borich model to assess the area of capacity building needs of male and female farmers in soil fertility management practices, Kwara State, Nigeria.

All these indicate that the model has been utilised several times to determine the competency or training need of farmers. This gives the needed assurance for this study to be leveraged upon the borich model to determine the training need or competency of women involved in irrigation farming in irrigation farming in the North West Province South Africa.

2.10 Chapter Summary

This chapter provided a review of the literature and identified the training and process-related research issues. The literature review covered training, training types; training needs assessment concept; and Training Need Analysis (TNA) common models and theories in which the study cantered on the individual analysis model. In addition, the background on training needs and its important role in advancing human performance in a given situation was further highlighted in the chapter.

The chapter also outlined the lessons of women involved in irrigation farming globally on the skills and training needs. As a result, irrigation systems have been seen as a critical common resource of property needed to increase crop supplies and sustain livelihoods as well. South Africa, Lesotho, Zimbabwe, Nigeria, Iraq, and Cambodia women's training needs were all discussed.

The role that training plays and its impact on agriculture was also discussed, It was identified that since agriculture is the main source of livelihood for most developing countries, it is of utmost importance to provide training not only to producers, i.e. farmers, as farmers ' training yields a variety of results, but also to agricultural scientists and technologists. Also affected

were the factors influencing farmers' training. It was found that mostly farmers' socio-economic characteristics are responsible for their willingness to be trained or not to be trained.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The aim of the research methodology section is to orientate the reader on the study area. This study is quantitative in nature. Data were obtained from a primary survey of women farmers involved in irrigation farming. An outline of the research design, the population of the study, sampling procedures (such as sampling techniques and sample size) are also provided in this chapter. The methods and instruments used to collect data, issues of validity and reliability, ethical considerations as well as techniques used in analysing data are also discussed in this chapter.

3.1 Study area

The study was conducted in the North West Province, South Africa. The Province is made up of four districts as follows: Ngaka Modiri Molema District Municipality, Dr Ruth Segomotsi Mompati, Dr Kenneth Kaunda District Municipality and Bojana District Municipality. The focus of this study was on small irrigation farming of the Taung irrigation scheme (located in Dr Ruth Segomotsi Mompati District Municipality) and Dinokana falling within the Ngaka Modiri Molema District Municipality. According to the North West Parks Board, the surface area of the North West Province of South Africa is 118,797 square km (45,869 sq miles). The Province lies between 22- and 28-degrees longitude east of the Greenwich Meridian and between 25^{o} and 28^{o} degrees latitude south of the Equator (Cowley, 1985). The region is situated 1200 mm above sea level and has an annual rainfall of 430 mm. It has a very dry climate in winter, temperatures range from 16-38 degree Celsius.

According to Statistics South Africa (2011), the Province has a population of 3.9 million people and about 65% of them live in rural areas. It shares an international border with Botswana. Within South Africa, the Province is bordered to the south by the Free State and the Northern Cape, and the northeast and east by Limpopo and Gauteng provinces (NWPG, 2009). The North West Province was created in 1994 through the merger of Bophuthatswana, one of the former Bantustans (or black homelands) and the western part of the Transvaal, one of the four former South African provinces. Most residents in the Province are the Tswana people and speak Setswana as their home language. Smaller groups include Afrikaners, Sotho and Xhosa-speaking people. English is spoken primarily as a second language. The majority of residents are Christians. Mahikeng, formerly Mafikeng, is the provincial capital. Other major towns include Klerksdorp, Potchefstroom and Rustenburg.

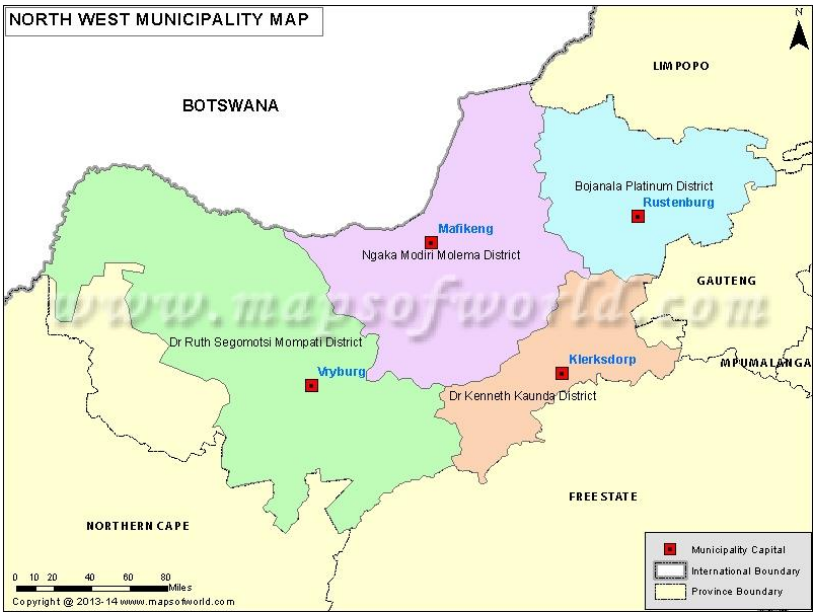

Figure 2 Map of North West, districts and capitals

Source: Mapsoftheworld.com (2016)

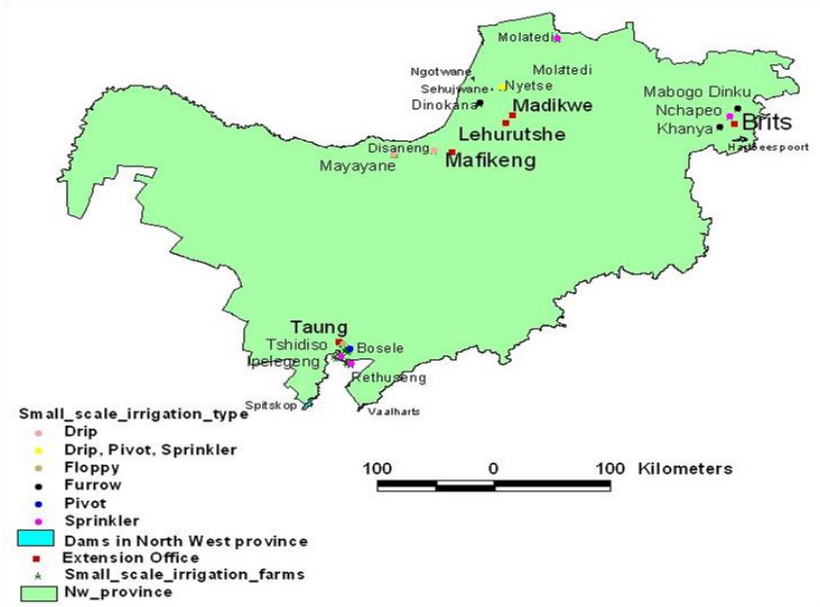

Figure 3: Map of the North West Province showing the irrigation schemes

Source: Palamuneli, Tekana and Oladele (2013)

3.2 Selection of Irrigation Schemes

The irrigation sites were selected for this study due to the functionality of the schemes and high concentration of women farmers.

3.2.1 Taung

The scheme is located in the western part of the North West Province in the Dr Ruth Mompati District Municipality. It was founded in 1939 by the South African government as part of the Vaal Harts scheme. It is situated in 27º 34 South and 24º 44 East. It lies between an altitude of 1100 m – 1300 m above sea level and has a slope factor of between 0-9 percent. The area is generally dry with average annual rainfall of 322 mm occurring mainly during summer and the area experiences high temperatures ranging from 18.7º C and 32.5º C (Tekana & Oladele, 2014). The region is the coldest in the province during July as temperatures drop to 0.7^0 Celsius on average during the night (GTLM, 2011). According to the DACERD (2013) report, the irrigation scheme irrigates the land by means of centre pivots, flood and sprinkler irrigation.

The scheme is divided into five schemes namely: Bosele; Ipelegeng; Reaitlhoma; Rethuseng and Tshidiso.

Farmers are selected and allocated land by the chief with the help of the Department of Agriculture. The scheme allows farmers to irrigate two or three crops per year. Varieties of crops are grown on the scheme and most often it is rotational. Acha (2014) state the prominent crops in Taung irrigation scheme are lucerne, barley, potatoes, groundnuts and onions. According to Palamuneli, Tekana and Oladele (2013) farmers within the North West Province predominately plough vegetables like green pepper, spinach, cabbage, lettuce, onion, green beans tomatoes, butternuts and beetroot. Both men and women are involved in farming activities, but their involvement is characterised by either social or cultural norms. Furthermore, the proportion of men and women differs in the Taung irrigation scheme; women mostly participate in many of the farm activities whereas men manage machinery, operate tractors and help with the harvesting.

3.2.2 Dinokana

The Dinokana project near Zeerust is located in the Ramotshere Moiloa Local Municipality in Ngaka Modiri Molema District Municipality. The vast Municipality covers a total area of 7200 km^2 and shares borders with Botswana in the North, Moses Kotane and Kgetleng River Local Municipality in the east and Ditsobotla and Mahikeng in the South. The natural environment is primarily characterised by tuft thorn veldt and mixed bushes. Its GPS coordinates are 25^o 17 south and 26^o 02 east. The area is generally dry with an average annual rainfall of 439 mm and high temperatures ranging from 19.4^{o}C and 30.8^o C. (Tekana & Oladele, 2014). According to Balarane and Oladele (2014), the prominent crops in Dinokana irrigation scheme are cash crops such as pumpkin, maize, beetroot, sorghum and groundnuts.

Farmers in the schemes do not have formal ownership of the allocated land; it is the responsibility of the tribal authority to see to it that land is allocated. The proportion of women and men in the agricultural activities on the irrigation schemes varies because men felt that women could not deal with the strain of the scheme and can only be on the go during harvesting and other off farm activities. In Dinokana the irrigation farm adds up to eighty-five hectares. It includes a previous rice scheme which has now been transformed to vegetable plots distributed to co-operatives by the village chief. Each plot of 2.5 to 5 hectares is also allocated to individual, either a female or a male farmer by the village Chief. Table 3.1 shows a summary of the irrigation schemes which include source of water, irrigation methods, temperature and market areas for farmers.

Table 2: Location distribution of respondents

District	Region	Name of the scheme	Distribution
Ruth Segomoti Mompati	Taung	Reaitlhoma	17
		Tshidiso	24
		Bosele	15
		Ipelegeng	10
		Rethuseng	7
Ngaka Modiri Molema	Zeerust	Dinokana	10
		Total	**83**

Source: Field survey 2016

Table 3: Description of Irrigation Schemes

Irrigation Scheme	Availability of Water	Irrigation Method	Temp °C (Jan -Min)	Temp °C (Jan -Min)	Rainfall (mm/a)	Market
Taung:			18.7	32.5	318	
Rethuseng Bosele Ipeleng Tshidiso	Receive water from Vaal Harts channelled by pipes	Sprinkler Pivot Sprinkler Floppy				Klerksdorp (230km), Mafikeng (265km), JHB
Zeerust: Dinokana		Furrow	19.4	30.8	439	Local community – most plots inactive. Cash crops

Source: Palamuneli, Tekana and Oladele (2013)

3.3 Research design

Pieterson and Maree (2007) describe research design as a strategy used to lead the researcher on how to continue determining the nature of relationships among identified variables. In this study, mixed methods were used. The expression 'mixed methods research' refers to research that amalgamates both qualitative and quantitative data within a single study (Wisdom *et al.*, 2012, Creswell & Plano Clark, 2011). Glogowska, (2011) as well as Zhang and Creswell (2013) state that 'Mixing' refers to the procedure whereby the qualitative and quantitative fundamentals are connected to produce a fuller description of the research problem. The methods were focus group discussions and cross-sectional survey.

According to Bless and Higson-Smith (2000), the mixed methods research approach is concerned about the condition that exists, processes that are prevailing, developments that are ongoing and trends that are developing. In this study, an assessment of demographic characteristics of women farmers was undertaken as well as an analysis of the socio-economic conditions of farmers involved in the irrigation scheme. An examination of the training needs of women farmers was done in order to identify the benefits of the schemes, as well as an assessment of the role of the scheme in terms of empowering women farmers involved in irrigation farming to reach their goal of becoming sustainable farmers.

3.4 Population of the study

According to Makapela (2015), population is described as the collection of elements that the investigator emphasises upon and which the outcomes attained by testing the sample will be generalised. In this study the target population was a total of 120 women farmers on irrigation schemes in the North West Province. The functional irrigation schemes are Taung and Dinokana irrigation schemes. Women farmers who own plots on the irrigation scheme and make decisions on their plots for production activities constitute the population of the study.

3.5 Sample size and Sampling procedure

The sampling method used in this study is a purposive stratified random sampling method. The technique is also known as judgmental sampling and it relies on the judgment of the researcher when it comes to selecting respondents. A sample assessed is mainly small when compared other probability sampling techniques (Palys, 2008). The key goal of the technique focuses on certain characteristics of a population that is showing interest in the study which will enable the researcher to answer research questions (Saunders *et al.*, 2012). Black (2010) adds that the technique is appropriate in a sense that it allows only a limited number of participants who are willing to contribute to the study.

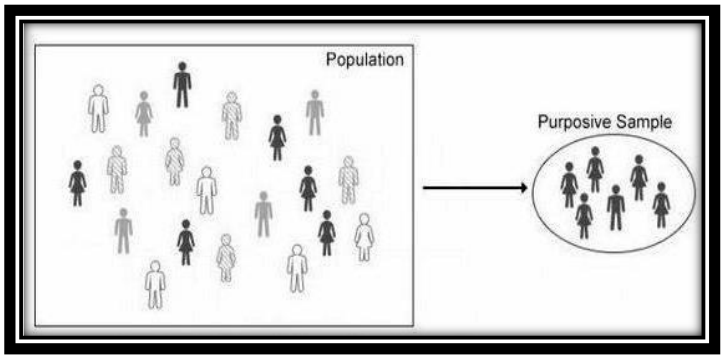

Figure 4: Purposive Stratified Random Sampling Method

Source: Patton (2001)

The study focused on Taung and Dinokana irrigation schemes since they are the only active irrigation schemes in the province. From these schemes, a total of 83-woman farmers were willing to participate in the study. The exact number of women farmers in each irrigation scheme could not be asserted as at the time of data collection from the provincial department of agriculture, they had not conducted a head count of the farmers.

Determining the sample size

To determine the sample size in the study of women involved in the irrigation schemes, Raosoft's sample size was employed. Various aspects were deliberated in determining the

sample size to be measured. First, the sample size would have to assure a certain confidence in the results. Second, it should ascertain margin for normal process variation as well as allow tester error. A confidence level of 95% was sought, with a 5% margin of error.

A sizing calculator recommended to determine the sample sizes was Raosoft Corporation. The calculator determines the sample size, n, using the following equations:

$$n = {}^{N\,x}/_{((N\text{-}1)\,E^2 + x)} \quad (1)$$

$$x = Z({}^{c}/_{100})^2 r\,(100\text{-}r) \quad (2)$$

$$E = \text{Sqrt}\,[{}^{(N\,-\,n)\,x}/_{n\,(N\text{-}1)}] \quad (3)$$

Sample formulas: Gutierrez *et al*. (2013); Christy and Kerry (2012).

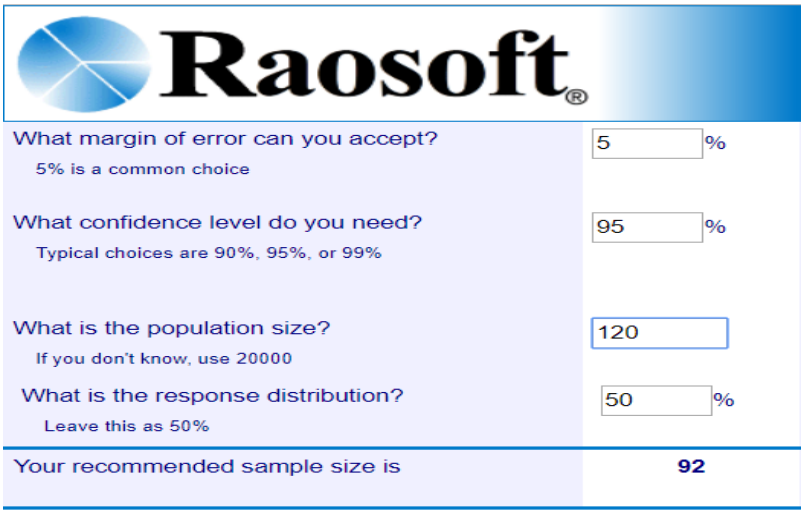

Figure 5: Raosoft Sample Sizing Calculator

Source: O'Leary *et al.* (2007)

Where N is the population size, E is the margin of error (5%)

r is the fraction of responses (50%), and

Z (c/100) is the critical value for the confidence level c (5%)

For a population size (N) of 120 women farmers, a margin of error (E) of 5% is assumed, r is the fraction of responses that is of interest, (50% yields the largest sample size) and(c/100) is

the critical value for the confidence level c (95%). The calculator yields a result of 92 respondents, but due to limitation a sample of 83 participants were willing to participate in the study since it was voluntary.

3.6 Data collection and measurements of variables

Data for this study was generated from primary sources based on the objectives of the study. The two methods used to collect data were the focus group discussions and questionnaire. Focus group discussions were held with women involved in irrigation farming on the irrigation schemes. The purpose was to obtain additional information from women farmers in order to enrich the responses obtained from the questionnaire. According to Kumar (2011), a focus group discussion is one of the strategies in qualitative research in which attitudes and perceptions towards an issue are explored through a free and open discussion between participants and the researcher.

The purpose of the focus group discussion is to draw upon the different types of irrigation system used by woman farmers involved in irrigation farming, discuss the competency level of women involved in irrigation farming and the importance of skills to irrigation farming. According to Bless *et al*. (2006), the purpose of a focus group discussion is to gather information that is beyond the scope of quantitative research.

A questionnaire with open and close-ended items was used to collect data for the study. The questionnaire was developed based on the objectives of the study. Section A of the questionnaire focused on household characteristics of participants (such as gender, age, marital status, level of education, size of household, head of household, number of dependents, house, number of months/years in farming, tenure status, size of farm, membership of any farmers' group, contact with extension agents, number of workers, source of labour, number of years of experience on the irrigation scheme, number of workers involved in the scheme and non-

farming activities). Open-ended items of the questionnaire allowed respondents the opportunity to provide responses as they wished, and an opportunity to provide detailed and prolonged responses as they desired (Mabe & Oladele, 2012).

Section B focused on farming enterprises. A dichotomous rating scale of Yes (2) and No (1) was used to measure the responses of women farmers and descriptive statistics such as percentages and frequencies were used to describe the data obtained from respondent (consisting of 23 items).

Table 4: Farming enterprises

Crops	Yes	No
Maize		
Wheat		
Sunflower		
Sorghum		
Groundnut		
Barley		
Lucerne		
Tomatoes		
Potatoes		
Cabbage		
Spinach		
Pumpkins		
Green pepper		
Onion		
Garlic		
Green beans		
Citrus		
Carrots		
Beetroot		
Mushroom		
Lettuce		
Cucumber		

Section C focused on the sources of information. A dichotomous rating scale (Yes/No) was used to measure the responses of respondents regarding their source of information, and descriptive statistics were used to describe the data (consisting of 9 items)

Table 5: Sources of information

	Use	
Source of information	**Yes**	**No**
Television		
Radio		
Newspaper		
Cell phones		
Internet		
Community library		
Extension workers		
SMS		
Other		

Section D requested information from respondents on competency and training needs. Items in this section of the questionnaire were measured on a 3-point Likert scale of (1) low, moderate (2) and high (3). A list of 23 farming skills was developed from the analysis based on the prevailing farming activities among women farmers and was used to measure competency of women in irrigation farming. The items were divided into three categories namely; pre and post-planting (10), irrigation (4) and marketing (9). A mean weighted discrepancy score (MWDS) was used to describe the overall rankings for each of the competencies (Elhamoly *et al*., 2014).

Table 6: Farming skills used to measure competency of women involved in irrigation farming

		IMPORTANCE			COMPETENCE		
	Pre- and post-planting	VI	I	NI	VC	C	NC
	Soil preparation for ploughing						
1	Determining inter and antra row spacing						
2	Determining seed depth						
3	Selecting appropriate planting methods for various crops						
4	Evaluating soil profile in farming						
5	Knowledge of crop rotation						
6	Calculating the amount of fertilizer to apply for various crops						
7	Appropriate application of herbicides and fungicides						
8	Calibrating planters and seeders for various crops						
9	Planning and carrying out harvesting appropriately for various crops						
10	Planning and carrying out harvesting appropriately for various crops						
	Irrigation management						
11	Evaluating farming land for soil and water conservation						
12	Recommending suitable profile and water conservation measures for specific farm land						
13	Scheduling irrigation and frequency						
14	Knowledge on the amount of water to use						
	Marketing						
15	Knowledge of the market for your produce						
16	Price determination for your produce						
17	Knowledge of reading and interpreting marketing information						
18	Knowledge of marketing contracts						
19	Value adding						
20	Service provider for storage facilities						
21	Farm record-keeping						
22	Financial management						
23	Packaging						

Very-Important(VI),Important(I),Not-Important(NI) Very-Competent(VC),Competent(C),Not-Competent(NC)

3.7 Validity and reliability

Validity determines whether the instrument measures what it was intended to measure (Thatcher, 2010). Creswell (2014) states that reliability is when an investigator uses certain processes to check for the precision of the research findings. The questionnaire was face validated by a panel of agricultural extension experts and researchers to determine its validity. The panel consisted of the head of department, lecturers and academics from the Department of Agricultural Economics and Extension. Human capital theory was applied and underlying the context of the questionnaire and also leads to the maturity of the individual as a fiscal factor (Shingarov, 2012).

Reliability is the extent to which results of a study are reliable over time and a precise illustration of the total population and the results can be repeated under a similar methodology. The outcomes of a research are measured as reliable if consistent results have been obtained in identical situations but different circumstances (Bolarinwa, 2015). Reliability of the instrument was improved through a number of ways. Firstly, a pilot test was performed on a selected group of women farmers in the Taung Irrigation Scheme.

Secondly, undergraduate students who were assisting with data collection were given training on the questionnaire before the data collection process. The training provided data collectors with a uniform understanding of the questions and how to ask them in order to be understood by respondents. To ensure the reliability of the questionnaire, a split-half technique was used to determine r^2 0.85 reliability coefficient. Scores obtained from the pre-test were subjected to Cronbach alpha test, which was used to assess the consistency of Likert scale questions used to assess the competence and training needs of respondents

3.8 Measurement of variables

The variables in the study included the personal characteristics of farmers, their livelihood strategies and food security status. The levels of measurement and their analysis are presented accordingly in the table below.

Table 7: Measurements of Variables

Variable	Level of measurement	Analysis
Age	Nominal	Frequency, percentages, dummy in regression
Marital status	Nominal	Frequency, percentages, dummy in regression
Religion	Nominal	Frequency, percentages
Number of dependents	Interval	Frequency, percentages
Household size	Interval	Frequency, percentages, dummy in regression
Total number of males in the household	Interval	Frequency, percentages
Enterprise	Nominal	Frequency, Percentages
Total number of females in the household	Interval	Frequency, percentages
Level of education	Nominal	Frequency, percentages, dummy in regression
Farm enterprise	Nominal	Frequency, percentages
Farming experience	Interval	Frequency, percentages, dummy in regression
Tenure status	Interval	Frequency, percentages
Farm size in Ha	Interval	Frequency, percentages
Member of farmers' group	Nominal	Frequency, percentages, dummy in regression
Contact with extension agents	Nominal	Frequency, percentages, dummy in regression

3.9 Data analysis

Descriptive statistics was used, this technique was applied to describe the sample's attributes. Cooper and Schindler (2011) indicate that descriptive statistical methods are used to represent the sharing of midpoints, spread and summary of the data. Descriptive instruments such as percentage and frequency tables were used in the study. The techniques were applied for the

specific objectives, which are the socioeconomic characteristics of the respondents, the type of irrigation methods, the type of enterprises and source if information for women farmers.

Data were analysed using the IBM Statistical Packages for the Social Sciences 21.0 (SPSS Inc, Chicago II., and USA). Descriptive statistics such as frequency distribution, percentages, mean and standard deviation were used to describe the personal characteristics of women farmers on the scheme. Tables were used to enhance the readability of the results. The importance and competencies of women involved in irrigation farming were measured on a 3-point Likert scale of NI, I and VI and NC, C and VC. A mean weighted discrepancy score (MWDS) was used to calculate and describe the overall rankings for each of the competencies. To determine the MWDS, the following statistical steps were used: A discrepancy score (DS) was calculated for each individual on each competency by taking the importance rating minus the ability (competency) rating; a weighted discrepancy score (WDS) was calculated for each individual for each of the competencies by multiplying the discrepancy score by the mean importance rating; and a MWDS for each of the competencies was calculated by taking the sum of the weighted discrepancy scores and dividing by the number of observations (Borich, 1980; Elhamoly *et al*., 2014).

$$MWDS = \sum \ (I_{ith} - C_{ith}) \times \bar{x}I \ / \ N$$

where I = importance rating for each task, C = competency rating for each task, $\bar{x}$ mean of importance rating, N = number of observations. Using the MWDS, the 23 competencies derived from the operations and activities carried on in the field were ranked (Borich, 1980; Elhamoly *et al*., 2014; Alibaygi & Zarafshani, 2008; Christensen *et al*., 2009; Oladele, 2015).

Analytical model

$$\text{Weight score (WS)} = \frac{(\text{No of V1} * 3) + (\text{No of I} * 2) + (\text{No of NI} * 1)}{\text{Total No of VI + I + NI}} * 100$$

The responses provided by farmers were collected in a 3-point continuum scale as very important (VI), important (I) and not important (NI) by assigning scores 3, 2 and 1 respectively. If the selected farmer in a particular irrigation scheme marked the thrust area X as very important, then the WS was 3. If all respondents in a particular farming scheme marked a thrust area X as not important/no response, then the WS was 1. If all farmers in a particular farming scheme marked the thrust area X as important, then the WS was 2. If majority of farmers marked the thrust X as very important and important, the WS was in between the range of 2-3. If majority of farmers marked the thrust X as not important, the WS was in between the range 2-3. Weighed score ranging between 3-2 was ranked within each group of skills or tasks.

Procedures on calculating the medium weight discrepancy score

The Excel-based MWDS calculator is a Microsoft Excel file. The worksheet is used to calculate discrepancy scores (DS) for competence and importance, and another spreadshe*et al*lows users to calculate what is/what should be scores. Calculations are programmed and the output comprises of the discrepancy scores, weighted discrepancy scores, and the MWDS for each item. The final MWDS are displayed in a summary table that indicates the MWDS for each item and the valid number for each sample as indicated in the figure below (Layfield & Dobbins, 2002).

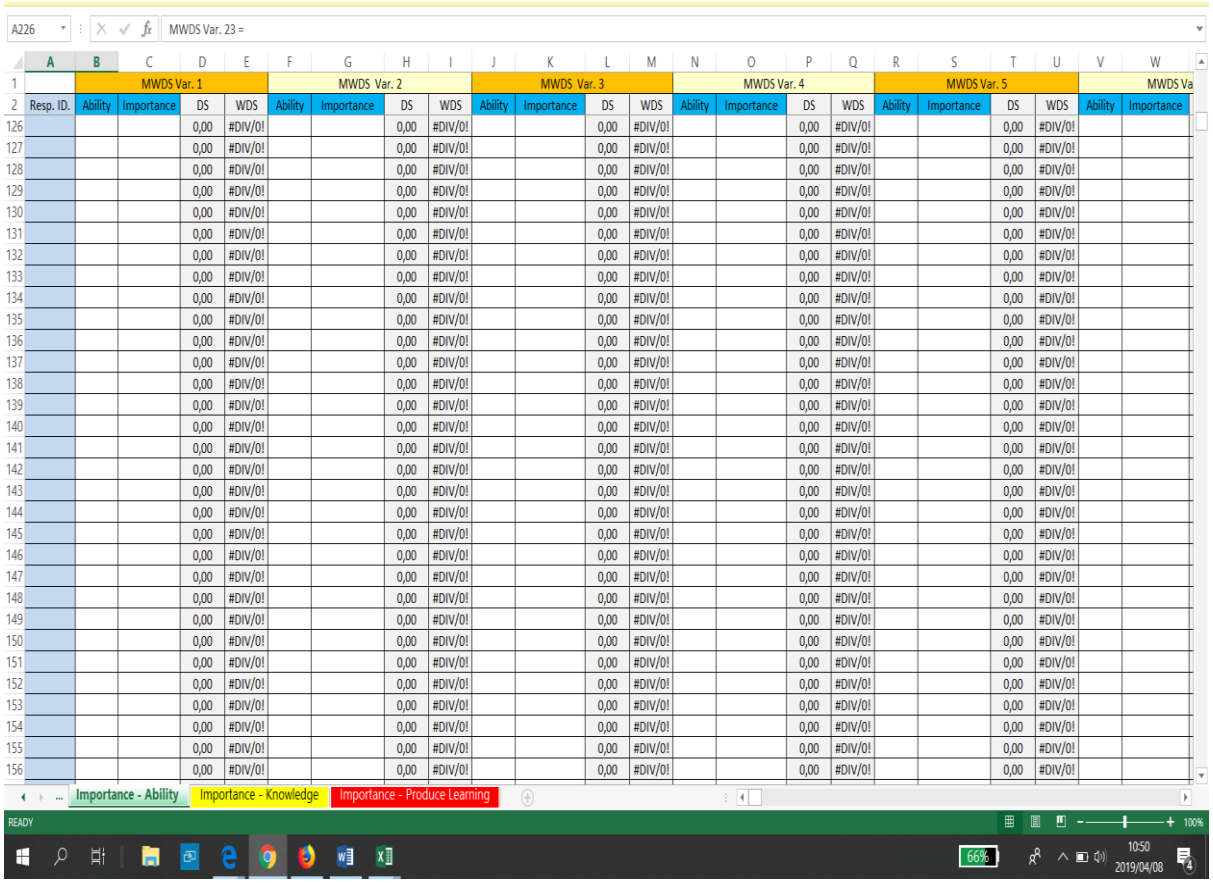

Figure 6: Sample View of the Mean Weighted Discrepancy Score Calculator

Source: McKim and Saucier (2011)

3.9.1 Linear Regression model

This regression model was used to segregate factors determining women farmers' competence with specific reference to the effect of socio-economic characteristics and types of irrigation on the irrigation scheme. The F test was used to test the significance of the linear regression.

3.9.2 Model specifications for Competence

Following Takana & Oladele (2011) Competence (Y) = f ($ß_0 Y_0$ + $ß_1$ Age+ $ß_2$ Marital status + $ß_3$ Number of dependents + $ß_4$ Number of households + $ß_5$ Level of educational + $ß_6$ Tenure status + $ß_7$ Farm size + $ß_8$ Member of farmers' group + $ß_9$ Contact with Extension Services + $ß_{10}$ Number of years in farming+ $ß_{11}$ Number of years being part of the irrigation scheme + $ß_{12}$ Number of workers in the irrigation scheme + $ß_{13}$ Central Pivots irrigation + $ß_{14}$ Flood irrigation

system + ß$_{15}$ Sprinkler irrigation + ß$_{16}$ Micro Irrigation + ß$_{17}$ Drip irrigation + ß$_{18}$ other irrigation.

$$Y = f\left(\beta_0 Y_0\right) + \beta 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

3.10 Ethical considerations

The study recognised the ethical consideration that was addressed through voluntary participation. The respondent's right to privacy was exercised and the permission to conduct interviews with participants in the study area was requested and obtained from community leaders. Obscurity was guaranteed to avoid identical reaction from the respondents. Conversant consent was uttered clearly for the respondents whether they want to partake in the study or not.

They were informed of the objectives of the study and participants were assured of the confidentiality of the information provided. Participants were also informed that the information provided might be used for further research purposes and to develop policy guidelines in the study area. Participants were treated with respect and dignity. The information provided was treated with utmost confidentiality. The ethical considerations and guidelines were in compliance with the regulations of the North-West University.

3.11 Project outcome

The identification of training needs for women engaging in irrigation farming is envisioned to bring about improvements among women within the agricultural sector. Such enhancement will also accommodate women with disabilities as to advance them to become more of commercial farmers than subsistence farmers. The effect of the success of the exercise in the province will uplift the level of competence among women farmers and also boost their confidence in irrigation farming. This concept will also give Rural Environment and

Agricultural Development a respectable image and also promote their grading in the National Department of Agriculture and other institutions such as Water Research Commission (WRC). The outcomes of the study add to the existing literature about training needs of woman in irrigation farming, its challenges and contribution towards women development and food security. Also, the research showed the effect of not being involved in water user associations in the province as well as its effect on the livelihood as well as the benefits aligned to such associations for the respondents.

3.12 Summary of Chapter

This chapter has provided an overview of how the study was conducted. The study was conducted in two Districts of the North West Province namely, Ngaka Modiri Molema District and Dr Ruth Segomotsi Mompati District. Eighty-three women farmers were interviewed from the list of farmers obtained from extension advisors. A questionnaire was designed as a primary tool for data collection and also through focus group discussions. Data was collected through face-to-face interviews and focus group discussions. Data collected was coded and entered into Microsoft excel and transferred to the Statistical Package for the Social Sciences (SPSS). Descriptive and inferential statistics were used in analysing the data. Models for measuring farmers' competency, i.e., Borich Model and inferential statistics, i.e., Linear Regression were all detailed.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

In this chapter the findings of the descriptive statistics of the study are presented. The aim of this was to assess the training needs of women in irrigation farming in the North West Province.

4.1 Results and discussion of the descriptive statistics of the respondents

The results obtained from the survey are presented in this chapter. The results focus on the demographic characteristics of farmers, level of education, tenure status, contact with extension officers and frequency of visits, farming enterprises, types of irrigation systems, source of information, type of irrigation, reasons for involvement in the irrigation scheme, the Weighted Score (WS) and ranking of farmers' competence on irrigation activities, the Weighted score (WS) and ranking of farmers' training needs on irrigation activities and a Mean Weighted Discrepancy Score on the overall ranking for each of the competencies.

4.2 Demographic characteristics of farmers in the study area

4.2.1 Location

The findings of the study as presented in table (8) indicate that the majority of the respondents with 88 per cent were situated in the Dr Ruth Segomotsi Mompati district which comprises of Reaitlhoma, Tshidiso, Bosele, Ipelegeng, Rethuseng. The results further indicate that only 12% of respondents were located in Dinokana which is situated in the Ngaka Modiri Molema District.

Table 8: Location distribution of respondents

Name of the scheme	Frequency	Percentage
Dr Ruth Segomotsi Mompati (Taung)		
Reaitlhoma	17	20.5
Tshidiso	24	29.0
Bosele	15	18.1
Ipelegeng	10	12
Rethuseng	7	8.4
Ngaka Modiri Molema District (Zeerust)		
Dinokana	10	12

Source: Field survey 2016

4.2.2 Age distribution of respondents

Figure (6) shows the personal characteristics of women farmers involved in irrigation schemes in the North West Province, South Africa. The results reveal that 37.3% of the women involved in irrigation are less than 50 years, while the majority of women (62.7%) are above 50 years of age. This may be attributed to the fact that older women have always engaged in farming activities and contribute to the agricultural, rural economies and food security in the household. The results are in line with Tekana and Oladele (2014) which indicated that there is a greater proportion of women over the age of 50 years as compared to other age distributions in Taung irrigation system. Balarane and Oladele (2014) reported that the prominent age group of farmers in irrigation schemes in the North West Province in South Africa is that of those over the age of 50 years.

Gumede (2013) revealed that majority of women farmers involved in irrigated agriculture were over the age of 50 years in three irrigation schemes; namely Mashushu, Steelpoort and Rambuda in Limpopo. Thagwana (2009) reported that in Tshiombo irrigation scheme in Limpopo, the majority of women involved in irrigation farming are over the age of fifty. The results also show that the younger generation is not involved in agriculture since they are not

interested in farming. Nowata (2014) indicated that there is a larger proportion of farmers who are over 50 years old in irrigation schemes of Sekhukhuni district. The results are also in accordance with (Mphahlele *et al.*'s 2010) findings which reported that in Tswelopele scheme in Sekhukhune district, the highest number of farmers participating in the scheme ranges from 45 to 65 years old. This is measured as a risk factor in the sustainability of the scheme over a long duration due to lack of youth. Moyo *et al.* (2017) added that women farmers in Mkoba irrigation scheme in Zimbabwe are dominating and are relatively old. SACAU (2013) stated that Africa's agriculture is mainly carried out by the elderly and the retired populace in rural areas as young people seek opportunities in growing urban areas and their environment.

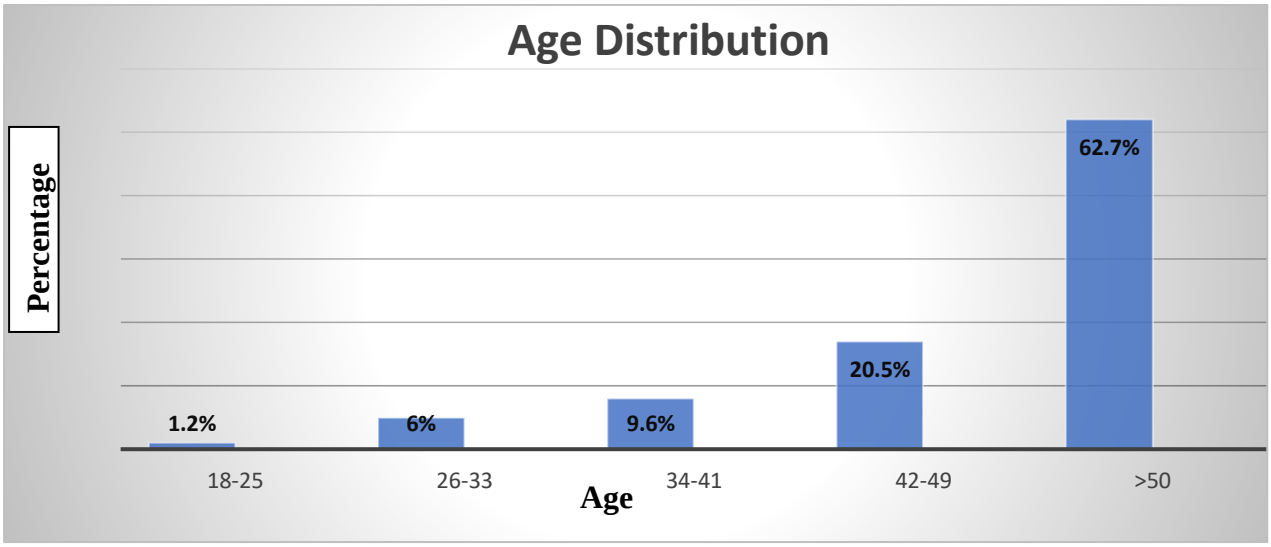

Figure 7: Age distribution of respondents

4.2.3 Marital Status

Figure (7) reveals that a greater proportion of farmers in the schemes were married (42.2%) while 31.3% were single and 26.5% were widows. The results are in line with Tekana and Oladele (2014) findings which showed that there is a superior proportion of married woman in Taung irrigation scheme in the North West Province than any other marital status. Sharaunga's (2015) findings indicated that there is a greater proportion of married women in irrigation farming as compared to another marital status in Msinga, South Africa. Thagwana (2009)

reported that in Tshiombo irrigation scheme, Limpopo province, the majority of women in the irrigation scheme are married. Simango (2015) also stated that there is a larger distribution of married women in Marange Irrigation Scheme in Zimbabwe as compared to other marital status. The results are in contrast with Acha's (2014) findings which indicated that there is a greater proportion of single women than married ones in Taung irrigation scheme in the North West Province in South Africa.

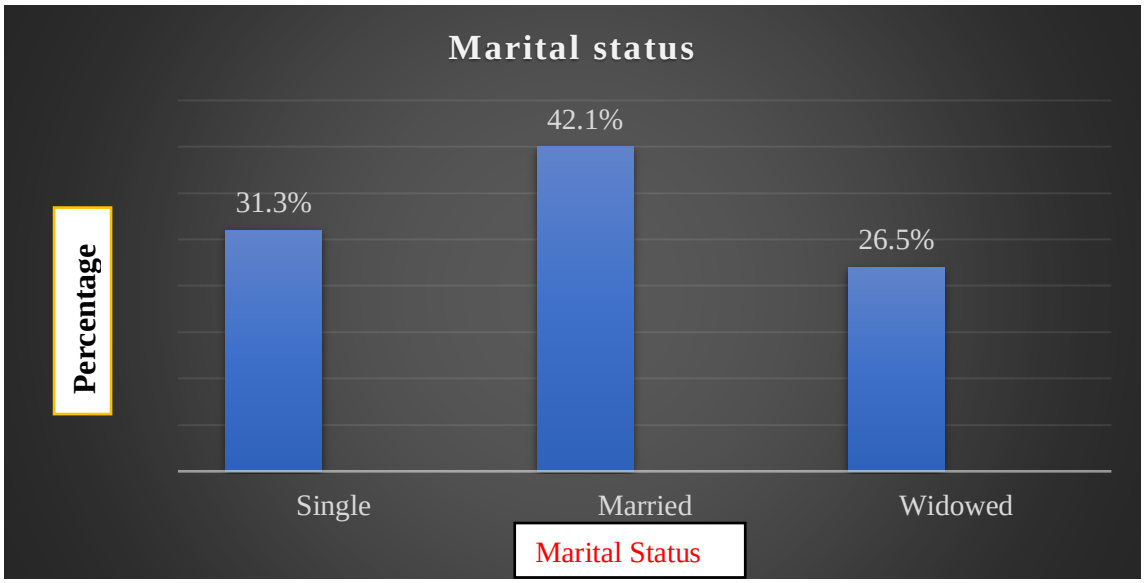

Figure 8: Age distribution of respondents

4.2.4 Educational status of the respondents

The results in table (9) shows that 34.9% of the respondents interviewed had a primary school education, 24.1% had high school education, and 10.8% had no formal schooling, while only 2.4% had college and tertiary education. The results are in line with Tekana and Oladele (2014) that indicated that in Taung, Nyetse, Molatedi, Mayaeyane area in the North West Province, South Africa, a greater proportion of women in irrigation farming have primary education. Acha (2014) also reported that there is a greater proportion of women farmers with primary education than any other educational level in Taung irrigation scheme in South Africa.

Gumede (2013) finding also showed that majority of women involved in irrigation schemes had low level of education in Mashushu, Rambuda and Steelpoort irrigation schemes in Limpopo. Mehra and Rojan (2008) reported that women are less in most parts of Africa, Asia and the middle East. This has a negative impact on their admittance and capability to recognize technical information, globally women have less access to education and training in agriculture. Ntai (2011) reported that in Lesotho, there is a steep deterioration level of education found in farmers older than 40 years. This may be due to the fact that agriculture is perceived as a career for less intelligent individuals and therefore education is not necessary (Qhobela, 2005). Education serves as one of the crucial aspects in farm production due to hasty changes in the economy and environment.

The result is in contrast with Moyo *et al.* (2017) that indicated that the educational level of women farmers in the Mkoba irrigation scheme of Zimbabwe exceeds 11 years which makes it easy for them to adopt new crops and improvement in production. Mutambara and Munodawafa (2014) indicated that low level of education reduces understanding of farming concepts and access to information which are both pivotal in sustaining high production. Furthermore, they added that the level of education acts as one of the significant variables in crop choice and production potential. According Montenegro and Patrinos (2014), education is one of the key catalysts towards improving farm production because of the rapid changes in technology and the economy. Hill (2011) as well as Sinyolo, Mudhara and Wale (2014) indicated that access to education by women adds to their confidence and negotiation skills for more decent work which consequently would lead to women empowerment. Oni *et al.* (2011) and Ahmed *et al.* (2012) stated that education allows women to adopt new technologies for water irrigation management.

Table 9: Educational status of the respondents

Level of Education	Frequency	Percentage
Primary school	29	34.9
Secondary school	21	25.3
High school	20	24.1
College	2	2.4
University	2	2.4
Non-formal education	9	10.8
Total	**83**	**100**

Source: Field survey 2016

4.4.5 House hold size of respondents

Household sizes denote to the quantity of people living together in a household including non-family members. As indicated in table (10), the majority of the respondents (59%) indicated that they have between 5-9 members into their households, 28.9% of the respondents have from 1-4 members, and 9.6 percent indicated they have between 10-15 members. About 2.4 per cent only indicated that they have over 15 members in their households. Women farmers often meet some difficulties which include lack of power and elementary control inside the family which has an effect on their cultivating framework systems (Global Forum for Rural Advisory Services GFRAS, 2016).

Table 10: Household size distribution of respondents

Household size	Frequency	Percentage
1-4	24	28.9
5-9	49	59.0
10-15	8	9.6
>15	2	2.4
Total	**83**	**100**

Source: Field survey 2016

4.2.6 Farming experience of respondents

Majority of women in the irrigation schemes (44.6%) indicated that they have more than 30 years in irrigation scheme, while 8.3% of respondents indicated that they had between one and five years of farming experience. This clearly suggests that most farmers have been working on the irrigation schemes for a longer period. Similar findings have been found by Tekana and Oladele (2014) on a study which was conducted in Taung irrigation scheme. Gumede (2013) reported that over fifty percent of women in irrigation scheme in Mashushu, Steelpoort, and Rambuda in Limpopo indicated that they have been involved in irrigated agriculture for more than 20 years. The results are in contrast with Balarane and Oladele (2014) results which indicated that majority of women in irrigation farming in the North West Province have less than ten years in irrigation farming.

Table 11: Farming experience of respondents (Years)

Farming Experience	Frequency	Percentage
1-5	38	45.8
6-11	18	21.7
12-17	10	12
18-23	8	9.6
>24	9	10.8
TOTAL	**83**	**100**

Source: Field survey 2016

4.2.7 Land tenure status of respondents

Table (12) shows the land tenure status for farm production. The result indicates that about 94% of the farmers were cultivating on communal farms allocated by the village Chief, 4.8% of farmers inherited the land they cultivate on, while 1.2% were farming on leased plots. Shumba (2011) indicated that land act as one of the crucial factors that regulate e welfare of many rural households.

The results are in line with Balarane and Oladele's (2014) findings which indicated that a larger proportion of farmers indicated that they seek permission from the chief to occupy land due to the customary system of land allocation. Mphahlele *et al.'s* (2010) findings indicated that in Tswelelopele irrigation scheme in Limpopo the irrigation schemes are located within the communal land which is mostly registered in state title as state allocated land to various tribes. Farmers within this scheme are allocated land on individual plots through permission to occupy (PTO) or letters of occupation from the village traditional authorities. Simango (2015) indicated that accessibility to land is one of the hindrances that women are facing in the agricultural sector. Olawepo and Fatulu (2012) mention that most married women in Africa attain land through their partners. Shumba (2011) reported that land is one of the key aspects of establishing the well-being of many rural inhabitants. FAO (2017) stated that factors such as land, extension in education, credit and access to technology still serve as a major constriction for woman farmers in developing countries.

Table 12: Land ownership

Land tenure status	Frequency	Percentage
Inherited	4	4.8
Rented	1	1.2
Allocated	78	94

Source: Field survey 2016

4.2.8 Extension Contacts

The results in table (13) show that 96.4% of farmers have contact with extension services while 3.6% indicated they did not have any contact with extension services. This implies that most of the respondents had access to extension services. Despite the fact that majority of the respondents indicated that they had contact with extension, it was noted that the service they get from extension was not particularly helpful in terms of building their competence.

Sinyolo *et al*. (2014) and Abedi *et al*. (2011) reported that contact with extension services bring about ways into new technologies and play a pivotal role in uplifting the agricultural efficiency and empower human society. The results are in line with Tekana and Oladele (2014) which indicated that majority of women in irrigation farming in the North West Province reported having received extension services. Palamuneli *et al*. (2013) reported that farmers in the North West irrigation schemes have contact with extension services and it has provided farmers with timely and reliable information about what is happening in the area regarding agricultural practices.

The results are also in line with Njuki *et al*. (2013) findings which stated that in Ghana, women have access to extension services, and the majority of them are satisfied with the services they receive. Van Averbeke (2011) pointed out that most researchers in South African smallholder irrigation schemes concluded that the performance of the majority of these enterprises is not performing well due to lack of extension services. The findings by Lamontagne-Godwin *et al*. (2016) revealed that women farmers in Ghana and Sri Lanka have less access to agricultural services. Meinzen-Dick *et al*. (2011) stated that in most developing countries, women are less likely to access resources and may, therefore be bypassed by extension service providers. Mehra and Rojan, (2008) argued that women farmers have less contact with extension services, reason being that the service is provided by men agents to male farmers and always assume that the message will be delivered to women. In that manner knowledge and information is transferred inadequately from husband to wife and further ignoring the constraints faced by women farmers. Mehra and Rojan (2008) further indicated that training of farmers should accompany extension services and visits in order to instil confidence and improve the level of competence in farmers.

Table 13: Respondent's distribution on Extension Visits

Extension contact	Frequency	Percentage
No	3	3.6
Yes	80	96.4
Total	**83**	**100**

Source: Field survey 2016

4.2.9 Distribution of respondents according to the source of labour, length of stay and engagement in off farm activities

About 62.2% of women farmers indicated that they were the source of labour for their farms while 28.9% maintained they involve their families to assist. Only 8.4% of farmers indicated that they hired labour. Raidimi (2014) reported that in Thulamela local municipality in Limpopo province, the majority of women are the source of labour on their farms. FAO (2011) and Ahmed *et al*. (2012) reported that women make up almost fifty percent of the agricultural labour force in Sub-Saharan Africa, an increase from about forty-five percent in 1980. Tekana and Oladele (2011) reported that women only provide labour especially during harvesting and other off-farm activities because men felt that they could not keep up with the duties of the scheme.

Machingura (2007) cited by Phakathi (2016) stated that the majority of small-scale farmers rely on the involvement of the women for production. According to IATE (2015), the agricultural labour force is particularly high for women in sub-Saharan Africa amounting to almost sixty percent. Samee *et al*. (2015) state that in Baluchistan, women are major contributors in all farm-related activities; they are solely responsible for weeding, seed cleaning and storage of crops. They cannot afford to employ other people as they do not generate enough income due to limited access to markets.

Table (14) further indicates how long respondents have been involved in the irrigation schemes. About 37% of farmers indicated that they have been on the scheme for more than 20 years, while only 19 % stated that they have been involved in irrigation farming less than 10 years. Despite the long years in irrigation farming, there are some challenges that impede productivity such as high-water tariffs, lack of skills and ownership rights. About 88% of the respondents highlighted that they are not involved in off-farming activities, meaning their main source of income and livelihood is from the farming activities they are involved with. Machingura (2007) stated that in Mbhashe and Ngqushwa areas, farmers have access to both on and off farming activities to generate income. Agricultural products generate on farm income while off farm wages are procured from off farm employment and social welfare grants.

Tekana and Oladele (2014) support the off-farm activities as they are a crucial strategy for overcoming credit constraints faced by farmers in rural areas. Most studies in developing countries have linked off-farm activities as one of the tools towards poverty alleviation as more credit is generated to meet household needs. Farmers engage in off-farm activities with expectations that they will generate enough capital to be able to purchase inputs to be used to improve their farming enterprise. Mehra and Rojan (2008) added that women must expand their opportunities for wage improvement by being involved in both on and off farm activities. MacNally (2002) argues that working in off-farm activities to generate income by farmers may have a negative impact on the adoption of technology due to a reduction in labour allocation for the farming enterprise. Oya (2010) argues that in Mozambique and Tanzania, husbands prevent women from engaging in off-farm paying employment. Majority of women in Sri Lanka earn their living through farming, as women are not allowed to perform any non-farm jobs (Molen, 2001).

Table 14: Distribution of respondents according to the source of labour, length of stay and Engagement in off farm activities

	Frequency	Percentage
Sources of labour		
Self	52	62.6
Family	24	28.9
Hired	7	8.4
Length of stay on an irrigation scheme		
1-10	16	19
11-20	36	43
>20	31	37
Engagement in off-farming activities		
No	73	88
Yes	10	12

Source: Field survey 2016

4.2.10 Respondents distribution on their Source of information

The finding in the table (15) shows that the prominent source of information for respondents in the study area was from extension agents with 66.3 per cent. Approximately 56.6 per cent of respondents reported receiving information from community meetings followed by 50.6 percent of respondents seeking information through cell phones. 38 per cent of respondents reported receiving information from television, while 1.2 percent reported receiving information from newspapers and internet. The result agrees with Rio (2013) who found that women farmers do not prefer radio as a source of information because of some programmes which are not accessible or were too general for them and maybe broadcasted when they are busy working. The results are in contrast with Alarima *et al.* (2011) which indicated that in Ogun, Ondo, Niger, Ebonyi, Kaduna and Abuja, the Federal Capital Territory the results showed that the of extension services and radio are the least method used for broadcasting information to farmers. Isaya (2015) reported that in Hai and Kilosa Districts, Tanzania, internet is the least method used to access agricultural information by women farmers.

Nowadays, the agricultural sector has become increasingly information-dependent. According to Asenso-Okyere and Mekonnen (2012), the use of information communication technologies such as the internet has the potential to get up-to-date information regarding certain diseases and such information could be used to advise farmers in rural villages. One of the Millennium Development Goals (MDG8) emphasises on the benefits of new technologies, especially the ICTs in the fight against poverty. It promotes gender equality and women empowerment as effective ways to battle hunger, diseases and also enhancing sustainable development and ensuring benefits of new technologies (UN, UNDP, UNEP, World Bank, 2015).

Table 15: Respondents distribution on their Source of information

Source of Information	Yes		No	
	Frequency	%	Frequency	%
Television	32	38	51	62
Radio	49	59	34	41
News Paper	1	1.2	82	98.8
Cell Phones	42	50.6	41	49.4
Internet	1	1.2	82	98.8
Community Meeting	47	56.6	36	43.4
Extension Agent	55	66.3	28	33.7

4.2.11 Types of farming enterprises practiced by farmers involved in irrigation farming

Figure (9) shows the different types of crops grown on irrigated land. Lucerne production is the most prominent crop (79.5%), while production of green pepper and carrots were not common. The majority of respondents produce lucerne in the study area. Department of Agriculture Conservation Environment and Rural Development (2013) reported that Taung irrigation scheme permits agrarians to irrigate two or three crops per year. Different crops are grown on the scheme and most often it is rotational such as Lucerne, maize, millet, onions, wheat, potatoes, and groundnuts.

The results are in line with the findings of Acha (2014) who found that in Taung irrigation, Lucerne is the prominent crop grown in the area. Lucerne production is higher than other crops. Fewer produced vegetables such as onions, potatoes, millets, and groundnuts. Lucerne is a perennial crop with a productive lifespan of five to six years. It is widely grown as forage for cattle and often harvested as hay. Respondents also indicated that it is valuable to animals. Phakathi (2016) stated that the most prominent crops in Ndumo B and Makhathini irrigation schemes, KwaZulu-Natal, South Africa are mainly cabbage, maize and beans. This may be due to the influence of climate. The results are in contrast with Balarane and Oladele (2014) which indicated that majority of the farmers in North West irrigation schemes produce maize. Sinyolo Mudhara, and Wale (2014) indicated that in Tugela Ferry irrigation scheme in KwaZulu-Natal, South Africa, maize, cabbage, potatoes, tomatoes, onions, beans, beetroot, spinach, and butternut are the prominent crops produced in the irrigation schemes.

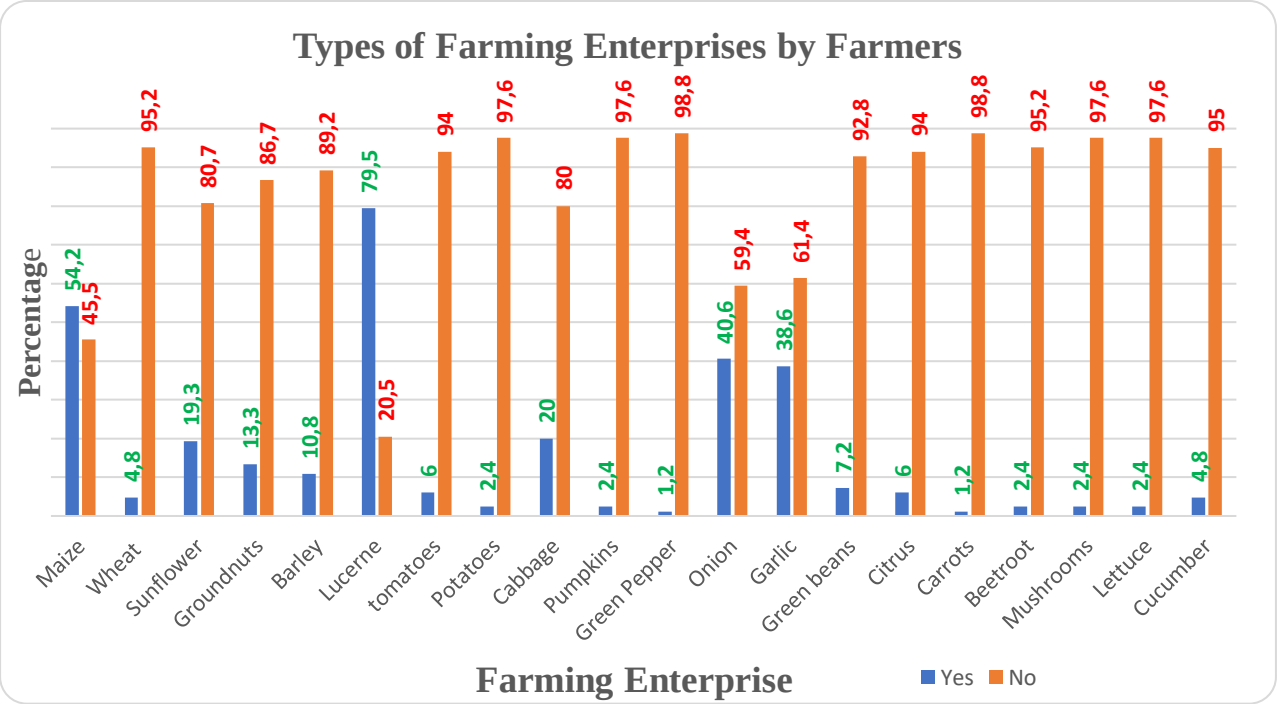

Figure 9: Type of farming enterprises practiced by farmers involved in irrigation farming

Source: Field survey 2016

4.2.12 Different types of irrigation systems used by women farmers involved in irrigation farming

The findings from the focus groups discussion about the different types of irrigation systems by the respondents is shown in Figure (10). About 87% of respondents indicated that they use central pivots for irrigation, about 40.9% of farmers use furrow irrigation and canal irrigation, 37.3% of farmers use sprinkler irrigation, while 27.7% are using drip irrigation systems. Reinders (2011) stated that the tenacity of an irrigation system is to apply the preferred quantity of water at the precise requested rate and consistently to the whole area in a cost-effective as possible. Acha (2014) reported that there are three methods of irrigation practiced at Taung irrigation scheme, namely centre pivot system, floppy irrigation system, and sprinkler irrigation in which the centre pivots irrigation system is the most prominent method employed.

Palamuneli *et al*. (2013) reported that the common methods used in Taung are centre pivots system, sprinkler system, and floppy irrigation system, while in Dinokana respondents use furrow irrigation system. The results are in line with Balarane and Oladele (2014) findings which reported that majority of farmers in the Taung irrigation schemes use centre pivots and furrow and irrigation method in Dinokana (Zeerust). Crosby *et al*. (2000) cited by Van Averbeke (2011) reported that furrow irrigation could match or even surpass the irrigation proficiency of other systems when used appropriately. Maepa, Makombe and Kanjere (2014) reported that all the Revitalization of Smallholder Irrigation Schemes (RESIS) in Limpopo are fitted with irrigation technology which differs according to sites. Such methods consist of floppy sprinklers, centre pivots, micro drips and sometimes the combination of all the methods.

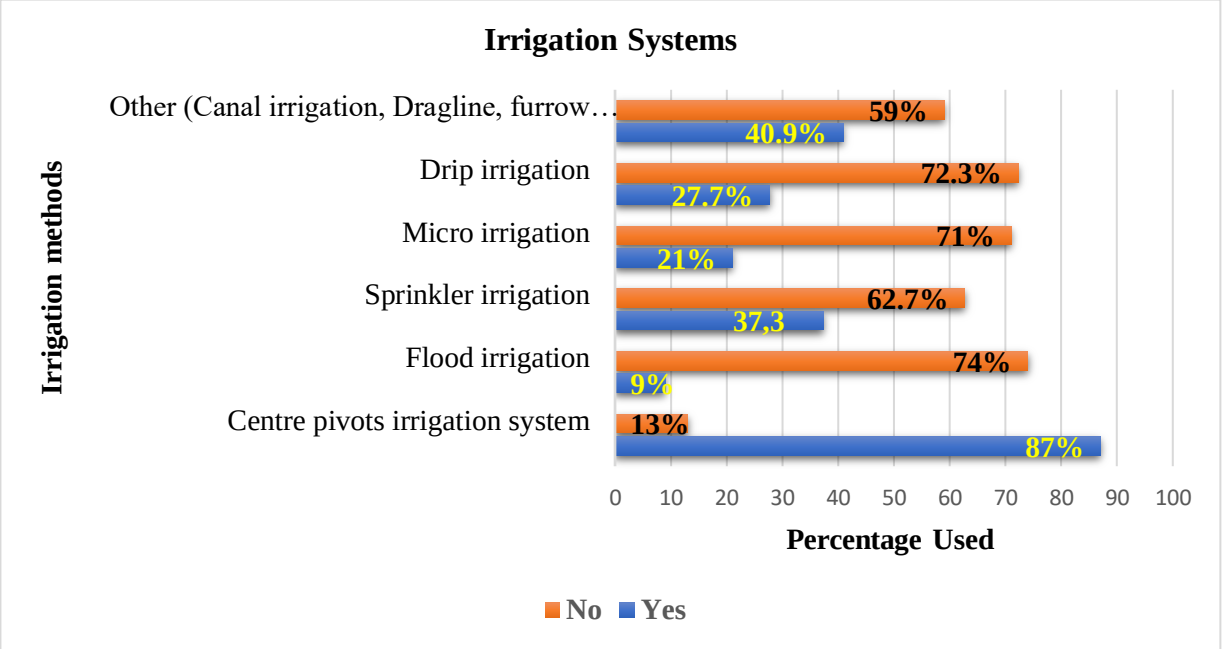

Figure 10: Different types of irrigation systems

Source: Field survey 2016

4.3 Focus group discussion on the competency level of women in irrigation farming tasks

Findings from the focus group discussion are shown in table (16). Based on the enterprises found on the irrigation schemes, a scale was developed to measure their competency in skills related to these enterprises. The Table indicates 23 farming activities for women in irrigation farming developed from the operations and activities carried out on the field by farmers on the existing field. The extents of agreement against all tasks as perceived by the farmers were assessed in this regard. The statements were arranged under three topics namely, Pre- and Post-Planting (10), Irrigation Management (4) and Marketing (9). The mean score of each task was derived from Not Competent (NC) = 1, Competent (C) = 2, Very Competent (VC) = 3. The 3-point Likert- type scale was found to vary from low (1), Moderate (2) and High (3) which concludes the mean above 2 signifies competence, while a mean less than 2 meant low competence of the identified tasks.

4.3.1 Pre- and Post-Planting Tasks

Table (16) shows the results of the range of competence from highest to lowest among women category with respect to Pre and Post Planting tasks. Respondents were asked to rate all ten tasks on a 3-point Likert-type scale type scale of low (1), Moderate (2) and high (3) with a mean of greater than 2 denoting high competence and a mean less than 2 denoting low competence for the Pre- and Post-Planting Tasks. The results reveal that all 10 tasks had a mean score of less than 2, indicating that respondent are not competent in pre and post planting tasks identified. The results reveal that 55% were competent in knowledge of crop rotation and 53% had knowledge in soil preparation for ploughing. About 66 % of respondents indicated low competence in calibrating planters and seeders for various crops, 63% in appropriate application of herbicides and fungicides and calibrating planters and seeders for various crops while 59% in planning and carrying out harvesting appropriately for various crops. The finding might be peculiar with the study area as a result of socio-economic characteristics (age and educational status) of the respondents from the study. The WS for the tasks was computed from the rating scale of VC (3), (C) (2) and (NC) (1) with cut-off point of 2. This implies that farmers are competent on tasks with mean score above 2, while tasks with mean score below 2 implies incompetence. The percentage of distribution of WS and ranking of these tasks specify areas for training needs.

Even though all competencies were below cut off point 2, soil preparation for ploughing ($\bar{x}$ =1.63, SD =0.58) and appropriate application of herbicides and fungicides ($\bar{x}$=1.63, SD=0.56) received the highest ranking while, calibrating planters and seeders for various crops ($\bar{x}$= 1.39, SD = 0.51), planning and carrying out harvesting appropriately for various crops ($\bar{x}$= 1.40, SD = 0.54); knowledge of crop rotation ($\bar{x}$= 1.45, SD = 0.57) were ranked amongst the lowest competencies. The results are in accordance to the findings of Mbongeni (2013) in a similar study in Kwazulu-Natal that female farmers were not competent in herbicides and fungicides

application, planting especially crop rotation and various harvesting techniques. The findings obtained in Nigeria by Okwu and Umoru (2009) revealed that women are incompetent on pesticides application, fertilizer application and improved farm implements. The results are in contract with Tekana's (2014) findings on a study which was conducted in Taung irrigation scheme, which indicated that over 50% of women were found to be competent in soil preparation for ploughing and knowledge of crop rotation. These results are, furthermore, in contrast with Thagwana (2009) who highlighted that women were all competent and responsible for all activities in agricultural production, including planting, weeding, watering, harvesting and ploughing in a study carried out in Limpopo province. The findings are also in contrast with Orr *et al.* (2014) which indicated that women farmers in Zambia have skills and are competent in land preparation techniques for crop production.

4.3.2 Irrigation Management Tasks

Regarding the perceived level of competence of women on irrigation management, the result revealed that of the 4 tasks, none of them was above the cut-off point of 2. This indicated that the competency level under irrigation management is very low. The results revealed that 55% of farmers were competent in irrigation scheduling and frequency and 54% had knowledge on the amount of water to use. The results further indicate that 60% are incompetent in recommendation of suitable profile and water conservation measures for specific farmland and evaluating of farming land for soil and water conservation (54%). The WS for the tasks was also figured from the rating scale of VC (3), (C) (2) and (NC) (1) with cut-off point of 2. The cut-off point suggests the tasks with mean score above 2 which shows competence while those below 2 show incompetence. All the 4 tasks in irrigation management show WS below 2 which denotes low competence. Gupta and Verma (2014) found that women in Rajasthan, India indicated training need on crop production. The finding is contrary to that of Orr *et al*. (2014)

who found that women farmers in Zambia have skills in land preparation techniques for crop production.

The tasks with the lowest competence mean score were knowledge on the amount of water to use ($\bar{x}$=1.33, SD = 0.52), followed by evaluating farming land for soil and water conservation ($\bar{x}$=1.45, SD = 0.55) and recommendation of suitable profile and water conservation measures for specific farmland ($\bar{x}$=1.46, SD = 0.57). The results are in accordance with Botlhoko (2016) findings which indicated that women farmers in irrigation schemes of the North West Province, South Africa, are incompetent in water management skills, such includes determining water requirements for crops, proper timing of irrigation application and irrigation scheduling.

The results are in line with Adekunle *et al.*'s (2015) findings which reported that women farmers in Oke-Oyi in Ilorin East Local Government Area (LGA) of Kwara State, Nigeria are incompetent in scheduling water for irrigation which results in irregular pumping of water. The results are not in agreement with Tekana (2014) findings which indicated that majority of women are competent in irrigation scheduling and frequency and also with the knowledge on the amount of water to use in Taung irrigation scheme in the North West Province. These findings also did not agree with Mbongeni (2013) who stated that 54.8% of his respondent indicated a high level of competency in irrigation scheduling among women farmers in Msinga town, Kwazulu-Natal.

Furthermore, in contrast, Thagwana (2009) indicated that women are very competent in irrigation management in Matombotswuka, Mutshenzheni, Maraxwe towns in Limpopo province. Adekunle, Oladipo and Busari (2015) also indicated in their study that, the poor knowledge on irrigation techniques greatly affects the farmer's competency in irrigation schemes. The finding of the study disagrees with Gomo, Mudhara, and Senzanje (2014) in a

similar study in Kwazulu-Natal that identified that even though respondents were competent, the need for training to ensure irrigation management was very important. This result can further be corroborated by Raidimi (2014) that when it comes to management task, women are still lacking behind and are really under-represented in irrigation management and decision-making task. Rio (2013) observed that in Kampot, Kandal, Prey Veng, Svay Rieng and Takeo, Colombia, women farmers prefer more practical training methods to enhance their competence and experience in agriculture.

4.3.3 Marketing tasks

The results further indicate that respondents were found to be incompetent in all nine farming tasks identified. This was due to the fact that the rating scale revealed that all the mean for the level of competence were below the cut-off point of 2, an indication that there is low competence among women in irrigation farming under marketing. The results for marketing tasks revealed that the competencies of respondents were very minimal with percentages ranging from 21% to 48%. All the 9 tasks in marketing showed WS below 2, which denotes low competence. The ranking based on the WS shows that knowledge of reading and interpreting marketing information, price determination for your produce, knowledge of marketing contracts, knowledge of the market for your produce, service provider for storage facilities and farm record-keeping were the most prominent tasks that recorded the lowest competence score. This implies that women farmers involved in irrigation farming are incompetent in marketing. The results are in line with Mugabi (2014) which showed that women farmers in Uganda also lack skills and need to develop their market opportunities. Stevenson and St-Onge (2005) added that women farmers are in need of a range of enterprise skills, including farm bookkeeping and business management and required training on financial management, marketing and access to markets, financial services, diversification and new markets, business and project plan preparation. Miniot and Hill (2007) argue that marketing

rests on skills of the farmer and the particular market being integrated. In most developing countries, the level of marketing skills is unlikely to be high because farmers have little information about current marketing approaches

The tasks with the lowest competence mean score were knowledge of reading and interpreting marketing information ($\bar{x}$ =1.19, SD =0.40), Value Adding ($\bar{x}$ =1.23, SD =0.45), price determination for produce ($\bar{x}$=1.25, SD=0.49) and knowledge of marketing contracts ($\bar{x}$=1.37, SD =0.59). Based on a similar study conducted by Tekana (2014) in Taung irrigation scheme in the North West Province, the findings revealed that women were incompetent in marketing skills. The results are also in agreement with Botlhoko's (2016) conclusions which showed that women farmers in irrigation schemes of the North-West Province, South Africa women farmers are incompetent in financial management, record keeping skills, Value adding to products and skills in product packaging.

In contrast, the findings did not agree with Mbongeni (2013) which indicated that women farmers are competent in marketing their farm produce in Kwazulu-Natal province. Furthermore, Mbongeni (2013) also indicated that female farmers were not competent in some aspects which include knowledge of marketing contracts, price determination and the knowledge of the target market that suits their farm produce. Phakati (2016) added that irrigators in Makhathini are competent with knowledge of marketing contracts and have managed to secure contracts for their produce with the organisation that holds the school feeding programme tenders with the government. Freguin-Gresh *et al*. (2012) found that majority of rural farmers in South Africa are struggling to engage in long-term market contracts, the reason being that most farmers lack market information and inadequate experience on grades and standard.

Table 16: Focus group discussion of the competence of skills among women farmers involved in irrigation farming

Competency categories and competency statements	*Competence*						
	NC	**C**	**VC**	**WS**	**Rank**	**M**	**SD**
Pre- and post-planting							
Soil preparation for ploughing	42	53	5	1.61	1	1.63	0.58
Determining inter and antra row spacing	45	49	6	1.61	1	1.61	0.60
Determining seed depth	47	48	5	1.58	5	1.58	0.59
Selecting appropriate planting methods for various crops	47	48	5	1.59	4	1.59	0.61
Evaluate soil profile in farming	53	42	5	1.46	6	1.52	0.59
Knowledge of crop rotation	42	55	3	1.39	9	1.45	0.57
Calculating the amount of fertilizer to apply for various crop	63	36	1	1.4	8	1.63	0.57
Appropriate application of herbicides and fungicides	63	35	2	1.37	10	1.63	0.56
Calibrating planters and seeders for various crops	66	30	4	1.45	7	1.39	0.51
Planning and carrying out harvesting appropriately for various crops	59	37	4	1.61		1.40	0.54
Irrigation management							
Evaluate farming land for soil and water conservation	54	43	3	1.46	3	1.45	0.55
Recommending suitable profiles and water conservation measures for specific farmland	60	36	4	1.63	2	1.46	0.57
Irrigation scheduling and frequency	41	55	4	1.7	1	1.71	0.62
Knowledge on the amount of water to use	54	38	8	1.45	4	1.33	0.52
Marketing							
Knowledge of the market for your produce	69	29	2	1.42	6	1.42	0.52
Price determination for your produce	59	40	1	1.25	8	1.25	0.49
Knowledge of reading and interpreting marketing information	77	21	2	1.19	9	1.19	0.40
Knowledge of marketing contracts	78	21	1	1.37	7	1.37	0.59
Value adding	66	28	6	1.51	3	1.23	0.45
Service provider for storage facilities	47	48	5	1.46	4	1.47	0.59
Farm record-keeping	58	37	5	1.46	4	1.48	0.59
Financial management	57	41	2	1.61	1	1.47	0.59
Packaging	57	41	2	1.61	1	1.47	0.59

Source: Field survey 2016
***The mean score is derived from Not Competent (NC) = 1, Competent (C) = 2, Very Competent (VC) = 3. Mean Score (M) Standard Deviation (SD)**

4.4 Women farmers perceived level of importance on irrigation farming tasks

From the focus group discussion Table (17) shows the list of 23 farming activities for women involved in irrigation farming developed from the operations and activities carried on the field by farmers on the existing field. The farming activities are divided into three categories namely; Pre- and Post-Planting (10), Irrigation (4) and Marketing (9).

4.4.1 Importance of pre- and post-planting tasks

Table (17) shows the rating of the importance of the task on a 3-point Likert-type scale of low (1) moderate (2) and high (3). Zarafshani and Baygi (2008) stated that the actual mean is 2 due to the rating scale, thus the mean greater than 2 denoted high importance, while a mean less than 2 denoted less importance of the farming tasks. The results overwhelmingly revealed high importance attached to the tasks, all the means for the level of importance of the tasks were above the cut-off point of 2. Training on appropriate application of herbicides and fungicides along with selecting appropriate planting methods for various crops (81%) were the most prominent and important needs under pre- and post-planting tasks followed by calibrating of planters and seeders for various crops and evaluation of soil profile in farming (78%). Training on planning and carrying out harvesting appropriately for various crops (68%), knowledge of crop rotation (58%) and calculating the amount of fertilizer application on various crops (57%) also followed closely. The percentage distribution of the tasks revealed that more training is required to meet the training needs of respondents.

The most important tasks, as ranked by the respondents under pre- and post-planting were appropriate application of herbicides and fungicides ($\bar{x}$ =2.63 SD= 0.57), knowledge of crop rotation ($\bar{x}$ =2.61, SD=0.59), calculating the amount of fertilizer to apply for various crops ($\bar{x}$ =2.60, SD= 0.57), calibrating planters and seeders for various crops ($\bar{x}$ = 2.55, SD=0.56) and evaluating soil profile in farming ($\bar{x}$ =2.54, SD=0.54). The results overwhelmingly revealed

high importance attached to competency and training needs for women in irrigation schemes. All the mean for the level of importance of training needs were above cut-off point 2 in pre- and post-planting tasks. All these findings are due to the fact that respondents were found to be illiterate, the continuous adoption of unscientific methods on planting, coupled with indiscreet use of chemical herbicides and fungicides. This calls for immediate control measures and proper training for women involved in irrigation farming

The result is supported by Sender (2002) who highlighted that women in agriculture make a very substantial effect and contribution food production and food security. Raidimi (2014) also agrees that women are responsible for determining the quantity and quality of food available and also determine what amount gets to the table. Furthermore, Raidimi (2014) agrees with the important role women play in the pre and post planting tasks in farming especially irrigation were identified significant and over the cut-off point in a similar study in Dzindi, Lambani, Malavuwe, Mulenzhe, Palmaryville, and Tshiombo all in Limpopo province. FAO (2001) also agrees that most of the pre and post planting activities in farming are carried out by women because they participate in production, harvesting, marketing, and storage. Sajeev *et al*. (2012) found that in Manipur, training on weed management and crop management are important for women farmers.

4.4.2 Importance of irrigation management tasks

Table (17) further shows the next section of the identified tasks under irrigation management. The results revealed high importance of all the attached tasks as they are all above cut-off point 2. The results show that 74% of respondents suggest training on recommendation suitable profile and water conservation measures for specific farmland are the most important need, followed by evaluation of farming land for soil and water conservation (68%) and knowledge on the amount of water to use (58%).

The most important tasks, as ranked by the respondents were, Knowledge on the amount of water to use ($\bar{x}$ =2.66, SD = 0.52), Evaluating farming land for soil and water conservation ($\bar{x}$ =2.54, SD=0.55), Recommendation suitable profile and water conservation measures for specific farm land ($\bar{x}$ = 2.37, SD=0.57) and lastly Irrigation scheduling and frequency ($\bar{x}$ = 2.30, SD=0.62). All the means for the level of importance on training needs were above cut-off point 2 in irrigation management tasks. These findings are in line with Alarima *et al*. (2011), which stated that in Ogun, Ondo, Niger, Ebonyi, Kaduna and Abuja, the Federal Capital Territory, farmers have rated high importance in irrigation management where farmers need training. This may be due to the fact that an effective water management is the pillar of the irrigation scheme. Luthans *et al*. (2007) added that training in water management is important in the agricultural sector. Skills received through training build farmers confidence and competence towards farming. According to Tekana and Oladele (2011), training in irrigation and water management is vital as it improves knowledge of water management which boosts farm productivity in the irrigation schemes.

Adekunle *et al*. (2015) stated that in Kwara State, Nigeria, most women farmers involved in irrigation farming might not be knowing their responsibilities in terms of water distribution and therefore value it as highly important since it will give them a chance to have a role in participatory irrigation management. Sajeeev and Singha (2010) revealed that women in Arunachal Pradesh stated their most important training needs is on water conservation and irrigation management. Domenech and Ringler (2013) argue that the importance of providing training to women farmers will enable them to operate irrigation technologies as well as managing water accordingly and be able to participate in the design and implementation of irrigation projects.

4.2.3 Importance of marketing tasks

Table (17) lastly shows the perceived level of importance of marketing tasks. The means for all the level of importance of the task were above the cut-off point of 2. The percentage distribution indicated that knowledge on marketing contracts emerged the most important, 81% of respondents expressed interest in it, followed by farm record-keeping (68%) and price determination for your produce and financial management (58%). The actual percentage distribution identified revealed that there was high importance for needs to be devoted to the training needs for women in irrigation schemes since all the tasks were above the cut-off point of 2. Mehra and Rojas (2008) emphasise that women are less likely to receive basic business skills and training on marketing and quality standards due to poor access to credit to carry out these upgrading.

The most important tasks, as ranked by the respondents were Knowledge of reading and interpreting marketing information ($\bar{x}$ =2.81, SD=0.40), Value adding ($\bar{x}$ = 2.77, SD= 0.59), Price determination for your produce ($\bar{x}$ =2.75, SD=0.49) and Knowledge of marketing contracts ($\bar{x}$=2.63, SD=0.59). The results are in line with Yusuf *et al.* (2014) which found that in the Eastern Cape, South Africa, women farmers view record-keeping and marketing skills as very important in any agricultural enterprise. According to Louw *et al*. (2008), access to market information is very important to guarantee product traceability. Baloyi (2010) and Poulton *et al.* (2010) indicated that women farmers do not only have a deficiency in market power, but they also grieve from political voice due limited education and their geographical location. According to Cai *et al.* (2011), access to market information and well-unconditional markets is critical in influencing the general value of agrarian products and net returns for farmers.

Machete (2004) indicated that it is important to understand marketing and financial management in a farming enterprise in order to create a constant flow of information regarding the cost-effectiveness, liquidity and decreasing risk concerning the scheme. According to Rekha and Rojas (2008), most women in developing countries are keenly involved in marketing their produce; therefore. it is important for them to acquire more training marketing skills. Nichols and Hilmi (2009) argue that it is important for farmers to know how to conduct marketing research, as this will enable them to investigate what consumers' want, where they are and what price they are willing to pay.

Table 17: Focus group Discussions on the Importance of skills on irrigation farming tasks among women involved in irrigation farming

Competency Categories And Competency Statements	VI	I	NI	M	Rank	SD
Pre- And Post-Planting						
Soil Preparation For Ploughing	47	48	5	2.39	8	0.59
Determining Inter Antra Row Spacing	47	47	6	2.39	8	0.61
Determining Seed Depth	53	42	5	2.42	6	0.59
Selecting Appropriate Planting Methods For Various Crops	81	19	0	2.41	7	0.40
Knowledge Of Crop Rotation	58	37	5	2.61	2	0.45
Calculating The Amount Of Fertilizer To Apply For Various Crops	57	41	2	2.60	3	0.59
Appropriate Application Of Herbicides And Fungicides	81	19	0	2.63	1	0.59
Calibrating Planters And Seeders For Various Crops	78	21	1	2.55	4	0.59
Planning And Carrying Out Harvesting Appropriately For Various Crops	68	28	4	2.39	8	0.55
Evaluating Soil Profile In Farming	78	21	1	2.54	5	0.58
Irrigation Management						
Evaluating Farming Land For Soil And Water Conservation	68	27	5	2.54	2	0.59
Recommendation Suitable Profile And Water Conservation Measures For Specific Farm Land	74	21	5	2.37	3	0.59
Irrigation Scheduling And Frequency	47	48	5	2.30	4	0.55
Knowledge On The Amount Of Water To Use	58	37	5	2.66	1	0.59
Marketing						
Knowledge Of The Market For Your Produce	57	41	2	2.58	5	0.55
Price Determination For Your Produce	58	37	5	2.75	3	0.40
Knowledge Of Reading And Interpreting Marketing Information	57	37	6	2.81	1	0.45
Knowledge Of Marketing Contracts	81	19	0	2.63	4	0.59
Value Adding	57	41	2	2.77	2	0.58
Farm Record-Keeping	68	28	4	2.54	6	0.55
Service Provider For Storage Facilities	47	48	5	2.54	6	0.55
Financial Management	58	37	5	2.54	6	0.55
Packaging	57	41	2	2.54	6	0.55

Source: Field survey 2016

Note *The mean score is derived from Not Important (NI), Important (I), Very important (VI) Mean (M) Standard Deviation) SD`

4.5 Competence and Training needs among women in irrigation farming

In order to obtain the Mean Weighted Discrepancy Score (MWDS) for each competency, a Discrepancy Score (DS) from each respondent during the focus group discussion on each competency was calculated by subtracting the ability rating from the importance rating. A Weighted Discrepancy Score (WDS) was then calculated for respondents on each competency by multiplying the Discrepancy Score (DS) by the mean importance rating for the competency. A MWDS for each competency was then calculated by dividing the sum of the WDS score by the number of observations for the competency. Finally, the 23 competencies listed were ranked using the Mean Weighted Score (Borich 1980), Edward and Briers (1999). Using the MWDS the 23 competencies were then ranked according to the arranged three topics namely, Pre- and Post-Planting (10), Irrigation Management (4) and Marketing (9).

Table (18) shows the results of the competence needs of women in irrigation farming as determined by the mean weighted discrepancy scores MWDS. According to Oladele (2015), the higher the MWDS the greater the competence need for the assigned task. Cannon *et al*. (2012) as well as Ryan *et al*. (2014) also added that high competence score on the assigned tasks implies less training needs. Harder *et al*. (2009) stated that a positive MWDS designates training is needed while a negative MWDS indicates no training is necessary. The perusal data presented in the table reveal that from the ten competencies under Pre and Post planting, only two were set to be positive with the greatest need as perceived by respondents, such included, Soil preparation for ploughing (MWDS = 0.91) and Planning and carrying out harvesting appropriately for various crops (MWDS = 0.11). The other eight competency variables were negative, implying that the perception of women farmers on the need to acquire training on the negative competencies can be connected to the technicalities involved in carrying such activities.

The results in this study are supported by Alarima *et al.*'s (2011) findings which indicated that in Nigeria, farmers have reported high training needs in fertilizer usage and nutrient management, disease and pest control, weed control and soil preparations. Ibeawuchi *et al*. (2015) also reported that in Nigeria, training is essential for women farmers on crop disease resistant varieties, mixed cropping and the use of Integrated Pest Management (IPM) in order to lessen the use of pesticides. The results are also in line with Mech *et al*.'s (2010) findings which indicated that women in Assam, India stated that they are involved in activities such as land preparations, application of fertilizers and plant protection against pest and diseases and further added that such activities are difficult and therefore, necessitates training and skills development.

The findings obtained by Sajeev *et al.* (2012) in Manipur, India, revealed that over half of the respondents expressed their needs for skill-oriented training on technologies for soil management. Beaman *et al*. (2013) argue that even if women are given chemicals such as fertilizers, fungicides and herbicides for free, it may not improve farm returns therefore there is a need for proper training on how to use or apply them. According to Yekeni and Oguntade (2014), women farmers in Akinyele local government of Oyo State, Nigeria maintain pest and disease control methods, fertilizer application and chemical weed control are the most crucial areas that need training. Ibeawuchi *et al*. (2015) found that in Nigeria, training is essential for women farmers on crop disease resistant varieties, mixed cropping and the use of Integrated Pest Management (IPM) in order to lessen the use of pesticides. The results are line with Hashemi *et al*. (2012) findings that majority of women farmers need training on selecting appropriate pesticide product for a specific pest problem and calibrating the sprayer to apply the correct amount of pesticides in Ashjerd village of the country, Marvdasht in Fars Province in the southwest part of Iran.

The result further revealed that the competency need under irrigation and management was only for recommendation of suitable profile and water conservation measures for specific farm land (MWDS= 0.19) with the other three competencies being negative. The results are in accordance Alarima *et al*. (2011) findings which indicated that farmers in Ogun, Ondo, Niger, Ebonyi, Kaduna and Abuja, the Federal Capital Territory revealed that training needs in Water management is highly required. This implies that there is a need for women farmers to be equipped with training on water management in the irrigation schemes.

Positive MWDS were obtained for all competencies under marketing. The competency with the greatest need for marketing as perceived by respondents were, knowledge of reading and interpreting marketing information (MWDS= 0.56), price determination for your produce (MWDS=0.29), and knowledge of marketing contracts (MWDS=0.24). The result indicates that there is a need for training in all marketing competencies even though Tekana and Oladele (2011) findings indicated that farmers in Taung irrigation scheme in the North West Province reported that they have received training in record keeping and financial management, but that has not improved their level competency in financial management and other marketing competencies. This implies that there is high level of training required for women farmers in the irrigation scheme.

The results are in line with Alarima *et al*. (2011) conclusions which indicated that in Nigeria, women farmers reported that there is high training need in marketing competencies such as value adding to produce. Gader *et al*. (2013) indicated that farmers in Gezira Scheme, Sudan reported that the training needs of farmers with the highest ranking included agricultural marketing and processing of agricultural product. Ndifon *et al*. (2012) finding indicated that production and marketing skills along with managing finances forms part of the paramount interest of training needs for women farmers in South-South Nigeria.

The results revealed that those women in the study area possess poor knowledge in all listed competencies. Hence these practices can be considered while formulating training courses in irrigation schemes. The incorporation of agriculture training with enterprise training can assist women to manage and market their farming products. This can also contribute in them taking advantage of newer agricultural opportunities. The implication of the results indicated that there is a need for training in all 23 identified competencies. Ajayi *et al*. (2003) evaluated the women farmers training needs, which emphasised the operation of training programmes and poverty reduction to be more effective in Oyo state, Nigeria. Likewise, Al–Shadiadeh (2007) conducted a descriptive study in the semi desert areas of South Jordan which indicated that training needs are very important for any agricultural enterprise and for farmers to improve farmer's competence.

Table 18: The Mean weighted discrepancy score (MWDS) for level of competence and level of importance on the selected tasks of woman in Irrigation farming

Competency Categories And Competency Statements	Competency	Importance	MWDS
Pre- And Post-Planting	M	M	
Soil Preparation For Ploughing	1.61	2.39	0.91
Determining Inter Antra Row Spacing	1.61	2.39	-0.04
Determining Seed Depth	1.58	2.42	-0.09
Selecting Appropriate Planting Methods For Various Crops	1.59	2.41	-0.47
Knowledge Of Crop Rotation	1.46	2.61	-0.36
Calculating The Amount Of Fertilizer To Apply For Various Crops	1.39	2.60	-0.18
Appropriate Application Of Herbicides And Fungicides	1.4	2.63	-0.10
Calibrating Planters And Seeders For Various Crops	1.37	2.55	-0.23
Planning And Carrying Out Harvesting Appropriately For Various Crops	1.45	2.39	0.11
Evaluating Soil Profile In Farming	1.61	2.54	-0.24
Irrigation Management			
Evaluating Farming Land For Soil And Water Conservation	1.46	2.54	-0.10
Recommendation Suitable Profile And Water Conservation Measures For Specific Farm Land	1.63	2.37	0.19
Irrigation Scheduling And Frequency	1.7	2.30	-0.08
Knowledge On The Amount Of Water To Use	1.45	2.66	-0.35
Marketing			
Knowledge Of The Market For Your Produce	1.42	2.58	0.18
Price Determination For Your Produce	1.25	2.75	0.29
Knowledge Of Reading And Interpreting Marketing Information	1.19	2.81	0.56
Knowledge Of Marketing Contracts	1.37	2.63	0.24
Value Adding	1.51	2.77	0.14
Farm Record-Keeping	1.46	2.54	0.23
Service Provider For Storage Facilities	1.46	2.54	0.23
Financial Management	1.61	2.54	0.23
Packaging	1.61	2.54	0.23

Source: Field survey 2016
Note Mean (M); Medium Weight Discrepancy Score (MWDS)

4.6 Linear regression analysis showing the assessment of the competence level of women in Irrigation Farming

Table (19) shows the estimated parameters for the assessment of the competence level of women that are involved in irrigation farming in the North West Province of South Africa using ordinary least square regression. The model had a good fit and it is significant at 10%. The autonomous level of competence is 15.556. The independent variables were significantly related with the F value of 39.802, $p = < 0.05$. Ten out of the eighteen explanatory variables were significant while the remaining variables were insignificant.

The degree of competency of women involved in irrigation farming has either positive or negative relationship with their socioeconomic characteristics such as marital status (-1.353) at ($p<0.05$), number of dependents (-0.476) at ($p<0.05$), number of members in household (0.209) at ($p<0.10$), member of farmers group (-2.162) at ($p<0.05$), use of central pivot irrigation type (2.963) at ($p<0.01$), Use of flood irrigation system (3.111) at ($p<0.01$), Use of sprinkler irrigation type (2.836) at ($p<0.05$), Use of micro irrigation type (2.773) at ($p<0.05$), Use of drip irrigation type (2.775) at ($p<0.05$) and Use of other irrigation types (canal, dragline/furrow) (3.843) at ($p<0.01$).

Obviously, since some of these variables that captured the socioeconomic characteristics of the respondents showed statistical significance, it implies that the null hypothesis should be rejected. On the other hand, the seven insignificant variables recorded in the ordinary least square model fitted were level of education, tenure status, farm size, contact with extension services, number of years in farming, number of years in being part of the irrigation scheme and number of workers in the irrigation scheme do not have a significant relationship with competence of women involved in irrigation farming in the study area.

Respondents marital status was statistically significant ($p<0.05$) with a negative coefficient (-1.353). This implies that there is indirect relationship between the marital status of the female farming households and competency level in the study area. It means that those female irrigational farmers that were married had their competency level being reduced by 1.353, when compared with other female farmers who fell into other marital status in the study area. This might be due to the task demanded by marriage alone which made the famers lose concentration, hence competency. This agrees with Tekana (2014) who stated in a similar study carried that, women in the study area show different competency level to skills such as preparation of ploughing, knowledge of crop, irrigation scheduling and frequency and knowledge on the amount of water to use. The result also agrees with the findings of Abongile (2016), who stated that respondents showed different competency in the areas of agricultural skills and knowledge.

Similarly, the parameter of the number of dependents is statistically significant ($p<0.05$) with negative sign (-0.476). This implies that as the number of dependent members in a household increases, the level of competency decreased by 0.476. This might be due to the pressure exerted on such a female irrigational farmer by the dependent members which makes them lose focus, hence competency level. This result agrees with the findings of Islam *et al*. (2013) in which the number of dependents had no positive significance with the level of competency. And on the other hand, the result disagrees with Biswas (2009), Roy (2009) and Alam (2008) in which they found that the household dependents all had a positive significance on the level of competency of the female farmer.

In addition, the coefficient of number of members in household was statistically significant ($p<0.10$) with a positive coefficient (0.209). This indicates that respondents' member of households has a strong positive relationship with their competency level. This may be so

probably because some household members are cooperative and supportive which could invariably lead to increase in the female farmer's competency level in the study area. This is a result that agrees with the findings of Biswas (2009), Roy (2009) and the findings of Alam (2008) who all stated that the number of members in the household were positively significant with the level of competency.

In the same vein, the member of farmer's group parameter of the women in irrigation farming households have a significant ($p<0.05$) and negative (-2.162) effect on their competency level. This indicates that if the women farming households' membership of farmer's group increases by one individual, such household's competency level would decrease by 2.162 units. As expected, the parameter of use of central pivot irrigation type (which was captured in its dummy form in the dataset) was positive (2.963) and significant ($p<0.01$). This implies that rural farming women households that use central pivot irrigation type have better possibility of increasing their competency level. This is expected as use of central pivot irrigation type indicates a better farming practice which might invariably reflect in improved competency level as against their counterparts without such irrigational assets. Moreover, assets possession is one of the major means of wealth accumulation in rural areas (Babatunde *et al.* 2011; Beyene & Muche, 2010).

Furthermore, the parameter of use of flood irrigation system (captured in its dummy form) had a positive (3.111) and significant coefficient ($p<0.01$). This indicates that access to flooding type of irrigation for the respondents' farming enterprises increases the women's households' competency level. This is an apriori expected result. In addition, the parameter of the use of sprinkler irrigation (Captured in its dummy form) was positive (2.836) and significant ($p<0.05$) as expected. This means that the rural farming women who adopt the use of sprinkler irrigational system are more competent than their counterparts without such irrigational method

in the study area. This by implication indicates that the more the number of women with sprinkler irrigation system, the more their competency level.

In the same vein, the coefficient of use of mirco-irrigation type by the respondents, captured in its dummy form was found to be positive (2.773) and significant ($p<0.05$). This indicates that micro irrigation adoption by the rural women in the study area contributes to their competency level. This result agrees with the findings of Namara *et al*. (2005) who identified advantages of respondents in their study area after adopting different micro-irrigation types in their agricultural endeavours. Furthermore, Viswanathan *et al*. (2016) also highlighted that the adoption of micro-irrigation systems in their study area also showed some level of positivity, i.e., the overdraft of ground water can then be managed.

Also, the parameter estimate of the Use of drip irrigation type was positive (2.775) and significant at ($p<0.05$) to the farming women's competency level in the study area. This shows that there is positive and direct relationship between the choice of drip irrigation method by these women farmers and their competency level in the study area. The finding of the study agrees with the results of Upadhyay (2005) who identified that women extensively contributed to vegetable farming under the adoption of the drip-irrigation systems.

Finally, the parameter of the use of other types of irrigation such as canal, dragline, furrow was positive (3.843) and significant at ($p<0.01$) to the competency level of the respondents. This by implication indicates that the women farmers with use of other irrigation types are found to be competent in the study area. This result can be buttressed with the study of Van Averbeke *et al*. (2011) who highlighted that farmers in Limpopo gladly adopted the short furrow irrigation system and also indicated a positive outcome in their level of production. The result

disagrees with the findings of Du plessis and Van der Stoep (2001) that highlighted that the adoption of micro-irrigation systems is a risky option.

Table 19: Linear Regression analysis of the Assessment of the competence level of women farmers involved in irrigation schemes

Parameters	B	S. E	Beta	t	sig
Constant	15.556	4.827		3.223	0.002
Age	0.047	0.032	0.064	1.451	0.152
Marital status	-1.353	0.523	-0.116	-2.588	0.012**
Number of dependents	-0.476	0.191	-0.121	-2.497	0.015**
Number of members in household	0.209	0.122	0.071	1.72	0.090*
Level of education	-0.042	0.226	-0.007	-0.188	0.852
Tenure status	-0.414	0.334	-0.048	-1.241	0.219
Farm size	-0.022	0.014	-0.064	-1.538	0.129
Member of farmers' group	-2.162	0.944	-0.092	-2.29	0.025**
Contact with extension services	-1.248	1.969	-0.026	-0.634	0.529
Number of years in farming	-0.431	2.974	-0.482	-0.145	0.885
Number of years spent in the irrigation scheme	0.415	2.972	0.465	0.14	0.889
Number of workers in the irrigation scheme	0.008	0.03	0.01	0.245	0.805
Use of central pivots irrigation type	2.963	0.871	0.19	3.401	0.001**
Use of flood irrigation system	3.111	1.005	0.195	3.097	0.003**
Use of sprinkler irrigation type	2.836	1.149	0.164	2.468	0.016**
Use of micro irrigation type	2.773	1.112	..168	2.492	0.015**
Use of drip irrigation type	2.775	1.233	0.174	2.251	0.028**
Other irrigation types (canal, dragline/furrow)	3.843	0.999	0.246	3.845	0.000***
R	0.958[a]				
R Square	0.918				
F	39.802				
Sig	0.000[b]				
P	0				

Source: Field survey 2016
Note ***1% significance ** 5% significance *10 % significance

4.7 Summary of Chapter

An overview of how data was analysed has been presented in this chapter. Descriptive analysis was used to explain the demographic characteristics of women farmers involved in the irrigation schemes. The weighted score (WS) for the tasks was computed from a rating scale of VC (3), (C) (2) and (NC) (1) with cut-off point of 2 to measure the competency level of respondents. The weighted score (WS) was also calculated from the rating scale of very important (VI) (3), important (I) (2) and (NI) (1) with the cut-off point of 2 to measure the level of importance from the identified task. The cut-off point implies that a cut-off point above 2 is an indication that the task is very important. To determine the level of competence and importance, a mean weigh discrepancy score (MWDS) was used. Linear regression analysis was used to determine the relationship between the competency of women farmers and independent variables..

The results of the study showed that (62.7%) women farmers involved in irrigation farming were over 50 years old. The results also showed that (31.3%) of the respondents are single while 42.1% are married. The study showed that (34.9%) of the respondents interviewed have primary school education level. The result showed that (1.2%) of the irrigated land is rented and (48.2%) belongs to the chief while (50.6%) is privately owned. The results indicated that (96.4%) of the respondents do have contact with extension. About (62.6%) of respondents act as their own source of labour while (8.4%) hire people to work on their farms.

The results indicated that (79.5%) of the respondents produce Lucerne followed by Maize with 54.2%. Farmers indicated that they use Center Pivots (87%) followed by (40.9%) of farmers using furrow irrigation. Farmers indicated that they rely on extension officers (66.3%), Community meetings (56.6%) and Radio (59%) and cell phones (50.6%) for agricultural

information. The results on the perceived level of competence on the 23 farming activities for women in irrigation farming developed from the operations and activities categories as Pre and Post planting (10), Irrigation Management (4) and Marketing (9) revealed that, all 10 tasks had a mean score less than 2, indicating that respondent are not competent in pre and post planting tasks identified.

Regarding the perceived level of competence of women on irrigation management, the results revealed that of the 4 tasks, none of them was above the cut-off point of 2, implying that the competency level under irrigation management is very minimal. The results further indicate that respondents were found to be incompetent in all nine farming tasks identified under Marketing. The rating scale revealed that all the mean for the level of competence were below cut-off point 2, a signal that there is low competence among women in irrigation farming in marketing.

Women farmers perceived level of importance on irrigation farming on the 23 farming activities tasks showed the rating on a 3-point Likert-type scale, low (1), moderate (2) and high (3). The rating scale indicated that mean greater than 2 denotes high importance, while a mean less than 2 denoted less importance of the farming tasks. The results revealed high importance attached to the tasks. The most important tasks, as ranked by the respondents under Pre and Post-Planting are appropriate application of herbicides and fungicides ($\bar{x}$ =2.63 SD= 0.57), knowledge of crop rotation ($\bar{x}$=2.61, SD=0.59). The perceived level of importance on irrigation management tasks revealed high importance of all the attached tasks as they are all above cut-off point 2. The most important tasks, as ranked by the respondents were, Knowledge on the amount of water to use ($\bar{x}$ =2.66, SD = 0.52), Evaluating farming land for soil and water conservation ($\bar{x}$=2.54, SD=0.55). The means for all the level of importance on marketing task were above the cut-off point of 2. The most highly ranked tasks were Knowledge of reading

and interpreting marketing information ($\bar{x}$ =2.81, SD=0.40), Value adding ($\bar{x}$ = 2.77, SD= 0.59).

The results of the descriptive statistics provided information related to demographic, socioeconomic characteristic. The descriptive statistics showed were. Borich Model was used to measure the competence of women farmers in irrigation farming in the North West Province. Based on the evidence presented in this chapter, it can be concluded that there is low level of competence among women farmers on irrigation farming tasks in the North West Province. The results of regression were also discussed and showed that ten out of the eighteen explanatory variables were significant while the rest seven variables were insignificant. The next chapter is the summary, conclusion and recommendations.

CHAPTER FIVE

MAJOR FINDING SUMMARY, CONCLUSION AND RECOMMENDATION

5.0 Chapter Introduction

The main objective of the study was to analyse the training needs among women involved in irrigation farming in the North West Province. The irrigation sites were selected for this study due to the functionality of the schemes and high concentration of women farmers. Data were obtained from a primary survey of women farmers involved in irrigation farming. In this study, a questionnaire with open and close-ended items was used; a focus group discussions and cross-sectional survey were also employed respectively. Section A of the questionnaire focused on household characteristics of participants, Section B focused on farming enterprises, Section C focused on the sources of information, Section D requested information from respondents on competency and training needs. The population of the study consisted of all women on irrigation schemes in the North West Province. To obtain a representative sample of women involved in Taung and Dinokana irrigation schemes, a stratified random sampling method was employed, using a Raosoft's sample size calculator with a confidence interval of 95% and 5% error; accordingly. Due to limitations, 83 women were able to respond to structured questionnaire. In analysing the data, descriptive and inferential statistics were used.

5.1 Summary of major findings

The result revealed that the majority of women (62.7%) are above 50 years of age. This may be attributed to the fact that older women have always engaged in farming activities and contribute to the agricultural, rural economies and food security in the household. The result also revealed that a greater proportion (42.2%) of farmers in the schemes were married. The result showed that 34.9% of respondents interviewed had a primary school education, 24.1% had high school education, and 10.8% had no formal schooling while only 2.4% had college

and tertiary education. Furthermore, the majority of women in the irrigation schemes (44.6%) indicated that they have more than 30 years in irrigation scheme; this clearly suggests that most farmers have been working on the irrigation schemes for a longer period.

The result indicated that about 94% of the farmers were cultivating on communal farms allocated by the village Chief, the study also revealed that majority with 96.4% of farmers had contact with extension services. About 62.2% of women farmers indicated that they were the source of labour for their farms, about 88% of the respondents highlighted that they are not involved in off-farming activities, meaning their main source of income and livelihood is from the farming activities they are involved with.

Lucerne production is the most prominent crop (79.5%), about 87% of respondents indicated that they use central pivots for irrigation, about 66.3 % of agriculturists showed that they get information through extension officers, the low-level of technical know-how and affordability play a major role in farmers not being able to use the internet. The range of competence from highest to lowest among women category with respect to Pre and Post Planting tasks, where respondents were asked to rate all ten tasks on a 3-point Likert-type scale type scale of low (1), Moderate (2) and high (3) with a mean of greater than 2 denoting high competence and a mean less than 2 denoting low competence for the Pre- and Post-Planting Tasks.

The result revealed that all 10 tasks had a mean score less than 2, indicating that respondents are not competent in pre and post planting tasks identified. Even though all competencies were below cut off point 2, soil preparation for ploughing ($\bar{x}$ =1.63, SD =0.58) and appropriate application of herbicides and fungicides ($\bar{x}$ =1.63, SD=0.56) received the highest ranking while, calibrating planters and seeders for various crops ($\bar{x}$ = 1.39, SD = 0.51), planning and carrying out harvesting appropriately for various crops ($\bar{x}$ = 1.40, SD = 0.54); knowledge of crop rotation ($\bar{x}$ = 1.45, SD = 0.57) were ranked amongst the lowest competencies.

Regarding the perceived level of competence of women on irrigation management, the result revealed that of the 4 tasks, none of them was above the cut-off point of 2. This indicates that the competency level under irrigation management is very low. The tasks with the lowest competence mean score were knowledge on the amount of water to use ($\bar{x}$=1.33, SD = 0.52), followed by evaluating farming land for soil and water conservation ($\bar{x}$=1.45, SD = 0.55) and recommendation of suitable profile and water conservation measures for specific farmland ($\bar{x}$ =1.46, SD = 0.57).

When it came to the marketing tasks, respondents were found to be incompetent in all nine farming tasks identified, due to the fact that the rating scale revealed that all the mean for the level of competence were below the cut-off point of 2, the tasks with the lowest competence mean score were knowledge of reading and interpreting marketing information ($\bar{x}$=1.19, SD =0.40), Value Adding ($\bar{x}$ =1.23, SD =0.45), price determination for produce ($\bar{x}$ =1.25, SD=0.49) and knowledge of marketing contracts ($\bar{x}$=1.37, SD =0.59).

The importance of the task was on a 3-point Likert-type scale of low (1), moderate (2) and high (3). From the rating scale, the actual mean was found to be 2, thus the mean greater than 2 denoted high importance, while a mean less than 2 denoted less importance of the farming tasks. The results overwhelmingly revealed high importance attached to the tasks. The most important tasks, as ranked by the respondents under pre- and post-planting were appropriate application of herbicides and fungicides ($\bar{x}$=2.63 SD= 0.57), knowledge of crop rotation ($\bar{x}$ =2.61, SD=0.59), calculating the amount of fertilizer to apply for various crops ($\bar{x}$=2.60, SD= 0.57), calibrating planters and seeders for various crops ($\bar{x}$ = 2.55, SD=0.56) and evaluating soil profile in farming ($\bar{x}$=2.54, SD=0.54).

The result revealed high importance of irrigation management of the entire attached tasks as they are all above cut-off point 2. The most important tasks, as ranked by the respondents were,

Knowledge on the amount of water to use ($\bar{x}$=2.66, SD = 0.52), Evaluating farming land for soil and water conservation ($\bar{x}$=2.54, SD=0.55), Recommendation suitable profile and water conservation measures for specific farm land ($\bar{x}$ = 2.37, SD=0.57) and lastly, Irrigation scheduling and frequency ($\bar{x}$ = 2.30, SD=0.62).

The results further indicated that the means of all tasks under the importance of marketing tasks were above the cut-off point of 2. The most important tasks, as ranked by the respondents were Knowledge of reading and interpreting marketing information ($\bar{x}$ =2.81, SD=0.40), Value adding ($\bar{x}$ = 2.77, SD= 0.59), Price determination for your produce ($\bar{x}$ =2.75, SD=0.49) and Knowledge of marketing contracts ($\bar{x}$=2.63, SD=0.59).

The finding revealed that from the ten competencies under Pre and Post planting, only two were positive with the greatest need as perceived by respondents, which are soil preparation for ploughing (MWDS = 0.91) and planning and carrying out harvesting appropriately for various crops (MWDS = 0.11). The other eight competency variables were negative, implying that the perception of women farmers on the need to acquire training on the negative competencies can be connected to the technicalities involves in carrying such activities.

The result further revealed that the competency need under irrigation and management was only for recommendation of suitable profile and water conservation measures for specific farm land (MWDS= 0.19) with the other three competencies being negative.

Positive MWDS were obtained for all competencies under marketing. The competency with the greatest need for marketing as perceived by respondents were, knowledge of reading and interpreting marketing information (MWDS= 0.56), price determination for your produce (MWDS=0.29), and knowledge of marketing contracts (MWDS=0.24).

The report from the focus group organized further showed that respondents in Taung irrigation schemes stated that they have no membership of any water association. Furthermore, respondents in Dinokana indicated that they also do not belong to any water user association, but belong to cooperatives such as the Motlhaka farming cooperative. Due to the absence of water user associations, women farmers involved in this scheme indicated that part of the water that was used for irrigation in Motlhaka farming cooperative was transferred to the community. The focus group also showed that farmers involved in these schemes pay close to R 6000 per month for electricity. This amount at times could range from R 66 0000 to R 72 000 per annum. Water and electricity bills are high and water channels from the dam to the farms are not properly maintained.

All respondents in both groups further indicated that their main challenges were related to irrigation and marketing because farmers were not given training course in irrigation farming. Women in both schemes indicated that they do not have the knowledge and skills required to perform effectively and efficiently on the farms. The discussions indicated that women would be very grateful if government could invest more on them by organising trainings through the Department of Agriculture that will meet their needs for them to improve their skills and level of competence.

The ordinary least square regression was employed to test the relationship between the socioeconomic characteristics of the respondents against their competency level among which was seen that ten out of the eighteen explanatory variables were significant at different level either positively or negatively. This null hypothesis was rejected. Marital status was negatively significant at 5% level i.e. ($P<0.05$) to their competency level, number of dependents was negatively significant at 5% level i.e. ($P<0.05$) to their competency level, number of members in household was positively significant at 10% i.e. ($P<0.10$) to their competency level, member

of farmers group was negatively significant at 5% i.e. (P<0.05) to their competency level, use of central pivot irrigation type was positively significant at 1% i.e. (P<0.01) to their competency level, use of flood irrigation system was positively significant at 1% i.e. (P<0.01)to their competency level, use of sprinkler irrigation type was positively significant at 5% i.e. (P<0.05)to their competency level, use of micro irrigation type was positively significant at 5% i.e. (P<0.05) to their competency level, use of drip irrigation type was positively significant at 5% i.e. (P<0.05) to their competency level, use of other irrigation types (canal, dragline/furrow) was also found to be positively significant at 1% i.e. (P<0.01) to their competency level.

5.2 Conclusion

The study analysed the training needs among women involved in irrigation farming in the North West Province. The result revealed that all 10 tasks had a mean score less than 2, thus indicating that respondent are not competent in pre and post planting tasks identified. The perceived level of competence of women on irrigation management was all below the cut-off point of 2 indicating a low level of competency. When it came to the marketing tasks, respondents were found to be incompetent in all nine farming tasks identified. The importance of the farming task, high importance of irrigation management, and the importance of marketing tasks were found to be 2 indicating a high importance as a mean of 2 and greater denoted high importance of the farming tasks.

5.3 Recommendation

The results and analysis of the data collected in the study provide insight to the government and policy makers on the developmental strategy to embark upon in setting policies and guidelines that will enhance competency among women farmers involved in irrigation farming in North West Province. The following policy recommendations were made based on the findings from the study:

i. From the findings of the study, it was revealed that majority of respondents are above 50 years. It is, therefore, recommended that younger women should be encouraged to get involved in irrigation farming.

ii. Recognised support should be given to women farmers in order to own land and have full access to water and improves their productivity

iii. Regular extension visits accompanied with method demonstrations should be encouraged and strengthened because communication with farmers are found to be more intensive and more significant in farming through training and visits by extension officers as the popular medium of information dissemination.

iv. The government of the day should also introduce training courses and facilities especially related to marketing and irrigation, as all the respondents from both focus group indicated that that was the main challenge they face.

v. The government should come to women involved in irrigation farming with incentives to encourage them to improve their level of competencies, specifically in pre and post planting tasks.

vi. When it comes to marketing tasks, the government should also introduce measures and incentives to improve their level of competencies.

vii. There should be support programmes for the women farmers, and also train farmers with skills in preparing a good proposal to qualify for a financial support.

viii. The benefits of participating in the water use association should be used as a proxy to encourage more subsistence female farmers to become commercial farmers which will encourage and lead to entrepreneurship development

ix. It is also recommended that policy makers improve the efficiency of water rates, tariffs, and electricity by introducing volumetric measurements which allow irrigators to pay only the amount in relation to the quantity of water used.

x. Unceasing nursing and evaluation of irrigation schemes by the North-West Department of Agriculture mutually with farmers is essential to provide feedback to farmers and in order to assist them improve their productivity and to prevent the schemes from collapsing.

FURTHER FINDINGS FROM THE FOCUS GROUP DISCUSSION

In each of the two grouped irrigation schemes, (Taung and Dinokana irrigation schemes), women were organised into groups of 5-8 farmers and the discussions facilitated by the researcher. The results obtained from the Focus Group Discussions (FGDs) held in Bosele, Rethuse, Tshidiso, Tshenolo and Ipelegeng irrigation schemes under Taung and Dinokana irrigation scheme.

Water User Association (WUA)

Report from the respondents in Taung irrigation schemes stated that they have no membership of any water association. Another focus group discussion was organised in Dinokana. The area is situated near Zeerust town in the North West Province, South Africa. Women farmers involved in this scheme also indicated that they do not belong to any water user association but belong to cooperatives such as the Motlhaka farming cooperative. The cooperative comprises of both female and male farmers. Male farmers are in charge of many duties in the scheme. Males decide on the types of crops to be planted and how water should be distributed. This creates a lot of tension in the scheme as most women farmers feel they are being oppressed. Even though they are subjected to all these challenges, they still find working on the schemes helpful as they can produce enough food for their families.

Due to the absence of water user association associations, women farmers involved in this scheme indicated that part of the water that was used for irrigation in Motlhaka farming cooperative was transferred to the community. Water supply on the scheme is not the same as it was in the past. This is largely due to climate change. Farmers are constantly fighting with the community since water is now becoming scarce in the area. Respondents reported that they are expected to buy diesel every time when they want water and sometimes, water does not

reach their farms. This suggestion does not support the findings of Ndelwa (2014) who highlighted the importance of establishing and being a member of a water user association.

The establishment and membership of a water association are to enable the community to participate in water resources management and water resources conflicts resolution in their respective areas. Furthermore, membership of a water association is to ensure that water resources are managed duly, primarily by the users themselves. The result of the focal group also shows that their non-membership of an association is in contrast to findings of studies by Kolavalli and Brewer (1999) and Saruchera (2008) who found out that membership of a water association will give improved water control, reduce cost of irrigation and also give democratization in decision making of water users.

Benefits of water user associations

The result of the study indicated that respondents said they did not have any benefit which is as a result of them not being a member of a water user association. Women farmers in Taung irrigation scheme are exposed to high rates of water bills since there are no associations to negotiate on their behalf. Furthermore, there is no proper monitoring of water distribution and use. Most schemes use centre pivots which consumes a lot of electricity. Farmers involved in these schemes pay close to R6000 per month for electricity. This amount at times could range from R66 0000 to R72 000 per annum. Water and electricity bills are high and water channels from the dam to the farms are not properly maintained. In most instances, respondents receive statements from Management of the Dry Harts Dam without an indication of the volume of water used (that corresponds to the amount of water used).

They further indicated that even during rainy days, their water bills still remain high and this affects their income significantly. This result does not agree with the findings of Ngirazle, Bushara, and Knox (2015) that highlighted that the WUAs are responsible for the provision of

adequate and reliable water supplies, yet this can only be achieved where the on-farm delivery infrastructure is in good condition and maintained by WUA members. Furthermore, Ngirazle *et al*. (2015) indicated that WUA is responsible for the provision of adequate and reliable water supplies and brings individual water users at a local level together to co-operate on how best they can use their water resources.

Challenges faced by women farmers in Irrigation schemes

All respondents in both groups further indicated that their main concern is not pre- and post-planting. Their main challenges are irrigation and marketing. Respondents indicated that they just apply water as long as it is available. Most of them indicated that they do not have financial and marketing skills needed to function adequately on the farms. These are major reasons why they are unable to keep records of the quantity of produce harvested and sold. Water use management is very crucial as knowledge in this sector will assist farmers and allow them to know the right channels to use in order to preserve water.

Respondents from the study indicated that they pay high rates which can be unsatisfactory because how their water usage was measured to be given such high rates and bills to pay could not be explained. The finding of the study agrees with Kiymaz, Ozekici, and Hamdy (2006) who in a similar study identified respondents in their study area facing the challenge of paying high rates in water usage and who cannot specifically quantity their usage. Sagorday (2003) also recorded a similar problem in his study, which also agrees with the finding of the study. Furthermore, respondents indicated the electricity bill they receive as also very ambiguous which per annum could be as high as 34, 000 Rands.

Areas of training needs

From the study, the results showed that women farmers were not given any training course in irrigation farming. With regard to the area of training needs, responses from farmers towards identified training needs (such as land preparation) were mixed and diversified. Some farmers indicated that they had no clue on how to prepare land; they just come in during the weeding period and control pests such as birds. The respondents also indicated that they have never received training courses in irrigation topics, such as irrigation methods, irrigation scheduling, water saving, new irrigation methods, environmental issues, hence it is one cogent aspect that is required by the respondents. This is corroborated by Kiymaz *et al*. (2006) who also identified that respondents in their study area also required training in irrigation.

Women Farmers emphasised that they will be pleased to have any form of training regarding land preparation. This will enable them to learn new techniques that they may never have been exposed to. Due to the large sizes of farms, respondents indicated that soil preparation in Taung irrigation scheme is done using tractors, thus the reason why male farmers dominate the sector since they are the ones who know how to operate the tractors. Women farmers in Dinokana are still using small implements such as rakes and hoes to prepare and cultivate their plots.

All women farmers in this scheme indicated that they need training on how to use the machinery and other techniques in order for them to know how to determine the planting depth of seeds and other appropriate planting methods for various crops. Even though extension services exist, women farmers still feel that the support from all the services is not enough as they are still facing the same needs to uplift their competence. Women farmers in both schemes indicated that they do not have the knowledge and skills required to perform effectively and

efficiently on the farms. Even though they are exposed to some of these tasks in other farms, they cannot perform them since they do not have adequate training in these skills.

Some women farmers indicated that they do not attend meetings as they believe such meetings do not bring any change towards their challenges. Government extension officers do not make any follow-ups after training farmers and this affects their progress. The farmers further indicated that their efforts are not properly acknowledged and recognised. Other farmers feel that they are fine with their knowledge and would not adapt to new approaches. Since they lack skills on negotiating contracts, it is difficult for them to know how to package their produce. They do not have set standards on packaging and in most cases, they are forced to sell as long as their produce does not stay long in their small storage facilities. Based on this background, training is thus needed in order for these farmers to know how to package their final products. Most women farmers have no access to credit from government subsidies or banks.

Preferred adjustments and adaptations for women to realize their aspirations

Respondents further requested the renovation of tunnels since most on them are dilapidated. Areas that are far from dams do not receive enough water due to leakages from damaged tunnels. Farmers advised that drilling of boreholes near their farms would be far much cheaper than getting water from the dam situated in Dry Harts (as it is very costly for them). Respondents complained about theft. Implements are exposed due to lack of storage facilities. Farmers requested financial assistance from government in order to pay water and electricity bills. The money made from the sale of produce cannot cover their farming expenses and their livelihood. Farmers in the schemes are of the opinion that water problems could be resolved if water user associations are created in the area to defend and address their issues. Farmers are willing to be part of these forums if formed.

The discussions indicated that women would be very grateful if government could invest more on them by organising trainings through the Department of Agriculture that will meet their needs for them to improve their skills and level of competence. Such training should be more on financial management as they are struggling to understand some financial concepts due to high rates of illiteracy in the area. Women farmers in this scheme believe that only demonstration method can assist whereby they are taken step-by-step to understand the concepts. They believe that more time should be dedicated to training since some of the farmers are slow learners. They further indicated that during previous trainings, facilitators would just come in and give them pamphlets without any further explanations. Respondents maintained that forming water user association forums could be of great benefit to women. With such associations, women will have an avenue to discuss their challenges and frustrations.

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APPENDIX A: Questionnaire

Dear Respondents

NORTH-WEST UNIVERSITY MAFIKENG CAMPUS, DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION. I am conducting a study on "**Training Needs Analysis of Women in Irrigation Farming in the North West Province, South Africa**." The information provided in this questionnaire will be treated as confidential as possible. Your name is not required and the analysis will be group referenced. Could you please spare some of your valuable time in responding to questions. Thanks for your cooperation. Your assistance is required in providing correct answers to the following questions. The researcher is a student of the above-mentioned department and school. Your answers will be treated confidentially and used for academic purpose only

INSTRUCTION: Please write and tick where appropriate

Questionnaire number: ……....
Municipality: …….....

Section A: Demographic Characteristics of respondents

(1). Location _____

(2). Age (Years) _____

(3). Marital Status (a) Married [ ] (b) Single [ ] (c) Divorced (d) Widowed [ ]

(4). Educational status (a) Standard [ ] (b) Matric [ ] (c) Diploma [ ] (d) Degree [ ] (e) None [ ]

(5). Race (a) Black [ ] (b) White [ ] (c) Coloured [ ] (d) Indian [ ] (e) Others, specify _____

(6). Religion (a) Christianity [ ] (b) Islam [ ] (c) Traditional worshipper [ ] (d) Others, specify _____

(7). Household size _____

(8). Farming experience (in Years) _____

(9). Land ownership (a) Yes [ ] (b) No [ ]

Land tenure status: Personal/ inherited ☐ Rented ☐ Allocated ☐

(10). What is the size of your Plots/farm in hectares? _____

(11). If you do not have a personal farm, where do you farm on? (a) Family land [ ] (b) Communal land [ ]

(c) Lease land [ ] (d) others, specify _____

(12). What was your employment background before becoming an entrepreneur?

(a) Unemployed [ ] (b) Employed [ ] (c) Others, specify _____

(13). Indicate the years of employment (a) 1-3 years [ ] (b) [ ] 4-6 years

(c) 7-9 years [ ] (d) ≥ 10 years, specify _____

(14). How many employees do you have in your business? _____

(15). How many employees do you have on full-time basis? (a) 1-3 person [ ]

(b) 4-6 persons [ ] (c) 7-9 persons [ ] (d) ≥ 10 persons [ ]

(e) Others, specify _____

(16). How many employees do you have that work on part-time basis? (a) 1-3 person [ ]

(b) 4-6 persons [ ] (c) 7-9 persons [ ] (d) ≥10 persons (e) others, specify _____

(17). Kindly indicate the income level of the business per annum _____

(18). Do you receive extension visits? (a) Yes [ ] (b) No [ ]

If yes, how often? Regularly ☐ Occasionally ☐ Rarely ☐

(19). From what source(s) do you use to obtain information on entrepreneurial activities and farming?

(20) (a) Colleagues [ ] (b) Friends [ ] (c) Relatives [ ] (d) Extension agent [ ] (e) Radio (f)

Television [ ] (g) Newspaper (h) others, specify _____

(21)Are all you plots in one location? _____

(22)Are you a member of farmers' group? Yes ☐ No ☐

(23)Is the extension officer from: Government ☐ Non-governmental ☐ Parastatals ☐

(24)What are your sources of labour? Self ☐ Family ☐ Hired ☐

(25)How long have you been farming? _____years?

(26)How long have you been part of an irrigation scheme? _____Years?

(27) Please mention the name of the irrigation scheme_____

(28)Do you engage in non-farming activities? Yes☐ No☐

If yes, please mention them: _____

(29)Do you pay water rates? _____

(30)How much do you pay per month for water rates? _____

(31)Do you pay water tariffs? _____

(32)How much do you pay per month for Water tariffs? _____

(33)Do you pay for using electricity? _____

(34)How much do you pay per month for using electricity?

_____

SECTION B: ENTREPRENEURIAL ACTIVITIES AND AREAS IN WHICH YOUR BUSINESS OPERATES

(35)Indicate the farming enterprises in which you are engaged in? (Mark with an X)

Crops	Yes	No
Maize		
Wheat		
Sunflower		
Sorghum		
Groundnut		
Barley		
Lucerne		
Tomatoes		
Potatoes		
Cabbage		
Spinach		
Pumpkins		
Green pepper		
Onion		
Garlic		
Green beans		
Citrus		
Carrots		
Beetroot		
Mushroom		
Lettuce		
Cucumber		

(36)What type of cropping system do you practise? (Mark with an X)

	Yes	No
Mono cropping system		
Double cropping system		
Multiple cropping system		
Mixed cropping		
Crop livestock integration		

(37)Please indicate method of irrigation practised: (Mark with an X)

Method of irrigation practised	Bucket irrigation method	
	Sprinkler irrigation method	
	Furrow irrigation method	
	Flood irrigation method	
	Basin	
	Canal	
	Drip	

(38)Please indicate the sources of water for the irrigation scheme (Mark with an X)

Dam	
River	
Reservoir	
Bore hole	
Municipal water	
Fountain	
Other	

Section C Focused on the sources of information

(39)Please indicate the sources of information on (Mark with an X)

	Yes	No
Television		
Radio		
Phone		
Internet		
News paper		
Magazine		
Computer		

Section D requested information from respondents on competency and training needs

(40) Competency and Importance on skills and training needs

Skills and Training Needs	NC	C	CV	NI	I	V I
Soil preparation for ploughing						
Determining inter and intra row spacing						
Determining seed depth						
Selecting appropriate planting methods for various crops						
Evaluating soil profile in farming areas						
Evaluating farming land for soil and water conservation						
Recommending suitable soil and water conservation measures for specific farm lands						
Knowledge of crop rotation						
Calculating the amount of fertilizer to apply for various crops						
Appropriate application of herbicide and fungicide						
Calibrating planters and seeders for various crops						
Planning and carrying out harvesting appropriately for various crops						
Irrigation scheduling and frequency						
Knowledge on the amount of water to use						
Knowledge of the market for your produce						
Price determination for your produce						
Knowledge of reading and interpreting market information						
Knowledge of the marketing contracts						
Value adding						
Service provider for Storage facilities						
Farm record keeping						
Financial management						
Packaging						

NC=Not competent C= Competent VC= Very competent NI=Not Important I= Important VI=Very Important

Focal group Discussions

(41) Are you a member of any water user association? (a) Yes [ ] (b) No [ ]

(42)If (YES), does your membership of the water user association contribute to your entrepreneurial practice? (a) Yes [ ] (b) No [ ]

(43)Name the benefits of water user association

_____

_____

(44)What are the problems associated with water user associations?

_____

_____

(45)What are your area of training needs?

_____

_____

(46)What are your preferred adjustment and adaptive measures for women to realise their aspiration?

_____

_____

(47)Please indicate how your membership of the water user associations contributed to you and your business from the list below

Entrepreneurial Contribution	Degree of helpfulness of the water user associations			
	Very well	Fairly	Poorly	Not at all
Affordable land lease				
Financial assistance				
Affordable training programmes				
Extension/advisory services				
Provision of credit facilities				
Provision of affordable market				
Others, specify				

APPENDIX B: Letter of Introduction

Department of Agricultural Economics & Extension

The Head of Department
North West Department of Agriculture
Agri. Centre
MMABATHO

REQUEST FOR DATA COLLECTION: Seleke Christopher Tshwene

1 Above matter refers.

2 Seleke Christopher Tshwene mentioned above is a registered student (student number: 16969669) Studying PhD in Agriculture with North West University.

His research topic is ***"Training needs of analysis of woman in irrigation farming in North West Province".***

3. Herewith, permission and your support are humbly sought in allowing him to collect data that is essential and a prerequisite for the completion of the study.

Thanking you in advance

APPENDIX C: Informed Consent Release

Investigator:

I am interested in learning more about the "Training **Needs Analysis of Women in Irrigation Farming in the North West Province, South Africa** ". You will be asked to signal and respond to some questions. All facts will be kept *confidential*. I will allocate a number to your responses, and only I will have the key to specify which number belongs to which contributor. I will not disclose particulars or I will change information about where you work, where you live, any personal information about you, and so forth.

.

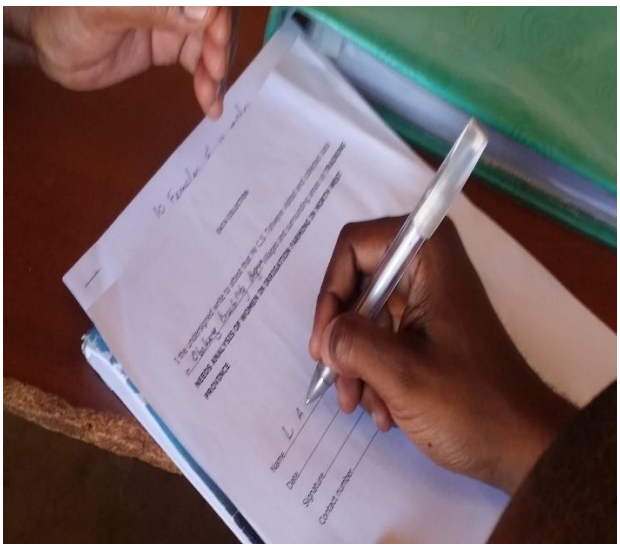
_____ _____

Signature of participant Date

_____ _____

Signature of investigator Date

APPENDIX D: Pictures of researcher, interpreter with some of the respondents across the study area



APPENDIX E: List of publications

The following manuscripts have been drafted out of this thesis and also undergoing a review process

1 Work in progress on Publication 1

Tshwene C., Oladele, I, & Ijatuyi, Enioluwa Jonathan. Assessment of training needs of Women in Irrigation Farming in the North West Province, South Africa. ***Acta Universitatis Danubius. Œconomica*** (*submmited*)

2 Work in progress on Publication 2

Tshwene C., & Oladele,O. I, Analysis of Competence among Women in Irrigation Farming in the North West Province South Africa. A Borich Need Model Approach

Journal of Agriculture food and information *(submitted).*

3 Work in progress on Publication 3

Tshwene C. & Oladele, O. I Relationship between socioeconomic characteristics of women farmers and their competency level in irrigation farming in the North West Province: Using a simple linear regression ***International Journal of Gender and Entrepreneurship***, (Tentative publisher)