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ANALYSIS OF DECISION MAKING IN SMALLHOLDER IRRIGATION PRACTICE: A CASE STUDY OF SHILOH AND ZANYOKWE IRRIGATION SCHEMES IN CENTRAL EASTERN CAPE, SOUTH AFRICA

BY

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A thesis submitted to the Department of Agricultural Economics, Extension and Rural Development in fulfilment of the requirement for the degree of Doctor of Philosophy (PhD) Agriculture, Extension and Rural Development

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DEDICATION

To my beloved mother late Mrs Agholor Ogidigbo Rebecca who passed on to glory on the 18th of May 2012.

Have a peaceful rest.

DECLARATION

I declare that this thesis is entirely my work and all sources and materials used for this study have been duly acknowledged. This thesis has been submitted in fulfillment of the requirement for the degree of Doctor of Philosophy (PhD) Agriculture, Extension and Rural Development at the University of Fort Hare. I solemnly declare that this thesis have not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

Dated at Alice this …….. Day of …….. 2014

……

Agholor A. Isaac

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To God is the glory.

Isaac A. Agholor
University of Fort Hare, Alice campus
August, 2014

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ACRONYMS

CASP: Comprehensive Agricultural Support Programme

DA: Department of Agriculture

DAFF: Department of Agriculture, Forestry and Fisheries

DBSA: Development Bank of Southern Africa

DFID: Department for International Development

DWA: Department of Water Affairs

ECSECC: Eastern Cape Socio-Economic Consultative Council

FAO: Food and Agricultural Organization

FARA: Forum for Agricultural Research in Africa

FSP: Farmer Support Programme

GEAR: Growth, Employment, and Redistribution

GFI: Gross Farm sector Income

GDP: Gross Domestic Product

HLPE: High Level Panel of Experts

IDP: Integrated Development Plan

IMT: Irrigation Management Transfer

MEC: Member of the Executive Council

MPO: Milk Producers' Organisation

NDA: National Department of Agriculture

NGOs: Non- Governmental Organizations

OECD: Organisation for Economic Co-operation and Development

PGDP: Provincial Growth Development Plan

SIS: Smallholder Irrigation Scheme

SPSS: Statistical Package for Social Science

SSA: Sub-Saharan Africa

UNDP: United Nations Development Programme

USDA: United States Department of Agriculture

WCED: World Commission on Environment and Development

WRC: Water Research Commission

WUA: Water User Association

WHO: World Health Organization

ABSTRACT

The study was conducted in Zanyokwe and Shiloh smallholder irrigation schemes located in Eastern Cape Province at Amathole and Chris Hani districts respectively. The choice of Zanyokwe and Shiloh smallholder irrigation scheme for this study is mainly supported by the fact that it had a substantial level of crop farming activity taking place especially at Zanyokwe while the Shiloh smallholder irrigation specialises dairy farming. The study examined decision making in smallholder irrigation practice with particular reference to Shiloh and Zanyokwe irrigation schemes. The general objective of the thesis was to analyse and model the determinants of SIS farmer's decision making. The specific objectives of the study are as follows: to investigate the determinants of decision making among smallholder irrigation farmers; to examine the relationship between household and farm characteristics and institutional factors that explain decision making in smallholder irrigation scheme; assess the contribution of smallholder irrigation farming to household food security; and determine the production and marketing constraints of smallholder farmers' in both schemes.

The theoretical and conceptual framework of the study gave a detailed discussion on the determinants of decision making of households. The theories used to understand household behaviour under different assumptions were variously discussed. Comprehensive illustrations of analytical framework of the study were also conceptualised. This study used a survey design, quantitative and qualitative research methodologies involving the use of questionnaires and focus group discussions. The data was coded and analysed using the Statistical Package for Social Science (SPSS). However, frequencies, percentages, bar and pie chart was also computed to describe the data. In consideration of the conceptual framework of the study, the agricultural household model was adopted to analyse smallholder farmer's household decision making.

Twenty one explanatory variables identified in the conceptual framework of the study were discussed and some of these identified variables were incorporated into the model. The logistic regression model was used as a method of analysis because it can estimate the probability of a certain event occurring and it accommodates a lot of variables which can be ranked in order to illustrate which variables are significant.

In the binary logistic model used, seven variables (farm experience, size of farmland, land rights/PTO, water sufficiency, farm asset, market information and production variation) out of the twelve predictor variables were found to have significant effect on influencing household decision making in Shiloh smallholder irrigation scheme, while five variables (gender, age, education, road distance and extension access) were not significant. Of the seven significant variables, four had positive signs (land rights/PTO, water sufficiency and market information); which means that an increase in either of these variables may be associated with an increase in household decision making in Shiloh. The other three predictor variables (farm experience, farm asset and product variation) had negative signs; this means an increase in either of these variables may be associated with a decrease in decision making.

In Zanyokwe, six variables (farm experience, land rights/PTO, water sufficiency, farm asset, market information and production variation) out of the twelve predictor variables were found to have significant impact on influencing household decision making, while six variables (gender, age, education, size of farm land, road distance and extension access) were not significant. Of the six significant variables, two had positive signs (water sufficiency and farm asset); which means that an increase in either of these variables may be associated with an increase in household decision making in Zanyokwe. The other four predictor variables (farm experience, land

rights/PTO, market information and product variation) had negative signs; this means an increase in either of these variables may be associated with a decrease in decision making.

The study concludes that smallholder agriculture is essential for employment generation and food security of households. It is apparent that household food security will not be achieved without giving attention to the role played by smallholders' farmers in South Africa. It is pertinent to promulgate an efficient policy programme to address the diversity of smallholders' situations and identify the main constraints on investment. Therefore, all spheres of government, the private sector and NGOs should consider investment in smallholder agriculture through coordinated strategies and political support. This study also recommends that government should develop a strategic Smallholder Investment Plan which would improve investments in smallholder agriculture.

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Adequate emphasis has been laid on identifying the role played by agriculture in the process of economic development. Agriculture is the wheel on which the economies of most Sub-Saharan Africa (SSA) revolve, but its performance in the last two decades has been discouraging with the sector's growth being exceeded by rapid increases in population. In Southern and Eastern Africa, per capita food production and employment have declined over the past three decades, while food requirements continue to increase due to rapid population growth of 2-3% (World Bank 2008). Since majority of the African population is engaged in subsistence agriculture, their state of hunger and poverty directly reflects the poor performance of traditional agricultural systems. Declining agricultural productivity has been a major force behind growing poverty among African smallholder farmers, and early recovery offers goods prospects for rural population to quit poverty. Therefore, the development of smallholder farmers is essential for ensuring the production of enough food, stable growth in arable and cash crop production.

However, to increase agricultural productivity, concerted effort must be made to tap effectively the existing resources endowed in the sector and agro-ecological diversity of the region. In Sub-Sahara Africa (SSA), agriculture accounts for 35% of the region's GDP, 40% of exports and 70% of employment (World Bank, 2008). Building agricultural productivity and food security will require broad dissemination of newly developed technologies and improvement of agricultural research and development (R&D). The linkage between extension and research, extension and farmers in most developing countries over the years has been very weak.

The new phenomenon is that for extension to succeed in its support to boost agricultural productivity, it must enhance its linkages and networks with research institutions, farmers and among extension providers- public, private and NGOs (Madukwe, 2006).

Agriculture is the main stay to the South Africa economy and remains the principal occupation of the majority of the poor rural community. Primary agriculture remains an important sector in the economy and it includes all economic activities from provisioning of farm inputs to farming and accounts for 3.9% of the Gross Domestic Product (GDP), while the Agro – food areas accounts for 9% (Terblanche, 2008). South Africa is one of the major stakeholders in the Africa continent endowed with natural resources but stagnation in agriculture has led to an increasing incidence of poverty and food insecurity. The entrance of smallholder farmers into mainstream agriculture is a government priority, but practical empowerment remains rare. The use of agricultural sector and extension support in reducing poverty in the country is important given the enormous resources available in the sector. A major way to the development of agriculture and improvement of production in the sector is the provision of extension support. The focus of extension support have been poverty alleviation, food security, employment creation, provision of raw materials and the sustainable management of natural resources. The main potential to reduce rural poverty and inequality depends on the strong development of overall frameworks for the provision of social security, education and training, as well as health care, and in developing infrastructures in most rural areas (OECD, 2006). South Africa has at least 330 smallholder irrigation scheme (SIS) situated mainly in the former homelands (Denison and Manona, 2007) with 79 percent located in Eastern Cape. In South Africa, the total land areas put under irrigation is approximately 1.3 million hectares with about 0.1 million hectares used by smallholder farmers (Backeberg, 2006; Van Averbeke, 2008). The main reason for the

establishment of this SIS was to allow farmers access to irrigated land with a view to improving rural livelihoods and sustainable crop production (FAO, 2007). Scheduling has been adopted in some schemes because it is difficult for farmers to access full stream of water at the same time. Scheduling which entails the timing of an irrigation event and the control of the amount of irrigation water released at such an event have been implemented in some irrigation schemes in South Africa.

Decision are made at every stage of agricultural production and the process whereby decisions are made is behavioural hence, understanding the decision making process requires an understanding of human behaviour (Johnson, 1976). Decision making is a process by which a person categorises a choice to be made, collects and weighs information about the choices, and select from among the alternatives (Caroll and Johnson 1990). Household characteristics, farm characteristics, institutional arrangements, biophysical and economic factors influences decision making of smallholder farmers (Zeleke, 2008). Smallholder livelihood systems are relatively multifaceted, and it involves both production of crops, livestock and off-farm activities (Upton, 1996). Decision making at the farm level is primarily the function of the farmer. The decision making task of the farmer is likely to be easier and more efficient when there is no risk factor. However, policies within the agricultural sector produce results that influence household behaviour well beyond farm production decisions. The total quantity of an agricultural commodity offered for sale in a given market over a given period is influenced by the price of the commodity, the prices of alternative products and of purchased inputs, the size of the agricultural labour force and the production technology. In all, decisions of the farmer in a given period are assumed to be derived from the maximization of expected utility (or expected profit) subject to land availability, labour, credit, and other constraints (Feder, *et al* 1985). Therefore,

profit is a function of the farmer's choices of crops, livestock and technology to adopt in each time period. According to Feder, *et al* (1985) imperfections in the credit and labour markets may also affect farmer's choice and decision making. However, to evaluate decision making, the study will draw on perceptions from those farmers served by the SIS; on access to open discussions, on objectives, activities, performance, along with consultative action plan and participatory process.

1.2 Statement of problem

In South Africa, there have been a number of policy initiatives to support the agricultural sector. Some of these initiatives were the liberalization and deregulation of agricultural markets which was in line with global drive in the 1980s. Moreover, these market-oriented modifications overlapped with macro-level political economy changes during the period which lasted till the end of apartheid in 1994. During the post-independence era, the Marketing Act No 47 of 1996, specified the extent of participation of smallholder farmers in agricultural markets and also provided for the modulation of policies that focus on agro-food markets. This Act was the main tool used to control the functioning of the post-apartheid agricultural sector (Kirsten and Vink, 2000). Liberalization and deregulation of agricultural markets posed restraints that debar smallholder farmers' market access for agro-food. Furthermore, institutional provisions along the value chain and policies seldom prioritize the needs of smallholder farmers and thus increased the barriers to accessing markets (Makhura and Mokoena, 2003).

The call for bigger investment in smallholder agriculture has been gaining support and has been seen as an avenue for poverty alleviation. However, there is a debate as to how effective it could be. According to the Organisation for Economic Co-operation and Development [OECD] (2006), the long term solution to poverty reduction requires involving a greater part of the rural poor in

agricultural activities that will produce enough income. Over the 10 year period, (1985 to 1995), employment in agriculture had fallen from 1.3 million to about 920,000, representing a 30% decline. In addition, for the 3 year period (2002 to 2005), employment in agriculture again declined from 940,000 to 628,000, representing a decrease of 33% (Stats SA, 2008). Changes in land use from agriculture to game farming and private reserves have also contributed to job shedding while overall casualization of the labour force has increase from 33% to 49% by1996 – 2002 (Stats SA, 2005). Smallholder livestock husbandry remains a primary land use option in communal areas over most of southern Africa (Shackleton *et al* 2002). With changes in macro-economic policy, labour market and changing environment, farmers adopt multiple livelihood strategies and decisions (Cousins, 1999). The increases in farm input prices and the reduction of Government support for agriculture have discouraged many smallholder farmers. The Provincial Growth Development Plan (PGDP) noted that government spending on agriculture nation-wide and in the Eastern Cape in particular continues to decline. PGDP, further stated that the important resources endowed in the area is not efficiently used to the benefit of the poor in the Province (Government of Eastern Cape, 2003). Irrigation development serves to achieve double or triple cropping per year and assist in more efficient land and water resources utilization than in rain fed farming (Makadho, 1994, Pazvakavambwa and Van der Zaag, 2002). Despite the considerable potential of irrigation, several SIS in developing countries have been labelled 'socio-economic failures' (Makadho, 1994; Chancellor and Hide, 1997). Generally, SIS in South Africa have been performing below average and have failed to deliver on their development objectives of increasing crop production and poverty alleviation. Crosby (2000) asserted that little crop harvest (output) is one of the factors responsible for the failure of many SIS in South Africa coupled with insufficient technical know-how about crop production practices among

farmers has also been acknowledged as another limitation to crop production (Fanadzo *et al* 2010).

Nevertheless, enough research has not been done to associate crop production practices to increased productivity with a view of coming up with best management practices. As noted by De Lange *et al* (2000), research and expenditure had hitherto focused on infrastructural development, without a corresponding human skill development to effectively utilize and maintain the infrastructure. De Lange, *et al* 2000, posited that the dependency syndrome was the main cause of the failure of the SIS that was initiated in the former Ciskei. Most farmers performed poorly when they were left alone to manage the scheme because they had no initial access to the centralised management decisions and design of the scheme. Burdge (2004) argued that the involvement of the farming community in irrigation decision making minimizes local resistance to projects and therefore reduces disruption. Thus, it increases project success by preventing major planning problems and associated waste. In addition, experiences from most countries in sub-Saharan Africa have shown that most schemes can perform well if smallholder farmers are incorporated in decision-making, and management of SIS (FAO, 2000).

A successful pursuit of rural development interventions that involve crop production requires a clear understanding of the smallholders' choice, decisions and livelihood strategies within the socio-economic and policy environment they are operating. Therefore, there is need to explore the possibilities of raising smallholder farmers' productivity and income through more effective use of the available labour and embedded land and water resources. The aim of this study is; therefore, to analyse the determinants of smallholder farmers' decisions in irrigation practice.

1.2.1 Purpose of the study

The long-term solution to poverty in South Africa requires the involvement of a greater part of the rural poor farmers in economic activities that will sufficiently generate income and employment. The reduction of rural poverty and inequality lies in the development of overall frameworks that will provide social security, education and training, infrastructures and health care (OECD, 2006).

Integrating the smallholder crop farmers into the main stream of agriculture entails the conversion of the traditional subsistence production systems into commercial arable crops, cash crops and livestock production. Such initiative requires understanding of the farmers' adoption behaviours and decision making in order to pursue a successful rural poverty reduction strategy. Farmers' willingness to cultivate crops or rear livestock that are high yielding is dependent on household and farm characteristics, biophysical, economic and institutional factors. These factors must be accentuated for government and NGOs to carry out successful rural development interventions. The most important question this study attempts to address is "What are the determinant factors that influence smallholder farmers' decision making in Shiloh and Zanyokwe?

The adoption of irrigation in agricultural production is a key for socio-economic development, poverty relief and sustainable livelihoods; however, decisions to adopt or have access to irrigation facilities alone does not necessarily guarantee the effective use of irrigation technologies, specifically for reducing poverty. In many developing countries, the decision to adopt irrigation practice will not bring about poverty eradication but a means to relieving poverty. It may be difficult to measure empirically how irrigation adoption decision can reduce poverty for households, but an attempt will be made to at least assess the impact that these

decisions on irrigation technologies have on rural livelihoods and how it can be used to bring about development at community level. When the constraints that influence the socio-economic development and sustainable livelihoods of smallholder farmers are clearly understood, it will be easier to start working on those barriers, to reduce their negative impact.

The purpose of this study therefore, is to come up with appropriate scientific information for policy-makers that will guide them towards improvement of smallholder irrigation schemes and thereby accomplish the broad goal of reducing poverty in South Africa.

1.2.2 The objectives of the study

The objectives of the study are categorised into general and specific objectives.

1.2.3 The general objective

The general objective of the thesis is to analyse and model the determinants of SIS farmer's decision making

1.2.4 The specific objectives

The specific objectives of the study are as follows:

1. To investigate the determinants of decision making among smallholder irrigation farmers
2. To examine the relationship between household and farm characteristics and institutional factors that explain decision making in smallholder irrigation scheme.
3. Assess the contribution of smallholder irrigation farming to household food security.
4. Determine the production and marketing constraints of smallholder farmers' in Zanyokwe and Shiloh irrigation schemes.

1.2. 5 Research questions

The research questions which will be addressed in the study are as follows:

1. What are the determinants of decision making among smallholder irrigation farmers?
2. What are the influences of institutional arrangements on household as farm factors in decision making of smallholder irrigation farmers?
3. To what extent does smallholder irrigation farming contributes to household food security?
4. What are the production and marketing constraints of smallholder irrigation farmers in Zanyokwe and Shiloh schemes?

1.2.6 Hypothesis of the study

The study is guided by the following hypotheses:

1. Decision making of irrigators differs significantly from each other in household and farm characteristics.
2. Institutional arrangements significantly influence decision making of smallholder irrigation farmers in Shiloh and Zanyokwe
3. Smallholder irrigation farming enhances household food security.

1.2.7 Originality of the study

According to Phillips and Pugh (1994) originality of a study is the level at which a particular field of study makes an exceptional contribution to knowledge. Originality is also concerned with the impact of a particular study to new knowledge. However, many types of research undertakings have been acknowledged as creating originality. Some of these include: looking at new areas or topics that people in the same discipline have not looked at before; using different approaches and methodologies that are not often used; and trying out something in a particular area that has previously only been done in other area through the application of existing theory in

a distinctive manner (Blaxter, Hughes and Tight 2001, Remenyi and Money 2004). Although this study draws extensively on information and studies which have been done in the field of smallholder irrigation schemes, not much has been done in the area of decision making in smallholder irrigation practices in the South African context. The methodologies or approaches adopted in this study (as illustrated in chapter 4) incorporates quantitative and qualitative methodologies, and focus group discussion with respondents. The focus group discussion which involves participatory approach makes the study original. This study therefore filled the gap left by previous studies, by providing pragmatic evidence on the topic while also focusing on the determinant factors affecting decision making in irrigation practices. The present study broke new ground by specifically focusing on decisions of smallholder irrigation farmers in Zanyokwe and Shiloh schemes. In addition, the scrutiny of data collected for this study involved procedures which went beyond mere summarising and describing of data. The analysis used in this study, involved looking for clarifications, explanations, interpretations and discussion of empirical results. Such processes, according to Oliver (2004) are likely to make a pioneering impact to new knowledge.

1.2.8 The structure of the thesis

The background, purpose or justification of the study; objectives and research questions, hypothesis and originality of the study were examined in chapter 1. The broad overview and contribution of agricultural sector to the economy, the role of agriculture, livestock farming, GDP contributions, hectares cultivated, total production, employment and general trends; and specific review of extension services and support to farmers in South Africa are discussed in chapter 2. In chapter 3, we extensively reviewed literature on the historical overview of smallholder irrigation schemes in South Africa; typology of smallholder irrigation schemes in

South Africa; the fundamentals of decision making; theories of decision making; Hierarchical Decision Model; smallholder irrigation practice and food security; gender and smallholder irrigation practice; constraints of irrigation development in South Africa; sustainability of smallholder irrigation scheme in South Africa; irrigation scheduling and insight from the reviewed literature. In chapter 4, we also examine the theoretical and conceptual framework of the study and chapter 5 deals with the methods used for data collection and analysis. Detailed discussions of demographic characteristics of households are presented in chapter 6. Empirical results and discussions and major findings are presented in chapter 7. The summary, conclusion and policy implications are presented in chapter 8.

CHAPTER 2

SOUTH AFRICAN AGRICULTURE

2.1 Introduction

The primary objective of this chapter is to concisely present a broad overview of the South African Agricultural sector. The chapter is structured into two sections, beginning with overview of the South African agricultural sector including discussions on the role of agriculture, livestock farming, GDP contributions, hectares cultivated, total production, employment and general trends; the second section provides a specific review of Extension services and support to farmers.

2.2 Overview of South African Agriculture

The South African Agriculture is sustained by frameworks of policies that cut across agricultural institutions, distinct labour patterns, natural resources and technology and extension support services. Agricultural land constitutes 99.1 million hectares of the total surface area of 122 million hectares in South Africa. Natural pastures which are mainly committed to extensive livestock farming occupy much of this land. However, only about 15.8 million hectares of this area is for arable crops, while 81 million hectares are categorized as stable pastures. Forest and woodland cover 8 million hectares (National Department of Agriculture, 2001). Primary agriculture remains an important sector in the economy and it includes all economic activities from supply of farm inputs to farming which makes up to 3% of the Gross Domestic Product [GDP] (Department of Agriculture,2010). Although the GDP of primary agriculture seems small, it still remains important in the provision of raw materials, foreign exchange and employment notably in the rural areas. Agriculture contributed about R62 billion to the total GDP and its separate value was R127 812 billion in 2009. Since 1970, the sector performed well with about

11.8% GDP increase per annum, while the entire economy did well with an increase of about 14.9% GDP the same period (DA, 2010).

Growth, Employment, and Redistribution (GEAR) as a macroeconomic strategy, was adopted by the Department of Finance in June 1996 as a five year plan directed at the solidification of economic development, growth of employment, and restructuring of income and socioeconomic opportunities in favour of the poor. The main goals of GEAR were economic growth of 6% in the year 2000, inflation of less than 10%, increase in employment, a ratio of gross domestic savings to GDP of 21.5 percent in the year 2000, improvement in income distribution, relaxation of exchange controls and reduction of the budget deficit to below 4% of GDP (South Africa Reserve Bank, 2001). Agriculture, as a primary sector has played an immense role in South Africa in spite of the seeming dominance of the mining sector. However, while the agricultural sector has experience a high level of growth and productivity over the past two decades (Thirtle *et al,* 1993*),* it has experienced a decline, and now it contributes less than 5% of GDP with a lower proportion of employment(Lipton, 1996). According to Statistics South Africa (Stats SA, 2010), the agricultural sector shed a large number of jobs between 2008 and 2010 as a result of economic recession. In spite of the recession, the agricultural sector had already witness considerable job losses between 2001 and 2007 (Stats SA, 2007).

2.2.1 Background of the agricultural sector employment in South Africa

At the beginning of this millennium, the agricultural sector added about 10% to total employment in South Africa as compared to the current 5%. There has been a remarkable decline in employment in the agricultural sector as the number of people employed in commercial agriculture were put at 1.1 million in 1992 and by 1996, it decreased to 914 000 (Newman *et al.,* 1997, Aliber *et al,* (2007). Out of this number 67% were engaged on a regular basis while 33%

were engaged as casual or seasonal workers. Record also shows that the number of farm employees involved in regular work on commercial farms decreased by 15.7% from 724 000 in 1988 to 610 000 in 1996 (National Department of Agriculture, 2000). The white population has the highest number of people in full time agricultural jobs and lowest among Africans and the coloured. Amongst the whites employed in the agriculture and hunting subsectors, 97% had full time jobs compared with 83% among Africans and 75% among coloured. In the employment classification, 82% of coloured, 58% of Africans, 22% of Indians and 12% Whites were engaged in agricultural jobs categorized as elementary such as fruit picking and weeding. Within the employment ranking, 15% Whites, and an equivalent 15% Indians were employed as farm managers, specialists or technicians compared with only 1% of either Africans or coloured. (Stats, SA 2000).

2.2.2 Job losses in the agricultural sector

Between 1988 and 1999 agricultural sector shed a total of 140 000 regular jobs. However, with the increase in the use of casual labour, job security has been on the decrease (Simbi and Aliber 2000). Many reasons have been adduced for declining employment in the agricultural sector. According to Vink and Kirsten (1999), the decline in the number of people employed in the agricultural sector over the past decades has been exacerbated by bad policies that inhibited export opportunities, discouraged the growth of "labour- saving technology, and actively encouraged the adoption of capital- intensive farming practices". Bhorat (undated), asserted that the regulatory scenery and the cost of doing business in South Africa are quite unfavourable compared to other countries with the same growth ranking. Vink (2003) asserted that the introduction of new labour laws and minimum wage not only increased casualization of farm workers but also aggravated job losses in the sector during 2000s. Figure 2.1, portrays a clear

insight that employment in the primary sector [agriculture, forestry, fishing and hunting, and quarrying] has witness a major decrease between 2001 and 2010. It also shows that the secondary and tertiary sectors of the South Africa economy have been able to make up for decreasing employment in the agricultural sector and also create additional employment.

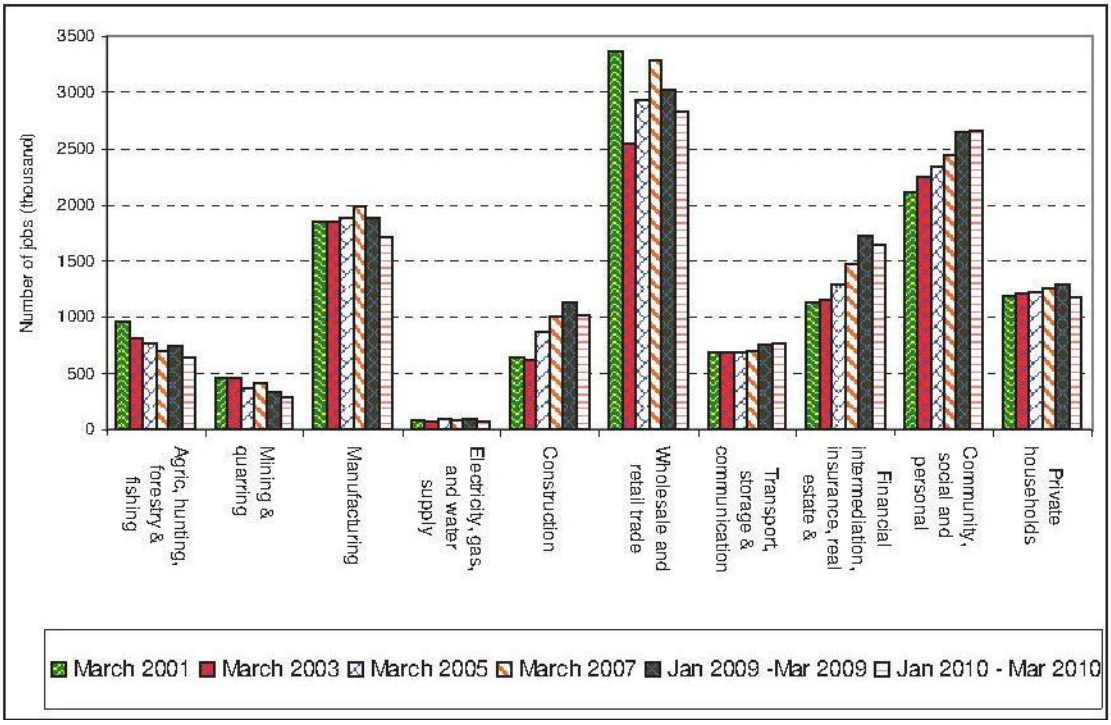

Figure 2.1 Trends in employment by sector between 2001 and 2010.

Source: Stats SA, 2010.

In March 2001 the agricultural sector employed 1 000 workers, but the number increased to about 1 500 in March 2010. However, the mining and quarrying sector lost considerable number of jobs during this time. Employment in other sectors, such as construction and manufacturing has been increasing because these sectors created substantial employment between March 2001

and January to March 2010 while the agricultural sector has been consistently losing a considerable number of jobs over time.

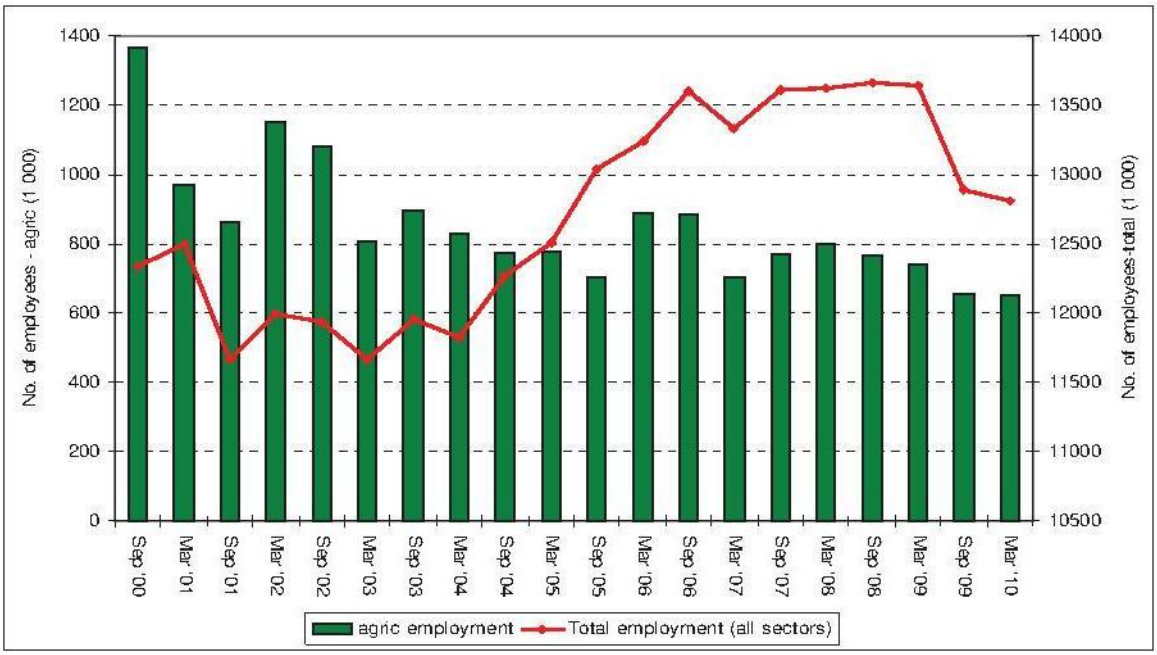

Figure 2.2: Trends in agricultural sector employment and total employment between September 2000 and March 2010

Source: Stats SA, 2010

From March 2009 to March 2010, a total of 833 000 job losses were documented and these were attributed to economic recession. Between September 2000 and March 2010, total employment in the sector increased by 467 000 jobs, that is from 12, 3 million to 12.8 million jobs. The figure is not much, because of the consequence of economic recession. Figure 2.2 further explains the trend in employment in the agricultural sector from September 2000 to March 2010. In spite of the fact that total employment increased considerably during the period under review, employment in the agricultural sector, decreased by more than half, that is from 1.4 million jobs in September 2000 to 650 000 jobs in March 2010. Table 2.2 below shows the distribution of

agricultural employment in South Africa per province. In the first quarter of 2008, the Western Cape and KwaZulu-Natal employed the highest number of workers in the agriculture sector. These were 181 000 employees (23%) and 129 000 employees (16%) respectively. This was followed by Free State which employed 85 000 workers (11%) in the sector. Distinct agricultural investments noticed in these Provinces (Western Cape and KwaZulu-Natal) could be one of the reasons why they employed the highest number of workers (Statistics South Africa, 2010).

Table 2.1: Distribution of agricultural sector employment across the provinces

Province	'000									
	2008				2009				2010	Lost jobs (Q1 2008 to Q1 2010
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	
Western Cape	181	162	119	131	145	146	127	132	177	4
Eastern Cape	75	84	74	79	82	86	73	66	61	14
Northern Cape	65	48	64	54	41	57	40	50	44	21
Free State	85	80	83	72	89	87	84	74	75	10
KwaZulu-Natal	129	165	151	163	134	103	113	105	115	14
North West	59	46	59	64	49	45	37	40	41	18
Gauteng	58	63	65	63	56	40	42	24	29	29
Mpumalanga	76	75	82	79	81	79	74	66	65	11
Limpopo	70	65	69	59	60	68	63	57	44	26
Total	**799**	**790**	**766**	**764**	**738**	**710**	**653**	**615**	**650**	**149**

Source: Stats SA

According to Stats SA (2007), the market value of agricultural assets, farm debts, total expenditure by agriculture and gross farm income are higher in these provinces than in other provinces. The North West and Gauteng provinces employed the lowest number of workers with 59 000 (7%) and 58 000 (7%) respectively. Gauteng and Limpopo lost the highest number of jobs between the first quarter of 2008 and the first quarter of 2010 with 29 000 and 26 000 jobs respectively. The Western Cape is the only province that lost about 4 000 jobs (the least), while each of the remaining provinces lost more than 10 000 jobs during the same period.

2.2.3 Farming income

The gross income of farmers or producers accounts for R128 848 billion as at 30th June, 2010 (Figure 2.3) and when this figure is compared to 2009, it shows a decrease of 0, 6% that is R129 621 million (DA, 2010). The fall in income were attributed mainly to lower prices that farmers received for grains and oil seeds. The gross income from field crops decreased by 13, 8% to R31 214 million for the year ended 30 June 2010. The income realised from maize was 16,4% less than the previous year (12months). Income from sunflower seed and soya beans also showed sizable decrease of 27,2% to R1 705 million and 17% to R1 380 million respectively. However, the income realised from sugar cane increased with about 12.0% over the previous year. Income from groundnuts increased by 5, 3% to R790 million (DA, 2010).

The gross income from horticultural products increased by 3.3% to R32 778 million, as compared to R31 739 million for 2008/09. Income from citrus and subtropical fruit decreased by 1, 3% and 1, 8% and amounted to R4 719 million and R2 063 million respectively. Income from deciduous fruit rose by 2, 1% to R8 659 million, while income from viticulture dropped by 0, 4% to R3. 530. However, income from vegetable production increased by 7.6% to R11 690 million (DA, 2010). Animal products recorded an increase of 5.1% over the previous year and accounted for as much as R64 855 million compared to R61, 680 million in the previous year (2008/2009). The poultry industry recorded an improvement of 2.8% increase while milk producers also witness a marginal increase of 4, 5% over the same period. The income realised from wool recorded an improvement of 27.2%; while payments for salaries and wages; and interest paid by farmers to financial institutions amounted to R12.027 million and R5.094 million respectively (DA, 2010).

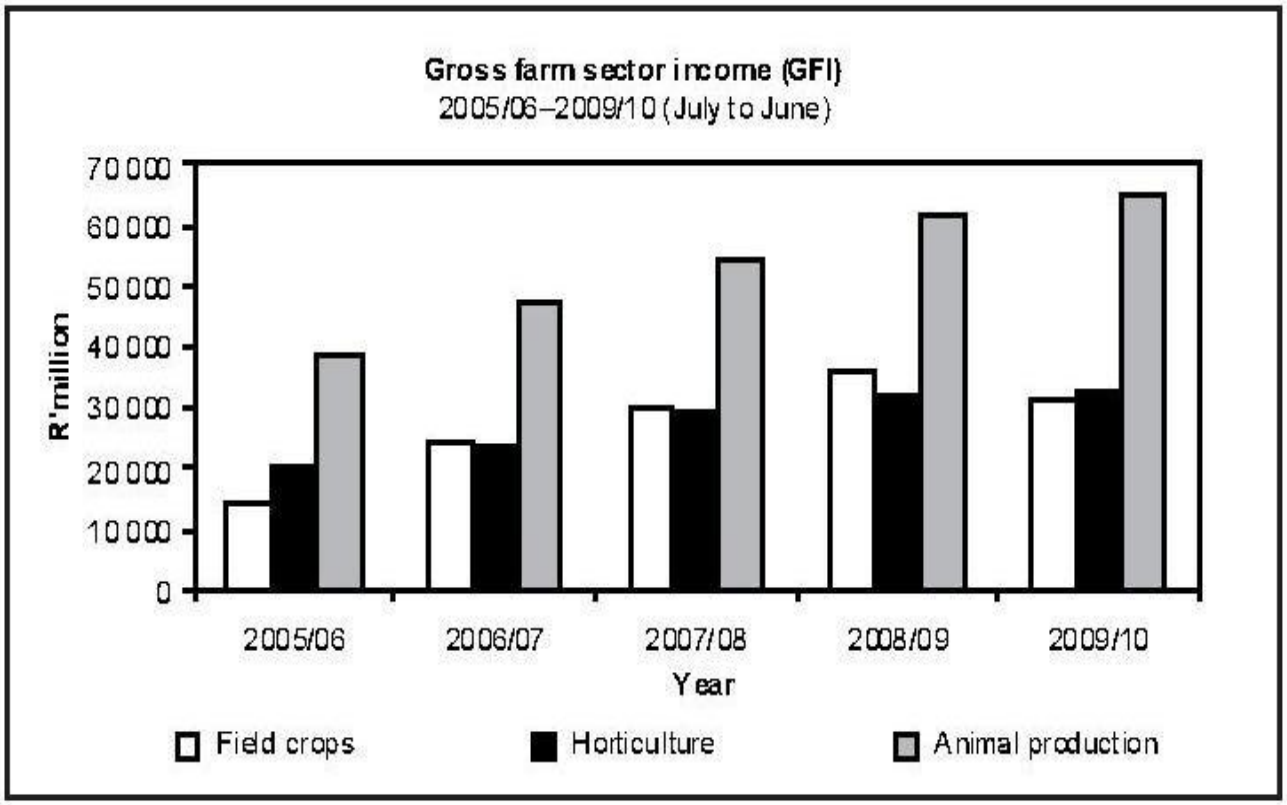

Figure 2.3 Gross farm sector income [GFI] 2005/06 – 2009/10 [July to June] **sources: DA, 2010**

2.2.4 Imports and exports of agricultural products

Figure 2.4 below shows the value of agricultural imports and exports. It is evident from the figure that agricultural imports value for 2009/10 was R33 946 million which is 11. 6% lower compared to R38 401 million in the previous year (2008/2009). However, the value of exports dropped by 9, 8%, from R49 278 million to R44 469 million, at same period (DA, 2010).

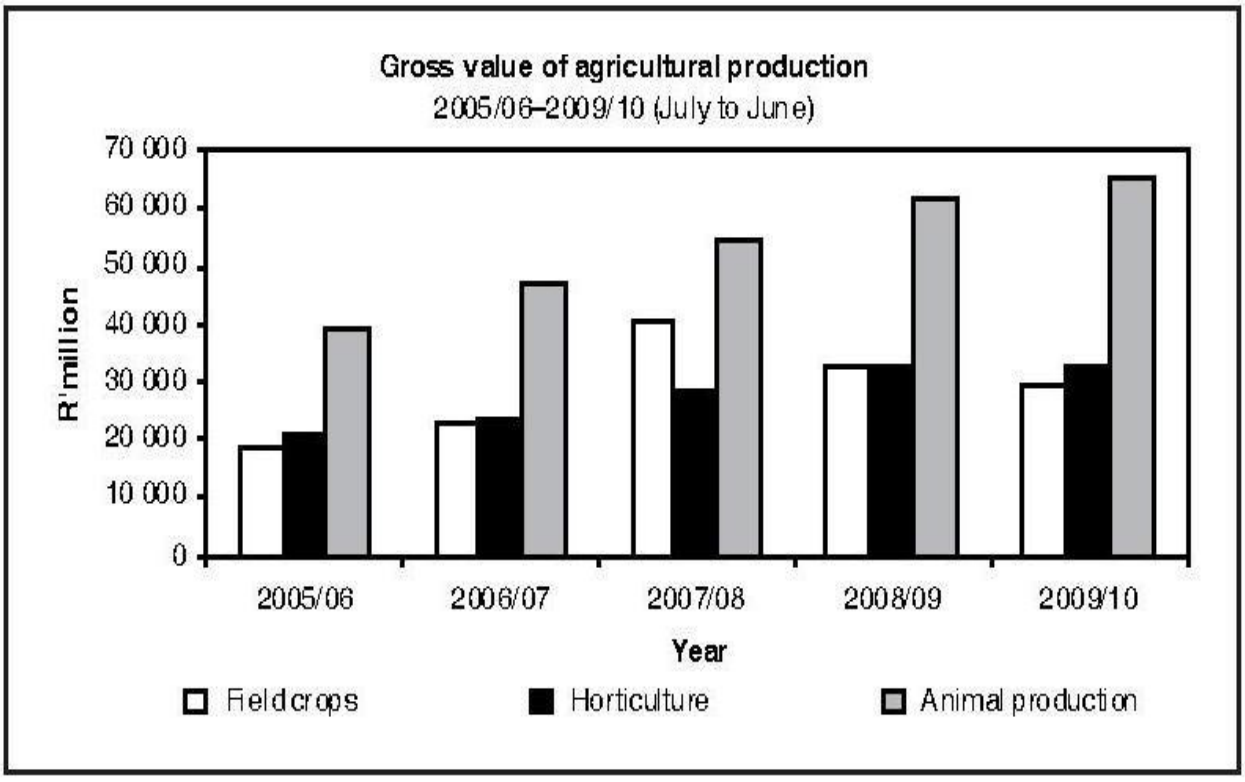

Figure 2:4 Value of Imports and Exports of Agricultural products 2005/06–2009/10 [July to June]

Source: DA 2010.

According to the 2009/10 export values, wine was the most significant export product which stood at R5 927 million, followed by citrus fruit R5 580 million, grapes R3 464 million, apples, pears and quinces R3 047 million and cane sugar R2 639 million. Rice import accounted for R3 410 million, oil cake R2 358 million, wheat and maize in R2 284 million, un-denatured ethyl alcohol R2 139 million and palm oil R1 776 million which accounted for the highest imported products (DA, 2010). The Netherlands, UK, Zimbabwe, Mozambique and Germany were principal exchange (trading) partners for export of farm produce with recorded export values of R4 714 million, R4 493 million, R3 240 million, R2 658 million, and R1 941million

respectively. About 20, 7% of total agricultural exports for the period July 2009 to June 2010 went to the Netherlands and the United Kingdom (DA, 2010). In contrast, the principal trading allies in terms of imported agricultural items in 2009/2010 were: UK (R1 961 million), Brazil (R3 073 million), Thailand (R2 776 million), Argentina (4 726 million), and Germany (R2 487) (DA, 2010).

2.2.5 Historic overview of Extension Support to agriculture

South Africa has two dissimilar extension services prior to democratic ascendancy in 1994. This dual extension services originated from the tools used by the then government to support White commercial farmers and land use administration in the former homeland areas on the other. Prior to 1994, a variety of measures that supported the white commercial farmers includes: the excessive control and guaranteed market price of produce; funding from the department of agriculture which includes amongst others subsidies for equipment and financial assistance through the Agricultural Credit Boards and Land Bank, with credit provided at subsidized interest rates. Following these support initiatives, South Africa became seemingly self-reliant in the production of all major agricultural produce. Nevertheless, majority of the black South Africans still remained in poverty (Singini and Van Rooyen., 1995).

2.2.6 Homeland era of Extension

The Homeland era started with Transkei's 'independence' in 1976 and it opened the way for homeland extension services with the development of agricultural agencies like Tractor, Agriven and Agriwane (Butler *et al*., 1978). The three agencies that were involved in setting and implementing agricultural services in the homeland were: government departments, the advisory services branch of the Department of Bantu Administration and Development (BAD),

and the Bantu Investment Corporation (BIC). However, each of these agencies had different mandate. The BAD was mandated to provide basic extension services by focusing on the improvement of the livelihood of the already impoverished and overcrowded homeland as a result of forced removals while BIC focused on large-scale farming ventures (Butler et. al., 1978). The appraisal of extension performance in the homeland at this time, recorded that about 90 000 literate white farmers were serviced by 3 000 qualified extension staff while about 600 black farmers were served by less than 10 extension officers. The Development Bank of Southern Africa (DBSA) which was established in 1983 introduced the Farmer Support Programme (FSP) whose primary objective was the promotion of operational changes from subsistence to commercial agriculture by providing incentives to existing farmers in the Homeland. The programme of the DBSA incorporated the promotion of agricultural activities with other non-farm related development activities (Van Rooyen, 1995). The FSP was restructured in 1989 with additional aims of providing inputs and capital to farmers; mechanization services; marketing services; extension services and research and training. According to Hayward and Botha (1995), the FSP was saddled with the following problems:

(i) the provision of substandard Extension support which was attributed to low quality education of Extension staff assigned to the area (ii) No proper linkage between Extension and research (iii) Obsolete extension approach which has not conformed to changing conventional Extension approach (iv) Farmers were lured to use farm inputs that were not cost effective to acquire thus pushing them into debt (v) Farmer's training and resource centres created in the homeland were under-utilized as they had only 15% to 20% occupancy rate (vi) the FSP programme lacked harmonization between the then Department of Agriculture and Agricultural

Corporations. The FSP ran between 1987 and 1993 before it was reintegrated into the nine provinces that evolved from the new democratic South Africa in 1994.

2.3 Conclusion

This chapter examines the current contemporary trend in South African agriculture with particular reference to the general overview of the South African agricultural sector including discussions on the role of agriculture, livestock farming, GDP contributions, hectares cultivated, total production, employment and general trends. The South African Agriculture is sustained by frameworks of policies that cut across agricultural institutions, distinct labour patterns, natural resources and technology and extension support services. The specific review of extension services and support to farmers were also discussed.

CHAPTER 3

REVIEW OF IMPORTANT CONCEPTS

3.1 Introduction

Creswell (2003) asserted that the primary aim of literature review is to share with people the results of other studies that are similar to the one under study. The literature review were organized to include: historical overview of smallholder irrigation schemes in South Africa; typology of smallholder irrigation schemes in South Africa; the fundamentals of decision making; theories of decision making; hierarchical decision model. The review of smallholder irrigation practice and food security; gender and smallholder irrigation practice; constraints of irrigation development in South Africa; sustainability of smallholder irrigation scheme in South Africa; irrigation scheduling and insight from the reviewed literature were also extensively discussed.

3.2 Smallholder farmers

The term smallholder farmers have various meanings as perceived by individual, country or regions. The term smallholder is used to mean subsistence farmer, peasant farmer, resource poor farmer, and small scale farmer. There are no conventional definitions of smallholder farmer adopted in South Africa. However, in most regions of South Africa, the meaning of smallholder relays to the size of land holding cultivated by a farmer. In Zambia for instance, smallholder farmers are defined as small households that possess or cultivate less than 2.0 hectares of arable land (Chipokolo, 2006).

Smallholder irrigators in South Africa are divided into four major groups: farmers with plot in the scheme; autonomous irrigation farmers; communal horticulturists and home gardeners (Du

Plessis *et al* 2002). The majority of smallholder farmers in the irrigation schemes have small plots of land with majority of them farming at a subsistence level (Monde *et al* 2005 and Backeberg, 2006). In 2004, there were about 287 smallholder irrigation schemes with approximately 31 000 plot holders as compared to about 1.2 million ha irrigated land in use for commercial agriculture by 28 350 farmers in South Africa (Arcus, 2004; Aliber, 2003). Smallholder irrigation schemes are real assets used to increase the livelihood of smallholder farmers. In sum, the recorded number of smallholder irrigation schemes in 2010 was 302, and it covers a total area of 47, 667 hectares with as many as 34 158 plot-holder population (Van Averbeke *et al*, 2010).

3.2.1 Historical overview of smallholder irrigation schemes in South Africa

The history of smallholder irrigation schemes in South Africa were characterised by policies and economic development of the country. Thus the smallholder irrigation schemes were established in phases (Table 3.1).

3.2.2 The post colonization phase

The post colonial phase of smallholder irrigation scheme was introduced in 19th century, reinforced by missionary movement. This stage happened together with the early part of the individual diversion scheme phase (Backeberg and Groenewald, 1995). The technology applied was then referred to as river diversion technique. In terms of area covered by irrigation, it was negligible and it stopped functioning by the end of the 19th century.

3.2.3 Smallholder canal scheme phase

The canal phase was the second stage of smallholder irrigation development which started decades after the failure of the post-colonial phase. This canal phase lasted from 1930 to 1960

which overlapped with the era of public schemes irrigation development (Bruwer and Van Heerden, 1995). The primary aim of the smallholder schemes at this period was to offer the 'Bantu areas' a sustainable means of livelihood (The Commission, 1995). The provision of the Act of 1913 and the Land Trust Act of 1936 restricted land ownership by blacks to zones that was referred to as Bantu areas and The Commission (1995), gave impetus to the smallholder irrigation schemes in the Northern areas managed by the Europeans. An increase in farm income was recorded from 1952 to 1953 in the smallholder schemes run by the Europeans (The Commission, 1995).

Table 3.1 Classification of existing smallholder irrigation scheme development

Era	**No of scheme**	**Area (ha)**	**Mean area per scheme (ha)**	**Main technology adopted**
Smallholder canal scheme (1930 – 1969)	74	18226	246	Gravity-fed surface irrigation
Independent homeland (1970 – 1990)	62	12994	210	Different forms of overhead irrigation
IMT and revitalisation (1990 – present)	64	2383	37	Pump and sprinklers or micro-irrigation
Year of establishment uncertain	177	15897	136	Mostly overhead irrigation
Total	**317**	**49505**	**156**	

Source: Van Averbeke (2008).

The river was the source of water and it is diverted to the farm by means of concrete canal diversion system. However; some schemes using storage dams were also built at the same period using concrete canal conveyance system to take water to the field. The plots size on these smallholder schemes ranged between 1.28 and 1.71 hectares (Van Averbeke *et al*, 2006). The Permission To Occupy (PTO) were given to plot holders in the schemes and only the State has the sole power to either reject or replace plot holders whose conduct does not conform to the laid down operational rules (Van Averbeke, 2006).

3.2.4 Independent homeland phase

The independent homeland phase of smallholder irrigation development lasted from 1970 to 1990. It was designed for the foundation of economic and agricultural development of the homelands because the professed independence in the homelands requires better economy (Beinart, 2001). The development of new smallholder irrigation schemes formed part of the economic agenda of the homeland government. This was so because agriculture in the homeland was viewed as the remedy for development since the resource base of homeland areas was entirely rural (Lahiff, 2000). In all, 64 smallholder irrigation schemes covering about 13 000ha (Table 1) were built during the period (Arcus, 2005). The number of existing smallholder irrigation schemes that date back to the period 1970 to 1990 may probably be higher, because there were no proper records at that time. The Keiskammahoek, Tyefu, Xonxa, and Ncora were the irrigation schemes that cover more than 500ha of land (Van Averbeke *et al*, 1998). The adopted irrigation method and technology was the pressurized overhead irrigation system considered as the most modern that was available at the time.

3.2.5 Irrigation Management Transfer (IMT) and Revitalisation Phase

The latest phase of smallholder irrigation scheme was referred to as Irrigation Management Transfer (IMT). The funding of the scheme from 1990 to 1994 was the prerogative of the Independent Development Trust, assisted at the later stage by the provincial Department of Agriculture and Department of Health and Public Work (Van Averbeke and Mei, 1996).

Irrigation development during this period (1990s) was aimed at reducing poverty and enhanced food security at community level. Revitalisation however, was connected to IMT which is the transfer of the responsibility of managing, operating and maintaining irrigation schemes from the government to the farmers (Van Averbeke and Mei, 1996). The economic policy initiative put in

place at this period was the Growth Employment and Redistribution (GEAR) which substituted the Reconstruction and Development Programme (RDP). IMT was adopted as an approach to improve irrigation scheme management with the aim of increasing the effectiveness and profitability of irrigated agriculture and reduce continuing government expenditure on operation and maintenance of irrigation schemes (Shah *et al* 2002). The adoption of the policy of IMT was similar to GEAR, as it is aimed at improving the lives of rural communities through the acceptance of irrigation farming. The 'Water Care' programme which started in 1998 gave rise to the Revitalisation of Smallholder Irrigation Schemes (RESIS) which emphasised the rehabilitation of the existing irrigation infrastructures (Arcus, 2005). However, in 2005 there was policy shift that culminated to the commercialisation of smallholder irrigation schemes. The shift from rehabilitation of infrastructure to commercialisation of schemes may have arisen or influenced by the Black Economic Empowerment (BEE) policy introduced in South Africa (DOA, 2006). Nevertheless, the canal irrigation schemes which have hitherto been associated with development were gradually linked with subsistence which discouraged further revitalisation of irrigation schemes (Unlu *et al* 2006). IMT was a worldwide trend (Vermillion, 1997) but in the case of South Africa the procedure was hasty (Laker, 2004) and subsequently, many of the transferred schemes especially the large ones that requires high level management skills collapsed (Bembridge, 2000).

3.3 Typology of smallholder irrigation schemes in South Africa

Smallholder irrigation schemes in South Africa are grouped into: food plot schemes, peasant schemes, business-farmer schemes and equity labourer schemes (Denison and Manona, 2007). The factors considered in the typology by them were lucrativeness of farm enterprise, irrigation system and farm plot size (Denison and Manona, 2007).

3.3.1 Food plot schemes

The food plot size smallholder farmers usually occupy a plot size of less than 0.5ha and the irrigation system practiced is the canal or moveable sprinklers. The purposes of farmers in the food plot schemes were mainly for subsistence with low farm inputs involving the use of family labour. However, surplus produce from the farm were sold either at the farm gate or at the local markets.

3.3.2 Peasant schemes

The peasant smallholder farmer occupies a plot size of between 1ha to 2ha and the canal irrigation systems were mostly adopted. The peasant schemes served multipurpose for the practicing farmers in line with their livelihoods with diverse methodologies to production (Denison and Manona 2007). The sales of farm produce were done in both local and urban markets.

3.3.3 Business farmer (commercial) schemes

The business farmer schemes are the full time commercial farmers that occupy plot size of more than 2ha and they adopt a fairly simple overhead or micro-irrigation system. Access to market and finance are imperative as production inputs and output are relatively high. The farm produce are sold at a distant market and labour requirements are sometimes high.

3.3.4 Equity-labourer

The equity-labourer are farmers that have acquired combined landholding and are usually full time commercial farmers with premeditated and strategic partners who assist in the management of the farm business. The plot holders are also part of the farm workers who are remunerated from the returns of the farm business for the provision of the land (Denison and Manona 2007).

3.4 The fundamentals of decision making process

Decision making is defined as a choice amongst alternatives that will give varied returns or expectations for which there are preferences. According to Howard (2007), decision making has three main elements: [1] alternatives (what an individual can do), [2] available information (what an individual knows) and [3] preferences (what an individual wants). These three elements are intertwined and if one element is absent or incomplete, there is no decision made (Howard 2007). Decision making is a procedure by which an individual or group classifies a choice or judgement to be made, collects and assess information about alternatives and choose from amongst the alternatives (Caroll and Johnson, 1990). Decision making is a primary issue in smallholder agricultural production and the improvement of quality of decision making is a panacea to change since behaviour is a mere completion of what has been decided. In assisting smallholder farmers in decision making, it is important to understand how decisions are taken and how farmers actually cope with decisional conflicts. Janis (1972) posited that decisional conflicts are concurrent contradictory tendencies within a person to accept or reject a given course of action. Such conflicts become severe as the decision maker becomes mindful of the risk of encountering losses and recognises the difficulties of withdrawing a decision.

Intervening variables like needs, perceptions and knowledge have been found to be vital in the analysis, understanding and prediction of behaviour (Duvel, 1991 and, Duvel and Botha 1999). The study of intervening variables (needs, perceptions and knowledge) has been going on since the early 1960s (Mitchell, 1979). Studies by Sarantakos (1998) and Brunn & Kalland (1996) agreed that the society that is being studied is exemplified through perception, attitudes, knowledge and behaviour of its people. As posited by Brunn and Kalland [Sa], the study of human perception, knowledge and attitude has the prospects of enhancing decision making.

Researchers like Etzioni and Lehman (1980), also noted that the social function of attitude and perception studies not only offer an idea into the planning system but also serve as means for enhancing public involvement in decision making. According to Giles and Stansfield (1990), decision making procedure involves: (i) identifying the problem; (ii) recognizing the alternatives; (iii) collecting the information and scrutinizing the alternatives; iv) make decision and implementing action; and (v) evaluate the outcome. The decision making in agriculture covers large areas like biotic, economic, environmental, social and political factors that bring about uncertainty of outcomes over which the decision maker have no complete control. The totality of a person's belief determines his attitudes, decisions, and behaviour (Ajzen and Fishbein 1980). This implies that a person who believes that carrying out a given behaviour will lead to positive outcomes will continue to hold a favourable attitude towards performing the behaviour, while a person who believes that carrying out the behaviour will lead to negative outcomes will reject or hold an unfavourable attitude towards carrying out the behaviour (Ajzen and Fishbein, 1980). This is significant mainly in smallholder farming systems, where variances between favourable and unfavourable consequences are very noticeable. In decision making, the decision maker, try as much as possible to achieve the favourite or desired outcomes, objectives, or goals. In some instances, the choice made by decision maker may have a known outcome (certain/without risk), or unknown outcome (uncertainty). In a specified social environment, the probability of an alternative to be chosen by a decision maker is influenced by the characteristics of the decision maker and the worth attached to the alternative (Zeleke, 2008). However, one particular alternative may receive diverse choice responses from various decision makers because of differences in their characteristics and worth that is attached. It is conventionally acknowledged

that the decision maker chooses the alternative from which he maximizes the greatest utility or satisfaction.

3.4.1 Theories of decision making

The theory of decision making is conceptualised from three main approaches namely: normative, descriptive and prescriptive (Bell *et al*, 1988 and Edwards *et al,* 2007).

3.4.2 Normative theory

Normative theory proposes that human beings make decisions based on the anticipated outcomes of their decisions. In this perspective, decision maker is perceived as a person who acts rationally, analyses the consequences of each alternative, rank order the consequences before finally making the optimal decision, that is by maximising utility (Klein and Methlie, 1990). According to Edwards and Fasolo (2001), an optimal decision is considered as the best option which usually is measured quantitatively. In the normative approach, concepts of how to select and handle uncertainties are settled based on mathematical concepts (Edwards and Fasolo, 2007). The normative method emphasises statistical reasoning, likelihood and the laws of economic theory hence mathematicians approach decision making from normative perspective (Bell, *et al* 1988). The normative theory stresses rational choice and utility. Choice rationality is dependent on consistent conformity to rules (referred to as axioms) that guide a person to their reasonable choice in the decision making process. In making a choice, it is imperative to ascertain all likely courses (options) of action, referred to as alternatives, and assess these alternatives in line with the set of rules intended to maximize utility. Normative decision approach allows alternatives to be evaluated according to two main features: a) preference- which is the preferred or favourite outcome(s) identified with each alternative; b) likelihood- which is the probability of realizing

the outcome that is linked to the alternative. Preference and probability for each alternative is valued and can then be computed using probability and statistical reasoning (Bell *et al,* 1988). A refined mathematical interpretation of each alternative measures the personal preference and likelihood of each alternative into numeric value which is applied to rationally decide which alternative has the highest expected utility. Consequently, the normative theory suggests that decision makers should follow reasonably consistent procedures in decision making by applying the rules. Nevertheless, there are critiques to this theory. Some of the critiques of the normative theory argued that individuals are usually not totally rational or reliable or even conscious of the various elements that interfere into their decision making. In addition, people may be good at approximating the relative occurrences of events; and they may be limited in interpreting these occurrences into probabilities (Zey, 1992).

3.4.3 Descriptive theory

The descriptive theory of decision making is also referred to as the behavioural decision theory and it stresses how people make decisions. The descriptive theory makes observations and forecasts as to how human beings integrates preferences and information into their decision making instead of recommending what rational method one should follow to maximize personal preferences (Fischhoff, 2008). Most studies of decision making process asserted that individuals do not logically apply reasoning in the process of making decisions. When making inferences, individuals have a tendency to disregard several types of normative and pertinent information (Fischhoff *et al*, 1979). According to Stanovich and West (2000), individual's responses to decision making often deviate from actions that is considered normative on many reasoning task. This deviation is however, demonstrated by incorrect assessment of probabilities; showing biases; ineffective testing of hypothesis; violation of the axioms of utility theory; improper

standardization of degrees of belief; over prediction of their own judgement on others; and allowing previous knowledge to be connected or involved in logical reasoning. The descriptive viewpoint describes such measures which is not logical as *heuristics*- which describes the shortcut individuals take in arriving at a decision. Nevertheless, some shortcuts are rationally sound and effective while others may by-pass rational procedures and thus impart biases in the choice individuals make. Tversky and Kahneman (1974) posited that heuristics are at times good because they can reduce time and effort in arriving at an acceptable decision. In line with descriptive perception, youthful decision patterns often show tendencies that bring bias and decrease long-term utility. In her model of 'Theory of Real-life Choice' Gladwin (1980) asserted that the descriptive approach has proven to possess high analytical power in farmers' decision making strategies.

3.4.4 Prescriptive theory

The prescriptive theory centres on assisting people make better decisions by applying the normative principles. The prescriptive decision theory basically contains methods, measures and processes which are assumed to assist in creating a more precise and effective decision making. The model is centred on observation of poor decision making procedures, where the main steps may have been avoided or inadequately considered (Hucyznski and Buchanan 2001). The model features a series of steps and logical outline with emphasis on rationality. According to Stewart (1997), the prescriptive model is centred on a normative theory that identifies an optimal decision rule while in the descriptive model; decision is determined by the decision maker's behaviour with the goal of obtaining an exact decision maker's real decision process. Prescriptive and descriptive models of behaviour allow the simplification of decision making procedures which have a number of implications for modelling farmer's behaviour. The most

popular analogy adopted to illustrate, in simple terms, the idea of descriptive and prescriptive theories is that farmers can be compared to scientists. Farmers when likened to as scientists prepare hypotheses or constructs based on their current belief, the arrays of evidence they see and their perception of the immediate operational environment. From these formulated hypotheses they come up with expectations as to how the environment around them will behave and continually test these hypotheses against what they interpret to have occurred (Murray-Prior, 1998).

3.5 Hierarchical decision model

The hierarchical decision model which encompasses a two-stage decision procedure was proposed by Gladwin (1989). The main assumption of the model was that alternatives are made up of a set of 'aspect' (Gladwin, 1980). An aspect is defined as a "dimension/factor or feature of an alternative" (Gladwin, 1980). An 'aspect' also represents values which are quantitative or of qualitative dimensions for instance price, quality, or comfort (Tyersky, 1972). Gladwin postulated that decision makers split or divide all 'aspects' into a few separate categories. An 'aspect' such as riskiness of rearing livestock may be treated as a constraint (for example, a farmer may conclude that a particular livestock is too risky to rear in his environment) or livestock A is less risky to rear than livestock B. There are two-stage decision processes: pre-attentive or unconscious processing and optimization decision subject to constraints.

3.5.1 Pre-attentive or unconscious processing

The pre-attentive process refers to information processing stage that is not within the decision maker's usual attention and consciousness (Gladwin, 1980; and Gladwin and Murtaugh 1980).

In this stage, decisions are taken quickly and decision makers thin down the set of alternatives to a smaller subset by making sure that the options meet a set of criteria or 'aspect' which takes the form of eliminating the undesired alternatives (Tyersky, 1972). When the problems have been reduced to a choice between two or more alternatives, the main decision process for the second stage occurs.

3.5.2 Maximization subject to constraints

This stage begins when the problem have been reduced to a choice between alternatives. The stage is an important numerical form of "maximization subject to constraints" (Gladwin 1976). The numerical values may represent price, quantity, and comfort or they could be other features of the alternatives. In other words, a farmer determining to increase his livestock numbers ponders on various aspects of these alternatives. For instance, the farmer estimates future profit, estimates future stock carrying capacity, and reflect on the effect of such increase on future cash flow, reflect on labour requirements and implication for future price (Tyersky,1972; and Gladwin 1980). Alternatives are ranked and a decision maker accepts the one with highest ranking after it has passed through the constraints or 'aspects'. When an alternative does not pass through an 'aspect' the second best alternative gets the chance of being selected. The elimination by 'aspect' model stated that an individual derives utility from 'aspects' of commodity rather than the commodity itself. Consequently, one can ascribe a number to each 'aspect' representing its utility. In the elimination by 'aspects' model, the utility or value of a particular aspect governs the probability of it being selected (Tyersky, 1972).

3.6 Smallholder irrigation practice and food security

In Sub-Saharan Africa, water resources are plentiful but less than 2% renewable water resources are in use. Agricultural activities in the region are almost completely rain-fed with irrigation presently gaining acceptance and playing a distinct role. However, only about 4% of the regions entire cultivated area is put under irrigation in comparison to 37% in Asia, and 14% in Latin America (You *et al,* 2010). Increased use of the region's water resources would considerably enhance staple food production and high-value export crops. Smallholder irrigation is an important device in assisting farmers to transit from subsistence agricultural practice to commercial farming. Nevertheless, there are many challenges still facing water resource use in agriculture. These include socio-economic, political, climatic, design aspects, inadequate farmers' participation and lack of planning and management (Bembridge, 2000).

The satisfactory access to the means of procuring fundamental food requirements through cultivation or manufacturing is referred to as food security (Peacock, 1995). Food security could also be explained as the scenario where individual in a specific group are able to obtain sufficient food for a healthy life (Rukuni *et al,* 1990). Food security equation as illustrated by Rukuni and Benstern (1985) entails food accessibility and availability (handiness of food through production and storage). Food insecurity may be chronic (continuous extreme food insecurity occasioned by the inability to obtain food) or transitory (temporary drop in access to adequate food).

The primary aim of the establishment of smallholder irrigation schemes in Sub-Saharan Africa was to provide access to irrigated land and enhance food productivity amongst rural livelihoods (FAO, 2001). Improved food security situation of households has impact on smallholder farmers' production decisions and agricultural intensification (Crosby *et al*, 2000). Barau *et al*, (1999) observed that sustainable livelihood for rural communities are dependent on farmers' access to

smallholder irrigation. In the same vein (Hussain, *et al* [Sa]), posited that smallholder irrigation is a powerful tool towards achieving food security, increased farm employment and stable income generation. Adequate access to ideal irrigation practice will generate and enhance opportunities for smallholder farmers to expand their income base, reduce vulnerability occasioned by seasonal changes and decline in agricultural production as well as external shocks. The reduction in the occurrence of food insecurity in most communal areas as advocated by the policy makers and academia is the production of appropriate and user friendly smallholder irrigation technology (Manzungu and Van der Zaag, 1996). The use of irrigation in arid and semi-arid areas increases the potentials for more agricultural activities during period of water stress and some intermittent dry spills. With irrigation, empowered households can grow crops more than once a year thus enhancing their food security status. In a study by Sithole and Testerink (1983) on cropping and food insecurity, it was concluded that smallholder irrigation increases crop production and also encouraged more agro-industries for processing farm output. The study further asserted that there were increased employment prospects and purchasing power of the people which implies that individuals were able to meet their household needs and thus enhanced food security. In another study by Webb (1991), households (in a village called Chakunda in Gambia) were not only food secured but also recorded a substantial improvement in food consumption because of their participation in smallholder irrigation practice.

Webb further listed the benefits of participating in irrigation practices as increased income and better purchasing power of the farmers exemplified by traders' patronage of buying farm produce from irrigation schemes. In another study by Meinzen-Dick *et al* (1993) on farmers adopting the use of irrigation, 72% were found to be food secured as compared to non-users of irrigation. The development of irrigation schemes in the former homelands was to assuage

poverty amongst households (Vink and Van Rooyen, 2009). In these areas (homelands), irrigated agriculture potentially contributed meaningfully to food security, increased income of participating farmers (Bembridge 2000), and employment creation *via* primary and secondary production activities (Backeberg *et al* 1996). While acknowledging the critical importance of smallholder irrigation, the Water Research Commission (WRC) extended the water resources to accommodate most farming communities (Van Averbeke *et al,* 2011). Investment in smallholder irrigation development has a positive effect on rural income, local food supplies and food security of households.

3.6.1 Gender and smallholder irrigation practice

Gender is a set of socially created roles, behaviours, responsibilities and attributes connected to being a male or a female in a given society. Gender analysis searches and highlights the relationships that exist between men and women and the inequalities inherent in those relationships, by posing such questions as: Who does what? Who has what? Who decides? Who gains and who loses? Gender analysis examines the pattern of power relationship within a household and how it interrelate with those at the others spheres like the state or community (Chitsike, 2013). Gender mainstreaming is a concept that considers the recognition of all gender issues which are essential within the schedule or problems being considered by any or all highlighted development programmes. Gender mainstreaming focuses on objectives and activities which are necessary for addressing gender issues.

Women have diverse needs and priorities, which are as important as those of the men for agricultural development and food security. There has been a remarkable growth in the number of female-headed household, but still the number of male households in smallholder irrigation has been unprecedented in Africa. However, most women in Gambia and South Africa still keep

and maintain productive infrastructures in smaller irrigated plots (Chancellor, 1997). In South Africa, some women have in the past demanded and received training in the maintenance of farm infrastructure to circumvent over reliance on men (de Lange, 1994). In most smallholder irrigation, men make expenditure decisions with women partially participating, and the final ratification of the decisions made is often in the hands of the male farmers (Chancellor, 1997). However, in most women headed household this is not the case but there are many occasions where male relatives decides mainly if the expenditure relates to the purchase of expensive farm inputs and equipment. Alderman *et al* (1995) posited that most households do not equitably distribute resources between men and women and this disparity in resource allocation has implications on agricultural productivity. Empirical evidence has shown that increasing women's control of farm inputs and other farm resources impact positively on livelihood food security and child nutrition (Quisumbing, 2003; Skoufias, 2005).

In spite of the positive impact of extension services, access to extension still remains very low among rural household especially for women. Gender partiality in access to extension services, land, cash and labour are prevalent amongst resource poor farmers especially women. Normally, methods used in determining household access to extension service delivery are the number of interactions and the percentage of farming household that were visited by extension agents. In line with these measures, a number of studies show that women access to extension services have dwindled consistently when compared to the men. In a study carried out in Malawi by Gilbert *et al,* (2002), revealed that 19% of women had regular contacts with extension as compared to 81% of men. In Uganda 1.3% of women had contacts with extension services compared to 2.03% of men (Smale 2008). In a similar study carried out in Karnataka India, 19% of female-headed households had contacts with extension services as compared to 27% of male headed-household

(World Bank and IFRI, 2010). A comprehensive survey of FAO on activities of extension in 115 countries in the early 1990s revealed that women had 2-10% extension contact with a meagre 5% extension resources worldwide (Swanson *et al*, 1990). Nevertheless, in a study carried out on quality of extension services in Amathole district in South Africa, it was reported that more female farmers had overall satisfaction with services offered by extension than males (Agholor, *et al*, 2013). In India, female household reported that they were more satisfied with extension service delivery than male headed households. In Ethiopia, 94% of females as against 92% males were found to be satisfied with extension advice (World Bank and IFPRI, 2010). In the area of leadership and management position, it was reported that 15% of males as against 3% of females occupies management position in farmers' cooperatives in India (World Bank and IFPRI, 2010). Nonetheless, recent findings do not display any significant improvements in gender-awareness and equity in extension services delivery, in spite of the tireless effort of gender mainstreaming. Empowerment of women is frequently cited as an essential factor for poverty alleviation, particularly in the third Millennium Development Goal (MDG3), which also advocated for gender equality (United Nations 2000). Rectifying the apparent gender imbalance is the key access point for developing socio-economic empowerment programmes. Women, particularly amongst the poor rural households are central stakeholders within the agricultural sector, whose productive functions and activities exceed by far their reproductive role (Amalu, 2012).

In the light of the foregoing, gender mainstreaming must be made an integral part of smallholder irrigation and agricultural development. Institutions and policy makers must shun the notion of regarding gender issues as power tussle between men and women, refute gender-blindness (non-recognition of roles and responsibilities between men and women) and accept gender-sensitive

(consciousness of the ways men and women are differently affected by policies and programmes) approach in any development interventions.

3.6.2 Constraints of irrigation development in South Africa

Smallholder irrigation schemes in SSA have not performed well as they are consistently constrained by poor yields, low economic returns and inadequate maintenance of infrastructures (Barghouti and LeMoigne 1990; Underhill 1990). The constraints of smallholder irrigation in South Africa are considered in the following perspective:

3.6.3 Smallholders and agricultural marketing

Smallholder farmers over the years have experienced several challenges in getting access to the markets. Market access encompasses the ability of the farmer to get necessary farm inputs, farm services and the ability to distribute farm products to consumers. The problem of market access was not too pronounced in the era of marketing boards which was in operation from 1940 to 1990 (Van Tilburg and Van Schalkwyk, 2012). The then marketing board were mandated to provide farm inputs, farm services, credits and output market services involving collection of harvest, quality assessment and buying of produce. In most developing countries marketing boards were dissolved in the 1980s and 1990s mainly because their activities were found to be economically unviable and unsustainable following a huge load on the national budget (Van Tilburg and Van Schalkwyk, 2012). Following the dissolution, smallholder farmers were unexpectedly deprived of full support services such as the provision of farm inputs (seeds and fertiliser), ploughing of land, extension and credit services and market services involving the harvest and collection of produce, assessment of quality and purchases of farm produce which were hitherto provided by marketing boards (Van Tilburg and Van Schalkwyk, 2012). This

situation caused a serious problem amongst smallholders and emerging farmers seeking access to markets while they lack inadequate experience to function in a competitive free market economy. In the former homelands of South Africa, smallholders and emerging farmers were deprived of considerable support. Though a good number of smallholder and emerging farmers were allowed access to land, they were unable to obtain title deed which made it impossible to use the acquired land as collateral for loans or working capital (Tregurtha and Vink, 1999). Most farmers, notably those working in the former homelands experienced a lot of problems especially in transaction and transport cost to access market for their produce (Tregurtha and Vink, 1999). The abrupt consequence of the deregulation and liberalisation process was the exposure of farmers to a market setting where they create marketing decision without adequate skills and experience (Groenewald, *et al* 2003). This circumstance therefore, created the need for adequate Market Information System (MIS) which can give suitable support for agricultural decision-making. Smallholder farmers need more tactical information on markets, production arrangements and technological changes because of their exposure to market forces. Nevertheless, the obvious absence of access to market has negative influence on smallholder farmers (Groenewald, *et al* 2003).

However, the positive outcome of the market deregulation and liberalisation was the decrease in South Africa's market alterations. There was also an increase in the production of agricultural export commodities especially in crops and animals with high market efficacy which contributed to reasonable food price inflation in spite of the difficult season witnessed during the 1997-1998 (Ministry of Agriculture and Land Affairs, 1998). The free market environment increased the entry to the marketing value chain. According to the National Department of Agriculture (NDA), Directorate of Marketing (2005), there were noticeable market access gaps generated by either

inadequate access to marketing infrastructure or inadequate access to MIS and training. In this phenomenon, smallholder farmers were challenged by lack of suitable market access. In a study by the NDA, Directorate of Marketing (2005), in 13 rural development areas under the South African Integrated Sustainable Rural Development Strategy (ISRDS), asserted that long distance and lack of transportation made it impossible for smallholder farmers to access formal market. In the pre-deregulation and post-deregulation periods, smallholder farmers in South Africa have been denied both production and marketing infrastructures (NDA, Directorate of Marketing, 2005). Making markets function for the smallholder farmer will assist in poverty alleviation and enhance sustainable agricultural development.

3.6.4 Institutions and support services in smallholder scheme

Institutions are a "set of formal and informal rules, together with their implementation arrangements" (Schmoller 1990, cited by Furubotn and Richter, 2000). In any collective action like the smallholder irrigation scheme, there must be a set of formal or informal rules and regulations for effective administration. Smallholder irrigators and their elected or volunteer leadership set up in the form of scheme committees, sub-committees and wards often find it extremely difficult to implement rules of the organisation. Rational individual farmers who are pursuing their own goal instead of collective goals often challenge institutions and undermine the leadership structure put in place (Orne-Gliemann, 2008). Institutional problems have influence on the routine maintenance of irrigation infrastructure and water distribution (Letsoalo and Van Averbeke, 2006). Lack of maintenance of irrigation infrastructure reduces water delivery and thus poses a menace to the sustenance of irrigated agriculture in South Africa (Shah *et al.*, 2002). The building of social capital and the capacity development of irrigators in the form of training should be given priority (DeLange *et al* 2000), but indications are that capacity building and the

development of social capital alone may not be sufficient (Van Averbeke, 2008). Some studies that were carried out by researchers in South Africa observed that land tenure as an institution has impact as follows: (i) tenure restriction negatively impacts and disallowed land-exchange among farmers in most schemes (Bembridge, 2000); (ii) men were main plot holders in the various schemes whilst women were engaged in the actual farming activities and (iii) the tenure system that is operational in most schemes prohibited farmers from using their plots or land holding as collateral for obtaining loans from banks or any registered financial service provider (Machete *et al* 2004). The study by Tlou *et al* (2006) which was commissioned to give clarity and recommendations on the issue of land tenure in smallholder schemes posited that the existing tenure system had the highest negative impact when compared to other factors that is applicable to irrigation agriculture. In South Africa, the land tenure arrangement is not very distinct mainly because most of the legislation on land tenure when plots were firstly handed over to the farmers has been repealed (Manona *et al* 2010).

Nevertheless, plot holders in most of the scheme still feel confident and secured about their full tenure rights, such as who owns the plots of land but are less confident on renting the land because initially it was forbidden to rent out plots of land (Van Averbeke, 2008). On the other hand, plot holders are also not secured or confident in renting in land, because there are no legal protections in place on owners claiming back their plots before the lease agreement elapse (Manona *et al*, 2010). In the assessment of most smallholder irrigation scheme, inadequate support services have been identified as a recurrent issue (Mnkeni *et al* 2010). The development of both human and social capital through training of farmers is essential in farm and scheme management. Another critical area where support is needed is the development of consistent linkages for the marketing of farm produce (Magingxa *et al* 2009). In most smallholder irrigation

schemes, farmers have not acquired the required level of marketing competence to ideally perform to expectation (Averbeke *et al* 2011). However, the need for support services is general although it may vary amongst schemes. Till date, higher institutions assigned to train extension officers; research institutes in charge of technological improvement of smallholder schemes, and public extension mandated for farmers' guidance and support services have performed grossly below expectation (Averbeke *et al* 2011).

3.6.5 Low crop yield in smallholder scheme

The problem of low yield exacerbated by poor farming practices has been obvious in most schemes in South Africa (Crosby *et al,* 2000). In most smallholder schemes, production records show that maize yield has been less that 3tons/ha (Van Averbeke 2008; and Mnkeni *et al,* 2010). Low yield has been associated with insufficient technical know-how in crop production among plot holders (Machete, *et al* 2004; Denison and Manona, 2007). The basic crop production practices which are known to be within the control of plot holders, such as weed control, fertilizer application, seed rate, and the choice of cultivars have been acknowledged as the main issues affecting increased productivity (Mnkeni *et al,* 2010). The study carried out by (Fanadzo *et al* 2010) asserted there were considerable differences between production output achieved by farmers in the scheme and output achieved during on-farm trials using good management practices in Zanyokwe irrigation scheme. Despite the facts that on-farm trial plots are usually smaller and easier to manage than the large field crops, the findings of Fanadzo (2010) posited that lack of farm management principles was the main factor hindering crop productivity at Zanyokwe scheme. This findings of Fanadzo, gave credence to the assertion of Mnkeni *et al*, (2010) that investment in capacity building and skills development among farming household could improve productivity on most schemes.

3.6.6 Revitalisation and needs analysis of farmers

The main aim of Irrigation Management Transfer (IMT) is to handover the task of supervision, operation and maintenance of schemes to the farmers. However, to successfully handover these responsibilities to farmers, the revitalisation of existing scheme became eminent. In most areas of the world, IMT was also employed as a method in scheme management with the primary aim of reducing government expenses on operation and maintenance and to enhance the profitability of irrigated agriculture (Shah *et al*, 2000). Irrigation schemes are multifaceted, dynamic and socio-biophysical units (Lankford and Gillingham 2001). Smallholder irrigation schemes are affected by numerous factors such as natural resource endowment, technology, plot size, farmers profile and marketing prospects (Lankford, 2004 and Bolding, 2007). Owing to the diversity among irrigation schemes, different approaches to interventions are required in responding to the different needs, resources or infrastructures in a particular scheme (Averbeke *et al*, 2011). The non-recognition and appreciation of the diverse needs analysis and motives of farmers before upgrading of technology in the scheme contributed to the recurrent failure of government interventions to assist farmers (Denison and Manona, 2007). Though the typology of smallholder irrigation alluded to in 3.3 above is suggestive; it offers insights into the recent position and can be applied in identifying the type of scheme that may be revitalised based on the needs of farmers. Most revitalisation interventions have yielded little returns and awkward developmental outcomes (Averbeke, *et al*, [sa]). According to Denison and Manona (2007), the conversion of pump sprinkler to pumped overhead systems in the scheme induced commercialisation agenda and uncontrollable drive for land acquisition. This gave rise to the elimination of the vulnerable groups such as the food-plot producers and peasants because they could no longer operate in the scheme under a higher cost. Denison and Manona (2007) evaluated the effect of intricate

irrigation technology by analysing 10 studies on smallholder schemes in 2004. It was observed that innovative (enterprise) models were constrained to change to higher-value crops to be able to meet the cost of water tariff, electricity and management cost at the expense of medium-value crops such as mixed vegetables. However, irrigation experts advocated that this model should not be used as an alternative for new schemes or form part of an agenda towards the revitalisation of existing scheme (Crosby *et al*, 2000 and Laker, 2004). Nonetheless, this prototype has been introduced on some schemes in Limpopo Province, KwaZulu-Natal and Eastern Cape during the Revitalisation of Smallholder Irrigation Scheme (RESIS) (Umhlaba, 2010). The condition of canal schemes which has not been revitalised is slightly not the same. According to Mohamed (2006), canal schemes generally do not need to be revitalised because it has low operating cost; accommodates farmers with meagre financial base and make a significant input to the livelihood. Canal schemes allows the full range of farming objectives and gives the farmers the option of choosing between the use of local manure and fertiliser in the running of their farming enterprise (Averbeke *et al,* [sa]). There is flexibility and stability in the operations of canal schemes which supports a number of individuals as opposed to the radical model that depend on technical knowledge and high cost associated infrastructure. The developed typology of irrigation schemes will invariably be the most appropriate development route to be adopted in revitalisation consideration for prospective schemes. The proper identification of this route and engagement of stakeholders and farmers in decision making on ways to improve their scheme is imperative in enhancing support to smallholder farmers with a view of obtaining returns on investment.

3.6.7 Sustainability of smallholder irrigation scheme in South Africa

The concept of sustainable development was made distinct by the World Commission on Environment and Development (WCED). Sustainable development is defined as the development that accommodates the needs of the current situation without distorting the capability of future generations to meet their individual needs (WCED, 1987). The definition of sustainable development is generalised and well directed, but exposed to various explanations and connotations (Stokke, 1991). Sustainability of smallholder agriculture encompasses meeting the livelihood requirements without thwarting or obstructing the needs of neighbours or future generations. By implication, this definition suggests that ecological, economic and social dimensions must be considered for sustainability of agriculture in the context of smallholder farmers (Whiteside *et al,* 1996). The ecological dimension involves the conservation of natural resources on which agriculture depends. In the economic dimension, financial viability on the part of the farming households and the community is emphasised while in the social, the aspirations, needs and cultural aspects are considered. These arrays of dimensions connotes that development programmes and policies that will bring about sustainability requires interdisciplinary approach and different stages of interventions with the creation of enabling environment.

In spite of numerous constraints of smallholder irrigation schemes in South Africa, they can still become efficient and sustainable considering the endowed agro-ecological diversity of the country. The policy setting affecting sustainable agriculture is rapidly changing, because of political changes in the country (Van Zyl *et al,* 1996). Agricultural policies at the national and provincial terrain remain at the levels of objectives and values followed by insignificant development strategies and priorities (Van Zyl *et al,* 1996). Nevertheless, a variety of initiatives

have been put in place to develop environmental policy across a range of sectors. For instance water policies have been developed considerably with strategies to increase water tariff and charges for catchment management and resource conservation. Non-formal training strategies to prepare farmers with skills in sustainable agriculture are paramount and priority must be given to intra-disciplinary skills (RDS, 1996). According to the (OECD, 2006), the main solution to poverty alleviation requires the total involvement of the smallholder farmers in agricultural cooperative activities that will allow them pool their resources together for sustainable agricultural development. Farmers' cooperative has been effective in improving smallholder farmer's access to farm inputs and markets thus enhancing sustainability (Ortmann and Kings, 2006). The effect of market and socio-economic conditions on the motivation of farmers must be critically considered (Brown and Nooter 1992). The prospect for more support of locally centred savings and loans societies should be enhanced and the possibility of forming linkages with the commercial sectors must be considered. The role of farmers and their participation in effective water use efficiency will assist in bringing about a sustainable smallholder irrigation practice. Implementation strategies must not be ready- made but must be dynamic and sensitive to the environment with the intention of supporting local people (Uderhill, 1990). However, it is doubtful if these concerns are taken into account when implementing irrigation policies in South Africa. World Bank appraisal of successes in smallholder irrigation in the Sahel asserted that motivation and involvement of farmers in decision making are critical components attached to farmers' success. For sustainability to be effective, an upgraded harmonization of all relevant department linked with smallholder irrigation is required. The provincial council for development in Eastern Cape is already delivering an ideal institutional model that includes sub-committees, and agriculture is one of the composition of the committee, with public, private and

NGOs as members (Eastern Cape Government, 2009). As part of a linkage structure, partnership between organizations with complementary proficiencies and skills are also required to boost pooling of resources and avert bureaucratic problems.

3. 7 Irrigation scheduling

South Africa is ranked 29th driest country of about 139 countries in the world (Muller, *et al* 2005). Currently, rain-fed agriculture that mainly rely on blue water (run-off) is adopted and practiced on about 97% of the accessible agricultural land in Sub-Saharan Africa (SSA) in spite of the positive stand of irrigated farming (FAO, 2002). In South Africa, rainfall pattern remains unreliable and unevenly distributed across the entire provinces with spheres of water movement divided into green water (vapour) and blue water (run-off) flows. At present, emphasis has been placed on the management of water resources used for irrigated agriculture. Nevertheless, the growth of smallholder irrigation schemes has been uncertain over the past 20 years, coupled with the dilapidated irrigation infrastructures and mismanagement (FAO, 2002). In South Africa, the increase of blue water is limited to few areas while many of the areas lack water. However, in some areas where watersheds or basins are available, for example the Uthukela and Pongola, the distance from source to areas of demand are far coupled with the high cost of transmission per cubic metre (DWA, 2010). In addition, building of new dams and purchase of irrigation infrastructures are costly coupled with difficult and bureaucratic process that may take years from beginning to commissioning (DWA, 2010). Hamdy *et al*, (2003) asserted that the more water is conserved for agricultural production, the lesser the need for the investment in water infrastructure. Agriculture is the highest consumer of water in South Africa and measures are already in place to regulate and manage its demand and use efficiency as exemplified in most smallholder irrigation projects. Considering the scare water resources, the Water Research

Commission (WRC) has over the years invested in tools that will help water managers to optimise water use efficiency with the application and adoption of irrigation scheduling.

Irrigation scheduling is the timing of irrigation occurrence and the control of irrigation water released at a particular period to the field of crops. The main aim of irrigation scheduling is to reduce water wastage, enhance efficient use of water to prevent stress to crops, reduce loss of fertilizer to leaching and saving the cost of energy by the application of the desired amount of water to crop field at the right period and at right place (Stephens, 2006). Appropriate irrigation scheduling entails a comprehensive foundation for making irrigation decisions. Irrigation scheduling reduces soil water runoff and guide against percolation losses. It also results in lower energy and water use with optimum crop yields. Nevertheless, irrigation scheduling may cause an increase in water and energy consumption in situations where available water is not efficiently conserved and maximised (Van der Gulik, 2006). However, the methods adopted in irrigation scheduling depend on soil water measurements, examination of plant stress and meteorological evidence or data collected in a particular place. In general, irrigation scheduling techniques can be classified into three main categories as follows: Plant-centred, soil-centred and Evapotranspiration (ET) techniques.

3.7.1 Plant-centred technique

The use of plant-centred techniques for irrigation scheduling management includes: Stomata conductance and thermal sensing, sap flow, xylem cavitation or fracture, leaf water potential and rate of photosynthesis in relation to unit area (Jones, 2004, Allen *et al.,* 1999 and Tyree and Dixon, 1983). This plant-centred technique entails that plant growth is openly linked to plant water level and only indirectly linked to soil moisture and the existing condition of the atmosphere. This technique is beneficial as the plant integrates soil water alongside with the

atmospheric water and reveals the existing conditions in plant growth process (USDA, 1991). In contrast, the plant-centred techniques do not provide evidence or information on how much water to apply at a specified time and are subject to accurate measurement only during the day time. The technique does not respond to plants that have high water status and different range of available soil moisture. Another disadvantage is that considerable loss in potential yield may occur as soon as water stress is observed in a plant (Jones, 2004). However, plant indicators assist the farmer to directly use the plant/crops for signs as to when to irrigate. Looking or observing the features of a plant can portray a good idea of the status of the soil moisture.

3.7.2 Infrared/Canopy temperature

The infrared (IR) is another technique of irrigation scheduling which involves measuring the plant temperature by infrared thermometer. When there is water stress in plants, there is usually a closure of the stomata opening which will in turn trigger up the plant temperature. The infrared readings are capable of noticing this temperature increase. However, the use of this method allow for initial temperature reading to obtain a baseline temperature from a well water field that is free of water stress. In determining the moisture/water level of the plant, baseline field reading taken earlier is compared with current field reading and decision is made as to whether to apply water to the field or not (Martin, 2001).

3.7.3 Soil-centred technique

In the application of soil-centred approach, the accurate measurement of soil water is essential in determining the quantity of water required to bring the soil water to field capacity. The soil-centred technique used in irrigation scheduling includes: Hand-feel, tensiometer, electrical resistance blocks, neuron gauge (neuron scatter), Time Domain Reflectometer (TDR), and

capacitance probe. All of these are classified as soil moisture measuring tools used for irrigation scheduling purposes.

Hand-feel or personal experience: This is a method of irrigation scheduling that involves observation of the soil by simple feel. A fair estimate of the soil moisture could be ascertained by squeezing a small sample of soil in between the fingers and or thumb. The aim of the hand feel is to observe whether there are changes in the visual characteristics of soil. Simple observation could also be made in the case of crops. Crops that are water stressed in most instances change from luxuriant growth (green succulent leaves) to slow retarded growth exhibiting greyish dull colour. The inherent advantage of this approach is that, it is easy and does not require technical know-how. In contrast, accuracy is not guaranteed as experience is required for good perception and judgement. There is another problem of determining the subsoil moisture condition as observation and feel is only limited to top soil. In addition, when the visual signs of water stress are detected *via* observation, yield losses may be unavoidable (SAI, 2010). However, irrigation experts have recommended that visual observation be used for initial or introductory assessment and must be used in conjunction with other methods or approaches. Excess water application or water stress condition is easier to determine using technical equipment (SAI, 2010).

Soil moisture monitoring: This method involves measuring soil moisture to find out whether there is water stress that can reduce yield or excess water that can cause water logging thus resulting in the leaching of soil nutrients. The measurement of soil moisture is done using soil moisture equipment like the tensiometer.

Tensiometer: the tensiometer is an instrument that is used to measure the amount of soil water available in the soil at a given period. It has an absorbent ceramic cup fixed to the lower end of a transparent plastic tube, water tank (reservoir), and calibrated vacuum gauge use in measuring

soil moisture (University of Minnesota, 1991). Soil moisture tension is defined as a measure of the effort put in by a growing crop to obtain water from the soil. The soil water tension is measured in centibars (cbars) in relation to the amount of soil water available to crops. The tensiometer records the tension occurring between soil and water particles. Usually, the soil moisture tension increases with less water in the soil, thereby increases the reading on the tensiometer. In most soil, the readings that is under 10 cbars means that the soil is wet and ideal for a particular crop while reading of above 50cbars indicates dryness of soil. Tensiometer as an instrument for measuring soil water tension functions best in coarse textured or in fine clay soils (Van der Gulik, 2006). In some circumstances, when fine soils are dried, the tension often surpasses the maximum tensiometer gauge reading. Therefore, Watermarks which is an electrical device with sensor that works on the same principles like the tensiometer are used in such situation because it is able to read and record high soil water tension occurring in fine soils. The benefit associated with the use of tensiometer is that it gives instant result of available soil water for crops and it is easy to install and use.

Electrical resistance block: This is another soil moisture monitoring approach which involves the use of electrodes fixed in porous gypsum blocks to relay electrical measurement in relation to soil moisture. The ideology behind this approach is that moisture content can be assessed by the resistance two electrodes implanted in the soil. The functionality is that the more available water is in the soil, the lesser the resistance. In measuring the soil moisture, the blocks are placed in the soil at required depth with wire leads extended above the soil surface and connected to a meter for reading (Martin, 2001).The disadvantage of this approach is that measurements are affected by levels of salts concentration in the soil, fertilisers and temperature vagaries. It is not

recommended for irrigation scheduling in field crops but could be used in horticultural fields (USDA, 1991).

Neuron gauge (neuron probe): This is another moisture monitoring method with the procedure based on the measurement of moving neurons which contains a radioactive source that sends out fast neutrons (Figure 3.1). These neutrons are similar in size like the hydrogen atom, an important part of water. When fast neurons collide with hydrogen atom, they slow down. It is the detector within the neutron probe that measures the rate of fast neutron leaving and the slow neutron that is bounced back. The ratio of this phenomenon is then used to measure the soil moisture content (Martin, 2001 and ICT International, 2009). The neuron probe is considered to be very accurate and reliable as a tool for determining the soil moisture content. Although it is considered very expensive, it has been accepted by many as reliable soil moisture measurement tool (Howell, 1996 and Harms, 2002).

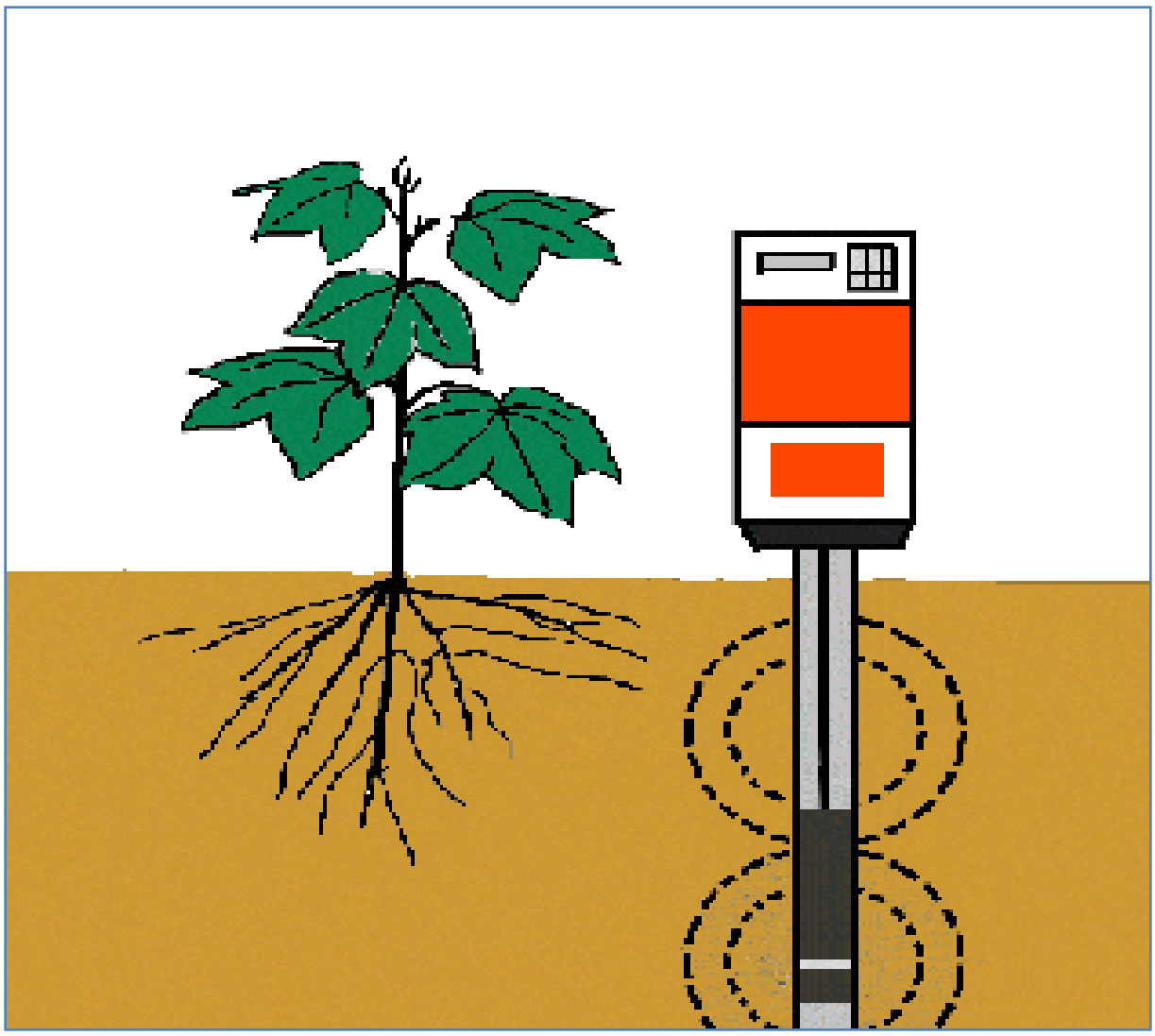

Figure 3.1 Diagram of a moisture gauge (neutron probe) adapted from Martin, 2001.

3.7.4 Time-Domain Reflectometer (TDR Probe)

The Time Domain Reflectometer (TDR) is a new technique of determining the moisture content of the soil. The operational modality is that the availability of water in the soil slows the speed generated by the electromagnetic wave while water stress allows an increased speed of the electromagnetic wave. The TDR sends an electromagnetic wave *via* a pair of parallel metal spikes buried into the ground at a chosen depth. The device then measures the time it takes the

wave to go below the guide and bounces back up the guide and the time is noted for conversion to soil moisture (Martin, 2001).

3.7.5 Capacitance (Capacitance probes, Frequency Domain Reflectometers)

Capacitance Probes and the Frequency Domain Reflectometers (FDR) use an AC oscillator in forming a complete circuit. Following the insertion of parallel metal rings probes or spikes into the soil, a circuit frequency is developed. There is usually a change in frequency depending on the soil moisture. The TDR, FDR and Capacitance Probes have recorded good successes in operation but not without limitations. These techniques only read a small fraction of soil around the probes are also very sensitive to air gaps created between the tube and the soil. However, these seeming new technologies require technical know-how to operate effectively (Martin, 2001).

3.7.6 Evapotranspiration based Irrigation scheduling

The combination of water that is evaporated from the soil and transpired through the plant is referred to Evapotranspiration (ET). The Evapotranspiration based irrigation scheduling entails the use of data collected in respect of the weather in a particular place. The weather record includes: solar temperature, relative humidity, wind speed and amount of rainfall in line with the characteristics of the plant in terms of crop coefficient (properties of crops used in predicting evapotranspiration). ET can be determined using evaporation pans and atmometers or calculated by using the climatic data (Dukes, 2009). The historical ET approach of irrigation scheduling is hinged on the idea that irrigation is attuned to replace the amount of water noticed or assessed to be lost from the system. Normally, a farmer may determine monthly ET rates and adjust the

scheduled irrigation to tally with the rates (Dukes, 2009). However, this method is not perfect because of weather variations (Dukes, 2009).

3.8 Conclusion and Insight from the reviewed concepts

Decision making is a central issue in smallholder irrigation practice. Quality decision making is important to changing attitude of smallholder farmers. In assisting smallholder farmers in decision making, it is important to understand how decisions are taken and how farmers actually cope with decisional conflicts. The clamour for bigger investment in smallholder agriculture has been gaining support and has been identified as an avenue for poverty alleviation. The solution to poverty reduction requires involving a greater part of the rural poor in agricultural activities that will produce enough income. Improved food security situation of households has impact on smallholder farmers' production decisions. Smallholder irrigation practice in South Africa have not performed because they are perpetually constrained by inadequate market access, institutions and support services, low crop yield, revitalisation and needs analysis of farmers and problem of sustainability of smallholder irrigation practice. In spite of numerous constraints of smallholder irrigation schemes in South Africa, they can still become efficient and sustainable considering the endowed agro-ecological diversity of the country. Non-formal training strategies to prepare farmers with skills in sustainable agriculture are paramount and priority must be given to intra-disciplinary skills (RDS, 1996). The role of farmers and their participation in effective water use efficiency will assist in bringing about a sustainable smallholder irrigation practice. For agricultural sustainability to be effective, an upgraded harmonization of all relevant department linked with smallholder irrigation practice is required. The provincial council for development in Eastern Cape is already delivering an institutional model that includes sub-committees, and agriculture is one of the committees, with public, private and NGOs as members (Eastern Cape

Government, 2009). As part of a linkage structure, partnership between organizations with complementary proficiencies and skills are also required to boost pooling of resources and avert bureaucratic problems. Concerted effort must be placed on smallholder irrigation practice as a way of increasing food and raw material production. Smallholder irrigation is an avenue towards achieving food security, increased farm employment and stable income generation for most rural households in South Africa. Adequate access to irrigation practice will generate and enhance opportunities for smallholder farmers to expand their income base, reduce vulnerability caused by seasonal changes and decline in agricultural production as well as external shocks.

CHAPTER 4

THEORETICAL AND CONCEPTUAL FRAMEWORK FOR DECISION MAKING PROCESS

4.1. Introduction

This chapter deals with the theoretical and conceptual framework of the study. It also provides a detailed discussion on the determinants of decision making of households. The theories used to understand household behaviour under different assumptions were variously discussed and comprehensive illustrations of analytical framework of the study were also conceptualised in this chapter.

4. 2 Theoretical framework

Farmers have individual perceptions about production decisions available to them. Previous economic studies examined decision making based on different farm and household characteristics (Roberts *et al,* 2004). Typically, many studies on decision making in the context of agriculture do not use a definite framework to model the development of the farmer's attitudes toward decision making. The application and use of numerous frameworks failed to appreciate the multifaceted nature of attitude development and its association with adoption behaviour (Hattam, 2006). The social psychology approach has identified weaknesses in methods that ignore attitudes to the surrounding environment and the genuine effort necessary to carry out the planned action (Edwards *et al,* 1998). However, the social psychology approach is accepted as being corresponding to the random utility approach usually used by economists (Hattam, 2006). This social psychology approach usually referred to as the Theory of Plan Behaviour (TPB) has been used as substitute to understand and describe farmer's behaviour in terms of agricultural decision making (Beedell and Rehman 1999). The TPB approach provides a research framework

to understand individuals' behaviour through intents (Ajzen, 1988). According to TPB, attitudes, personal norms, and behavioural controls are considered to be the main determinants of behavioural decisions. In addition, factors such as household characteristics of the farmer may also play a role in the development of decision making (Hattam, 2006). Although decisions making are considered to be the accurate determinant of actions; in the application of TPB, Hattam (2006) observed that creating positive attitudes toward the acceptance of a practice is not enough to induce decision implementation. Social pressures from important groups are also most important factors that hinder farmers' ability to change positive attitudes into adopting decisions. Lynne *et al,* (1995) in their analysis of Strawberry producers' attitudes towards the adoption of water conservation technologies in Florida observed that attitudes and perceptions were found to be significant in understanding farmers' behaviour towards decision to the adoption of water conservation technologies. The idea of household theory has been used extensively in most studies Ellis (1993). However, in the neo-classical theory, farm household also form the basic decision-making unit with respect to production and consumption (Arrow and Debreu, 1954). Many researchers have proposed a number of hypotheses with the aim of understanding decision-making process at farm household level. The hypothesis of Schultz (1964) on farm household asserted that farmers in developing countries were 'efficient but poor' while Lipton (1968) posited that farm households maximizes utility. In testing these hypotheses, numerous studies have developed in places like India (Saini 1969), Nigeria (Norman, 1974), and Kenya (Wolgin, 1975) with resemblances and variances in results. However, irrespective of these mixed and varied results, utility maximization hypothesis remains the basis for analysis of the farm household decisions not minding the changes added to suite different assumptions. The theories used to understand household behaviour under different assumptions were summed up and

defined by (Ellis, 1993). In the summary, Ellis (1993) defines several types of peasants: as "profit maximizing peasants", "risk averse peasant", "drudgery – averse peasant", "farm household peasant", and the "share – cropping". Ellis uses the term "peasant" instead of "smallholder farmer". However, in this study the term peasant will not be used as it connotes a distinct social group, instead the term "smallholder farmer" will be used. According to Shiferaw (2006), the farmer is the main decision maker on how and when to use technology to attain his preferred objectives. The challenge is how to understand the behaviour of the farmer in terms of his/her production, consumption and investment decisions, and the most essential factors that affect such decisions; such as household characteristics, farm characteristics, institutions, and bio-physical and economic factors. In this study, a complete analytical framework which takes into cognisance the factors that affect smallholder farmers' decision making is required (figure 4.1). This analytical framework developed here will help us understand the determinant factors influencing decisions making. These factors are grouped into household characteristics; farm characteristics; institutional factors; and bio-physical and economic factors. The conceptual framework of factors affecting smallholder's decision as illustrated in Figure 4.1 follows closely decision making of smallholder farmers. Although household's consumption decisions are important and inseparable from production decisions, this study has chosen to focus mainly on production; institutional arrangements (tenure and irrigation scheduling); household food security; and marketing decisions- making of smallholder farmers' in Zanyokwe and Shiloh irrigation schemes.

4.2.1 Conceptual framework of the study

4.2.2 Household characteristics

Smallholder farmer's production decisions are influenced by (Figure 4.1) their age, gender and education (Pattanyak *et al*, 2003). In a study by Tafesse (2007) on the effect of community irrigation project on farm production efficiency in Ethiopia, also found that household characteristics such as education of the household, years of irrigation experience, total income of households, and farm size were the significant determinants of household decision on irrigation utilization. Pests and diseases infestation, training received from extension, and ownership of information gadget like the radio were also recorded as having influence on decision making of smallholders irrigation farmers. Smallholder farmers decisions in the use of irrigation facilities changes over time as their experience matures ((Bannister and Nair, 2003). Smallholder farmers have objectives for cultivating crops and these objectives include: household consumption, source of cash for household, and fodder for livestock. These objectives are likely to influence their decision-making (Upton, 1996). The willingness of farmers to use irrigation facilities in crop production is also dependent on their attitudes and risk perceptions (Pannell, 1999). According to Shiferaw (2006), farmers are discouraged to invest in most agricultural activities especially crop production because of existing land rights and the duration of tenure. Short duration of tenure does not allow farmers to engage in long term production ventures like the cultivation of permanent crops. The behaviour of smallholder farmers towards risk management affects their decision-making. Behaviour or attitude towards risk may lead to (Ellis, 1993): (a) ideal economic decisions (b) reluctance to accept innovations and (c) changes to reduce the envisaged effects of risk. Therefore, it follows that in addition to economic considerations, the smallholder farmers also consider risk in their agricultural decision making. Therefore, the first

step in solving any agricultural related decision making in irrigation crop production is to identify the problem and criteria that farmers use when making choice between alternatives.

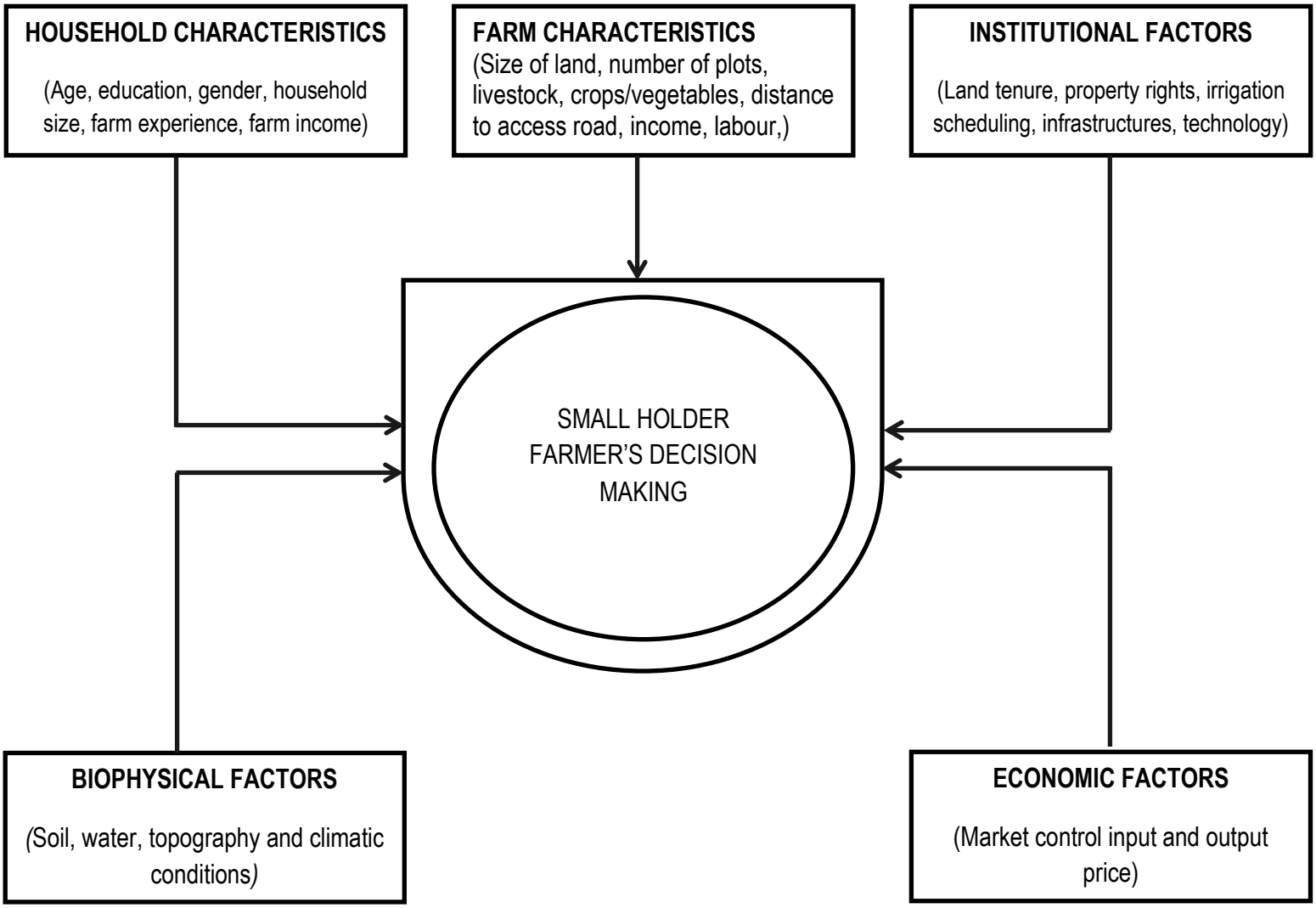

Figure 4.1 Conceptual framework of factors influencing smallholder decisions' in irrigation practices [Source: Own compilation 2012]

4.2.3 Farm characteristics

Smallholder irrigation schemes are assets when examined from the livelihood perspective as they can be used to increase the livelihood subsistence activity of crop and animal production. The farm characteristics or resource endowment includes the stages of agricultural intensification; size of available land holding/plots; labour accessibility and availability, the totality of the household income generated; livestock and crops owned; distance from farm to the market and access to available resources (Figure 4.1). Farm characteristics quantify the resources available for use in a household and influences decision making and adoption of innovations (Pattanyak *et al*, 2003). The more the farm characteristics or endowment assets, the larger the choice of possible livelihood investment decisions (Shiferaw, 2006). However, returns from family labour in the form of household income would affect the amount of labour allocated between agriculture and off-farm employment. Poor households that are without livelihood assets often participate in off-farm activities like petty trading. Land size could be an influential factor in decision making because it limits the number of crops that farmers can cultivate in a given production season. In a study by Gilmour (1995) on Nepalese farmers' response to tree planting and protection, it was found that the interest of farmers in releasing land and labour for growing trees deteriorated with distance to available trees and other resources. It follows that if the proximity of irrigation farm to household is far, it is anticipated that it will have an influence on household decision making especially in the supply of labour. Generally, farm characteristics or livelihood asset endowments are positively linked with decision making of households.

4.2.4 Institutional factors

Institutions are a "set of formal and informal rules, together with their implementation arrangements" (Schmoller 1900, cited by Furubotn and Richter, 2000). The primary goal of

institutions is to stimulate individual behaviour in a particular way. According to North (1990), the working of an institution depends on the personalities who use it. Institutions together with the individuals using them are termed organizations (e.g. Water Catchment Management Agencies, Water Users' Associations, farmers and member of the communities). Institutional policies outline the ways for easing financial constraints and assist in setting feasible livelihood options in terms of making decisions on crops and livestock subsidise. Improved policies on land holding rights, secure property rights, credits and insurance creates incentives for favourable investment decisions (Shiferaw, 2006). Smallholder investment decision making in a given setting depends on the quality of the available resources, access to appropriate technology (irrigation facilities). According to Sjaastad and Bromley, (1997) tenure insecurity is the likelihood of losing possession of a part or the whole of one's land without his/her consent. Land acquirement and ownership in agrarian community is not only for farming activities but also a means of storing wealth and transferring it to successive generation.

Tenure insecurity can therefore, have a connection on how farmers make use of their land in terms of short-term and long-term crops cultivation on the land. Tenure security determines household's ability to either remain subsistence or commercial farmer (Deininger and Feder 2001). Farmers are inclined to maintain and improve land in which they have a long-standing interest, in terms of their rights to cultivate the land, sell or rent the land (Hazell, 1993). Farmers' decision making ascends from tenure insecurity and production failures. Where farmers perceive uncertainties in land tenure arrangements, they show little interest in investment in crop production or livestock production.

Extension services encompasses farming advice, skills development and capacity building through a variety of training programmes including management and mentorship programmes

aimed at skill transfer to the farmers. According to Contado (1997), farmers perceive extension as a form of support to help improve their technical skills and productivity. Delivery of efficient extension service to smallholder farmers assist in effective decision making process of the farmer. The ability of smallholder farmers to manage new technology increases with available livelihood assets like size of land holding/plots; labour availability, and total household income (Shiferaw, 2006). Strengthening of agricultural production through investment in infrastructure and improved irrigation facilities will assist in food security in rural communities.

Stephens (2006) in his study on "Adoption of Irrigation scheduling methods in South Africa" asserted that elementary skills, procedures and trustworthiness of service provider are very important not only to 'buy into' the use of irrigation scheduling but also to enhance the acceptance of irrigation scheduling practice at farm level. Scheduling has been adopted in some irrigation schemes because it is not cost effective for farmers to access full stream of water at all-time especially when water tariffs are charged. Most SIS farmers cannot afford on-farm storage to store water for use in time of water stress. The decision of smallholder farmer to acquire and utilise a large area of land for crop production will definitely be affected by the irrigation scheduling arrangement that is in place.

4.2.5 Biophysical factors

Norris and Batie (1987) posited that farmer's consciousness of the biophysical features (soil erosion, slope or topography, climate and soil quality) is the first step in the acceptance process and is clearly linked with farmers' decision making. The slope of a field, rainfall pattern and other soil physical features are essential indicators for chances of erosion in an area (Lapar *et al,* 1999). The slope of a plot of land is expected to influence conservation decision for obvious reason that erosion tend to be more pronounced on steeper plots of land than flat ones. Farmers

have the perception that soil colour corresponds to fertility level of soils. The darker soil is believed by farmers to be more fertile. Land and nutrients depletion increases the probabilities of crop failures and risk-averse smallholder farmers will be expected to make decisions or invest in other businesses that will reduce these failures (Binswanger, 1989). The choice and decision to utilize irrigation technology will depend on returns from land that is used for production. Therefore, biophysical characteristics are capable of influencing decision making at household level.

4.2.6 Economic factors

The market reforms introduced in South Africa had an effect on the institutional arrangements where smallholder farmers make market and production decisions in agricultural production. Institutional changes have also affected market control as well as transaction cost in most agricultural commodity. In an effort to analyse the effects of these changes, the New Institutional Economics (NIE) approach has been adopted not only in South Africa but also in Sub-Saharan Africa. According to Delgado (1998), the application of NIE approach to smallholder agriculture has provided a breakthrough in understanding the constraints that impede farmers' market participation. Credit and yield price occasioned by imperfect markets are expected to make smallholder face low and different price decisions depending on each households equilibrium trading position (Janvry and Sadoulet, 1994). Owing to credit constraints, households may modify their production decisions by changing choice of farm enterprise. When operational local markets exist, resource users also expand the available production and investments options. For instance, the functioning of markets regulates access to credits to reduce the capital constraints and the level of use of productive inputs (e.g. fertilizer and high yielding crop variety). However,

this study will analyse the determinants of smallholder farmers' decision-making in irrigation practice.

4.2.7 Conclusion

The behaviour of the household in terms of production, consumption and investment decisions, and the most essential factors that affects such decisions: household characteristics, farm characteristics, institutions, bio-physical and economic factors were discussed. A complete analytical framework which takes into cognizance the factors that affects smallholder farmers' decision making were also presented. These factors were grouped into household characteristics; farm characteristics; institutional factors; bio-physical and economic factors. Although household's consumption decisions are important and inseparable from production decisions, this study has chosen to focus mainly on production; institutional arrangements; household food security; and marketing decision making of smallholder farmers' in Zanyokwe and Shiloh irrigation schemes.

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CHAPTER 5

METHODOLOGY

5.1 Introduction

This chapter briefly explains the method adopted in the study. The sample size was determined considering the population of the farmers in Shiloh and Zanyokwe in Eastern Cape. The instruments used for data collection and data analysis are also presented in this chapter. Also, the model adopted for the study and the explanation of the independent variables are comprehensively discussed in this chapter.

5.2 Selection and description of the study area

Eastern Cape is located on the South-Eastern seaboard of South Africa. The Province of the Eastern Cape is the second largest of the nine provinces in terms of surface area, comprising 170 600km Square, which represents about 14.0% of the country's total land mass. The Province includes what was traditionally known as the Border and North-Eastern Cape area, as well as the former 'homelands' of Transkei and Ciskei. It borders the Indian Ocean in the South-East, the Free State Province and Lesotho in the North, the Western and Northern Cape Provinces in the southwest as well as KwaZulu-Natal Province in the North-East.

The study was conducted in Zanyokwe and Shiloh Smallholder Irrigation Schemes located in Eastern Cape at Amathole and Chris Hani districts respectively. The choice of Zanyokwe smallholder irrigation Scheme and Shiloh smallholder irrigation scheme for this study is mainly supported by the fact that it had a substantial level of crop farming activity taking place especially at Zanyokwe while the Shiloh smallholder irrigation scheme specialises on dairy farming. Amathole is one the seven districts of Eastern Cape Province of South Africa.

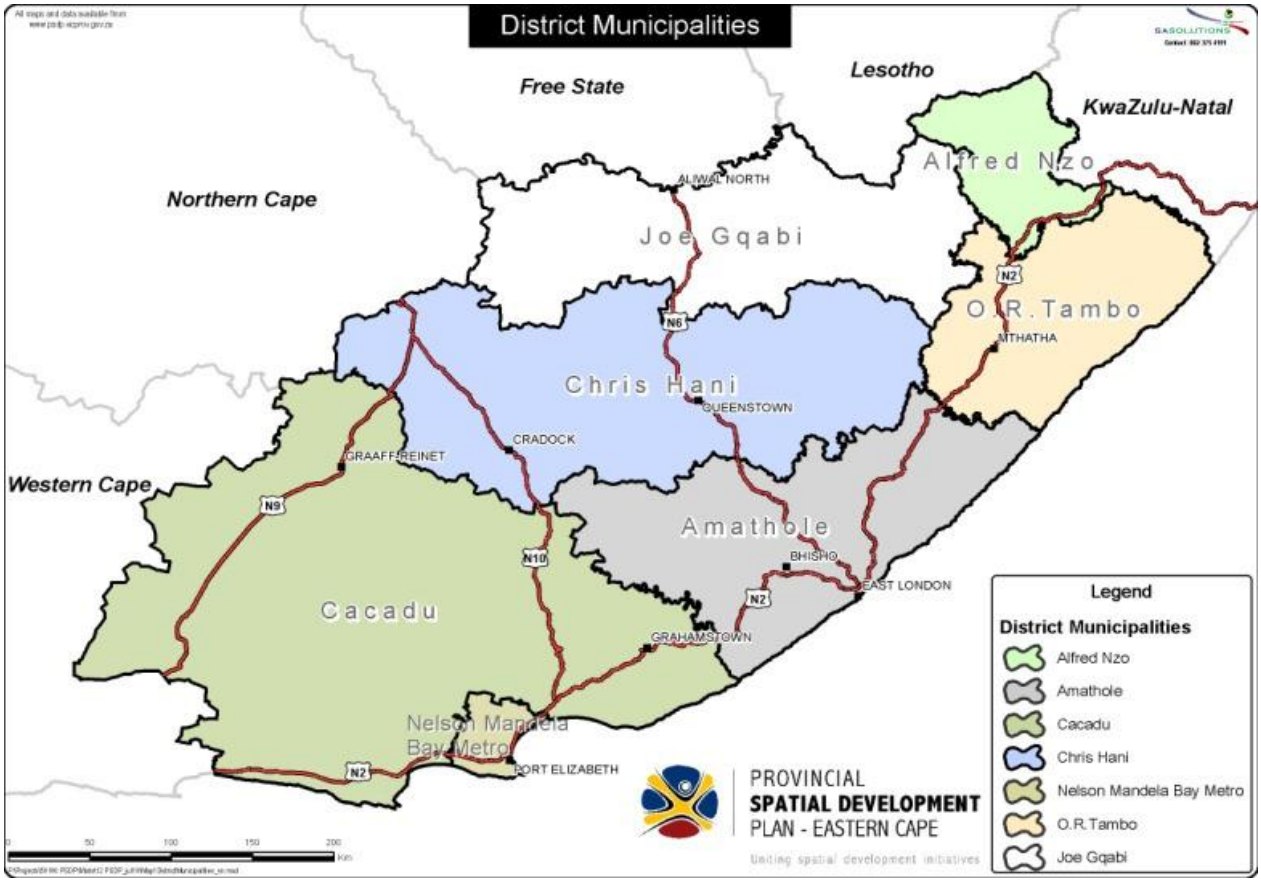

Figure 5.1 District Municipalities showing the study area.

Source: (ECSECC, 2009).

Amathole is surrounded by Chris Hani to the North, OR Tambo to the North-East, the Indian Ocean to the South-East, and Cacadu to the West. Zanyokwe Smallholder Irrigation Scheme is located in the Middle drift area of Amathole district of Eastern Cape, South Africa. It is about 30 km from King William's Town and about 20km inland on gravel road. The scheme is shared among six villages namely: Zingcuka, Kamma-Furrow, Ngqumeya, Zanyokwe, Lenye, and Burnshill, and is served by Sandile Dam. The Zanyokwe smallholder irrigation scheme covers approximately 635 hectares of which 434 hectares make the main Zanyokwe and the rest make Kamma-Furrow. Zanyokwe area is semi-arid with annual rainfall of about 590mm. The Zanyokwe area has varied soil types, with a substrate consisting of shale, mudstone and fine-

textured sandstone with dolerite sills and a dyke that occupy large areas, particularly in the extreme northern and southern sections of the region (Van Averbeke *et al,* 1998). There are also some nutrient-rich alluvial soils available along the Keiskamma River. These alluvial deposits enhance quality vegetal growth and development of pastures.

The Shiloh smallholder irrigation scheme is located in Lukhanji Local Municipality which is situated within the Chris Hani District of the Eastern Cape Province. The scheme is located on the R67 road to Fort Beautfort, about one kilometre from Whittlesea. It is also 40km from Queenstown and 102km from Fort Beautfort on both sides of the tarred road. The total area of the scheme is 455ha. There are approximately 237 beneficiaries in the dairy project serviced by the scheme.

Lukhanji Local Municipality where SIS is located comprises of Queenstown and surrounding villages like Ilinge, Hewu / Whittlesea, Nonesi and Ntabethemba. Lukhanji is landlocked by the Municipalities of Tsolwana and Inkwanca to the west and Emalahleni and Intsika Yethu to the north and Amahlathi to the east (Lukhanji IDP, 2008). The geographical area of the municipality is approximately 4231 square kilometres and consists of 27 wards (Lukhanji IDP, 2008). Lukhanji is a high altitude area reaching heights of 1070m above sea level. The temperatures in some areas like Queenstown are often in the extremes with figures reaching highs of 33°C in mid-summer and dropping to as low as -2ºC in winter (Lukhanji Local Municipality - IDP Review 2010/11). Lukhanji is characterised by dry high-veld Sandy Grassland and Valley Thicket. Poor vegetation cover and low diversity combined with poor farming methods on communal land often lead to erosion problems. Prevalent soil types are mostly sandy loams and clay loams (IDP, 2010/11).

5.2.1 Sampling of respondents

The survey which sought information on socio-economic demography, income, consumption and expenditure of households, decision making process, household food security and production, and marketing constraints in both schemes was conducted in 2012. In this study, a household comprise of all persons residing in a homestead. There were 412 ha of irrigated plots in Zanyokwe with 97 plot holders. The 97 plot holders were involved in crop production. In Shiloh, there were 450 ha of irrigated plots shared amongst 338 beneficiaries but only 60 households (farmers) utilised their plots for crop production why others do not. However, of the 450 irrigated plots, 318 ha were used for dairy production and only 96ha were used by 60 farmers for crop or vegetable production. Farmers involved in crop production were mainly considered in the sampling. List of farmers in the schemes were used and all farmers were allocated serial numbers for ease of identification and analysis.

5.2.2 Sampling size

The individual farm household was considered as the unit of analysis in this study. The sample size for each study site was determined using 5% margin of error, 95% confidence interval, and 60 households as finite population. Based on this set values, a sample size of 52 households were realised. However, for the purpose of this study, 60 households were chosen as the sample size since the larger the sample size the more certain the answers/responses truly reflects the population under study. Sixty households in each study sites were therefore, considered adequate to balance required level of reliability and cost. The samples were taken randomly from the areas served by Zanyokwe irrigation scheme which includes: Zingcuka, Kamma-Furrow, Ngqumeya, Zanyokwe, Lenye, and Burnshill. In Shiloh, all 60 farmers who were involved in crop production

were chosen. The areas served by Shiloh irrigation include: Queenstown and surrounding villages like Ilinge, Hewu / Whittlesea, Nonesi and Ntabethemba.

5.2.3 Instrument for data collection

The general objectives of the study were to analyse and model the determinants of smallholder irrigation scheme farmer's decision making, to test the preconceived hypothesis, and to make statistical inferences to the sampled population. The data collection procedure involved the use of structured and semi-structured questionnaires, interviews, personal observation and some field measurement. However, in order to ensure proper investigation, focus group discussion was also carried out.

5.2.4 Method of gathering data

Semi-structured questionnaire, interview and focus group discussions were used to collect data from the sampled households in both schemes (Shiloh and Zanyokwe).

5.3 The approach

To assess priority areas of focus, a formal reconnaissance survey and exploratory visit was first carried out to the two study sites. Following the knowledge gained through the exploratory visit, formal survey questionnaires were designed. To enhance the data collection process, enumerators who understand the local language (Isi-Xhosa) were informally trained on the ways of approaching the respondents, the way to arrange the interview and how to record information accurately. The actual survey was then carried out in the study areas involving the researcher, stakeholders and enumerators.

5.3.1 Focus group discussion

The focus group discussion techniques were adopted to fill the gaps that may have arisen from using the quantitative and qualitative method of data collection. Separate focus group discussions were performed in the two study sites (Zanyokwe and Shiloh). The focus groups were made up of the farmers in the irrigation scheme. Selected farmers, committee members and primary cooperative members in the scheme were involved in the focus group discussions and it was possible because of the operation of existing farmers' primary cooperative and committee. The main purpose of the focus group discussion was to obtain in-depth evidence on some of the perceptions of farmers on decision making in the scheme. However, the focus group discussions were facilitated by the scheme managers with the assistance of the researcher and four enumerators who were mainly for note taking. The focus group questions guide encompasses: introduction and ethical considerations, current trends of irrigation scheme, tenure security and land use, irrigation scheduling and other issues (See Appendix 1).

5.3.2 Data Analysis Method

The data were analysed using different analytical techniques. The descriptive statistics such as, mean, standard deviation, and binary logistics regression were used to analyse quantitative data obtained from the sample households. The qualitative data were compared and carefully examined for clarity and relevance. The determinants of decision making of household were quantified using the binary logistic regression approach. This approach was adopted because logistic regression models estimates probabilities of events as a function of a set of explanatory variables that are hypothesized to influence the outcome or result (Pohlmann and Leitner, 2003). The logistic regression method is more popularly used to classify individual into one or two populations when only predictor variables are known and to determine which characteristics best

predict decisions. There is usually no assumptions made with respect to the distributions of the predictor variables (X) and that X variables may be discrete or continuous (Afifi *et al*, 2004). The logistic regression method is an established approach applied in empirical studies focused on finding the determinants of investment decisions of smallholder agriculture (Mercer *et al*, 2005; Neupane *et al*, 2002). The conceptual framework developed (Figure 4.1) were used as a reference base throughout the analysis.

5.4 The adopted model

In consideration of the conceptual framework of the study (Figure 4.1), the agricultural household model was adopted to analyse smallholder farmer's decision making. In partial subsistence situations, production and consumption decisions of smallholder households are often co-dependent primarily because household labour is a major input for agricultural activities and the income or output from the household's agricultural production represents an important share of the income used for consumption purposes (Amacher *et al*, 1999). The agricultural household model is based on the literature of adoption and farm household (Feder *et al*, 1985 and Singh, *et al*, (1986). The theory illustrated that household maximizes utility (*U*) over a set of consumption items produced by a set of home grown agricultural product *(C_f)*, a set of consumption goods (*C_{nf})*, and leisure *(l*). The derivable utility from household consumption and levels depend on the preferences of its members (Ω_{HH}), formed by the characteristics of the household, for example the age, education and wealth status of its members.

$$MaxU\ (C_f, C_{nf}, l; \Omega_{HH}) \qquad (4.1)$$

C_f, C_{nf}

The amounts of farm produce to be consumed at farm level (C_f) or sold $(Q - C_f)$ are taken or chosen from a vector Q of farm outputs. Decision making are constrained by a constant technology that combines purchased inputs (X), labour (L), with the allocation of a fixed plot or land area ($A = A^o$) among m crops, given the physical conditions of the farm (ΩF),

$$Q = F(\alpha, X, L, A, \Omega_F) \qquad (4.2)$$

Every set of area shares (αi) among m crops sum up to 1, $\sum_i^m ai = 1, i = 1$ -------- m

Objective function in Eq. (4.1) can then be rewritten as:

$$Max\ V (C_f, C_{nf}, l; \Omega_{HH}) \qquad (4.3)$$

h (hired labour)

Where *h (hired labour)* $= (^{\alpha}1,..., \alpha^m) \geq 0; C_f, C_{nf}, X,$ *and* L).

The choices of household or hired labour allocation are constrained by the total time (T) available for farm production and leisure (l), and by the full income of the household. The total income in a single decision making period comprises of the net farm earnings that is profit from crop production and income that is outside (exogenous) the season's crop and different choices (Y^o), such as stocks carried over, remittances, pensions and other transfers from the past seasons:

$$T = H + l \qquad (4.4)$$

$$Pf\ (Q - C_f) - p_x X - wL + Y^O = p_{nf} C^{nf} + wH \qquad (4.5)$$

P_f *is* the price of farm produce sold, px is the average price of variable inputs, w is labour wage, and P_{nf} is the average price of purchased goods.

The other constraint like market, institution and cultural factors affecting production and consumption decisions can be explained as exogenous features (M). In the event that consumption and production decisions are not separable, the household's best possible choice

(h = α*, Cf*, Cnf*, X*, L*)* can be expressed as a reduced function of farm size, income from outside sources, and household, farm and market characteristics:

$h^* = h^* (A^O, Y^O, \Omega_{HH}, \Omega_F, \Omega M)$ *(4.6)*

The equation (4.6) above is the basis for econometric estimation to examine the factors affecting household decision making.

5.5 Determinants of farmers decision making

The binary logistic regression model was used to estimate factors that influence households' decision to remain or move out of the scheme. The dependent variable was binary with a value of 1 if a household indicates that he/she would remain in the scheme and 0 otherwise. Applying screening questions based on the willingness of respondents to remain in the scheme or not to remain in the scheme, two homogeneous mutually exclusive groups were created as follows:

Table 5.1 Distribution of respondents with respect to decision making to remain in scheme or not to remain

Zanyokwe (N=60)		
Group A	Remain in the scheme	55
Group B	Not to remain in the scheme	05
Total		60

Shiloh (N=60)		
Group A	Remain in the scheme	51
Group B	Not to remain in the scheme	09
Total		60

The binary logistics model used in this study as specified in equations 5.1 to 5.5 below illustrates the factors affecting households' decision making. Pohlmann and Leiter (2003) asserted that logistic regression models estimate the probabilities of events as a function of a set of

explanatory variables that are hypothesized to influence an outcome. The logistic regression model has assumed popularity of late (Kleinbaum and Klein, 2000). It is used to classify individuals into either one or two populations when only one set of predictor variables is known and to determine which features or characteristics best predict decision making. There are no assumptions made with respect to the distribution of the predictor variables (X); however, X variables may be discrete or continuous (Afifi, *et al*, 2004). The logistic regression approach is well established in empirical studies that seek to establish the determinants of decisions making in agricultural production (Mercer *et al*, 2005; Salam *et al*, 2000). Subsequent to Mercer, *et al*, (2005); Afifi *et al*, 2004), and Salam *et al*, (2000), let R_i represent a dichotomous variable that would equal 1, if households' decide to remain in the scheme and 0 if they did not. The probability of the choice to remain in the scheme, $Pr\ (R_i=1)$, or not $Pr\ (R_i=0)$ is derived as follows:

The probability of choice to remain in the scheme is

$$P = Pr\ (Ri = 1) = \frac{1}{1 + e^{-(ß_0 + ß_1 X_{1i} + \ldots + ß_k X_{ki})}} = \frac{e^{(ß_0 + ß_1 X_{1i} + \ldots + ß_k X_{ki})}}{1 + e^{(ß_0 + ß_1 X_{1i} + \ldots + ß_k X_{ki})}} \qquad (5.1)$$

On the other hand, the probability of choice not to remain in the scheme,

$$Pr\ (Ri = 0) = 1 - Prob\ (Ri = 1) = \frac{1}{1 + e\ (ß_0 + ß_{1X1}{}^{i} + \ldots + {}^{ß}{}_k X_{ki})} \qquad (5.2)$$

Dividing [5.1] by [5.2], we obtain

$$\frac{Pr\ (Ri = 1)}{Pr\ (Ri = 0)} = \frac{Pi}{1 - Pi} = e\ (ß_0 + ß_1 X_{1i} + \ldots ß_k X_{ki}) \qquad (5.3)$$

Taking the log in both sides of Eq. [5.3], results

$$In\left[\frac{Pr\,(Ri=1)}{1-Pr\,(Ri=0)}\right] = \beta_0 + \beta_1 X_{1i} + \ldots + \beta_k X_{ki} \qquad (5.4)$$

Where:

Subscript *i* represents *the* i^{th} observation in the sample

Pr is the probability of the outcome

β_0 is the intercept term

$\beta_1, \beta_2 \ldots, \beta_k$ are the coefficients associated with each explanatory (independent) variable $X_1, X_2 \ldots X_k$.

The data considered in the model took into account those in Zanyokwe and Shiloh irrigation schemes. The explanatory variables (X_i) included in the model were gender of household head (GENDER), age of household head (AGE), level of education (EDUC), farm experience of household head (FARMEXP), land size (LANDSIZ), distance of household to the nearest access road (ROADDIS), land rights of household head (LANRITS), farm infrastructure/asset of house hold head (FARMASET), water sufficiency in the scheme (WATSUFC), access to extension service (EXTACES), marketing information (MKTINFO), and produce variation and yield gap (PRODVAR). The dependent variable used in this logistic regression analysis was whether or not the plot holders decides to remain in the scheme (DECREM), where DECREM = 1 if plot household remain and 0 if they do not.

Following the above explanatory variables, the general form of Equation [5.4] was rewritten below to represent the probability of remaining in the scheme by sampled households' in the two study areas (Zanyokwe and Shiloh).

$$\text{In}\left[\frac{Pr\,(Ri=1)}{1-Pr\,(Ri=0)}\right] = \beta_0 + \beta_i\, GENDER + \beta_2\, AGE + \beta_3\, EDUC + \beta_4\, FARMEXP + \beta_5\, LANDSIZ + \beta_6\, ROADDIS +$$

$$\beta_7\, LANRITS + \beta_8\, FARMASET + \beta_9\, WATSUFC + \beta_{10}\, EXTACES + \beta_{11}\, MKTINFO + \beta_{12}\, PRODVAR \qquad (5.5)$$

5.5.1 The explanation of the independent variables in the study

Nineteen independent variables (explanatory variables) were identified as illustrated in the conceptual framework of the study (Figure 4.1) as major determinants of decision making in smallholder irrigation practice. Some of these identified variables were incorporated into the model as they have also been used extensively in other related studies to determine decision making. Studies by Tafesse (2007) and Pattanyak *et al* (2003) used the same logistic regression model to illustrate the determinants of decision making in smallholder agriculture. These determinant variables included household characteristics (age of household head, education of household head, gender of household head, household size, farm experience of household head and farm income of household head); farm characteristics (size of farm land, quantity of livestock, quantity of crops or vegetables produced, distance to the nearest town, farm income and labour); institutional factors (land tenure, property rights/PTO and farm infrastructures); biophysical factors (soil fertility and water availability) and economic factor (market information and price). However, these aforementioned factors are *priori* and are likely to impact positively or negatively in smallholder irrigation decision making.

5.5.2 Age

The age of the household is a discrete variable that is measured in this study in years. The age of the household and decision making is closely related because as the farmer's age increases, there is the possibility of the farmer becoming more conservative and less assertive in risk taking (Bembridge, 1984). With increase in age of farmer, improved decision making is expected to decrease (Dereje, 2008). The younger a farmer, the more he is ready to adopt innovation and more inclined positively to decision behaviour. Age has a very close link with farmer's decision

making (Solano et.al, 2006, Dlova *et.al*, 2004). However, it is expected in this study that decision making will be negatively related to age.

5.5.3 Education of household head

Household education could probably lead to informed decision making and awareness of the possible advantages of modernizing agriculture by means of technological inputs and diversification of household income which, in turn, would enhance household food supply (Najafi, 2003). The smallholder farmers must be acquitted with the idea of farming business and record keeping so that they should become proficient in decision making and managerial skills (Nompozolo, 2000). A good educational background reinforces endowed talents and can ensure basic foundation for informed decision making (Rwigema and Venter, 2004). Household education is likely to improve managerial ability and decision making in terms of better farm planning and the acquisition of better information to improve marketing ability. Dlova *et.al*, (2004) asserted that the probability of a farmer becoming successful increases when the farmer is exposed to some skilled training. Household agricultural development initiative should commence with training of the targeted farmers before other support services are provided (Doni, 1997). Household education is expected to positively influence smallholder decision making.

5.5.4 Gender of household

Studies relating to women's involvement in decision-making processes (Ozkan *et al*, 2000; Debasish *et al*, 2005) posited that men tend to dominate in decision-making at farm level especially on the area of finance and cost analysis. Nevertheless, these studies do not show or illustrate whether women's participation in decision-making process is important to farm management decision-making. The socio-cultural values and norms of the community allow

males the freedom to participate in all gatherings and meetings and consequently get more involved in decision making of groups. In this study therefore, gender is expected to influence decision making of household. Therefore, gender of household may be positively or negatively related to decision making.

5.5.5 Household size

The use of household and family are not consist in literature. A household is defined as a group of persons (or one person) who make common provision for food, shelter, and other important things that are necessary for living (Bongaarts, 2001). However, the provision of essential needs to a household differs among countries. The fundamental demographic characteristics of a household is the number of members it contains (Bongaarts, 2001). According to Bongaarts (2001), the determination of household is not always straightforward, with respect to visitors and members who are temporarily absent. In this study household size were based on the *de jure* population- that is, members who usually reside in the household even if they are temporarily absent at the time of the survey, and temporary visitors were excluded. This approach is mostly used in the analysis of household size in developing countries (Bongaarts, (2001) and Ayad *et al,* (1997). The larger the household size, the more likely the number of people that will assist in decision making and farm labour. However, this assertion will only be tenable if the household has matured people to work in the farm and may be involved in decision making. Therefore, decision making at household level may be positively related to household size.

5.5.6 Farming Experience

Farm experience in this study is measured in number of years the smallholder farmer began farming. Farmers with a higher experience appear to gather more information and are better

equipped with knowledge and skills, and are able to critically evaluate opportunities that are available (Chilot, 1994). Therefore, farming experience is expected to positively influence decision making of household in the study areas.

5.5.7 Size of irrigable farm land

Size of farm land is the total farm land under irrigation owned by the household measured in hectares. The larger the farm land, the higher the production level. Land size is an influential factor in decision making because it limits the number of crops that farmers can cultivate in a given production season. It is expected that households with large farms are more informed in investment decision making than those with small farms (Najafi, 2003) and the size of farm land under irrigation affect the level of decision making (Taha, 2007). The expected effect on improved decision making is positive because as large land is used for farming the higher the output.

5.5.8 Quantity of livestock

The level of affluence of most households is considered by the number of livestock owned, since livestock form part of wealth indicator in most rural areas. Livestock provides not only food for the households but also a number of other products which could be sold to provide additional benefit such meat, milk, manure, hides and skin. In time of crop failure occasioned by adverse weather condition, livestock becomes important alternative to cushion the effect of food shortages (Kang'ara *et al*, 2001). Households with more number of livestock have glaring opportunity in obtaining credit facilities (Endrias 2003). Farmers with more number of livestock are likely to have improved decision making and are likely to be early adopters of innovations

than other farmers who has less number of livestock. The quantity of livestock owned by the farmer is expected to have a positive effect on decision making of household.

5.5.9 Distance to the nearest town

The distance to the nearest town is calculated by the amount of time spent in hours to reach the nearest town for the purpose of sales of farm produce or the procurement of farm inputs. The longer it takes to get to the market, the more the cost and the less the freshness of their farm produces especially the perishable vegetables. Long distance discourages farmers from visiting the nearest town and hence the less likely he/she obtaining market information. Gilmour (1995) posited that the interest of farmers in offering themselves for labour for farming deteriorated with distance. Therefore, decision making will be distorted as farmers are locked out in the value chain management. However, distance to the nearest town is expected to have positive or negative effect on decision making of farmers.

5.5.10 Farm income

Farm income of households is measured by the amount of money realised from the sale of livestock and crops at the end of each production period. The total output includes all harvested vegetables and cereals by a farmer in each irrigation scheme within a production period. During harvest season, there is usually an increased aggregate output which will definitely increase the market supply of vegetables causing a fall in farm income. All things being equal, the higher the supply the lower the price of a given commodity hence the increased loss of farm revenue (income) in the case of inelastic demand (Foster, 1992). The assumption here is that income from farming influences improved decision making of household. It is expected that farm income may be positive or negative in decision making of households.

5.5.11 Labour

The number of persons that assist in farm labour influences the aggregate production output of a household. Poor households that are without adequate livelihood assets often participate in off-farm activities like petty trading and other menial businesses. With increase in household labour, improved decision making is expected to increase and correlate (Yishak, 2005). It is anticipated that the supply and availability of labour will positively influence household decision making.

5.5.12 Land tenure

Land ownership in agrarian community is not only for farming purposes but also a way of acquiring wealth and transferring it to successive generation. Tenure insecurity is the likelihood of losing possession of a part or the whole of one's land without his/her consent (Sjaastad and Bromley, 1997). Tenure insecurity can therefore, influence farmers use of their land in terms of short-term and long-term crops cultivation on the land. Tenure security determines household's ability to either decide to remain subsistence or commercial farmer (Deininger and Feder 2001). Farmers are able to maintain and improve land in which they have a long-standing interest, in terms of their rights to cultivate the land, sell or rent the land (Hazell, 1993). Farmers' decision making stems from tenure insecurity and production failures. Where farmers perceive uncertainties in land tenure arrangements, they become discouraged in investing in crop and livestock production. Tenure security is positive to decision making of household.

5.5.13 Property rights/PTO

Improved policies on land holding rights, secure property rights and Permission To Occupy (PTO) encourages favourable investment decisions making (Shiferaw, 2006). Obtaining land rights or permission to occupy influences certain transaction that would bring land to its intensive use, and also gives the farmer the encouragement for rational economic driving force to

transfer and improve land for investments. According to Place and Hazell (1993) farmers are more likely to improve land in which they have lasting interest, in terms of their rights to cultivate the land continuously and be able to dispose of the land in renting or even sale. The effect of Property rights/PTO is positive to decision making of household.

5.5.14 Farm asset and infrastructures

Smallholder farmers' investment decision making in a given period depends on the available resources and access to appropriate irrigation facilities. Farmers that have enough infrastructures or asset are more inclined to perceive farming positively than farmers who do not have enough farm assets. The objective means of decision making rest on the available farm implements owned by households. One measure, which has been used as an objective means of testing the positive perception of agriculture, is the degree to which households have been or are investing in agricultural implements or infrastructures. Households' decision to increase cultivated land or invest in the production of new crops depends on the farm infrastructure at his disposal. The effect of decision making is positive to farm asset and infrastructures.

5.5.15 Soil fertility

The fertility of land is a determinant of the amount of farm produce a farmer realises. Most irrigated land in the scheme are impoverished with low nutrient content and as a result there is low yield. The application of chemical fertilisers is necessary to enhance good crop yield. Infertile soil has an effect on farmers' decision making (Stephens, 2000). Good returns from fertile soil positively influences farmers' decision making especially in the area of increasing the quantity of crops to cultivate. In this study, the application of fertilizer was measured by asking whether a farmer applies fertiliser or not (using dummy variable). The household that applies fertiliser has a value of one and the household that do not apply fertiliser had a value of zero. It is

expected that households that use fertilisers are more likely to have improved investment decision making than non-users. The effect of household decision making is positive to fertiliser users.

5.5.16 Water sufficiency

In South Africa, irrigated land use for agriculture accounts for as much as 30% of the total crop production and water consumption *via* irrigation is the largest compared to other sectors (De Villiers *et al* 2004). Water availability allows the increased use of agrochemicals like fertilisers which in turn increases the level of yield and improves farm income (Smith, 2004). Inadequate water limits crop and livestock production. Water availability is therefore, positively related to decision making of household.

5.5.17 Climatic conditions

The vagary of global weather has influence on production decision making of plot holders in both irrigation schemes. There is usually a reduction in crop yield because of abrupt and erratic rainfall distribution pattern as most smallholder farmers rely on harvested rain water for irrigating their crop fields. The expected effect of climatic conditions on decision making may be positively or negatively related to decision making.

5.5.18 Market information

When farmers are constrained with market information about prices, they may sell their produce at low prices and buy when prices are high. The availability of market information influences smallholder farmer's production and investment options. An ideal functioning market normalises access to credits and reduce capital constraints. The successful farmers as described by Bembridge (1984) are those farmers that have better contact with all information sources at a

particular time. Sizeable amount of market information is pertinent to back up agricultural activities and to improve farmers' knowledge and farming efficiency (Nompozolo, 2000). Market information is therefore, positively related to decision making of smallholder irrigation farmers.

5.5.19 Extension services

Extension services assist farmers with information on food production and storage development, processing, farm management and marketing of agricultural produce (Rivera *et al*, 2001). Effective and well coordinated extension programme remains the key to agricultural development and yield performance. Access to extension services is expected to be positively related to decision making of households' in the study areas. Bembridge (1993) asserts that extension services entail: assisting farmers in adopting the right attitude and problem-solving; mirroring alternatives and identifying sources of information that help individual farmers toward self-reliance. Extension services also includes the dissemination of research information to the farmers and transferring farmers' problems back to the research centres; assisting farmers to access managerial competences *via* training and guidance in conflict and decision making and assisting in the promotion and conservation of the endowed natural resources within the environment of the farmers (Bembridge,1993).

5.5.20 Product variation (yield gap)

The product variance on annual basis is the difference between actual farm yields and the maximum achievable yield from the farming activities. In less developed countries, the non- availability and high cost of inputs and equipment often make productivity improvements more difficult to achieve. The perceived farmers' satisfaction and variations in the annual rate of yield coupled with prices offered for agricultural produce occasioned by imperfect markets are expected to

make smallholder face low and different price decisions depending on each household equilibrium trading position (Janvry and Sadoulet, 1994). Therefore, product variation and prices offered for farm produce are expected to influence positively the decision making of household. Table 5.1 shows the summary of the variables expected to influence the decision making of households. A concise description of each variable is given with the variable code, unit of measurement and expected sign.

5.6 Conclusion

The sampling and sample size and the model adopted for the study; and the justification of the independent variables was comprehensively discussed. Twenty one explanatory variables identified in the conceptual framework of the study (Figure 4.1) were discussed and some of these identified variables were incorporated into the model as they have also been used extensively in other related studies to determine decision making. The logistic regression model was used as a method of analysis because it can estimate the probability of a certain event occurring and it accommodates a lot of variables which can be ranked in a order to illustrate which variables affect the response variable. It also helps to shows the relationship between the independent variables.

Table 5.2 Summary of predictor variables hypothesised with their operational description, measurement and expected signs

Variable and code	Operational description	Measurement unit	Expected sign
Age (AGE)	The number of years a person has lived	Years	–
Gender (GENDER)	Household: Male = 1 female = 0	Dummy	-/+
Education (EDUC)	level of education achieved	Years	+
Household size (HHSIZE)	Number of family members	Number	+
Farming Experience (FARMEXP)	Number of years in farming	Number	+
Size of farm land (LANSIZ)	Estimates of size of farming area	Hectares	+
Quantity of livestock (QTYLS)	Number of livestock	Number	+
Distance to the nearest town (ROADDIS)	Location of respondents with respect to the nearest town	Kilometres	-/+
Farm income (FARMINCO)	Amount realised from farming over a period	Rand	-/+
Labour (LABR)	Man equivalent of family labour accessible	Number	+
Land tenure (LANTR)	Land ownership by households	Leasehold = 0, family land = 1, communal land = 2, own land = 3	+

Table 5.2 continued			
Land rights/PTO (LANDRIT)	Permission granted by government to household (1 = yes, no = 0	Dummy	+
Farm asset (FARMASET)	Available farm implements	Number	+
Soil fertility (SFER)	Fertiliser application by household(1 = yes, no = 0)	Dummy	+
Water Sufficiency (WATSUFC)	Adequate water throughout production (1 = yes, No = 0)	Dummy	+
Climatic conditions (CLIMC)	Effect of weather on production (1= yes, No = 0)	Dummy	-/+
Extension access (EXTACES)	Households access and perception of extension (1 = yes, NO = 0)		+
Market information (MKTINFO)	If market information exist for farm products (1 = yes, No = 0)	Dummy	+
Product variation (PRODVAR)	Actual farm yields and the maximum achievable yield	0 = decreased, 1 = increased, 2 = unchanged	+

Source: Own survey data 2012.

CHAPTER 6

RESULTS OF THE STUDY

6.1 Introduction

This chapter succinctly presents the socio-economic characteristics, farm characteristics and farm income of households in Shiloh and Zanyokwe irrigation schemes. The demographic and farm characteristics of the two schemes are discussed in this chapter.

6.2 Socio-economic characteristics of households in the study area

The number of respondents contained in the 120 households (60 in Zanyokwe and 60 in Shiloh) that were interviewed was 484 (220 in Shiloh and 264 in Zanyokwe). The numbers of females that were interviewed were higher in Shiloh than that of the males (Table 6.1). On the contrary, the number of males interviewed was higher than that of the females in Zanyokwe. There were 63 and 79 respondents that were within the age of 0 – 19 years in Shiloh and Zanyokwe respectively. Seventy nine (35.9%) of respondents were within the age of 20 – 39 years and in Zanyokwe 104 respondents (39.3%) were within the age of 20 – 39 years. In Shiloh, 11.8% (26) of the respondents and 10% in Zanyokwe had no formal education. Majority of the interviewed households passed junior school in Zanyokwe (46.3%) and 45% in Shiloh. Tertiary education appeared to be very low in the two study areas with 1.3% in Shiloh and 0.95 in Zanyokwe.

In Shiloh and Zanyokwe, the percentage of respondents that were employed was alike (3.6% in Shiloh and 3.1% in Zanyokwe). A large number of respondents interviewed were unemployed in both study areas. In Shiloh 30.9% of households interviewed were unemployed while in Zanyokwe the number of unemployed amounted to 71(32.2%). The percentage of house wives accounted for 8.6% and 9.5% in both Shiloh and Zanyokwe respectively. The numbers of pensioners were slightly different in both study areas. Pensioners in Shiloh amounted to 11.8%

and 12.7% in Zanyokwe. Scholars appear to be the highest population in the study areas with 45% in Shiloh and 42.2% in Zanyokwe.

Table 6.1 Socio-economic characteristics of households' members

Household characteristics:	**Shiloh**		**Zanyokwe**	
Gender:	No	%	No	%
Male	108	49.0	158	59.8
Female	112	51.0	106	40.1
Total	**220**	**100**	**264**	**100**
Age in years:				
1 – 19	63	28.6	79	29.9
20 – 39	79	35.9	104	39.3
40 – 59	43	19.5	41	15.5
60 – 79	32	14.5	38	14.3
More than 80	3	1.3	2	0.7
Total	**220**	**100**	**264**	**100**
Education:				
No school	28	12.7	66	25
Primary school	16	7.2	14	6.3
Junior school	99	45	102	46.3
High school	78	35.4	80	36.3
Tertiary	3	1.3	2	0.9
Total	**220**	**100**	**264**	**100**
Employment status:				
Employed	8	3.6	7	2.6
Unemployed	68	30.9	115	43.5
Housewives	19	8.6	21	7.9
Pensioners	26	11.8	28	10.6
Scholars	99	45	93	35.2
Total	**220**	**100**	**264**	**100**

Source: Own field survey 2012

6.2.1 Gender of household head in the study area

The results of the study (Table 6.2) show that the respondents in Shiloh consisted of 41.7% males and 58.3% females. In contrast, 73.3% of the respondents in Zanyokwe were male and 26.7% were female. The number of male plot holders in Zanyokwe was almost twice the number of those in Shiloh smallholder irrigation. On the average, both Shiloh and Zanyokwe had predominantly male plot holders. Male headed households are generally inclined to influence

decision making (Bembridge, 1987). The result of the study further revealed that 43.3% of farmers in both the Shiloh and Zanyokwe irrigation schemes were married. The results further revealed that in Shiloh 3.3% were widowers while the percentage in Zanyokwe was 6.7% (Table 6.2). The divorce rate was 10.5% and 15.0% in Shiloh and Zanyokwe respectively.

6.2.2 Age of household head in the study area

The age of the respondents in both Shiloh and Zanyokwe smallholder irrigation schemes ranged from 44 to 71 years. The number of youths with plots in the scheme was not very encouraging. Only 1.7% of the population sampled was 44years old. The mean age of respondents was 55.7 (Table 6.2). Agricultural production in the area is in the hands of old men and women who are not economically active while the able-bodied youths often migrate to urban cities in search of white collar jobs.

Table 6.2 Socio-economic characteristics of household head in the study area

Irrigation scheme	Shiloh (N=60)		Zanyokwe (N=60)	
Household characteristics	**Number**	**%**	**Number**	**%**
Gender:				
Male	25	41.7	44	73.3
Female	35	58.3	16	26.7
Total	60	100	60	100
Average age	60	55.7	60	55.7
Marital status:				
Married	26	43.3	26	43.3
Single	17	28.3	17	28.3
Widow	9	15.0	4	6.7
Widower	2	3.3	4	6.7
Divorcee	6	10.0	9	15.0
Total	60	100	60	100
Education level:				
No school	13	21.7	9	15.0
Primary school	14	23.3	14	23.3
Junior school	20	33.3	22	36.7
High school	10	16.7	13	21.7
Tertiary	3	5.0	2	3.3
Total	60	100	60	100
Employment status:				
Yes	5	8.3	3	5.0
No	55	91.7	57	95.0
Total	**60**	**100**	**60**	**100**

Source: Own field survey 2012

6.2.3 Education level of household head in the study area

The level of education was investigated in the study and the results revealed that there were more farmers with junior school education in the Shiloh and Zanyokwe schemes than any other educational level; with 33.3% and 36.7% respectively. Sixteen percent of farmers in Shiloh had high school training and 21.7% in Zanyokwe. The percentage of farmers who had no formal education in Shiloh was 21.7% while in Zanyokwe it was 15.0% (Table 6.2). The percentages of

farmers with a tertiary education in both schemes were close. In Shiloh, it was 5.0% while in Zanyokwe it was 3.3%.

6.2.4 Farm experience of house head in the study area

The farm experience of respondents was investigated and responses show 1.7% of the of total number of respondents in Shiloh had a minimum farm experience of five years while in Zanyokwe, 2.5% of the respondents had five years farm experience (Table 6.3).

Table 6.3 Farm experience of household head

Farm experience in years	Shiloh scheme		Zanyokwe scheme	
	No	(%)	No	(%)
5	2	3.4	3	5
6	1	1.6	2	3.4
7	3	5	2	3.4
8	3	5	2	3.4
9	6	10	6	10
10	5	8.4	4	6.6
11	7	11.6	9	15
12	6	10	6	10
13	5	8.4	5	8.4
14	4	6.6	4	6.6
15	4	6.6	5	8.4
16	6	10	5	8.4
17	4	6.6	5	6.6
18	2	3.4	4	1.6
19	1	1.6	1	1.6
20	1	1.6	1	1.6
Total	**60**	**100**	**60**	**100**

Source: Own field survey 2012

In Shiloh 4.2% of the respondents had 10 years farm experience while in the Zanyokwe smallholder irrigation scheme, 3.3% had the same length of experience. The longest farm experience was 20 years with 0.8% of farmers in both schemes. However, the majority of respondents had farm experience ranging from nine years to 17 years on the average. In farming, the length of experience has implication for the decision making of households, as the length of experience is related to the ability to make improved quality decisions. Farmers with

considerable experience are likely to access better information and apply it to the contemporary issues of decision making (Polson and Spencer, 1992).

6.2.5 Employment of household heads

Most of the households interviewed were entirely dependent on their plot holding for crop and livestock production. In Shiloh, 45.83% of the respondents were not in paid employment and 47.50% in Zanyokwe. The number of unemployed respondents in both Shiloh and Zanyokwe was not significantly different. In Shiloh 4.17% of the respondents were employed while 2.50% were employed in Zanyokwe (Figure 6.1). However, off-farm activities such as running Spaza shops, hawking, and engaging in menial jobs thrive well in the two study areas.

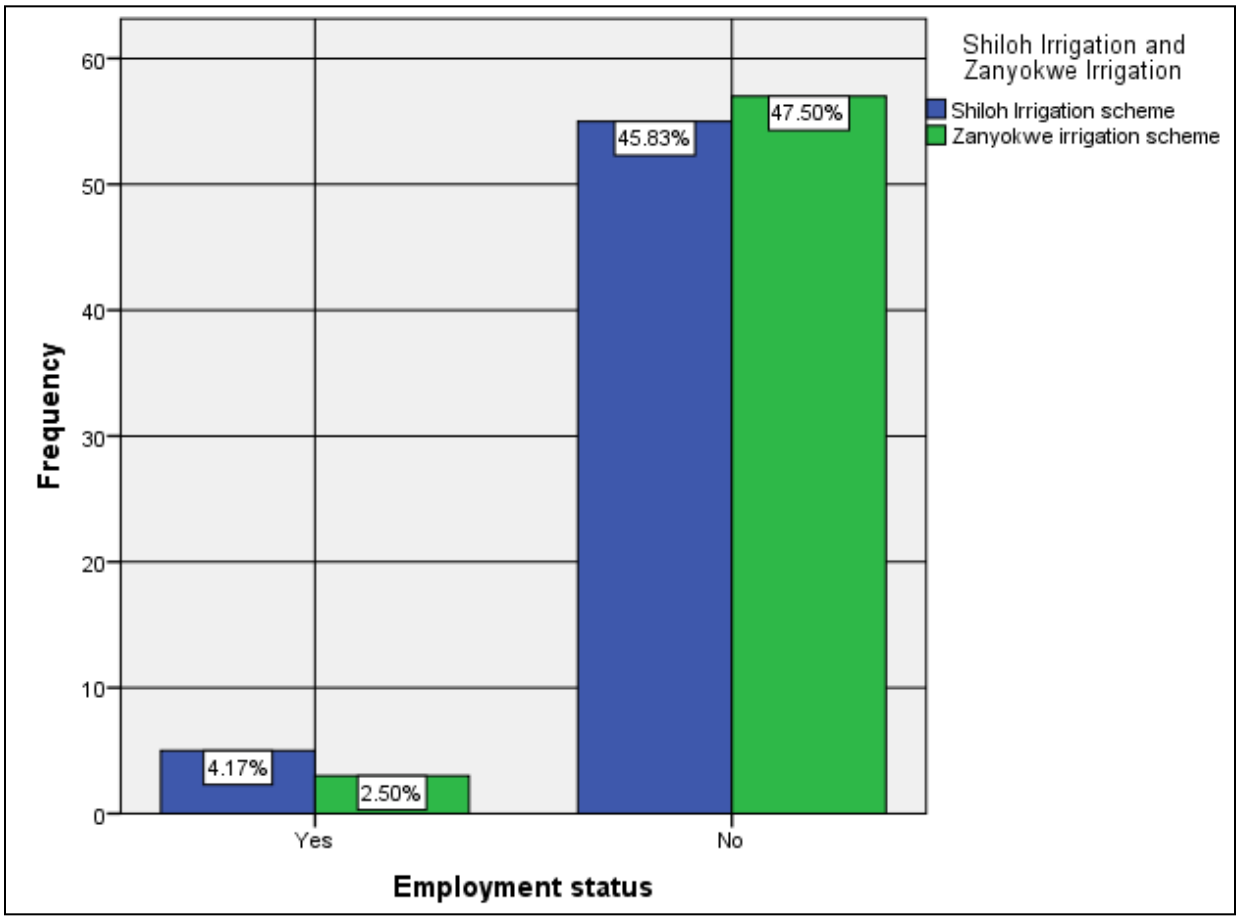

Figure 6.1 Distribution of employment of household heads.

Source: Field survey 2012

6.2.6 Time spent at home by household head

The time spent at home by household was investigated for both Shiloh and Zanyokwe households (Figure 6.2). The results show that about 40% of the respondents in Shiloh and 32% of those in Zanyokwe were rarely present at home. The percentages of households often present at home were the same for both Shiloh and Zanyokwe (Figure 6.2). Most respondents are engaged in farm activities during the day and therefore, spend little time at home.

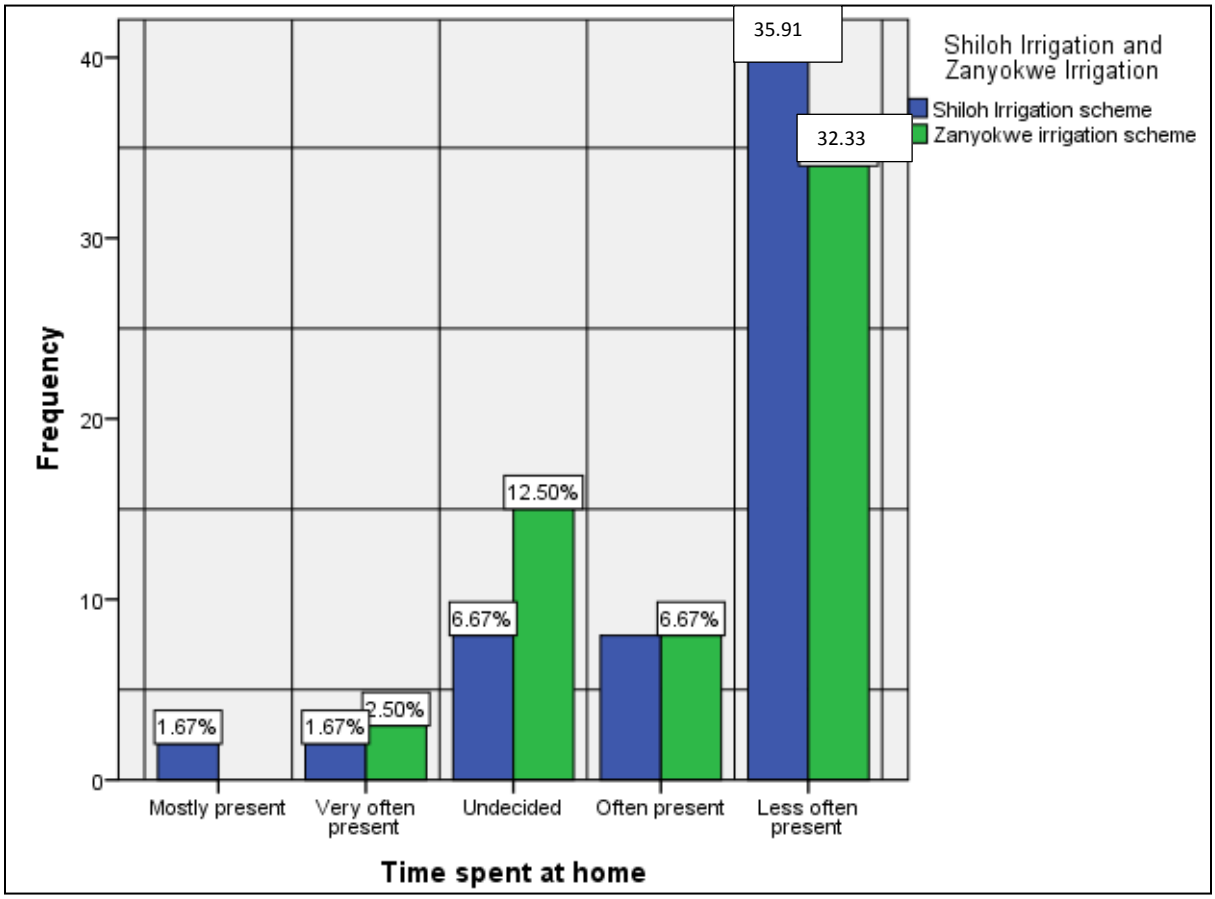

Figure 6.2 Distribution of households by time spent at home

Source: Field survey 2012

6.2.7 Household size in the study areas

The number of people living with the head of household in both Shiloh and Zanyokwe schemes is shown in Table 6.4. However, 120 farmers represent the household size used in the study. In

both schemes, the numbers of people living with household head who assist with farming were between 3 and 9 and 2 and 9 respectively. In Shiloh, 7 households interviewed maintained that only 4 person assists with farm labour, while in Zanyokwe 6 households maintained that only 2 assist with farm labour. Most households insist that dependants or relatives living with them were youths who prefer off-farm activities to farming.

Table 6.4 Distribution of households by size and number that assist with farm labour

Shiloh: Number of households	Number of family members involved in farming	Zanyokwe: Number of household	Number of family members involved in farming
7	4	6	2
8	5	8	5
9	3	10	6
10	6	11	7
12	9	12	8
14	8	13	9
60	**35**	**60**	**37**

Source: Field survey 2012

Although the number of persons living with households included able bodied adults of working age, they seldom assisted with farm labour. In the Zanyokwe irrigation scheme, 14 of the household interviewed agreed that only 8 persons living with them assisted with farm labour while in Shiloh, 13 of the households interviewed agreed that only 9 assisted with farm labour (Figure 6.3). The number of people in a household, who assist with farm labour in Shiloh and Zanyokwe, were very low. However, most dependants living in households in the communities were youths who are either not usually at home or interested in agricultural activities. Most households depended on hired labour during the time of planting and harvesting. Higher household size is justified in terms of provision of labour capacity for farming purposes (Hayes *et al,* 1997). On the contrary, larger household size tends to mount pressure on household consumption and other expenses than the purported labour it provides to farming (Paddy, 2003).

6. 3 External sources of household income

6.3.1 Salary and wages of household 2011/2012

Household income in the form of salary and wages was relatively low in both schemes. In Shiloh 46% of the respondents earned less than R500 as a salary or as wages while in Zanyokwe 3.33% of the respondents earned less than R500 as a salary or as wages. In Shiloh, 3.33% of the respondents earned between R5000 and R10 000. Most of these respondents were casual workers at the scheme and also had plots which were on sharecropping with their relatives. Comparatively, Zanyokwe respondents earned better salaries than respondents from Shiloh. A good number of people in these areas are unemployed thus salaries and wages do not contribute significantly to household income.

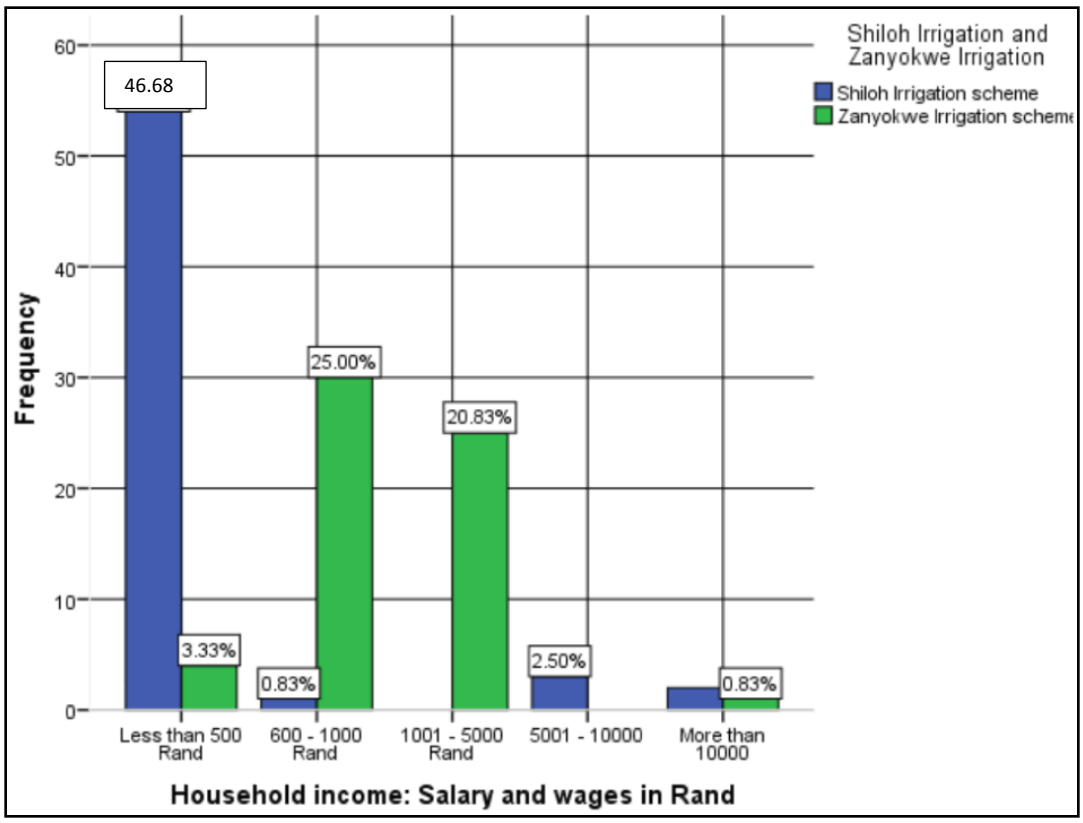

Figure 6.3 Distribution of household income with respect to salary and wages. Source: Field survey 2012

In Shiloh 0.8% of households earned between R600 – R1000 as salaries and wages while in Zanyokwe 25.00% of the respondents were in the same range of earnings. In comparison, households in Shiloh generated more income for their household than those in Zanyokwe (Figure 6.3). Finally, 0.8% of households in both schemes earned more than 1000 Rand.

6.3.2 Old age Pensions of households

Household income from pensions was investigated in both Shiloh and Zanyokwe. The number of pensioners in both schemes was low. There was no significant difference between households

that were on pension in Shiloh and Zanyokwe. The average overalls of 43.33% of respondents in Shiloh and 41.67% in Shiloh were not on pension (Figure 6.4).

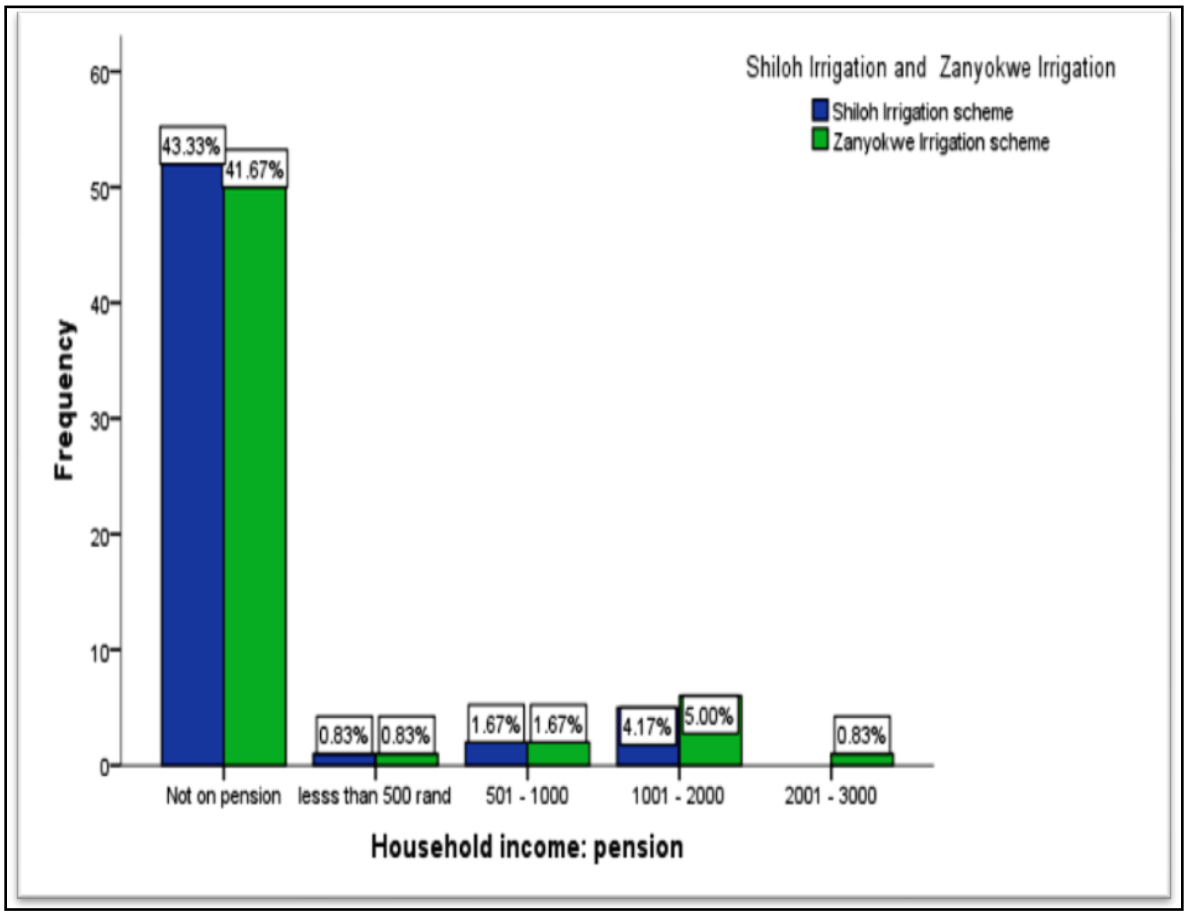

Figure 6.4 Distribution of households' income with respect to pension earned in the study areas. Source: Field survey 2012

Most of the respondents were not on pension or retirement. In Shiloh and Zanyokwe, overall average of 4.17% and 5.00% of respondents receives pension of between R501 and R1000 per month. However, 0.83% of pensioners earned between R2001 and R3000 in both Shiloh and Zanyokwe (Figure 6.4). The sum average of respondents reveals that households in both schemes do not generate enough income from pension.

6.3.3 Households' grant

Table 6.5 shows the percentage of household income realised from social grants. About 56.6% of the respondents in Shiloh received social grants ranging from R100 – R200 while in Zanyokwe 48.3% of the respondents also received social grants of between R100 and R200 to augment household income. However, there was no much difference in the percentage of households that received social grants of between R201 and R300 in Shiloh and Zanyokwe (Table 6.4). In Shiloh, 1.66% of households received social grants of between R401 and R500 per month while in Zanyokwe, 3.3% also received social grants of R401 – R500. Social grants have been a regular external source of income for almost all households in the study area. Households receive social grants, which are paid out on monthly basis from government. The beneficiaries of these social grants include old people, the disabled and less privileged children of not more than 18 years of age.

Table 6.5 Distribution of household income with respect to grants

Irrigation scheme (Rand)	**Shiloh (N=60)**		**Zanyokwe (N=60)**	
Rand	No	%	No	%
100 – 200	34	56.66	29	48.33
201 – 300	20	33.34	20	33.33
301 – 400	5	8.34	9	15.0
401 – 500	1	1.66	2	3.34
Total	**60**	**100**	**60**	**100**

Source : Field survey 2012

6.3.4 Remittance in kind to households in the study areas

Household incomes in the form of remittance in kind were mostly received from relations in the urban centres. Respondents asserted that these remittances are often not regular from relations in the urban centres. Households that have children left in their care by parents working in urban centres receive regular remittances in the form food items. However, 10.83% and 6.7% of households in Shiloh and Zanyokwe received remittance in kind worth less than R100 per month

respectively (Figure 6.5). In Shiloh 19.17% of household received between R101 and R200 per month worth in kind remittance while in Zanyokwe 20.83% receives remittance in the same range per month. There were no difference between the percentages of remittances of between R201 and R300 received by household in both schemes. However, in Shiloh and Zanyokwe, 0.83% and 2.50% of households received remittances in kind that was greater than R400 per month respectively. Comparatively, remittances received by households in the form of cash or kind from relations in urban centres are low and this may be attributed to the high cost of living in urban areas.

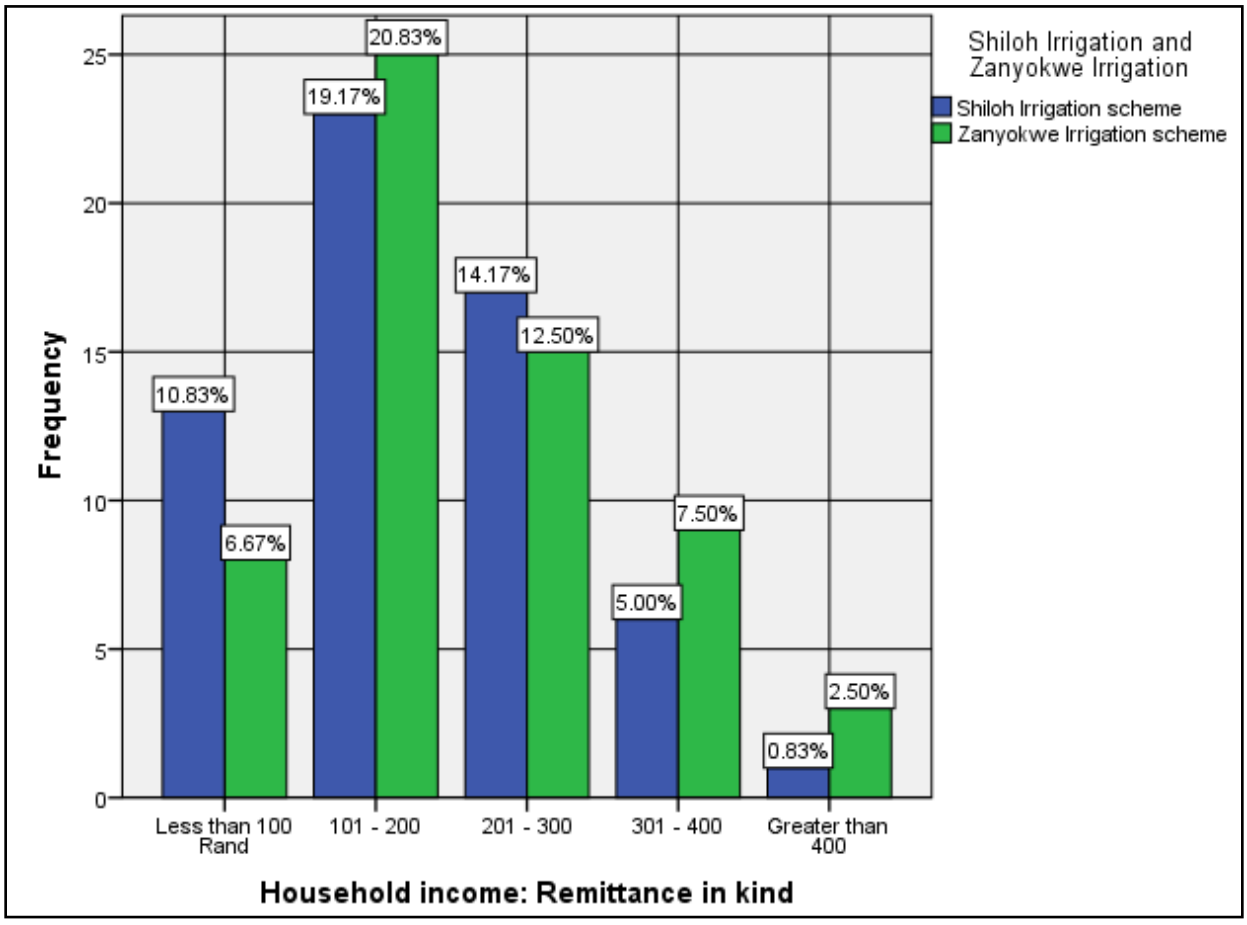

Figure 6. 5 Distribution of household income with respect to remittance in kind

Source: Field survey 2012

6.3.5 Remittance in cash

Table 6.6 shows the percentage of cash remittance to households. This came mainly from relatives living in urban centres. The results reveal that 11.6% of the respondents received remittance in cash of less than R100 per month in Shiloh and 3.3% in Zanyokwe. In Shiloh, 45% of households received between R101 and R200 while in Zanyokwe 43.3% households are within the same range were. Comparatively, the highest recipients of cash remittances of more than R400 per month were recorded in Zanyokwe with 13.3% while 6.6% of households in Shiloh received cash remittance of more than R400 (Table 6.6).

Table 6.6 Distribution of households by remittance in cash

Irrigation scheme		**Shiloh (N=60)**	**Zanyokwe (N=60)**	
Rand	No	%	No	%
≤ 100	7	11.6	2	3.3
101 – 200	27	45	26	43.3
201 – 300	16	26.6	18	30
301 – 400	6	10	6	10
≥ 400	4	6.6	8	13.3
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

6.4 Internal sources of household income of households (Non-agricultural activities)

Table 6.7 shows the various non-agricultural activities undertaken by households in the study area. In Shiloh, 16.6% of households owned Spaza shops, which contributed R300 to 400 as cash income per month. In Zanyokwe, only 20% of the total respondents owned Spaza shops, which also contributed a cash income of R300 to 400. Hawking and sale of liquor were other off-farm activities that contribute to household cash income. In Shiloh and Zanyokwe, 60.0% and 55% undertake hawking, an activities which contributed between R100 and 300 per month to the cash income of households respectively. Liquor sales also contributed to household cash income. There were few liquor sales outlets in the study

area. Liquor sales contributed between R100 and 200 per month to cash income of 23.3% of the households in Shiloh. However, in Zanyokwe the situation was a little different as only 25% of households sold liquor and the contribution of liquor sales to household cash income was also between R100 and 200 per month (Table 6.7).

Table 6.7 Distribution of internal sources of income (Non-agricultural activities)

Irrigation scheme		**Shiloh**		**Zanyokwe**	
Internal sources:	**(R)**	**No**	**%**	**No**	**%**
Spaza shop:	300 – 400	10	16.6	12	20
Hawking:	100 – 300	36	60	33	55
Liquor:	100 – 200	14	23.3	15	25
Total		**60**	**100**	**60**	**100**

Source field survey 2012

6.5 Farm size

The sizes of farm land cultivated in both irrigation schemes are presented in Table 6.8. Farm size is the area of farm land or plots of land under irrigation and owned by the household. This is measured in hectares. In the Shiloh irrigation scheme, most beneficiaries are food plot holders with 98.4% of farmers accessing less than 1ha of land for crop and livestock production. In most instances, the majority of farmers in Shiloh have either rented out their farm land to the dairy project located in the scheme or converted it to grazing camps. The fragmentation of irrigated land has negative implications for production decision making and farm mechanization. In Zanyokwe, 31.6% of beneficiaries in the scheme have a plot size of between the range of 3 and 6

ha (Table 6.8). Overall, respondents in both schemes asserted that the total land under irrigation in Shiloh (450 hectares) and Zanyokwe (412hectares) is owned by the community.

Table 6.8 Distribution of household by farm size

Irrigation scheme	Shiloh (N=60)		Zanyokwe (N=60)	
Size of farm land in hectares	**No**	**%**	**No**	**%**
≤ 1 ha	59	98.4	2	3.4
1 – 2 ha	_	_	15	25.0
3-4 ha	1	1.6	19	31.6
5 – 6 ha	_	_	19	31.6
≥ 6 ha	_	_	5	8.4
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

6.5.1 Location of farm land to the nearest access road in the study areas

The distance between irrigated plots of land and an access road influences labour availability and the supply of farm inputs. Farmers who are closer to the scheme have an advantage of getting to the farm early without having to walk long distances. In situations where irrigated farm land is far from the nearest access road, the likelihood of farmers incurring the cost of transportation increases, which will in turn overlap with an increase in the overall cost of production. In Shiloh, 23.33% (Figure 6.6) of the respondents observed that the nearest access road to the scheme was 2 kilometres

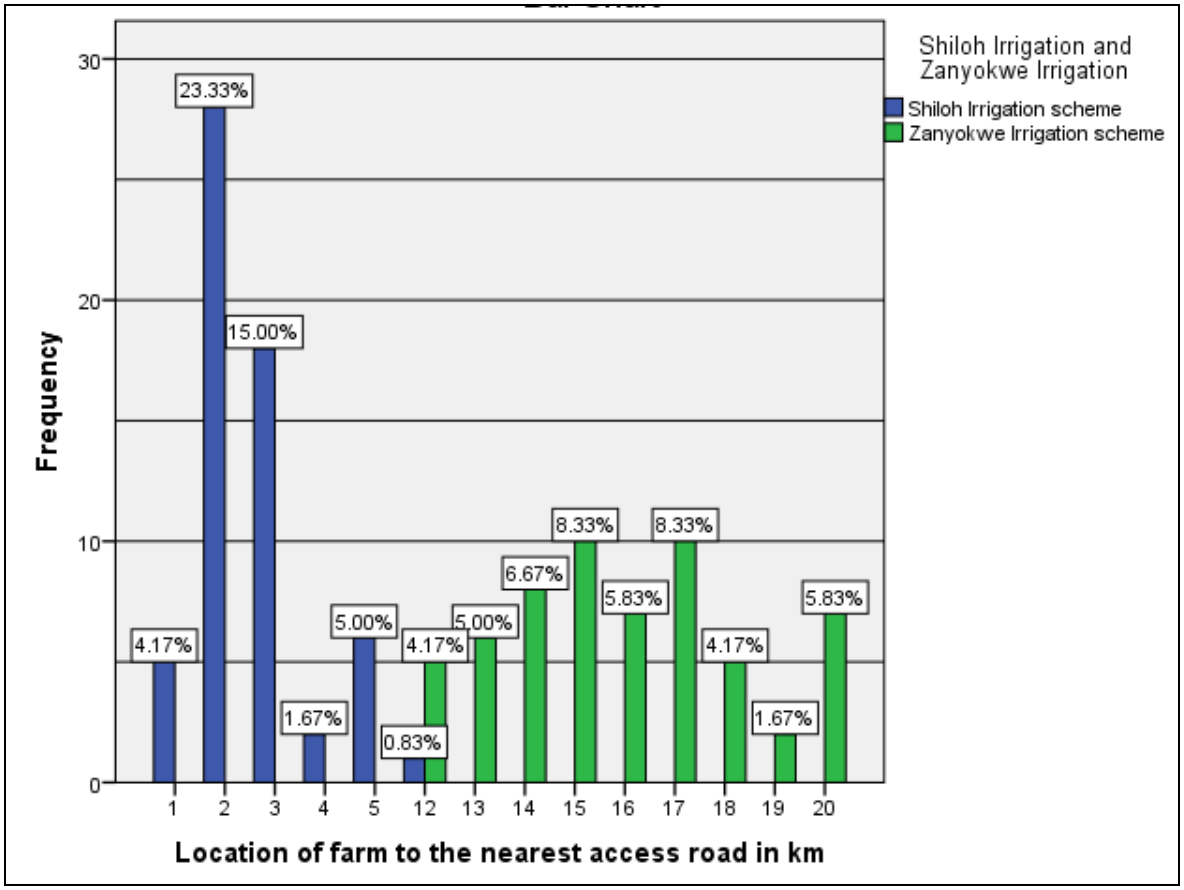

Figure 6.6 Distribution of respondents' location with respect of farm land to the nearest access road

Source: field survey 2012

In Zanyokwe, 8.33% of the respondents remarked that the location of the scheme to the nearest access road was 17 kilometres (Figure 6.6). However, distances in kilometres differed from one farmer to the other because the scheme, especially in Zanyokwe, serves at least 5 villages.

6.5.2 Location of farm to the nearest town in the study areas

Figure 6.7 illustrates the distance of the schemes to the nearest town. The overall distance from a farm to the nearest town was 35 kilometres in Shiloh and 46 kilometres in Zanyokwe (Figure 6.7). The distance phenomenon is particularly important in the marketing of farm produce and the supply of farm inputs. Low agricultural production exacerbated by distance to market and

inefficient marketing systems affect farmer's decision making. There was a total absence of organised marketing systems in both the Shiloh and Zanyokwe irrigation schemes, thus distance from farm to the nearest market remains a barrier to the farming household. The incidence of farm produce getting spoilt was experienced in both schemes. Most perishable vegetables, such as spinach, cabbage and carrots need to be transported to the market in good time. The majority of farmers sold their produce at farm gate to hawkers mainly because of the distance to the nearest town where a market exists.

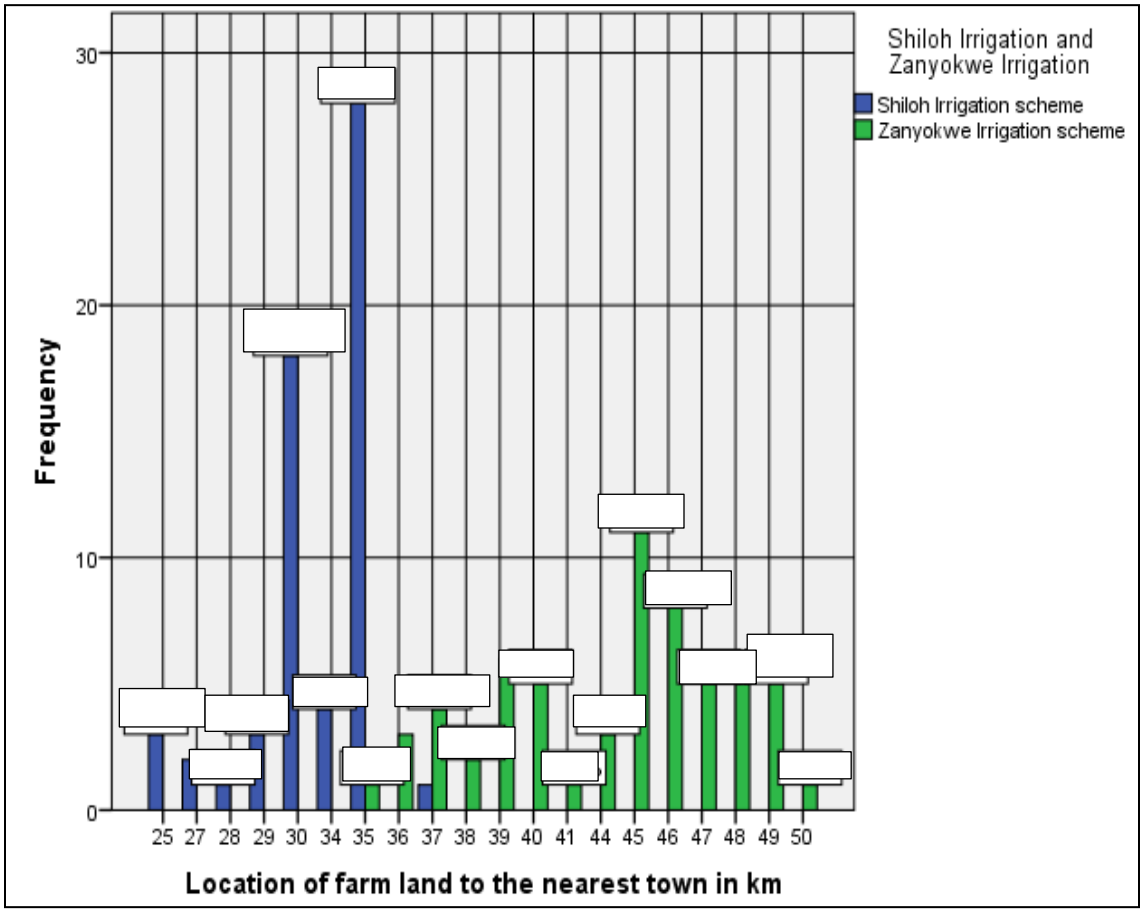

Figure 6.7 Distribution of farm land with respect to the nearest town in Km.

Source: Field survey 2012

6.6 Production and distribution of livestock in the study areas

Table 6.9 shows the number of livestock reared in the study area. In Shiloh, the respondents rear as many as 705 cattle, 692 sheep, 485 pigs and 75 donkeys. While in Zanyokwe, 712 Cattle, 728 sheep, 689 goats, 525 pigs and 74 donkeys were reared by households in the study area (Table 6.9). The keeping of these animals not only supplemented household income but it also assisted in the provision of support during lean periods and periods of adversity such as crop failure. Households often engaged in distress sales of small stock such as goats and sheep to meet immediate family cash needs. However, increased investment and ownership of livestock increased the potential for further investment and improved decision making of households.

Table 6.9 Distribution of livestock in the study area

Livestock type	Shiloh (N=60)	Zanyokwe (N=60)	Total
Cattle	705	712	1417
Sheep	692	728	1420
Goats	675	689	1368
Pigs	485	525	1010
Donkey	75	74	149

Source: Field survey 2012

6.6.1 Income earned from livestock in 2012/2013

Earnings from livestock sale contribute significantly to household income in the study area. In Shiloh, 66.6% of the respondents earned more than R4000 from the sales of cattle in 2012/2013 while in Zanyokwe 80% of the respondents earned more than R4000 from the sales of cattle during the same period (Table 6.10). Sheep, goats and pigs also contribute to the households' income. Overall, 15% of respondents in Shiloh and 80% in Zanyokwe earned an income of between R3001 and R4000 from sales of sheep in 2012/2013 respectively. Income earned from pigs and donkeys also contributes minimally to household income. Donkeys were only sold when households were in dire need for income while pigs were often sold for quick income.

However, 10% of respondents in Shiloh and 31.7% in Zanyokwe asserted that pig rearing contributed between of R3001 – R4000 in the last two years (Table 6.10).

Table 6.10 Distribution of income earned from livestock in 2012/2013

Livestock type:	**Shiloh (N=60)**		**Zanyokwe (N=60)**	
Income in Rand (R)	**Frequency**	**%**	**Frequency**	**%**
Cattle (R):				
2001- 3000	1	1.7	_	_
3001- 4000	19	31.7	12	20.0
≥ 4000	40	66.6	48	80.0
Total	**60**	**100**	**60**	**100**
Sheep (R):				
1001- 2000	20	33.3	_	_
2001- 3000	28	46.7	_	_
3001- 4000	9	15.0	48	80.0
≥R4000	3	5.0	12	20.0
Total	**60**	**100**	**60**	**100**
Goat (R):				
≤ 1000	13	21.7	_	_
1001- 2000	17	28.3	_	_
2001- 3000	28	46.7	12	20.0
3001- 4000	2	3.3	48	80.0
Total	**60**	**100**	**60**	**100**
Pig(R):				
≤ 1000	11	18.3	_	_
1001- 2000	28	46.7	_	_
2001- 3000	15	25.0	1	1.7
3001 – 4000	6	10.0	19	31.7
≥ 4000	_	_	40	66.7
Total	**60**	**100**	**60**	**100**
Donkey(R):				
≤1000	**54**	**90.0**	**54**	**90.0**
1001 – 2000	**6**	**10.0**	**6**	**10.0**
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

Generally, small and large stocks were sold to purchase food for households and the payment of school/ tuition fees and other household requirements.

6.6.2 Livestock consumed by households in 2012/2013

Livestock consumption in the study area was investigated and findings revealed that 4 cattle in Shiloh and 3 in Zanyokwe were consumed in 2012/2013 (Table 6.11). The total consumption of small stocks (sheep, goats and pigs) was higher in both Shiloh and Zanyokwe. In Shiloh, an total of 8 sheep and 3 goats were consumed in contrast to 11 sheep and 2 for goats in Zanyokwe. The consumption of small stocks was more pronounced during festivals and ceremonies. However, goats were mostly used during the initiation (circumcision) season, usually, in the month of December. Pigs' consumption amounted to 10 in Shiloh and 6 in Zanyokwe.

Table 6.11 Distribution of livestock with respect to number consumed by household in 2012/2013

	Shiloh		Zanyokwe	
Livestock	**Available**	**Num. Consumed**	**Available**	**Num. Consumed**
Cattle	63	4	81	3
Sheep	152	8	154	11
Goats	83	3	100	2
Pigs	97	10	119	6

Source: field survey 2012

6.7 Quantity of crops produced by households in 2012/2013 in the study areas

The average output of crops in Shiloh and Zanyokwe is shown in Table 6.12. In Shiloh, 96.7% of households produced less than one ton of maize from the irrigated plots of land under cultivation while in Zanyokwe 38.3% of household also produced less than one ton of maize from the irrigated plots of land. About twenty six percent of the households produced an average of 3 – 4 tons of cabbage in Shiloh and 41.7% households also produced an average of 3 – 4 tons in Zanyokwe in 2012/2013 production period. The yield from carrot was less than one ton for twenty six households (46.7%) and eleven (18.3%) in Shiloh and Zanyokwe respectively (Table 6.12). In Shiloh, 40% of households produced between 3 – 4 tons of spinach and 46.7% of households produced 3 to 4 tons in Zanyokwe. Beetroot production in both schemes was 3 to 4

tons for sixteen (26.7%) household in Shiloh and twenty four (40%) households in Zanyokwe also recorded a yield of 3 to 4 tons. In Shiloh and Zanyokwe, the potato yield was less than one ton for 21.7% household and 8.3% household respectively. Overall, there was low cropping intensity in both the Shiloh and Zanyokwe irrigation schemes, which resulted in low output. Crop production in Shiloh is minimal as the majority of the plot holders rented out their allocated plots to the dairy project situated close to the scheme. There are low outputs of almost all crops cultivated in both schemes for the last two years. In Zanyokwe, some of the plot holders were old and could not fully cultivate their entire irrigated plots of land. However, respondents also complained that the late arrival of farm inputs as well as the infrastructural defects exacerbated by inadequate maintenance contributed to the low yields in both schemes.

Table 6.12 Distribution of the quantity of crops produced by households in 2012/2013 in the study areas

Quantity of crops	Shiloh (N=60)		Zanyokwe (N=60)	
(tons)	**Frequency**	**%**	**Frequency**	**%**
Maize:				
≤ 1ton	58	96.7	23	38.3
1 – 2	2	3.3	25	41.7
3 – 4	_	_	12	20.0
Cabbage:				
≤ 1	15	25.0	2	3.3
1 – 2	26	43.3	21	35.0
3 – 4	16	26.7	25	41.7
5 – 6	21	35.0	12	20.0
Carrot:				
≤ 1	28	46.7	11	18.3
1 – 2 t	21	35.0	30	50.0
3 – 4 to	11	18.3	19	31.7
Spinach:				
≤ 1	5	8.3	2	3.3

Table 6: 12 cont.				
1 – 2	22	36.7	11	18.3
3 – 4	24	40.0	28	46.7
5 – 6	9	15.0	19	31.7
Beetroot:				
≤ 1	12	20.0	1	1.7
1 – 2	22	36.7	17	28.3
3 – 4	16	26.7	24	40.0
5 – 6	8	13.3	16	26.7
≥ 6	2	3.3	16	26.7
Potatoes:				
≤ 1	13	21.7	5	8.3
1 – 2	30	50.0	27	45.0
3- 4	17	28.3	27	45.0
5 – 6	_	_	1	1.7

Source: Field survey 2012

6.7.1 Quantity of crops consumed in 2012/2013

The consumption of crop produce was investigated and results revealed that 86.6% of respondents in Shiloh and 48.4% of respondents in Zanyokwe consumed less than one ton of maize. Farmers who consumed between 1 and 2 tons of total maize produced for the two years were 13.4% and 56.6% in Shiloh and Zanyokwe respectively. Cabbage consumption was a little higher than maize in both schemes. Fourteen percent of the respondents consumed a total of 1 to 2 tons from the average tonnage of cabbage produced in Shiloh and while that of Zanyokwe was 45% of respondents (Table 6.13). In Shiloh and Zanyokwe, the percentage of farmers who consumed 1 to 2 tons of carrot was 45% and 55% respectively. The respondents (58.4%) in Shiloh and (35%) in Zanyokwe consumed less than 1 ton of spinach. In Shiloh, results revealed that 85% of the respondents consumed less than 1 ton of beetroot and 83.4% of respondents in Zanyokwe. The percentage of farmers that consumed between 1 and 2 tons of potatoes in Shiloh and Zanyokwe were 47.2% and 33.6% respectively (Table 6.13). Farming in both schemes has been on the subsistence level and almost all farm produce was consumed at home.

Table 6.13 Distribution of household by quantity of crops consumed in 2012/2013

Quantity of crops consumed	Shiloh(N=60)		Zanyokwe (N=60)	
Quantity in tons	**Frequency**	**%**	**Frequency**	**%**
Maize:				
≤ 1 ton	52	86.6	29	48.4
1 – 2 tons	8	13.4	31	56.6
Cabbage:				
≤ 1 ton	35	58.4	27	45
1 – 2 tons	17	14.2	27	45
3 – 4 tons	8	13.4	6	10
Carrot:				
≤ 1 ton	27	45	21	35
1 – 2 tons	27	45	33	55
3 – 4 tons	6	10	6	5.0
Spinach:				
≤ 1 ton	35	58.4	25	41.6
1 – 2 tons	25	41.1	35	58.4
Beetroot:				
≤ 1 ton	51	85	50	83.4
1 – 2tons	9	15	10	16.6
Potatoes:				
≤ 1 ton	46	77.4	39	65.6
1 – 2 tons	14	47.2	20	33.6

Source: Field survey 2012

6.7.2 Quantity of crops sold by household in the year 2012/2013

Table 6.14 shows the quantity of crops sold by Shiloh and Zanyokwe households. In Shiloh, 98.4 % of respondents sold less than one ton of maize while in Zanyokwe 70% of respondents sold less than one ton of maize for the last two years. Overall, the percentage of Shiloh and Zanyokwe households that sold between 1 and 2 tons of maize was 1.6% and 30% respectively. About 28.3% of household in Shiloh sold between 1 and 2 tons of cabbage while in Zanyokwe 49% of respondents sold between 1 and 2 tons for the last two years (Table 6.14). The percentage of households that sold between 1 and 2 tons of carrots were 16.6% for Shiloh, and 23.4% for

Zanyokwe while the sales of spinach between 1 and 2 tons were 51.6% of households for Shiloh and 63.8% of households for Zanyokwe. Households (55%) in Shiloh sold less than 1 - 2 tons of beetroot and households (48.4%) in Zanyokwe sold less than one ton of beetroot in the 2012/2013. In Shiloh, 100% of respondents sold less than one ton of potatoes while in Zanyokwe 60% of households sold less than one ton of potatoes for the last two years. However, farmers only sell their surplus farm produce when they experience a bumper harvest in any production season. The sale of such surplus farm produce often increases household income and food security.

Table 6.14 Distribution of households by quantity of crops sold in 2012/2013

Quantity of crops sold	**Shiloh(N=60)**		**Zanyokwe (N=60)**	
Quantity in tons	**Frequency**	**%**	**Frequency**	**%**
Maize:				
≤ 1 ton	59	98.4	42	70
1 – 2 tons	1	1.6	18	30
Cabbage:				
≤ 1 ton	43	71.6	30	51
1 – 2 tons	17	28.3	30	49
Carrot:				
≤ 1 ton	50	83.4	46	76.6
1 – 2 tons	10	16.6	14	23.4
Spinach:				
≤ 1 ton	29	48.3	19	31.6
1 – 2 tons	31	51.6	41	68.3
Beetroot:				
≤ 1 ton	33	55	29	48.4
1 – 2tons	19	31.6	22	36.6
3 – 4tons	7	11.6	8	13.4
5 – 6tons	1	1.6	1	1.6
Potatoes:				
≤ 1 ton	60	100	36	60
1 – 2 tons	_	_	24	40

Source: Field survey 2012

6.8 Income earned from crops in 2012/2013

The income realised from crops in 2012/2013 is shown in table 6.15. In Shiloh, 50% of the respondents earned between R500 and R1000 from maize production while in Zanyokwe, 45% of the household earned between R500 and R1000 from the maize crop. The percentage of households that earned between R2500 and R3000 in Shiloh and Zanyokwe were 3.3% and 15% respectively. The income earned from cabbage in the last two years by households was between R1500 and R2000 for Shiloh (35.5%) and for Zanyokwe 50.0%). Income of R500 and R1000 was realised by 33.3% of households from the production of carrot in Shiloh while in Zanyokwe 46.7%, also received income of between R1500 and R2000 from the production of carrots in the last two years. In Shiloh, 30.0% of the respondents earned between R1500 and R2000 from the production of spinach while 31.7% of households in Zanyokwe had an average earnings of between R1500 and R2000 for the last two years of production. Forty five percent of households in Shiloh earned between R500 and R1000 from the production of butternut while in Zanyokwe, 50% of household earned between R500 and R1000 from butternut production in the last two years.

In Shiloh, 23.0% of households had earnings of between R1500 and R2000 from the production of beetroot while in Zanyokwe, 35.0 % of respondents received an income of between R1500 and R2000 from beetroot. The incomes from potato production were between R1500 and R2000 for 25.0% of households in Shiloh while 48.3% of households in Zanyokwe had an income of between R1500 and R2000 from the production of potatoes. However, there was low farmer performance levels in terms of income earned from crop production in both schemes. The low income achievement levels from both the Shiloh and Zanyokwe irrigation schemes were

attributed to poor tillage services, the late arrival of farm inputs and the dilapidated irrigation infrastructure.

Table 6.15 Distribution of households by income from crops in 2012/2013

Crops:	**Shiloh (N=60)**		**Zanyokwe (N=60)**	
Income in Rand (R)	**Frequency**	**%**	**Frequency**	**%**
Maize (R):				
≤ R500	11	18.3	5	8.3
R500 – R1000	30	50.0	27	45.0
R1500 – R2000	17	28.3	19	31.7
R2500 – R3000	2	3.3	9	15.0
Total	**60**	**100**	**60**	**100**
Cabbage (R):				
≤ R500	12	20.0	_	_
R500 – R1000	18	30.0	18	30.0
R1500 – R2000	21	35.0	30	50.0
R2500 – R3000	9	15	12	20.0
Total	**60**	**100**	**60**	**100**
Carrot (R):				
≤ R500	8	13.3	2	3.3
R500 – R1000	24	40.0	22	36.7
R1500 – R2000	20	33.3	28	46.7
R2500 – R3000	7	11.7	7	11.7
≥ R3000	1	1.7	1	1.7
Total	**60**	**100**	**60**	**100**
Spinach (R):				
≤ 500	20	33.3	20	33.3
R500 – 1000	21	35.0	20	33.3
R1500 – 2000	18	30.0	19	31.7
R2500 – 3000	1	1.7	1	1.7
Total	**60**	**100**	**60**	**100**
Butternut (R):				
≤ R500	15	25.0	12	20.0
R500 – 1000	27	45.0	30	50.0
R1500 – R2000	17	28.3	17	28.3
R2500 – 3000	1	1.7	1	1.7
Total	**60**	**100**	**60**	**100**
Beetroot (R):				
≤ R500	15	25.0	8	13.3
R500 – R1000	27	45.0	25	41.7
R1500 – 2000	14	23.0	21	35.0
R2500 – R3000	4	6.7	6	10.0
Total	**60**	**100**	**60**	**100**

Table 6.15 cont.

Potatoes (R):				
≤ 500	20	33.3	12	20.0
R500 – 1000	22	36.7	15	25.0
R1500 – R2000	15	25.0	29	48.3
R2500 – 3000	3	5.0	4	6.7
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

6.9 Farm assets available in the study area

The quantity of available farm assets in Shiloh and Zanyokwe is shown in Table 6. 16. In Shiloh and Zanyokwe, the available assets were either owned by the scheme or privately owned by the farmers. The simple farm assets which farmers could afford were the most common implements. These included the hoe, shovel, spade, watering can and knapsack sprayer. Sophisticated farm implements such as farm machines and tractor mounted implements were owned by the government but were kept under the control of the Schemes' management. The Zanyokwe Scheme had more farm assets compared than the Shiloh scheme. At the time of this report, respondents revealed that only 2 tractors from the 5 tractors available for use in Zanyokwe were in good working condition. In Shiloh the situation is also similar as only 2 of the available 3 tractors were in good working condition.. In Zanyokwe, 2 of the produce vehicles (trucks) were donated to the scheme by the Sector Education and Training Authority (SETA). In both schemes, the respondents raised serious concerns on the dearth farm assets, which have hampered their performances in the schemes. Farm assets are necessary to facilitate investments, as they can be used as collateral. Farm assets also determine the level of farm income and capital formation. The condition, quality and quantity of farm assets influence the type of investment that farmers can engage in (HLPE, 2013). The availability of farm assets definitely increases the smallholder farmers' potential to invest and enhances their food security status.

Table 6.16 Distribution of farm asset

Farm asset owned by scheme			Asset privately owned	
Farm asset	**Shiloh (Qty)**	**Zanyokwe (Qty)**	**Shiloh (Qty)**	**Zanyokwe (Qty)**
Tractor	3	5	-	-
Disc plough	2	2	-	-
Disc harrow	1	3	-	-
Skoffel	-	2	-	-
Maize harvester	-	1	-	-
Maize planter	1	4	-	-
Potato planter	-	1	-	-
Potato washer	-	1	-	-
Potato sorter	-	1	-	-
Potato lifter	-	1	-	-
Truck vehicles	-	3	-	-
Booms sprayer	1	1	-	-
Rippers	-	1	-	-
Fertiliser spreader	-	1	-	-
Rotavator	-	1	-	-
Hoe	16	-	38	48
Shovel	10	-	24	30
Spade	8	-	32	42
Watering cans	6	-	22	28
Knapsack sprayer	5	-	8	12

Source: Field survey 2012

6.10 Attendance at scheme management meetings

The scheme management committee is the main organ of governance where major decisions are discussed and implemented. Oettle and Koelle (2003) observed that information dissemination by extension officers through regular meetings with farming households determines the sustainability of agricultural development in the long run. Figure 6.8 illustrates the consistency of households' attendance at meetings convened by the scheme management committee. Households were asked if they frequently participated in the scheme management committee meetings, using the following response categories: Most often, very often, undecided, often, and less often. The attendance of meetings as exemplified in Figure 6.8 shows that the stipulated

category of participation was negative (Less often) in both Shiloh and Zanyokwe schemes. In the Shiloh scheme, 40% of the respondents asserted that they did not consistently attend meetings convened by the scheme management while 35% of respondents in Zanyokwe also did not attend meetings regularly (Figure 6.8). In both schemes, an insignificant number of respondents (6.67%, and 9.17%) attended meetings often in Shiloh and Zanyokwe respectively. Meetings are the only avenue for cross fertilisation of ideas to arrive at improved quality decision making. The failure of plot holders to attend and participate in meetings invariably affects not only their inclusiveness in decision making processes, but also hinders their access to agricultural development initiatives. Information obtained from meetings remains a good back up for the improved agricultural decision making of households.

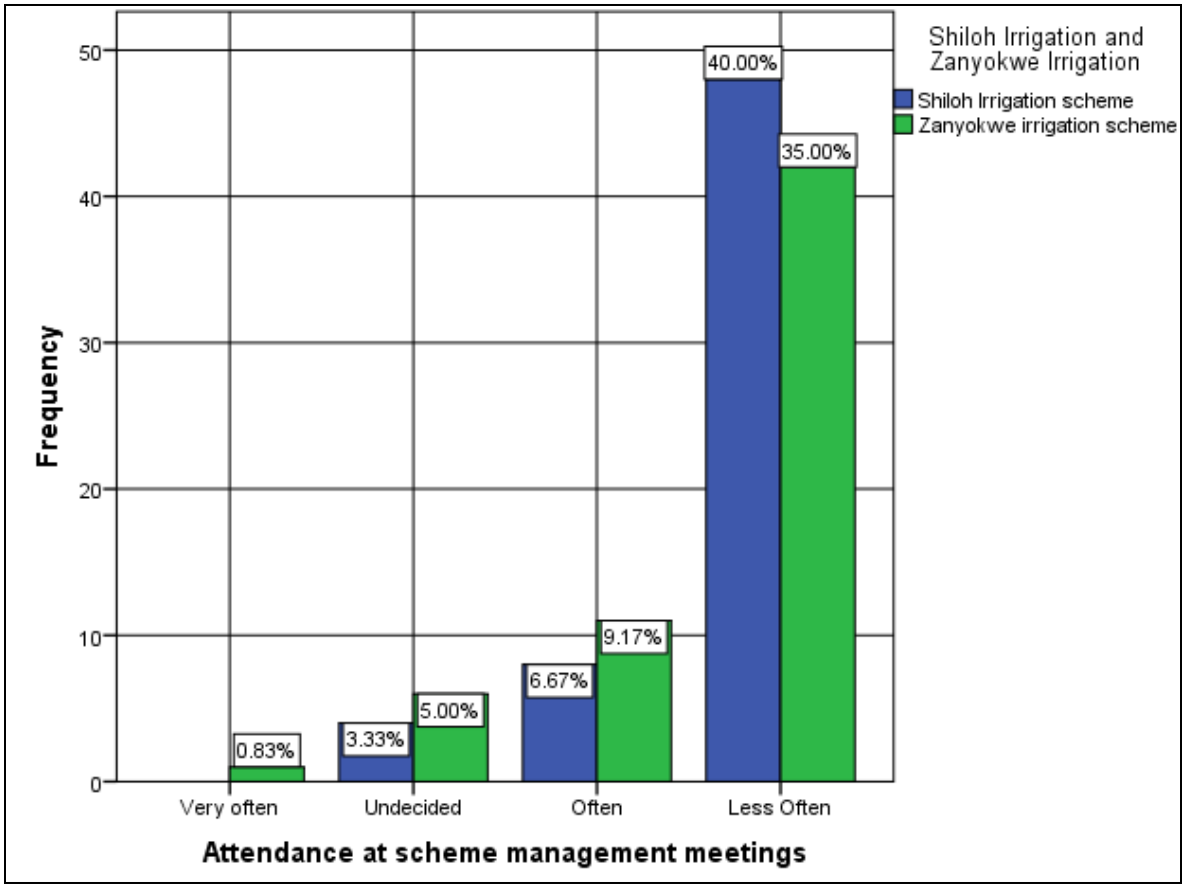

Figure 6.8 Distribution of households with respect to attendance at scheme management meetings

Source: Field survey 2012

6.11 Dissemination of meeting resolutions

Meeting resolutions are the declarations and adopted motions after sessions with farmers. Figure 6.9 shows the pattern for carrying the resolution passed to other farmers. In Shiloh, 25.83% of the respondents stated that they received meeting resolutions from other plot holders *via* informal group meetings while 10.83% of respondents in Zanyokwe received meeting resolution from informal meetings. Group formation in the scheme is essential not only for giving out meeting resolutions but also for social interactions towards the achievement of specific goals. Plot holders in the scheme also assist in passing on meeting resolutions informally to one another. In Shiloh,

18.33% of respondents received meeting resolutions from other farmers while in Zanyokwe, 24.17% respondents also received meetings resolution form other farmers.

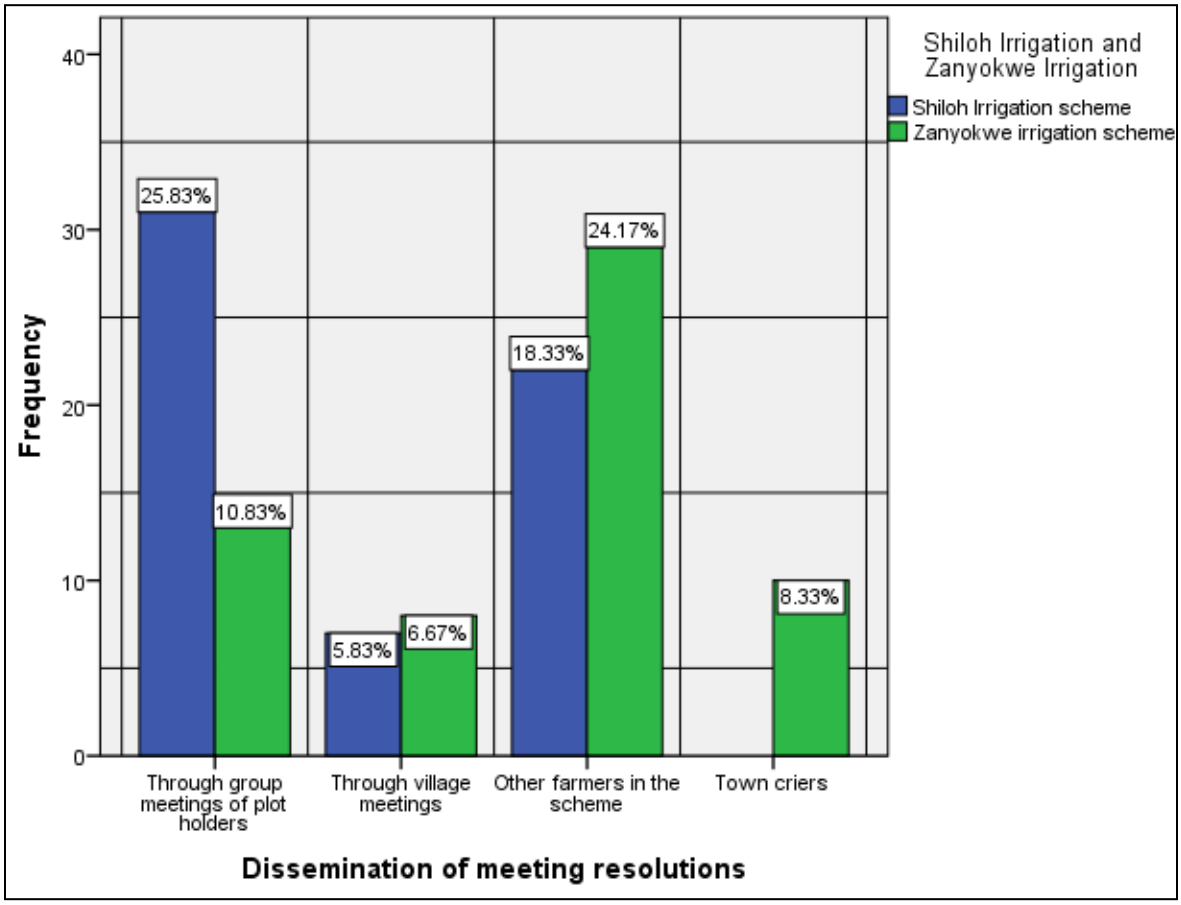

Figure 6.9 Distribution of households with respect to meeting resolutions dissemination

Source: Field survey 2012

6.12 Schedule of general meetings

The frequency of meetings was investigated as illustrated in Figure 6.10. The response categories were fortnightly, monthly, quarterly, bi-annually, annually and adhoc. In Shiloh, 24.17% of the farmers remarked that meetings were arranged on an adhoc basis, in contrast with 14.7% in Zanyokwe. Meetings on both schemes were irregular and even the adhoc meetings recorded poor attendance. In some instances the agenda for the proposed meetings was not known in advance and attendees' participation in the meeting deliberations was often poor because of a lack of

clarity of information and the purpose of the scheduled meeting. The farmers complained of a total absence of regulatory policies that govern the management committees which were saddled with the day to day running of the scheme. From the focus group discussions (Appendix1) held with farmers it was evident that the management committees that were informally constituted and had no defined term of office. Eight percent of the farmers in Shiloh and 10% in Zanyokwe asserted that meetings were held bi-annually. Five percent of farmers in Shiloh and 2.5% in Zanyokwe asserted that meetings were scheduled monthly. Scheduling regular meetings should be considered as an administrative strategy that will enhance unanimous and improved decision making. In Shiloh, 4.17% of respondents concurred that meetings are scheduled fortnightly and 5% for Zanyokwe. Overall, 4.17% of respondents in Shiloh and 13.33% in Zanyokwe posited that meetings were scheduled quarterly.

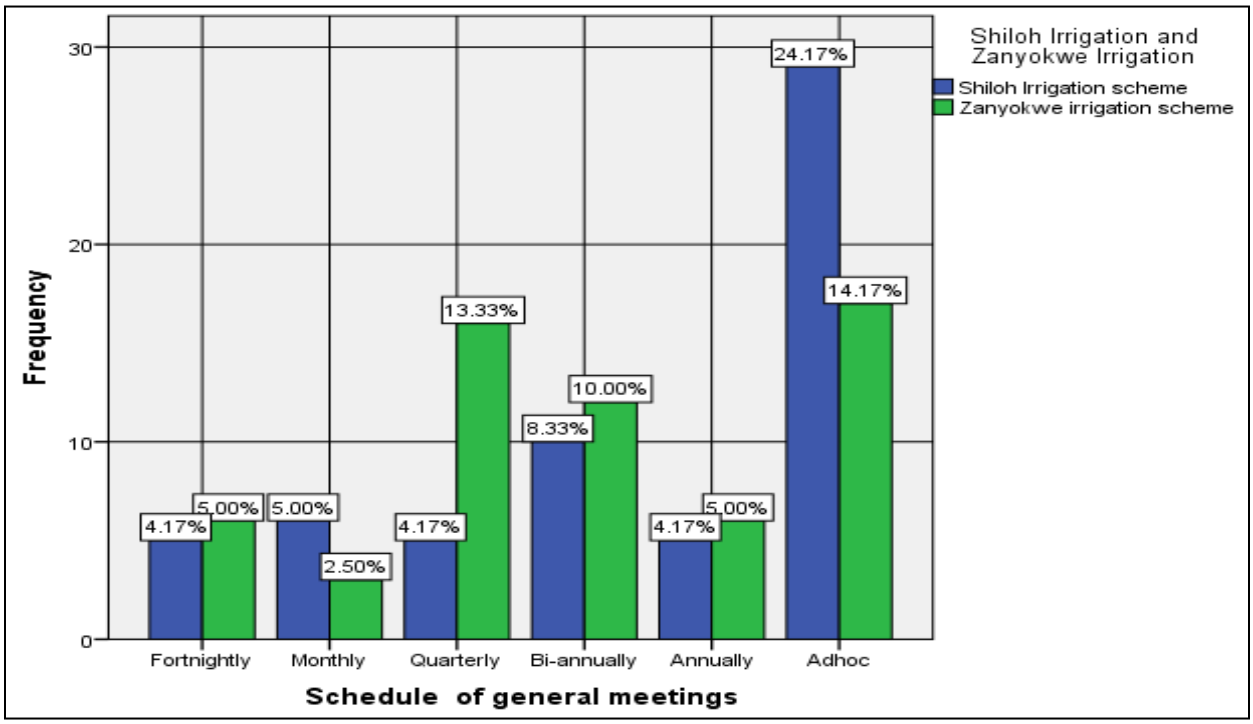

Figure 6.10 Distribution of households with respect to schedule of general meetings

Source: Field survey 2012

6.13 Permission to Occupy (PTO) and decision making

The PTO certificates are instruments used to specify that the plot holders' possession and use of land will not be impeded or obstructed by the state, entities or any person (Bruce, 1993). The majority of plot holders in the scheme acknowledged that they had acquired PTO certificates since they joined the scheme. The PTO certificates are an important aspect of tenure security for land and it encompasses the confidence with which one can express one's rights. The rights linked to land tenure include user rights, transfer rights and exclusion rights (Adams *et al* 1999). In Shiloh, 33.33% of respondents and 30% in Zanyokwe (Figure 6.11) indicated that their possession of a PTO did not only make them tenure secured but also generated increased interest in participating in decision making. However, 16.67% of respondents in Shiloh and 20% in Zanyokwe had the opposing view that PTO has allowed them to access limited plots of land, thereby discouraging them from further investment decision making. PTO certificates encourage land transactions and a positive change in attitude towards decision making by households, increase farmers' investment options and reduce the occurrence of land disputes among farmers through explicit definitions and the protection of rights (Roth, *et al*, 2000).

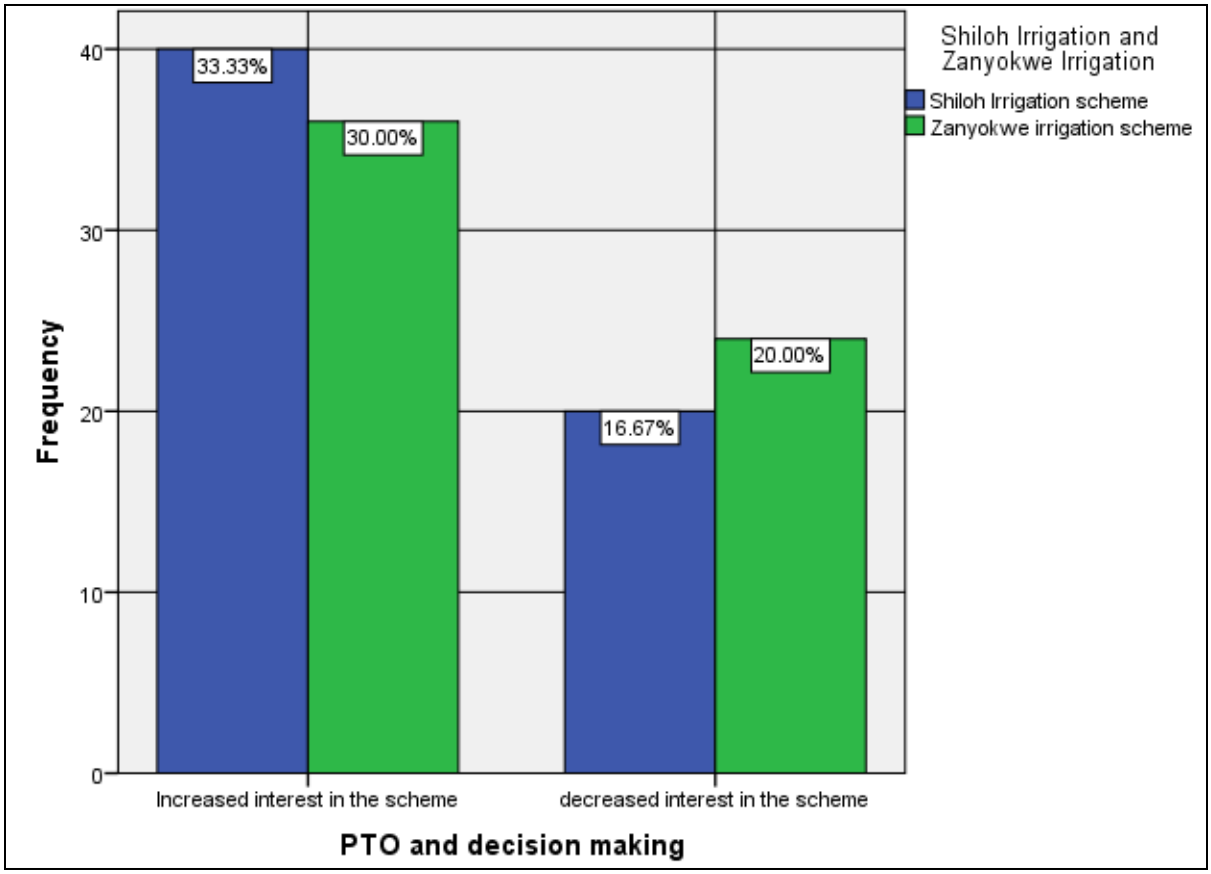

Figure 6.11 Distribution of households with respect to PTO and decision making

Source: Field survey 2012

6.14 Training undertaken by households in 2012/2013

The provision of support services in the area of training for plot holders is necessary to change the trend of low yield levels and enhance good scheme management. Weak support services are a regular issue in many smallholder irrigation scheme appraisals (Machete *et al* 2004). There is general consensus that human and social capacity development will assuage the current situation of smallholder irrigation schemes (Shah *et al*, 2000). According to Legoupil (1985), irrigated farming will only flourish when farmers are trained to adopt new farming systems that are more intensive and productive than cultivated dry land plots. Figure 6.12 illustrates the types of training undertaken by plot holders in the last two years of farming. The areas of training

covered by the respondents were: planting, harvesting, fertiliser application and diseases and pest control. In Shiloh, 10% of respondents participated in training on planting of crops and 21.67% participated in Zanyokwe.

Twenty three percent of respondents in Shiloh and 13.33% in Zanyokwe had training in harvesting. Training of plot holders on fertiliser application was not very encouraging as only 15.83% of respondents in Shiloh and 11.67% in Zanyokwe participated in the training. In Shiloh, 0.83% and 3.33% in Zanyokwe had training on diseases and pest control. Adequate empowerment of farmers will give them the necessary skills to assume responsibility in the management of their farms; thus, they become less dependent on public extension for assistance (Backeberg, 2005). Evidence from the focus group discussion (Appendix 1) also reveals that most farmers have not reached the required level of competence to optimally take advantage of the irrigated plots of land allocated to them. A study by Fanadzo (2010) focused on the need for balancing institutional, organisational, technical and infrastructural components of smallholder irrigation system so as to achieve sustainability.

Lopsided sector interventions in the area of fixing and repairing scheme infrastructures only may not achieve the desired impact of food security for households. Smallholder farmers require a support system that encompasses comprehensive training in all agronomic practices. Denison and Manona (2007) suggest that fund allocation for the training of smallholder farmers needs to be 40 to 50% of the total intervention budget of government. The positive effect of training farmers has been long-established in many places where the production of crops and cash income increased as a result of a higher yield level. In Afghanistan, for instance, smallholder farmers obtained an increase in potato output of 205% with a net income of US$ 3000/ha (Padma 2009). Farmers, after receiving training on proper crop management in Nigeria, realised a doubling in

the production of rice, and net cash income increased by 230% owing to a higher yield (List, 2009). Smallholder farmers in South Africa have limited support as training was formerly focused on commercial production, which is unsuitable for food insecure households (Botha and De Lange, 2005).

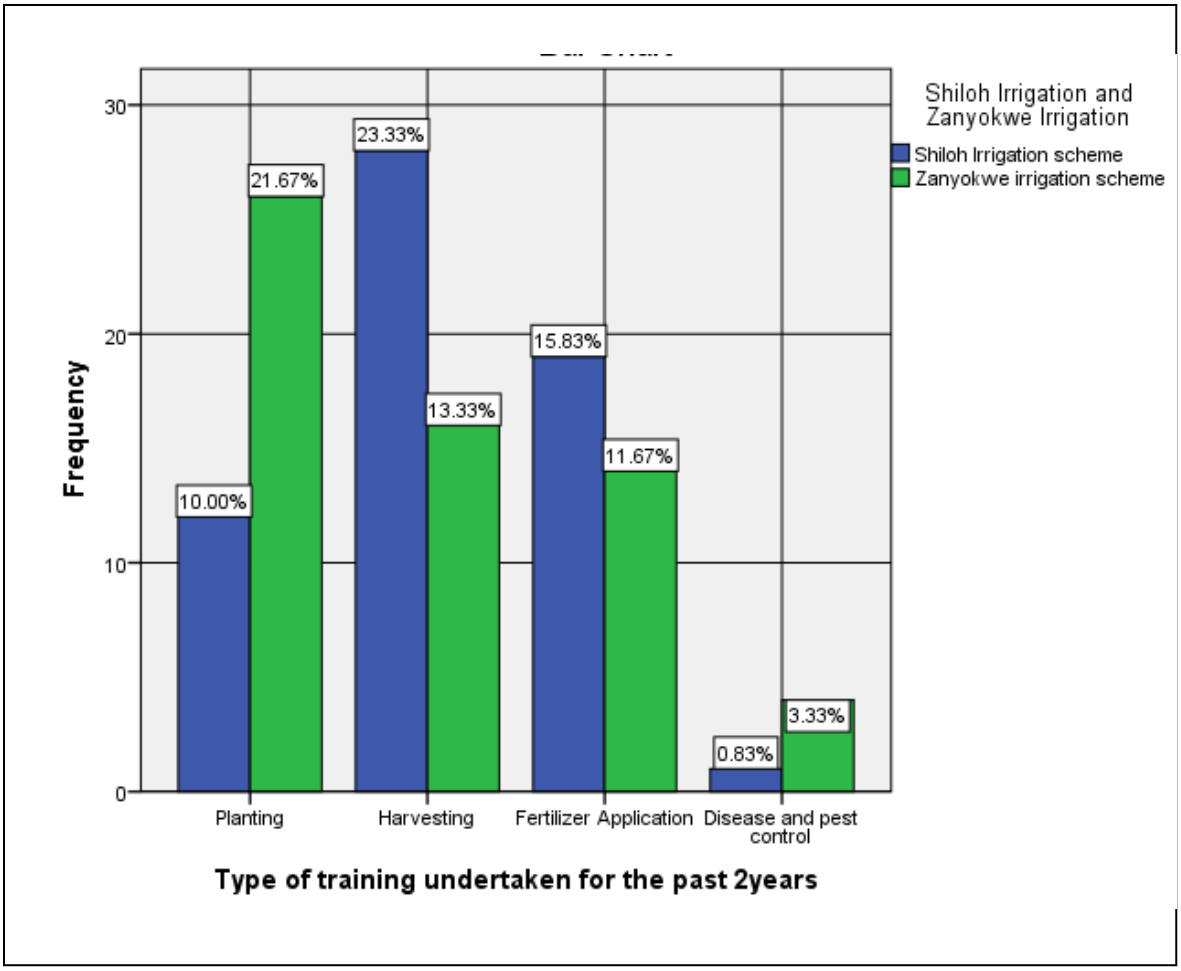

Figure 6.12 Distribution by households on types of training undertaken in 2012/2013

Source: Field survey 2012

6.15 Duration of training in 2012/2013 in the study areas

The training of smallholder farmers promotes learning activities and also helps to strengthen weak farming communities. The basic strategy for perfect extension work is to develop a

platform for rural livelihood development through training. Figure 6.13 shows the duration of training of farmers in Shiloh and Zanyokwe. In Shiloh, 34.17% of respondents had training for 1 to 2 days with 25% in Zanyokwe having the same length of training. Ten percent of respondents in Shiloh and 12.50% in Zanyokwe had 3 to 5 days training. However, some farmers complained of the short periods scheduled for training. There was general satisfaction with the training offered even though training was rarely conducted by extension officers. However, the training of farmers should be an on-going process and tailored to the needs of farming households.

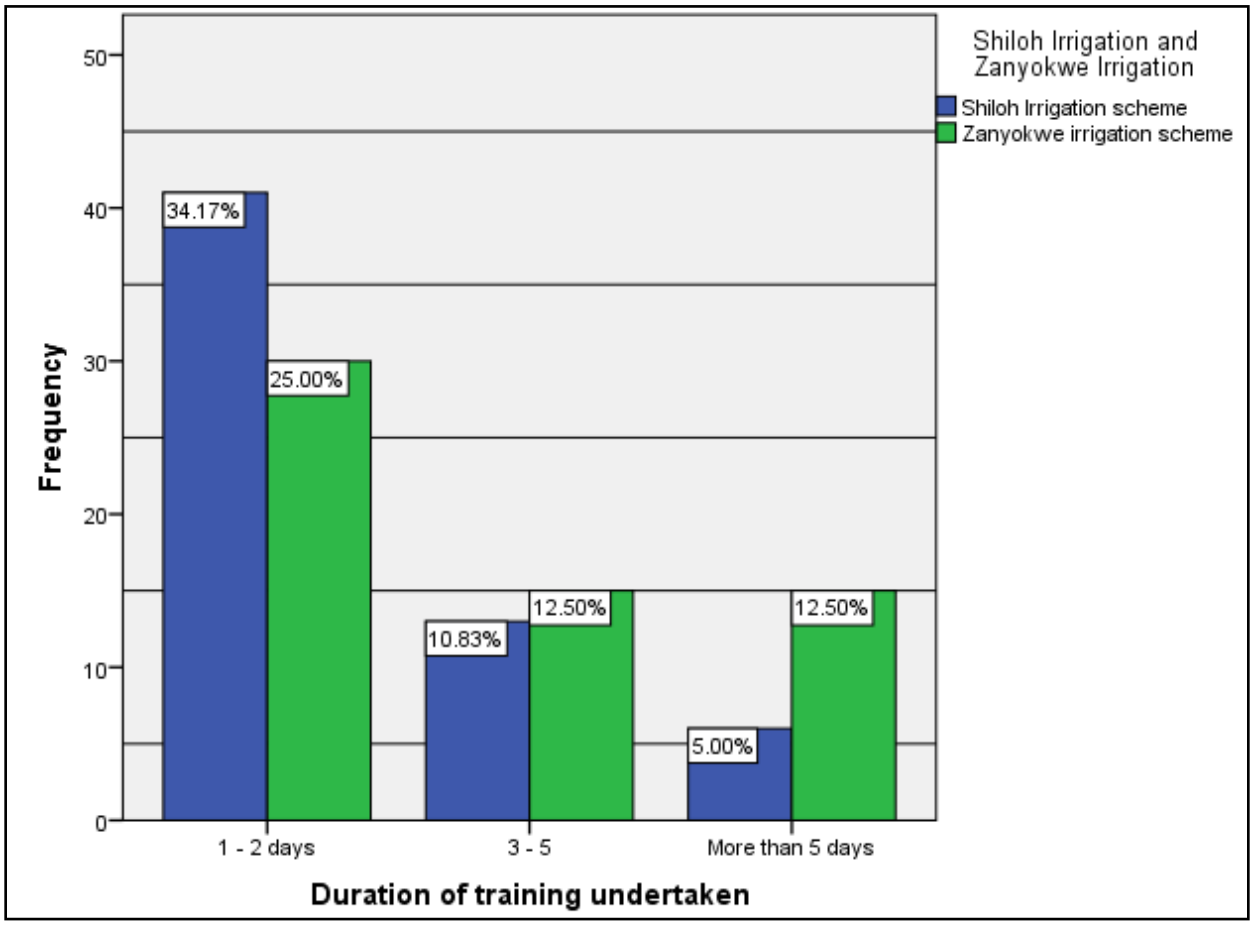

Figure 6.13 Distribution of households with respect to duration of training in 2012/2013

Source: Field survey 2012

In spite of the training offered by extension staff, significant gaps in training still exist, which became obvious when farmers were asked during the focus group discussion to mention the areas they needed training in. As highlighted by the respondents, the need for training was in the areas of pest control, infrastructure maintenance, and marketing.

6.16 Decision making on training needs of households

The decision to empower farmers through training must be made in consultation with farming households to obtain measurable benefits or outcomes. Farmers should be guided and accorded an avenue to pursue their own development and decide their own future, instead of being submissive recipients of extension programmes. Most often, smallholder farmers have little or no say in the planning and design of extension training programmes. This scenario of inadequate participation in programme decision making produces discontent among farmers, as extension officers often focus on programmes that are not relevant to the needs identified by the farmers themselves. Figures 6.14 and 6.15 illustrate decision making on training and participation in the decision process. From the results, 12.50% of households heads in Shiloh and 18.33% in Zanyokwe asserted that decisions on training needs were made by extension officers. In Shiloh, twenty nine percent of respondents in Shiloh and 24.17% in Zanyokwe accepted that they did not know how decisions on training were reached. In all, 8.33% of respondents in Shiloh and 7.50% in Zanyokwe claimed that decisions on training were made by the scheme management committee.

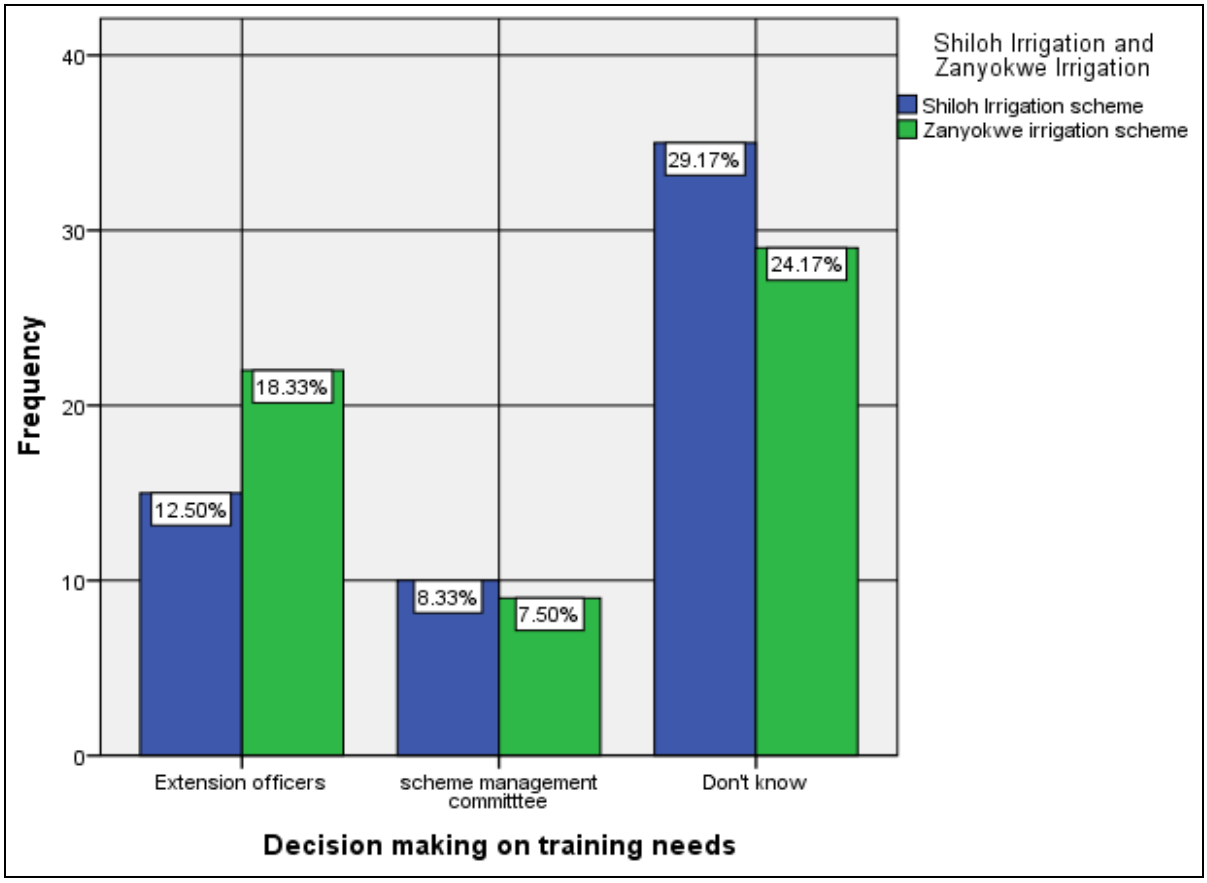

Figure 6.14 Distribution of households with respect to decision making on training needs

Source: Field survey 2012

In the participation aspect, the Likert-scale variables were used to elicit responses from farmers. The adopted variables were: most often, very often, undecided, often and less often. In both Shiloh and Zanyokwe 3.33% of respondents admitted to participating most often in the decision making process (Figure 6.15). Overall, the (less often) category of respondents in both Shiloh and Zanyokwe were 39.17% and 30% respectively. From the results, it is evident that training is planned and executed with little or no farmers' involvement or participation. The escalation of smallholder farmers' voices through social mobilisation and structures such as farmers' cooperatives is expected to bridge the gap between government agricultural institutions and smallholder farmers. Social mobilisation entails the building of local structures with competence

to analyse and solve problems collectively. Such structures if put in place will not only improve farmers' bargaining ability with institutions and government but also help them in accessing resources like farm infrastructure, farm inputs and access to credit.

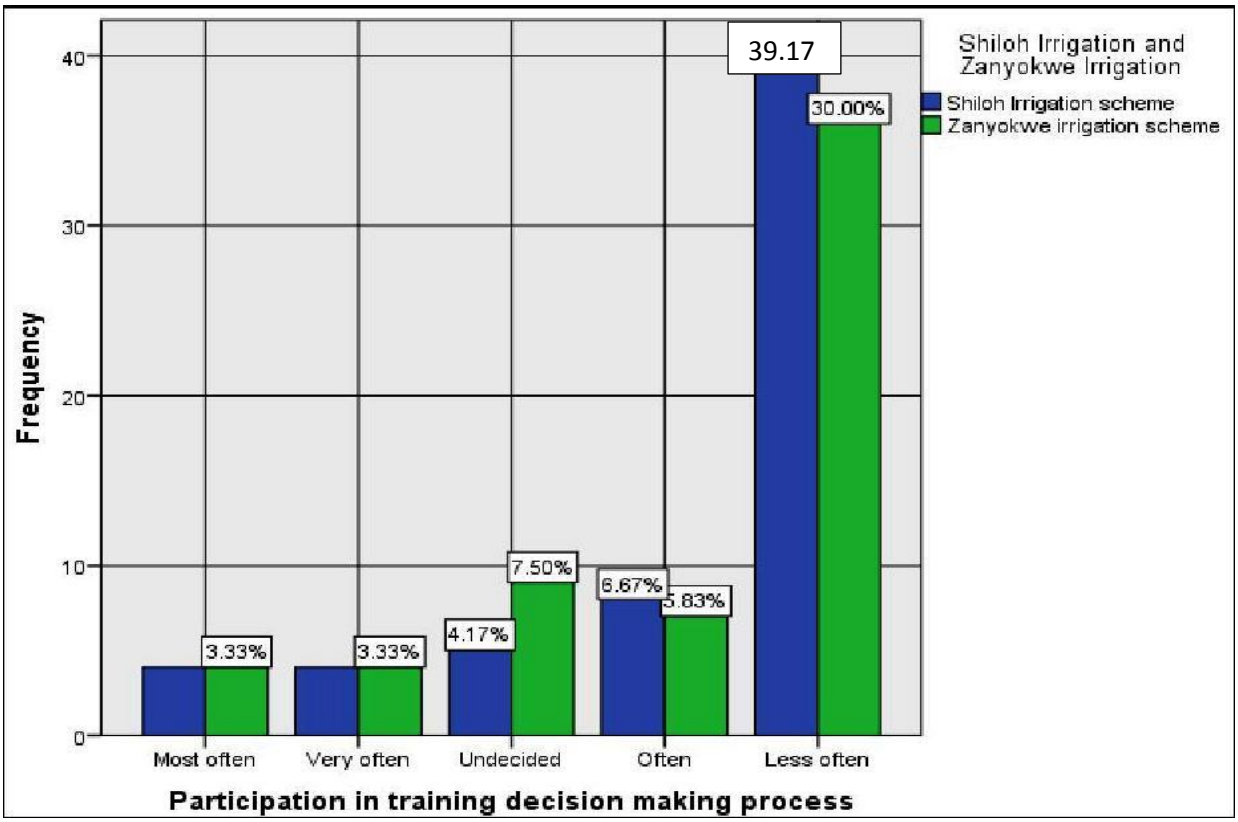

Figure 6.15 Distribution of households with respect to participation in training decision making process

Source: Field survey 2012

In a study on the Quality of extension services in the Amathole District, Agholor *et al* (2012) suggest that a pragmatic effort be made in putting together holistic participatory approaches that will allow equal participation in programme planning, designing and needs assessment of smallholder farmers.

6.17 Decision making on plot/land allocation to households

In South Africa, irrigated land is considered a valuable asset but regrettably irrigated land on smallholder irrigation schemes is not optimally used for farming (Perret, 2002 and Van Averbeke 2008). Defective land allocation systems and land exchange markets, mainly for land rentals invariably appear to be the reasons for low cropping intensity (Tshuma, 2009). Pitfalls associated with tenure security and an inadequate and murky legal framework has also been acknowledged as the reason for the malfunctioning of the land exchange market (Manona and Baiphethi, 2008). Smallholder access to land and security of tenure affects investment decision making.

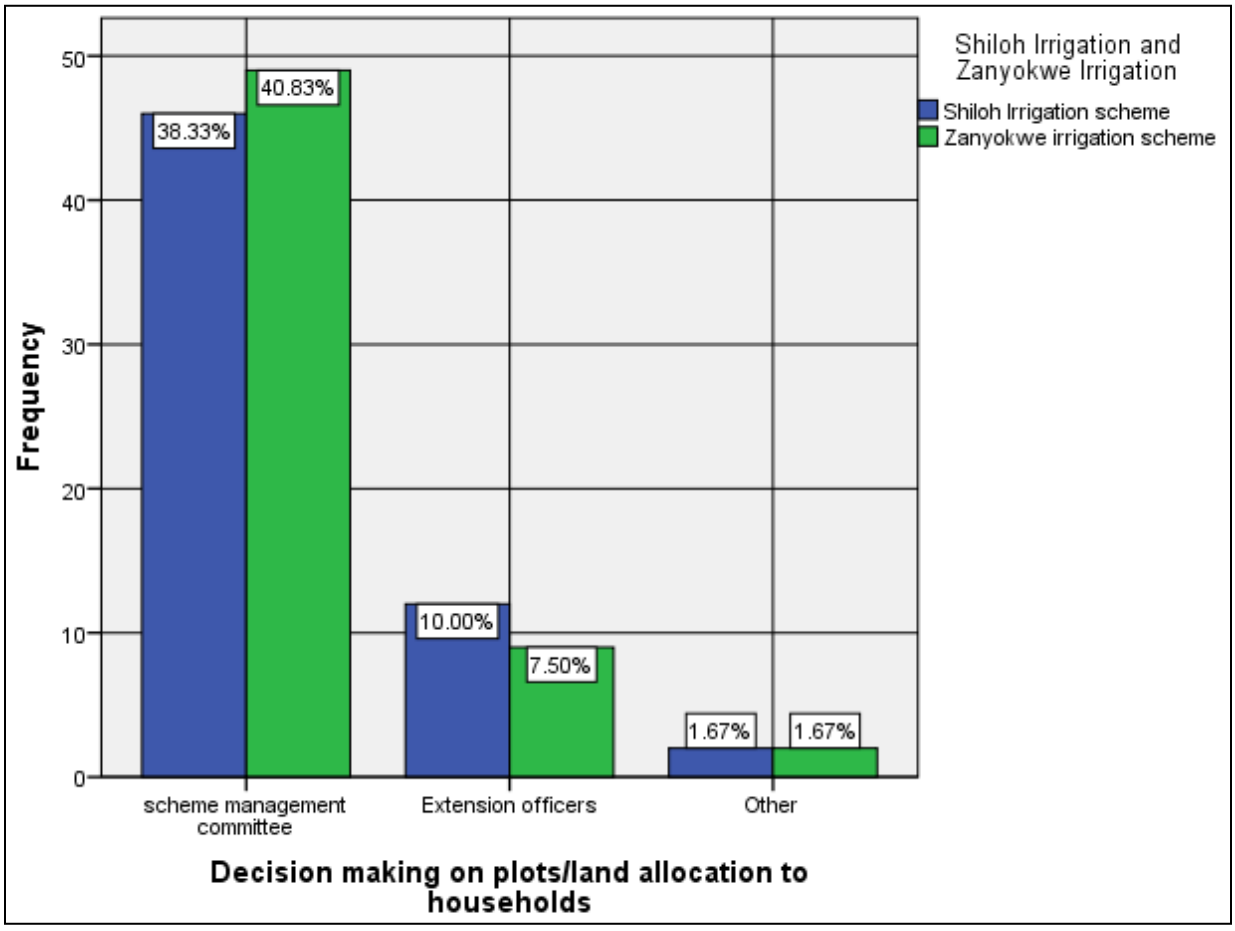

Figure 6.16 Distribution of households with respect to decision making on plot/land allocation. Source: Field survey 2012

The results of the study reveal that 38.33% of respondents in Shiloh and 40.83% in Zanyokwe agreed that the scheme management committee made all decisions on plot/land allocation (Figure 6.16). In Shiloh, 10% of households claimed that extension officers also made decisions on land allocation while in Zanyokwe the percentage was 7.50%. In the representation, 40.83% of respondents in Shiloh and 35% in Zanyokwe denied being represented during plot/land allocation. However, 9.17% of households in Shiloh and 15% in Zanyokwe admitted to being represented in plot/ land allocation decision making (Figure 6.17). Non-representation and restricted access to land will invariably hinder investment decisions and expansion opportunities for households. In order to utilise the available land optimally, farmers need to be fully represented in land allocation fora and other policy options associated with land allocation so as to be able to realise their potentials towards sustainable livelihood and food security.

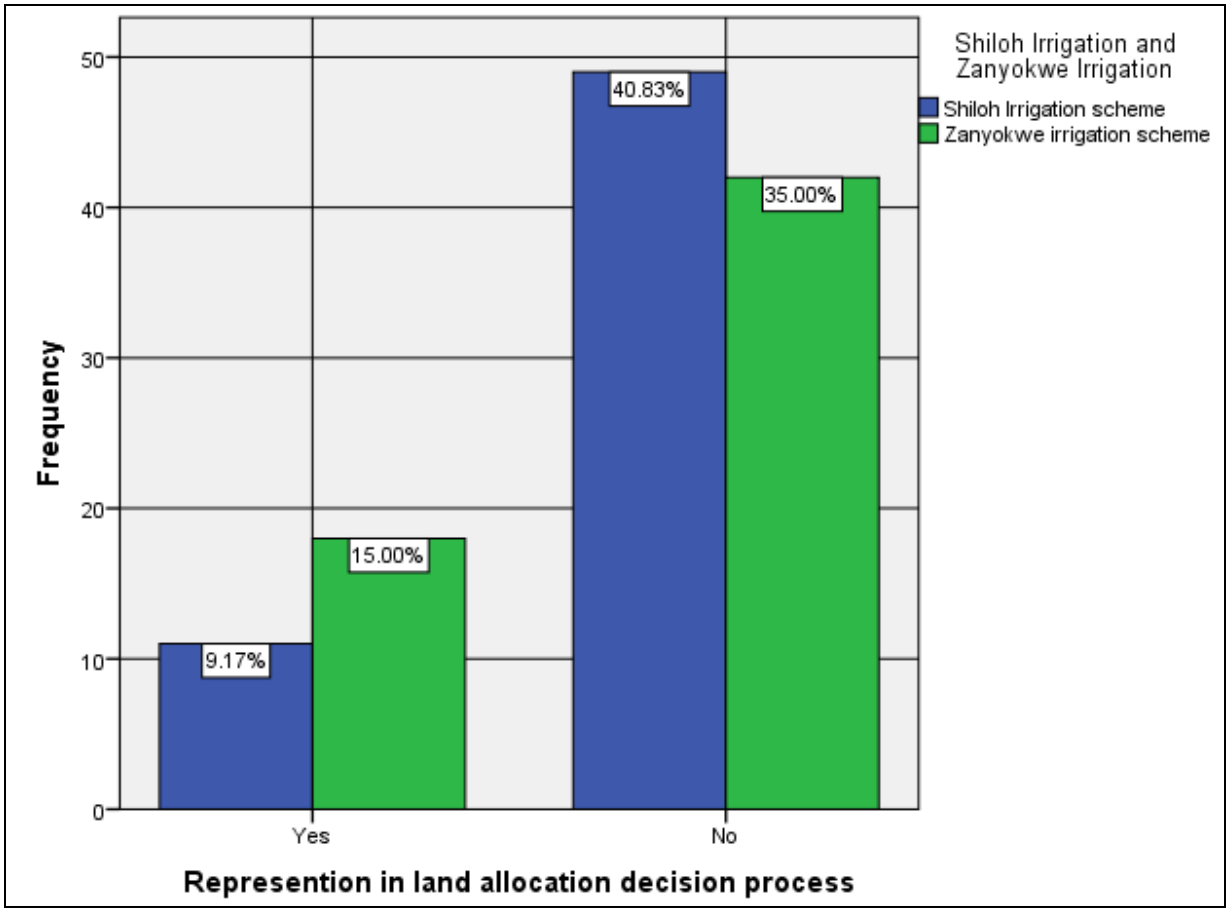

Figure 6.17 Distribution of households with respect to representation in land allocation decision making process

Source: Field survey 2012

6.18 Renting out of plots on sharecropping in the study areas

Table 6.17 shows the number of plot holders who rent out their plot to other farmers on a share cropping basis. In Shiloh, 30.83% of the respondents rent out their food plots of land either on a sharecropping or rental basis and 4.17% in Zanyokwe does the same. The strategic partner in sharecropping and renting in Shiloh was the owner of the dairy project located close to the Shiloh irrigation scheme. In Shiloh, the majority of plot holders were initially involved in plot renting or sharecropping for dividends but later the contract terms changed. At the time of this study, plot holders in the scheme did not wait for dividends but collected annual rental income

for their rented plots. The plot holders whose plots of land are located close to the dairy project received more annual rental income than plot holders whose plots of land were far from the dairy project. In Zanyokwe, minimal sharecropping arrangement was practiced; however, renting of plots also occurred with rental income payable annually. Households that rented plots in Zanyokwe used them mainly for crop production. The majority of farmers in the Shiloh scheme were dissatisfied with the differential rental income arrangement. Most households in Shiloh felt that, the same plot size should attract the same rental income. However, the majority of plot holders in Shiloh, at the time of this study had been reduced to mere land owners whose business was to watch the on-going farming activities at the dairy project site while waiting for annual rental income.

Table 6.17 Distribution of respondents with respect to renting of plots/sharecropping in the study areas

	Shiloh (N=60)	%	Zanyokwe (N=60)	%
Rent/sharecropping:				
Yes	37	61.6	5	8.3
No	23	38.3	55	91.6
Total	**60**	**100**	**60**	**100**

Source : Field survey 2012

6.19 Duration of rent/sharecropping

Land tenure arrangement that is not backed up with legislation will invariably, not only reduce access to available land but also weaken farmers' interest and dedication to farming in the long run. From a legal standpoint, tenure arrangement on smallholder irrigation schemes in South Africa is bedevilled with ambiguity because the pieces of legislation that were in place when plots were allocated has either been revoked or not implemented (Manona *et al* 2010). To this end, the duration of rent cannot be determined as it is not backed up by legislation. There were general feelings of insecurity among plot holders about rights to rent out plots of land in both

Shiloh and Zanyokwe because, in the past, renting was prohibited (Van Averbeke, 2008). On the other hand, there was also a feeling of insecurity among plot holders who were ready to increase their land holding by renting land. This is so because there are no legal restrictions on owners claiming back their plots before the expiry of the lease agreement. However, results of the study revealed that 20% of the respondents rent out their plots of land for two years in Shiloh and 36.6% does the same in Zanyokwe (Table 6.18). The majority of respondents in Shiloh and Zanyokwe rent out their plots of land for 5 to 6 years; 43.3% and 31.6% respectively. About thirteen percent of households in Shiloh and 16.6% in Zanyokwe rent out their land for periods of more than 6 years.

Table 6.18 Duration of rent/sharecropping

	Shiloh (N=60)		Zanyokwe (N=60)	
Duration of rent:	**Frequency**	**%**	**Frequency**	**%**
1 – 2 years	12	20.00	22	36.6
3 – 4 years	14	23.3	9	15
5 – 6 years	26	43.3	19	31.6
≥ 6 years	8	13.4	10	16.6
Total	**60**	**100**	**60**	**100**

6.20 Farmers' perception of irrigation scheduling in the study areas

Irrigation scheduling guarantees that crop water requirements are met, while at the same time avoiding water stress and water logging resulting from excess irrigation. The primary aim of irrigation scheduling is to agree on the quantity of irrigation water required by a crop per production cycle and how often water is to be applied, while taking into consideration realistic operating practices (Koegelenberg *et al*, 2003). There was no defined irrigation scheduling management in the schemes and farmers relied on their visual perceptions to determine whether the crop field required water or not. In a situation analysis, Monde *et al*, (2005) posited that there

were instances where excess irrigation was detected in the Zanyokwe scheme. The concomitant effects of such excess irrigation could be water logging and a rising water table. In schemes where scheduling arrangements are practiced in South Africa, the majority of farmers do not assess the soil water content and the acceptance of an objective scheduling practice is rather below expectation. Subsequent to the focus group discussions (Appendix 1) conducted on both schemes (Shiloh and Zanyokwe), almost all participants perceived irrigation scheduling as a good option to ameliorate the water shortages often experienced but were hardly ever ready for irrigation scheduling at the time of this study. In Shiloh, 85% concurred that irrigation scheduling remains a good option for efficient water management in the scheme while 90% in Zanyokwe had the same opinion. On the contrary, 15% of respondents in Shiloh and 10% in Zanyokwe had an opposing view (Table 6.19).

A limited water supply to crop fields has inadvertently affected yield levels of vegetable production. The pressure of irrigation water from the dam serving the Zanyokwe scheme reduces as it moves farther to the crop field and sometimes water may not be available because of a low pressure. The original plan was that water from a storage reservoir would move to the crop fields by the simple process of gravitation, but the reservoirs were not properly positioned to generate enough pressure to operate the water application system. Therefore, at Kamma-Furrow and Lenye North, access to irrigation water is obtained by pumping water directly from the river (van Averbeke, *et al* 1998). The results of this study revealed that out of the six villages served by the Zanyokwe irrigation scheme, two, namely, Kamma-furrow and Lenye North have used electricity to pump water to their crop fields since 2012.

Table 6.19 Distribution of households by perception of irrigation scheduling

	Shiloh (N=60)		Zanyokwe (N=60)	
Irrigation scheduling:	**Frequency**	**%**	**Frequency**	**%**
Yes	51	85	54	90
No	9	15	6	10
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

The respondents in these two locations asserted that the high cost of electricity, not only remain a daunting task but also increases their cost of crop production. Twenty percent of the respondents in Shiloh asserted that water supply in the scheme were sufficient from January through December and 13.3% in Zanyokwe (Table 6.20). On the contrary, 80% of respondents in Shiloh maintained that there was insufficient water from January through December as well as 86.6% in Zanyokwe.

Table 6.20 Distribution of households with respect to water sufficiency for irrigated crop field

	Shiloh (N=60)		Zanyokwe (N=60)	
Water sufficiency:	**Frequency**	**%**	**Frequency**	**%**
Yes	12	20	8	13.3
No	48	80	52	86.6
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

6. 21 Participation in the maintenance of available infrastructure

Table 6.21 illustrates households' participation in the maintenance of available infrastructures in the study areas. Inadequate participation and development of human capital in maintaining irrigation infrastructure effectively has been the main cause of the low level of crop productivity in most smallholder irrigation schemes (De Lange *et al*, 2000). Irrigation maintenance activities

should be logically planned by deciding what actions should be performed and by whom, within a specified time frame. The participation of farmers in routine maintenance includes the repair of leaking pipes and the removal of vegetation from embankments, canals and drains to enhance water delivery and lengthen the life span of the water distribution system in the scheme. According to Shah *et al* (2002), inadequate daily maintenance of irrigation infrastructures is the primary cause of low performance that characterises smallholder irrigation schemes in South Africa. In Shiloh, 45% of the respondents claimed to have participated in the maintenance of irrigation infrastructure and 46.6% in Zanyokwe made the same claim. However, 55% of respondents in Shiloh and 53.3% in Zanyokwe concurred that they do not participate in the maintenance of irrigation infrastructure. Conversely, the extent of involvement of households in infrastructure maintenance decision making was investigated (Figure 6.19). The five point *Likert* scale (most often, very often, undecided, often and less often) was used to determine households' level of involvement in maintenance decision making. About 4.17% of households in Shiloh were most often involved in maintenance decision making while Zanyokwe 0.83% were often involved. The percentage of respondents who were very often involved in maintenance decision making was 6.67% in Shiloh and 3.33% in Zanyokwe. The percentage of households that were rarely involved was 23.33% in Shiloh and 32.50% in Zanyokwe. From the results of the study, it is evident that an insignificant number of respondents were most often involved in maintenance decision making process (Figure 6.18).

Table 6.21 Distribution of households with respect participation in the maintenance of available infrastructure

	Shiloh (N=60)		Zanyokwe (N=60)	
Maintenance:	**Frequency**	**%**	**Frequency**	**%**
Yes	27	45	28	46.6
No	33	55	32	53.3
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

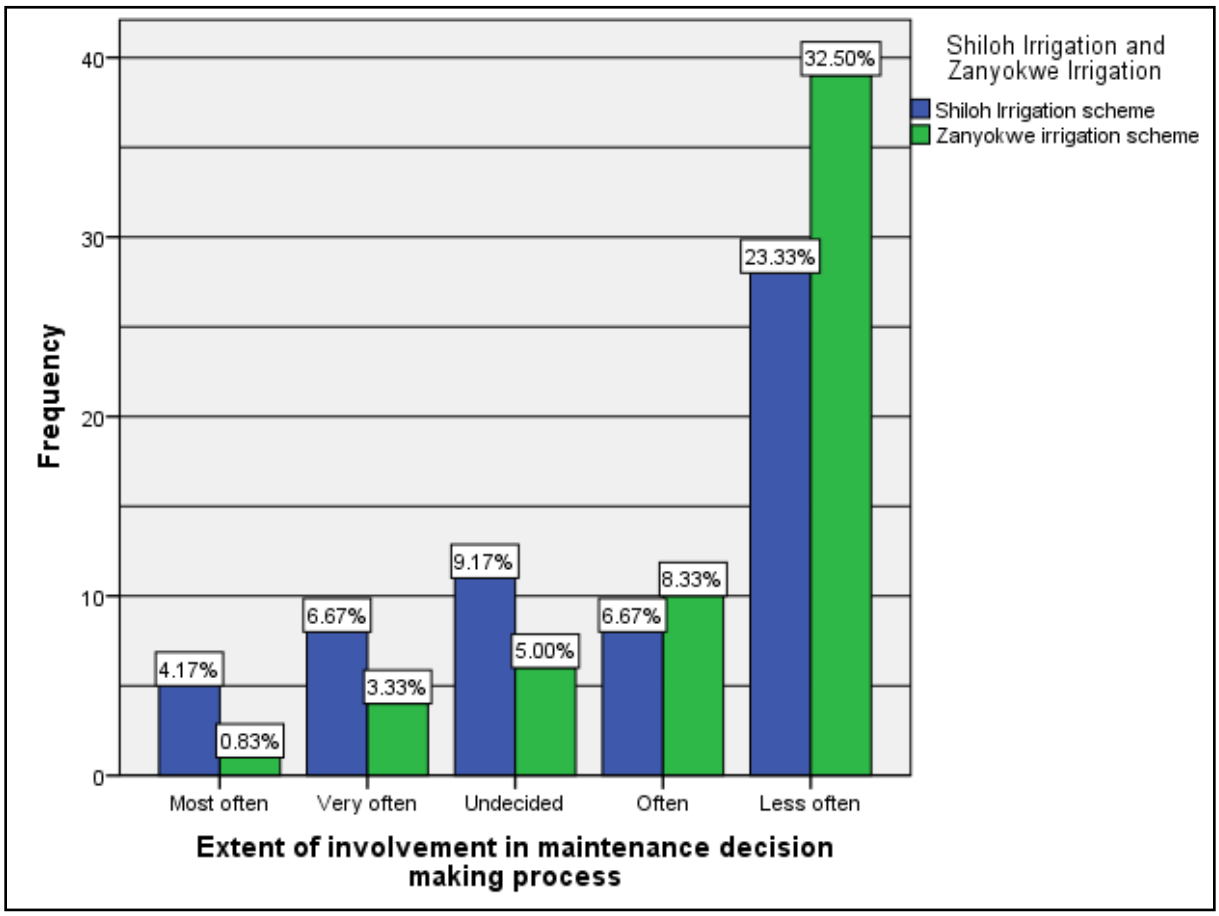

Figure 6.18 Distribution of respondents with respect to the extent of involvement in maintenance decision making

Source: Field survey 2012

6.22 Formal training on maintenance of infrastructure in the study areas

Table 6.22 shows the formal training of farmers in the maintenance of infrastructure. The need for the training of farmers' in the maintenance of infrastructure is very important in light of the deteriorating scheme infrastructure. A periodic practical training of smallholder farmers in the maintenance of scheme infrastructure must be put in place. From study results, it was evident that, for the previous two years, only 13.3% in Shiloh had had formal training in the maintenance of scheme infrastructure and 10% in Zanyokwe. In contrast, 86.6% in Shiloh attested that they

had not been involved in any form of infrastructure maintenance training; neither had 90% in Zanyokwe. However, from the interaction with farmers during the focus group discussion (Appendix 1), information days were the avenues for briefing on maintenance and farmers contend that they were not formally organised. As alluded to in most of the literature, the poor performance of farmers in most smallholder irrigation schemes includes poor maintenance of farm infrastructures, inadequate farmer training, lack of credit and poor marketing opportunities (Mnkeni *et al,* 2010).

Table 6.22 Distribution of households' with respect to formal training on maintenance of irrigation infrastructure

	Shiloh (N=60)		Zanyokwe (N=60)	
Formal training:	**Frequency**	**%**	**Frequency**	**%**
Yes	8	13.3	6	10
No	52	86.6	54	90
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

6.23 Primary objective of cultivating crops or rearing of animals

The primary objective of crop cultivation or livestock rearing was investigated (Table 6. 23). The statutory objective of setting up smallholder irrigation projects was to achieve local food self-sufficiency (Kirsten *et al,* 1990). In many instances the smallholder farmers are marginalised and their needs are often not prioritised. Unrestricted access to irrigation allows smallholder farmers to increase production, earn cash incomes and improve their livelihood, as well as ensure food security (Hussain *et.al,* [sa]). The results of the study show that in Shiloh and Zanyokwe 15% and 10% of respondents respectively declared that their primary objective for cultivating crops on their allocated food plots was to retain their land holding. About fifty eight percent of respondents in Shiloh and 46.6% in Zanyokwe also admitted that they utilised their food plot

primarily for subsistence farming (household consumption). However, 8.3% of respondents from both Shiloh and Zanyokwe cultivated their plots for a cash income.

Table 6.23 Distribution of households with respect to objective of cultivating crops or rearing of animals

Shiloh (N = 60)			Zanyokwe (N = 60)	
Objectives	**Frequency**	**%**	**Frequency**	**%**
Income	5	8.3	5	8.3
Subsistence	35	58.3	28	46.6
Occupation	11	18.3	19	31.6
Retain land	9	15	6	10
Others	-	-	2	3.3
	60	**100**	**60**	**100**

Source: Field survey 2012

6.24 Vegetable production January through December

Table 6.23 shows the percentage of farmers who produce vegetables all year round (January through December). Vegetable production is dependent on the availability of water and other resources. The annual water use in South Africa is approximately 22, 4000 million m3 and the percentage utilised for irrigation is approximately 50% of this volume (DAF, 2010). Crops have different water requirements. For example 15kg of maize requires about one millimetre of water, cabbage and soya bean, 380 to 500mm, and 500 to 900mm respectively (Du Plessis, 2003). Most farmers are seldom able to produce vegetables from January through December in the irrigation scheme because of water constraints. In Shiloh, 80% of the respondent posited that they do not produce vegetables throughout the year (January through December) and in Zanyokwe 75% do not. Only 20% and 25% of respondents in Shiloh and Zanyokwe respectively produce vegetables from January through December (Table 6.24). Given that no vegetables are produced consistently from January through December, the majority of households in the scheme are rendered food insecure. This result lends credence to the assertion of Monde *et al* (2005) that

notwithstanding access to an average of 4.5 hectares of irrigated land for each farmer, the majority of farmers on the Zanyokwe irrigation scheme remain poor, with monthly incomes of less than the 2005 poverty datum line of ZAR626.98 per adult equivalent.

Table 6.24 Distribution of households with respect to vegetable production January through December

	Shiloh (N=60)		Zanyokwe (N=60)	
Production:	**Frequency**	**%**	**Frequency**	**%**
Yes	12	20	15	25
No	48	80	45	75
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

6.25 Fertiliser application to crop field

The effective management of basic farm practices like fertiliser application, weed control, crop/plant population, and spacing are central to increased yield performance. Crosby *et.al* (2000) posits that low yields are evidence of poor farm practices adopted by smallholder farmers. Fanadoz (2010) noted that most farmers in the Zanyokwe irrigation scheme do not apply adequate fertiliser and in many instances, the timing of the application is also incorrect. The results show that 88.3% of Shiloh respondents and 93.3% Zanyokwe respondents apply fertiliser to their crops (Table 6.25). It has been suggested that, all things being equal, farmers who apply fertiliser to their crop fields are likely to obtain increased yield and more cash income. Therefore, with increased yield, households are expected to become more food secure. However, despite the realisation that the majority of farmers apply fertiliser in Shiloh and Zanyokwe, this study did not examine the timing of the applications and the quantity per crop.

Table 6.25 Distribution of households with respect to fertiliser application to crop field

	Shiloh (N=60)		Zanyokwe (N=60)	
Apply Fertiliser:	**Frequency**	**%**	**Frequency**	**%**
Yes	53	88.3	56	93.3
No	7	11.6	4	6.6
Total	**60**	**100**	**60**	**100**

Source: field survey 2012

6.26 Sustenance of farm yield till next harvest season

Agriculture is the primary source of livelihood strategy for food security in rural areas (Abalu, 1999). Farmers were asked whether their output for a particular season was enough to meet and sustain their consumption needs till the next farming season. In Shiloh, 8.3% claimed that their output, especially of maize was adequate to sustain them and their families till the next production season compared to 15% in Zanyokwe. However, the majority of respondents in Shiloh (91.6%) and Zanyokwe (85%) agreed that their production output did not sustain them till the following production season (Table 6.26). However, four main short term food-based coping strategies were highlighted to elicit responses from farmers (Table 6.27) on coping strategies they adopted, since their production output did not usually sustain them till the following farming season.

Engaging in off-farm activities appears to be the coping strategy ranked highest amongst the categories. In Shiloh, 66.6% of respondents asserted that their short term food coping strategy was to take up menial jobs for wages and 55% in Zanyokwe claimed to do the same. The exchange of farm produce for other food items (the barter system) was not a common phenomenon in the area as only 15% and 16.6% mentioned this category in Shiloh and Zanyokwe respectively. The respondents also commented that it was easier to sell their farm produce instead of searching for other farmers who may require them in an exchange. About

8.3% of respondents in Shiloh and 18.3% in Zanyokwe identified the category of borrowing food or money as a coping strategy. Borrowing money may predispose the smallholder farmer to indebtedness, thus rendering the household vulnerable in the long run. The pattern adopted by households in dealing with food shortages as exemplified in this study implied that the majority of households are not food secure.

Table 6.26 Distribution of households with respect to sustenance of farm output till next harvest season

	Shiloh (N=60)		Zanyokwe (N=60)	
Sustenance:	**Frequency**	**%**	**Frequency**	**%**
Yes	5	8.3	9	15
No	55	91.6	51	85
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

Table 6.27 Distribution of households' with respect to dealing with food shortages

Shiloh (N = 60)			**Zanyokwe (N = 60)**	
Dealing with food shortages	**Frequency**	**%**	**Frequency**	**%**
Engage in off-farm activities	40	66.6	33	55
Exchange of farm produce	9	15	10	16.6
Borrowing food/money	5	8.3	11	18.3
Selling of farm produce	2	3.3	4	6.6
Others	4	6.6	2	3.3
	60	**100**	**60**	**100**

Source: Field survey 2012

6.27 Extension officers' visit to the study area

Extension services are a necessary social improvement, a force contributing to agricultural change, which has developed over the years. Extension assists with the provision of information on issues such as food production and storage development, processing, farm management and

marketing of agricultural produce (Rivera *et.al*, 2001). The challenges facing extension service delivery in South Africa as highlighted by the National Education and Training Strategy for Agriculture and Rural Development include: the combined ratio (commercial and subsistence farmers) of 1:878; proximity between farmers, extensive areas covered by extension staff, client literacy and the level and functioning of farmers' organizations (DOA, 2005). A study by Harward and Botha (1995) also posits that extension services in South Africa are constrained by poor support services, inadequate contact between extension and research, outdated extension approach, and exposure of farmers to high farm inputs against their performance achievement, thereby pushing many farmers into debt. Nevertheless, an effective and well coordinated extension programme remains the key to agricultural development and yield performance.

Bembridge (1993) asserts that extension services entail: assisting farmers in adopting the right attitude and problem-solving; mirroring alternatives and identifying sources of information that help individual farmers toward self-reliance, disseminating research information to the farmers and transferring farmers' problems back to the research centres; assisting farmers to access managerial competences *via* training and guidance in conflict and decision making and assisting in the promotion and conservation of the endowed natural resources within the environment of the farmers. The 5-point *Likert* scale (most often, very often, undecided, often and less often) was used to determine the frequency of extension visits. The results of the study reveal that 10% of respondents in Shiloh agreed that extension visit occurred often as did 3.3% in Zanyokwe. About 13.3% of farmers in Shiloh asserted that extension visits were very often compared to 15% in Zanyokwe. However, in Shiloh 61.6% of respondents asserted that extension visits were infrequent compared to 60% in Zanyokwe (Table 6.28). Overall, 60% of the respondents in Shiloh and 71.6% of those in Zanyokwe concurred that the services provided by extension were

relevant to their situation (Table 6.28). From the focus group discussion (Appendix 1) the Shiloh and Zanyokwe irrigation schemes had one assigned extension officer each, at the time of this study.

Table 6.28 Distribution of households with respect to extension officers' visit to the study areas

	Shiloh (N=60)		Zanyokwe (N=60)	
Extension visit:	**Frequency**	**%**	**Frequency**	**%**
Most Often	2	3.3	5	8.3
Very Often	8	13.3	9	15
Undecided	7	11.6	8	13.3
Often	6	10	2	3.3
Less often	37	61.6	36	60
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

Table 6.29 Distribution of households with respect to relevancy of services provided by Extension

	Shiloh (N=60)		Zanyokwe (N=60)	
Services:	**Frequency**	**%**	**Frequency**	**%**
Yes	36	60	43	71.6
No	24	40	17	28.3
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

6.28 Decision on type of extension programme in the study areas

Table 6.30 shows decision making on the type of extension programme that farmers need. Farmers should be given the opportunity to decide and pilot their own development initiatives and settle on what they want for their own future, rather than becoming submissive recipients of various aids and training programmes (ASFG, undated). Farmers' participation in decisions making on issues that influence their well being is important to enhance collective responsibility for the outcome. Smallholder farmers are often marginalised and they lack the will power to lobby government for investment in areas of needs such as infrastructure or services,

improvements of rural roads, market facilities and even the type of extension services and programmes. Farmers in most cases have little or no say in the design, and implementation of aid programmes such as agricultural research agenda, emergency recovery interventions and types of extension programmes offered (ASFG, undated). The results of the study reveal that 60 % of respondents in Shiloh complained that extension officers unilaterally decided which type of extension programmes to offer them, as did 50% in Zanyokwe. However, 21.6% and 45% of respondents in Shiloh and Zanyokwe respectively, confirmed that the scheme management committee determined the type of extension programmes to provide. The percentage of respondents who concurred that all farmers were involved in deciding the type of extension programme was 13.3% in Shiloh and 5% in Zanyokwe. From the study results, it was evident that most extension programmes intended for farmers in both Shiloh and Zanyokwe were poorly focused and irrelevant to the needs of the farmers because there was inadequate input and involvement of farmers in the type of extension programmes offered.

Table 6.30 Distribution of households with respect to decision on type of extension programme

Shiloh (N = 60)			**Zanyokwe (N = 60)**	
Decision on type of extension service	**Frequency**	**%**	**Frequency**	**%**
Extension officer	36	60	30	50
Scheme management committee	13	21.6	27	45
Entire farmers	8	13.3	3	5
Others	3	5	-	-
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

6.29 Marketing information on farm produce in the study areas

A well-organized and effectual marketing system stimulates interest and increases yield performance of smallholder farmers while poor marketing arrangements remain the cause of poor agricultural production (Zenda, 2002). Most smallholder irrigation schemes are located in

areas that are not linked to main roads and transport facilities and therefore, farmers rarely send their farm produce to the market. Most farmers lack marketing and technical skills, as well as information that could assist them meet the quality requirement of consumers, buyers and super markets, such as SPAR, Shoprite etc. In most instances, smallholder farmers are motivated to invest in farming, processing and farm labour if there is an unrestricted access to buyers who offer fair and stable prices for their farm produce, thus increasing their food security status and overall cash income (ASFG, undated). In the focus group discussion (Appendix1), farmers claimed that they had marketing arrangement with conventional sales outlets such Shoprite, SPAR etc but the contractual arrangements often failed. In Shiloh, 25% of respondents posited that they had sufficient market information compared to 16.6% in Zanyokwe. Overall, 75% of respondents in Shiloh and 83.4% in Zanyokwe did not have sufficient market information (Table 6.31). The manner of determination of farm produce prices was not well defined, as farmers sold to buyers, who offered the farmers what they described as reasonable prices. Results of the study also revealed that 23.3% of farmers in Shiloh and 21.6% in Zanyokwe sold most of their farm produce within the village (Table 6.32). In Shiloh, 71.6% of the respondents sold their farm produce at the farm gate, while 63.2% did so in Zanyokwe. However, 18.3% and 8.34% respondents sold their farm produce in the local market Shiloh and Zanyokwe respectively. Although, farmers have sales arrangements in place, they are also often forced to sell their farm produce to farm gate customers, who offer below production cost prices. The advantages inherent in the sales of farm produce at the farm gate were obvious. Farmers remarked that the inconveniences and costs incurred for transportation of farm produce to the market for sale was removed when farm produce was sold at farm gate or in the community.

Table 6.31 Distribution of respondents with respect to marketing information on farm produce

	Shiloh (N=60)		Zanyokwe (N=60)	
Services:	**Frequency**	**%**	**Frequency**	**%**
Yes	15	25	10	16.6
No	45	75	50	83.3
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

Table 6.32 Distribution of respondents with respect to sales of farm produce

	Shiloh (N=60)		Zanyokwe (N=60)	
Sales point:	**Frequency**	**%**	**Frequency**	**%**
Inside village	14	23.3	13	21.6
Farm gate	31	51.6	38	63.3
Local market	11	18.3	5	8.34
Other	4	6.6	4	6.6
Total	**60**	**100**	**60**	**100**

Source: Field survey 2012

6.30 Variation in yield gap in 2012/2013 in the study areas

The most common yardstick for measuring agricultural productivity is the yield output. An increase in agricultural yield requires a scientific and technical solution that is relevant to smallholders' felt needs. This will enhance efficiency in the use of local resources and generate local employment (HLPE, 2013). In less developed countries, the non- availability and high cost of inputs and equipment often make productivity improvements more difficult to achieve. The perceived farmers' satisfaction and variations in the annual rate of yield for the last two years in both Shiloh and Zanyokwe scheme were assessed using the following variables: increased, decreased and unchanged. In Shiloh, 5.83% asserted that yield performance increased over the past two years and 3.33% in Zanyokwe. The percentage of respondents who posited that yield performance decreased was 26.67% in Shiloh and 22.50% in Zanyokwe (Figure 6.22). However, the percentages of respondents whose yield performance remained unchanged in both Shiloh and

Zanyokwe schemes were 17.50% and 24.17 % respectively. Diverse reasons where adduced for the decrease in the yield gap among households in the schemes. From the focus group discussion (Appendix 1) respondents stated that the non-availability of farm inputs at the right time, water problem, tractors, credit, transportation cost and marketing were their major constraints.

The yield gap is the difference between actual farm yields and the maximum achievable yield

Table 6.33 Distribution of respondents' in respect of variation in yield gap 2011/2012

Shiloh (N = 60)			**Zanyokwe (N = 60)**	
Yield gap variation	**Frequency**	**%**	**Frequency**	**%**
Increased	6	10	4	6.6
Decreased	34	56.6	26	43.3
Unchanged	20	33.3	30	50
Total	**60**	100	**60**	**100**

Source: Field survey 2012

6.31 Comparison of households with respect to remaining in the scheme

The characteristics of households who have decided to remain in the scheme and households who have decided otherwise for both Shiloh and Zanyokwe are shown in Tables 6.34 and 6.35 respectively. The data show positive characteristic differences between households who were satisfied and have decided to remain in the scheme and households who were not satisfied. Generally, households who do not wish to remain in both Shiloh and Zanyokwe have older heads than those households that wished to remain. The level of education of the heads of such households was a little higher amongst households that wished to remain than households that do not wished to remain in both Shiloh and Zanyokwe. However, farm size and internal income

sources (Spaza shop) were higher amongst households that do not wished to remain than households that wished to remain in Shiloh but almost the same in Zanyokwe.

Table 6.34 Distribution of mean comparison of household decision making in Shiloh

Variable description (Characteristics)	Remain in scheme: YES (N=51)		Remain in scheme: N0 (N=9)	
	Mean	**St. Dev**	**Mean**	**St. Dev**
Age***	55.75	5.809	61.30	6.730
Marital status	2.08	1.279	1.98	1.214
Level of education*	2.60	1.153	2.38	1.091
Farm experience	12.23	3.619	12.77	3.050
Employment	.10	4.37	.33	.510
Time spent at home *	4.37	1.057	4.63	.736
Number of persons living in household, who assist with farm labour**	1.33	.572	1.63	.758
Size of farm land in hectares *	1.03	.258	1.28	.490
Location of farm land to the nearest town in km	32.28	3.189	32.13	3.022
Distance from farm to nearest access road	.15	.360	.35	.481
Household income: Salary and wages in Rand	1.30	.962	1.47	.999
Household income: pension	1.33	.896	1.23	.593
Household income : Grants	1.55	.723	1.68	.748
Household income: Remittance in kind	2.32	.983	2.47	.892
Household income: Remittance in cash	2.55	1.048	2.65	1.022
Internal sources of household income: Spaza Internal sources of household income: Shop**	1.42	1.266	4.00	2.329
Internal sources of household income: Hawking	1.48	1.000	1.58	.966
Internal sources of household income: Selling liquor	1.07	.362	.95	.502

Note. The variables in which YES households differ significantly from NO households: at 0.01 (** *), 0.05 (**), and 0.1 (*) levels of significance.

Even though the differences were not statistically significant, households who wished to remain in Zanyokwe had higher land sizes than households who do not wish to remain. Also in Zanyokwe, the proportions of households that assist with farm labour were slightly higher

amongst household that do not wish to remain with the scheme than households that wish to remain.

Table 6.35 Distribution of mean comparison of household decision making in Zanyokwe

Variable description	Remain in scheme: YES (N=55)		Remain in scheme: NO (N=5)	
	Mean	St. Dev	Mean	St. Dev
Age***	59.12	6.471	61.38	6.219
Marital status	2.22	1.451	1.73	1.219
Level of education *	2.75	1.068	2.53	1.033
Farm experience	12.05	3.624	12.45	3.223
Employment	1.95	.220	.17	.376
Time spent at home **	4.22	.993	3.63	1.207
Number of persons living with household that assist with farm labour*	2.08	.787	2.68	.869
Size of farm land in hectares**	3.17	1.11	2.40	1.265
Location of farm land to the nearest town in km	43.45	4.3000	43.23	4.236
Distance from farm to nearest access road	.78	.415	.87	.343
Household income: Salary and wages in Rand	2.40	.694	2.70	.869
Household income: pension	1.45	1.064	1.52	1.066
Household income: Grants	1.73	.841	1.73	.841
Household income: Remittance in kind	2.57	1.064	2.56	1.065
Household income: Remittance in cash	2.87	1.96	2.86	1.096
Internal sources of household income: Spaza Internal sources of household income: Shop	1.22	.958	1.33	1.003
Internal sources of household income: Hawking	1.54	1.185	1.56	1.185
Internal sources of household income: Selling liquor	1.23	1.031	1.23	1.031

Note. The variables in which there are significant differences between YES and NO households: *** = at 0.01, ** = at 0.05, and * = 0.1 levels of significance.

CHAPTER 7

EMPIRICAL RESULTS FOR DECISION MAKING PROCESS

7.1 Introduction

The chapter explains the empirical results of the factors affecting farm households' decision making in both Shiloh and Zanyokwe smallholder irrigation schemes. It used binary logistic analysis. The factors were grouped into household characteristics; farm characteristics; institutional factors; bio-physical and economic factors, as illustrated in the framework of the study (Figure 4.1). The household characteristics included gender, age, education, and farm assets. The farm characteristics included size of land, quantity of produce (yield gap), and distance to access roads. The institutional factors included permission to occupy (land rights), infrastructure, and access to extension services. Biophysical and economic factors included water, and market information.

7. 2.1 Logistic regression results

In consideration of the model fit, the Leme show Goodness-of- Fit test statistics was 1.00, which implied that the model's estimates fit the data at a suitable level. Given that R^2 cannot be computed precisely for Logistics Regression (Norusis, 2004), a pseudo R^2 was therefore worked out. In this study, *Nagelkerke* R^2 was computed as a proxy estimate to R^2 in OLS regression which measures the proportion of the differences or variation in the response that is clarified by the model (Norusis, 2004). The *Nagelkerke* R^2 of 0.398 and 0.608 was obtained for Shiloh and Zanyokwe respectively, which implied that more of the variations were explained in Zanyokwe and less in Shiloh as illustrated in Tables 7.1 and 7.2. The overall correctly predicted percentage for Shiloh was 83.3 with 81.7 for Zanyokwe (Table 7.1 and 7.2).

In the binary logistic model, seven variables (farm experience, size of farmland, land rights/PTO, water sufficiency, farm asset, market information and production variation) out of the twelve predictor variables were found to have significant impact on influencing household decision making in Shiloh smallholder irrigation scheme, while five variables (gender, age, education, road distance and extension access) were not significant (Table 7.1). Of the seven significant variables, four had positive signs (land rights/PTO, water sufficiency and market information); which means that an increase in either of these variables may be associated with an increase in household decision making in Shiloh. The other three predictor variables (farm experience, farm asset and product variation) had negative signs; this means an increase in either of these variables may be associated with a decrease in decision making as illustrated in Table 7.1.

In Zanyokwe, six variables (farm experience, land rights/PTO, water sufficiency, farm asset, market information and production variation) out of the twelve predictor variables were found to have significant impact on influencing household decision making, while six variables (gender, age, education, size of farm land, road distance and extension access) were not significant (Table 7.2). Of the six significant variables, two had positive signs (water sufficiency and farm asset); which means that an increase in either of these variables may be associated with an increase in household decision making in Zanyokwe. The other four predictor variables (farm experience, land rights/PTO, market information and product variation) had negative signs; this means an increase in either of these variables may be associated with a decrease in decision making as illustrated in Table 7.2

Table 7.1 Determinants of decision making for choice to remain in the scheme (Shiloh)

Independent variable	B	S.E	Wald	df	Sig.	Exp(B)
GENDER	- .631	.632	.997	1	.318	.532
AGE	-.004	.054	.005	1	.946	.996
EDUC	-.165	.274	.361	1	.548	.848
FARMEXP	-.077	.089	.748	1	.038*	.926
LANDSIZ	9.970	20096.480	.000	1	.010*	21366.965
ROADDIS	-.53987	.775	.483	1	.487	.583
LANRITS	.970	.680	2.036	1	.015*	2.639
WATSUFC	1.299	1.096	1.404	1	.023*	3.667
FARMASET	-1.430	.678	4.444	1	.035*	.239
EXTACES	1.076	.720	2.232	1	.135	2.933
MKTINFO	.768	.668	1.323	1	.012*	2.933
PRODVAR	-1.390	.598	5.400	1	.020*	.249
-2 Log likelihood	44.819[a]					
Nagelkerke R^2	.398					
Percentage correctly predicted	83.3					

Note:

- Significant variables affecting decision making at 0.01(***), and 0.05 (**) and (0.1(*) levels of significance.

Table 7.2 Determinants of decision making for choice to remain in the scheme (Zanyokwe)

Independent variable	B	S.E	Wald	df	Sig.	Exp(B)
GENDER	.35	.613	.341	1	.559	1.431
AGE	-.039	.044	.800	1	.371	.962
EDUC	.155	.263	.346	1	.556	1.168
FARMEXP	-.118	.081	2.096	1	.014*	.889
LANDSIZ	.013	.277	.002	1	.963	1.013
ROADDIS	-2.008	1.083	3.436	1	.064	.134
LANRITS	-.439	.659	.444	1	.01*	.644
WATSUFC	2.197	.877	6.276	1	.012*	9.000
FARMASET	1.993	.810	6.049	1	.014*	7.34
EXTACES	1.026	.586	3.066	1	.080	2.790
MKTINFO	-.807	.645	1.567	1	.003**	.446
PRODVAR	-2.330	.699	11.121	1	.001**	.097
-2 Log likelihood	40.819[a]					
Nagelkerke R^2	.608					
Percentage correctly predicted	81.7					

Note:

Significant variables affecting decision making at 0.01(***), and 0.05 (**) and (0.1(*) levels of significance

7.2.2 Farm experience

Farm experience was significant with *p-value* of 0.038 in Shiloh but negatively related to decision making. The results suggest that, if farm experience increases, log odds for decision making is decreased by 0.77 in Shiloh. In Zanyokwe farm experience was also significant (*p-value* = 0.014) but negatively related to decision making. The results suggest that, for every unit increase in household farm experience there is a 0.118 decrease in the log odds of decision making of households in Zanyokwe. These results contradicts previous report presented by Enete

et al (2002), who posited that experienced farmers are more informed and are better able to make quality decisions. In most traditional societies, the older the person, the more his or her opinion on issues is respected and sought after during decision making. Nonetheless, farmers with few years of experience may have a broader range of skills, greater understanding regarding farming systems and may be better able to evaluate risk associated with farming timeously than the more experienced farmers.

7.2.3 Land size

The size of landholding was significant (*p-value* = 0.010) and positively related to decision making of households in Shiloh. The results suggest that, for every unit increase in land size there is 9.970 increases in the log odds for decision making of households in Shiloh. As indicated in chapter 6 Table 6.7 above, 49.2% of the surveyed households in Shiloh had less than 1ha irrigated food plot that was used for farming. Households on a plot of 1.5 morgen (approximately 1.28ha), (Commission for the Socio-Economic Development of the Bantu Areas within the Union of South Africa, 1955) produce enough income for sustenance and food security. The average landholding sizes of most households especially in Shiloh were grossly inadequate for households to be food secure. Consequently, we expected the marginal effect of increasing landholding size on the probability of remaining in the scheme. The positive impact of land holding size agrees with the findings of Darr and Uirbrig (2004); and Emtage and Suh (2004). When plot sizes are too small, farm mechanization is hindered since it becomes ineffective from a costing point of view to use tractors and other mechanized equipment. The idea is then that the smaller the plot, the more likely farmers are to rent out their land and thus are less likely to remain in the scheme. This result also lend credence to the findings of Lageman (1977) in

Nigeria, cited by Amold (1991) that as landholding size decreases farmers become more dependent on off-farm activities.

7.2.4 Land Rights/PTO

Farmers' perception of land rights was significantly and positively related to the decision to remain in the scheme in Shiloh (*P-value* = 0 .015) and Zanyokwe (*P-value* 0.05). These results imply that, if PTO is enhanced, log odds for decision making are increased by 9.970 and 0.013 in Shiloh and Zanyokwe respectively. These positive results are consistent with studies by Bannister and Nair (2003) in Haiti who asserted that farmers planted more trees on plots where they had better tenure security. Moreover, farmers were more prepared to maximally utilise land where they had land rights or tenure security than land or plots that were rented. In South Africa, one of the guiding principles of the tenure reform strategy is that it must allow farmers to decide the tenure system which is suitable for their circumstances (DLA 1997). The policy instrument put in place by the post apartheid government was the Communal Land Rights Act, (No 11 of 2004). This act was proposed as the primary tool for providing legally secured tenure, equal redress, self-regulating land administration and the setting up of Land Rights boards to repeal or adjust other land rights laws that was inherited from the apartheid regime (Manona *et al* 2010). Farmers with Land Rights or permission to occupy (PTO) are more likely to remain in the scheme. In addition, a number of studies argue that in situations of insecure tenure, the risk associated with losing land will discourage farmers from making investments. According to Carter and Olinto (2003), more significant investment occurred with farmers that had Property Rights or land title (PTO) than those farmers that did not.

7.2.5 Farm asset

The availability of farm assets (p-value = 0.35) was significant but negatively related to decision making in the Shiloh. The results imply that, for every unit increase in household farm asset there is 1.430 decrease in the log odds of decision making of households in Shiloh. In Zanyokwe, farm asset (*p-value* = 0.014) was significant and positively related to decision making. By implication, for every unit increase in farm asset in Zanyokwe, there are 1.993 increases in the log odds of decision making. One of the themes that emerged from our focus group discussions was the inadequate farm assets. Farmers claimed that this was the chief factor influencing decision making in the schemes. Inadequate access to mechanical land preparation equipment such as tractors was common and critically affected farmers' production decisions. In many cases farmers had to wait for several days to get tractors to cultivate their farm land. The effects of these delays were often that farmers planted their crops late. Therefore farm assets were crucial for making well informed production decisions in both schemes.

7.2.6 Water sufficiency

Water sufficiency was positive and significantly impact on decision making the in the schemes. Water sufficiency had a *p-value* = 0.023 in Shiloh and *p-value* of 0.012 in Zanyokwe. These results suggest that, if water sufficiency is enhanced, log odds for decision making are increased by 1.299 and 2.197 in Shiloh and Zanyokwe respectively. This result is not surprising because from the focus group discussion conducted, Kamma-Furrow and Lenye North in Zanyokwe scheme used paid electricity to pump water to their crop fields. This result is also consistent with the report of Stephen, 2007; Monde *et al* 2005 that decreased level of crop yield in many smallholder irrigation schemes in South Africa stems from inefficient water use. This inefficiency may either be as a result of under application or over-application of water (Stephen,

2007; Monde *et al* 2005)). With the increasing shortages of water and increasingly inefficient water use, the need to increase water productivity is urgent. It must come from good agronomic practices rather than increasing the area of land under irrigation (Machethe, *et al* 2004). Besides this, the majority of smallholder irrigation farmers in South Africa are not prepared at the moment for the introduction of irrigation scheduling (Stephens, 2006).

7.2.7 Market information

With respect to market information, the results suggest a significant and positive influence on decision making (*p-value*: 0.012) in Shiloh. The result suggests that if market information is enhanced, a log odd for decision making is increased by 0.768 in Shiloh. In Zanyokwe, market information (p-value: 0.003) was significant but negatively related to decision making of households'. The results suggest that, if market information is enhanced, logs odds for decision making decreases by 0.807 in Zanyokwe. This result is expected mainly because the farmers were not dissatisfied with their existing access to market information. The main concern here was proximity. Nevertheless, information about higher market prices for farm produce is likely to motivate farm households to participate in small-scale irrigation schemes. The marginal effect revealed that the probability of participation in irrigation scheme is higher for household with a good access to market information than households without such access. Furthermore, market information assists households in the purchase of farm inputs at the right time and at reasonable cost. Networking by farmers with farm gate customers using mobile phones, is gradually permeating rural areas and are very helpful for obtaining market information.

7.2.8 Produce output variation

The yield variation of farm produce (*p-value*: 0.020 for Shiloh and *p-value*: 0.001 for Zanyokwe) was significant but negatively related to decision making of households. The implication of these

results is that, for every unit increase in farm yield there are 1.390 and 2.330 increases in the log odds for decision making of households in Shiloh and Zanyokwe respectively. These findings is consistent with the report of Zeleke (2008), who reported that farmers with higher crop output per unit area of land were more likely to continue growing trees in the Sodo Zuriya (Ethiopia) tree planting scheme. Furthermore, in their study Darr and Uirbrig (2004) found that households who continued tree planting in the tree planting programme were farmers that generally derived higher returns on their agricultural yield. In Zanyokwe scheme, poorly managed cropping systems resulted in poor performance which resulted in low yields. In addition, low cropping intensity affected total production and income of farmers (Fanadzo, 2010 and Perret *et al* 2003). Thus, since households are rational in their decision making, the continued fluctuation of yield performance will certainly influence their decision making. Therefore, higher returns of farm output will encourage farmers in quality decision making.

7.3 Conclusion

From the results of the study, it is implied that smallholder decision making is influenced by the factors included in the model. In the model adopted, seven out of twelve independent variables were found to be significant in explaining the households' choice to remain in both the Shiloh and Zanyokwe smallholder irrigation schemes. The independent variables significant in both schemes were farm experience, distance of households to the nearest access road, farm infrastructure/asset, water sufficiency in the scheme, access to extension services, marketing information, and produce variation/ yield gap. The results imply that the logistic regression model describing the householders' choice to remain in the scheme conform to some of the explanatory variables and are well specified.

CHAPTER 8

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

8.1 Introduction

This section succinctly provides the summary, conclusions and policy implications of the findings. The policy implications were drawn from the results of the study. The chapter examines the objectives of the study that were previously mentioned in chapter one. The empirical results were summarised and future research directions were also highlighted.

8.2 Summary of the dissertation

The study examined decision making in smallholder irrigation practices with particular reference to the Shiloh and the Zanyokwe irrigation schemes. Specifically, the dissertation sought to: (1) describe the socio-demographic and farm characteristics of smallholder irrigation farmers in Shiloh and Zanyokwe; (2) examine and model the determinants of SIS farmer's decision making; (3) determine the impact of institutional arrangements in decision making of smallholder irrigation farmers; (4) assess the contribution of smallholder irrigation farming to household food security and determine the production and marketing constraints of smallholder farmers' in Zanyokwe and Shiloh irrigation schemes.

One of the keys to poverty alleviation in South Africa is the involvement of rural poor farmers in economic activities in ways that will sufficiently generate income and employment. The reduction of rural poverty and inequality lies in the development of overall frameworks that can provide social security, education and training, infrastructure and health care. Integrating smallholder farmers into main stream agriculture involves the conversion of the traditional subsistence production systems into commercial ventures. Such proposals require an understanding of the farmers' adoption behaviours and decision making in order to pursue

successful rural poverty reduction. Farmers' willingness to cultivate crops or rear livestock is dependent on household and farm characteristics as well as biophysical, economic and institutional factors. Positive intervention strategies in the above areas must be found in order for the government and NGOs to be able to carry out successful rural development interventions. The most important question this study attempted to address was "What are the determinant factors that influence smallholder farmers' decision making? The study was conducted in the Amathole district, where Zanyokwe smallholder irrigation Scheme is located and the Chris Hani districts where Shiloh smallholder irrigation Scheme is located. Both districts are found in the in Eastern Cape region of South Africa. The choice of Zanyokwe smallholder irrigation scheme and Shiloh smallholder irrigation scheme for this study was mainly supported by the fact that there was a substantial level of crop farming activity taking place at Zanyokwe while at Shiloh there were many dairy projects attached to the scheme. This study used a survey, quantitative and qualitative research methodologies involving the use of questionnaires and focus group discussions. The sample size was 240 and respondents included both farmers within the selected schemes and farmers from outside the schemes. The data was coded and analysed using the Statistical Package for Social Science (SPSS). This data was represented in various forms including bar and pie charts, frequencies and percentages. This study is of importance because the findings will help the government, non-governmental organisations, and farmers involved in decision making. In conclusion, the research findings are as follows:

8.2.1 Demographic characteristics

Research findings revealed that 41.7% of the respondents in Shiloh were male while 58.3% were female. In comparison, the male respondents in Zanyokwe constituted 73.3% and female respondents 26.7%. The number of male plot holders in Zanyokwe was almost twice that of male

plot holders in the Shiloh smallholder irrigation scheme. In general, males were the predominant plot holders in Shiloh and Zanyokwe. The results of the study further revealed that 43.3% of farmers in both Shiloh and Zanyokwe irrigation schemes were married. They also revealed that in Shiloh 3.3% were widowers while in Zanyokwe this figure was 6.7%. The divorce rate was 10.5% and 15.0% in Shiloh and Zanyokwe respectively.

The age range of the respondents in the Shiloh and Zanyokwe smallholder irrigation schemes was 44 to 71 years. The numbers of youths with plots in the scheme was not very encouraging. Only 1.7% of the total population sampled were 44years old and the mean age of the respondents was 55.7 years. Agricultural production in the area is in the hands of older men and women who are not economically active, while the able-bodied youth often migrate to urban centres in search of white collar jobs.

Findings revealed that farmers with their highest qualification being a junior school education ranked highest in Shiloh and Zanyokwe schemes; represented by 33.3% and 36.7% of respondents respectively. Farmers' that obtained high school education accounted for 16.7% in Shiloh and 21.7% in Zanyokwe. The percentage of farmers that had no formal school education in Shiloh was 21.7% while in the Zanyokwe the figure stood at 15.0%. The proportion of farmers who had achieved a tertiary education was similar for both schemes. In Shiloh, the respondents with a tertiary education made up 5.0% of the population while in Zanyokwe, 3.3%. of farmers claimed a tertiary education. The results show that 3.4% of farmers had a minimum of five years farm experience for Shiloh; while in Zanyokwe 5% reported that they had a minimum of five years farm experience.

Respondents with 10 years farm experience made up 8.4% of farmers in the Shiloh scheme and 6.6% of farmers in Zanyokwe had this level of experience. For both schemes the most experienced farmers had twenty years of experience though the majority of respondents had farm experience raging from nine years to 17 years. Experience in farming has implication for the decision making of household since experience is related to quality decision making (Polson and Spencer, 1992).

The findings revealed that most of the households interviewed were entirely dependent on their plot holding for crop and livestock production. In Shiloh, 45.83% of the respondents were not in paid employment and 47.5% in Zanyokwe. 47.50% of respondents were unemployed. The number of respondents that were unemployed in Shiloh and Zanyokwe was not significantly different. In Shiloh 4.17% of the respondents were employed while 2.50% of those in Zanyokwe were employed. Off-farm activities like running 'Spaza' shops, hawking, and engaging in menial work were common in the study areas.

Results show that 40% of the respondents in Shiloh were 'less often' at home while 34% of the respondents in Zanyokwe were 'less often' at home. The percentage of household often present at home was similar for Shiloh and Zanyokwe. Most of the respondents were engaged in farm activities during the day and so spent little time at home.

In both schemes, the numbers of people living with household head who assist with farming were between 3 and 9 and 2 and 9 respectively. In Shiloh, 7 households interviewed maintained that only 4 person assists with farm labour, while in Zanyokwe 6 households maintained that only 2 assist with farm labour. Most households insist that dependants or relatives living with them were youths who prefer off-farm activities to farming.

In the Zanyokwe irrigation scheme, 14 of the household interviewed agreed that only 8 persons living with them assisted with farm labour while in Shiloh, 13 of the households interviewed agreed that only 9 assisted with farm labour (Figure 6.3). The number of people in a household, who assist with farm labour in Shiloh and Zanyokwe, were very low. However, most dependants living in households in the communities were youths who are either not usually at home or interested in agricultural activities. Most households depended on hired labour during the time of planting and harvesting. The number of people living with households that assisted with farm labour in Shiloh and Zanyokwe was very low. This was partly explained by the fact that most dependants living with households were youths who are either not stable at home or were not interested in agricultural activities. Most households depended on hired labour in the planting and harvesting seasons.

8.2.2 Household livelihood strategies

Households' income in the form of salaries and wages was relatively low for both schemes. In Shiloh 45% of the respondents earned less than R500 a month in salaries and wages while in Zanyokwe 3.33% of the respondents earned less than R500. In Shiloh, 3.33% of the respondents earned between R5000 and R10 000 as salaries and wages. Most of these respondents were casual workers in the scheme who also had plots which they sharecropped with their relatives. The percentage salaries and wages for Zanyokwe were comparatively higher than Shiloh. A good number of people in these areas are unemployed thus salaries and wages do not contribute significantly to household income. In Shiloh, only 0.8% of households earned between R600 and R1000 from salaries and wages while in Zanyokwe 25.00% of the respondents were in the same earning bracket. In general, farmers in Shiloh

generate more income for their households than in Zanyokwe. Households in the two schemes that earned more than 1000 Rand were few, at 0.8% of the total respondents. The number of pensioners in the schemes was low. This figure was similar for the two schemes. An overall figure of 43.33% of respondents in Shiloh and 41.67% in Zanyokwe were not on pension. In Shiloh and Zanyokwe, an overall average of 4.17% and 5.00% of respondents respectively, received pensions of between R501 and R1000 per month. However, pensioners who earned between R2001 and R3000 accounted for 0.83% of those surveyed in both Shiloh and Zanyokwe. The sum average of respondents reveals that households in both schemes do not generate enough income from pensions.

Research findings revealed that 28.33% of the respondents in Shiloh received social grants ranging from R100 – R200 while in Zanyokwe 24.17% of the respondents receives social grants in this range, to support the household. However, there was no significant difference in social grants of between R201 and R300 received by Shiloh and Zanyokwe households. In Shiloh, 1.68% of households received social grants of between R401 and R500 a month while in Zanyokwe this figure was 3.3%. Social grants have been a regular external source of income for almost all households in the study area. Households receive social grants from the government on a monthly basis. The beneficiaries of these social grants include old people, and disabled or underprivileged children below the age of 18.

Household incomes in the form of remittances in kind were mostly received from relations in the urban centres. However, these remittances are often not regular. Households that had children left under their care by parents working in urban centres, received regular remittances in the form food items. In general, 10.83% of households in Shiloh and 6.17% of those in

Zanyokwe received remittance in kind of less than R100 per month.. In Shiloh 19.17% of household received between R101 and R200 per month while in Zanyokwe 20.83% received remittance of range. There wasn't a significance difference between the remittances of R201 – R300 received by household in the two schemes. In terms of remittances over R400 per month the figures began to diverge with 0.83% in Shiloh receiving this amount while 2.5% in Zanyokwe received such remittances. Comparatively, remittances received by household in the form of either cash or kind, from relations in urban centres was low. This may be attributed to high cost of living in urban areas. Findings revealed that 5.8% of the respondents receive remittance in cash of less than R100 per month in Shiloh while 1.7% in Zanyokwe received under R100 a month. In Shiloh, 22.5% of households that received between R101 – R200 while in Zanyokwe, 21.7% of households were in that range. Comparatively, the highest receipts of cash remittances, that is, more than R400 per month, were recorded in Zanyokwe where 6.7% received these. In Shiloh 3.3% of households received cash remittance of more than R400.

In Shiloh, 4.2% of households owned 'Spaza' shops. These contributed R300 – 400 incash income every month. In Zanyokwe only 1.7% of the total respondents owned 'Spaza' shops, earning them also R300-R400 a month in income. Hawking and the sale of liquor were other off-farm activities that contributed to household cash income. In Shiloh and Zanyokwe, 5.8% of farmers (7farmers) and 5.0% of farmers (6farmers) respectively, used hawking to generate household incomes of between R100 and300 monthly. Liquor sales also contributed to households' cash income. The numbers of liquor sale outlets in the study area were very few but nonetheless, 1.7% of households in Shiloh who sells liquor contribute an average of R100

– R200 to the household monthly cash income. The situation in Zanyokwe is quite different as only 1.7% of households sell liquor but the contribution of liquor sales to household cash income was more than R300.00 a month.

8.2.3 Land and agriculture (farm characteristics)

Findings revealed that in Shiloh irrigation scheme, most of the beneficiaries were food plot holders with 98.4% of farmers accessing less than 1ha of land for crop and livestock production. In the majority of cases, the farmers in Shiloh had either rented out their farm land to the dairy project located in the scheme or converted it into grazing camps. The fragmentation of irrigated land has negative implication for production decision making and farm mechanization. In Zanyokwe, 31.6% of beneficiaries in the scheme had a plot size in the range of 3 and 6 ha. Overall results revealed that the schemes irrigated similar areas of land. Shiloh had 450 hectares irrigated while Zanyokwe had 412 hectares irrigated. The distance between irrigated plots of land and access roads influences labour availability and the supply of farm inputs. Farmers that are closer to the scheme have the advantage of getting to their farms early without having to walk long distances. In situations where the irrigated farm land is far from the nearest access road, the likelihood of farmers incurring transportation costs increases, pushing up the overall cost of production. In Shiloh, findings revealed that the nearest access road to the scheme was 2 kilometer away, while in Zanyokwe, the nearest access road was 17 kilometres away. On an individual farmer basis, however, the distances were highly variable. This was the case especially for the Zanyokwe scheme because it serves at least 5 villages.

The Overall distances of farms from the nearest town were 35 kilometres' for Shiloh and 46 kilometres for Zanyokwe. The distance factor is particularly important in marketing of farm produce and supply of farm inputs. Low agricultural production is exacerbated by distance to

markets and inefficient marketing systems affect farmers' decision making. There was a total absence of organised marketing for both Shiloh and Zanyokwe irrigation schemes and thus distance from the farms to the nearest market remains a barrier to the farming households. The incidence of farm produce getting spoilt has been experienced in both schemes. Most vegetables like spinach, cabbage and carrots need to be transported to the market timeously. The majority of farmers sell their produce at farm gates to hawkers, mainly because of the great distances to the nearest market.

In Shiloh, findings revealed that 705 cattle, 692 sheep, 485 pigs and 75 donkeys were reared by households. While in Zanyokwe, 712 Cattle, 728 sheep, 689 goats, 525 pigs and 74 donkeys were reared by households. The farming of this livestock not only supplements household income but also sustains families during periods of lack and adversity such as crop failure. Households often engage in distress sales of small stock such as goats and sheep, to provide for immediate family cash needs. Increased investment and expansion of livestock numbers increases the potential for further investment and improved decision making for households.

Earnings from the sale of livestock contribute significantly to household income in both study areas. In Shiloh, 66.6% of the respondents earned more than R4000 from the sales of cattle in the last two years while in Zanyokwe 80% of the respondents earned more than R4000 from the sales of cattle over the same period. Sheep, goats and pigs also contribute to the household income. Overall, 15% of respondents in Shiloh and 80% of respondents in Zanyokwe earned an average income of between R3001 and R4000 from sales of sheep over the last two years. Income earned from pigs and donkeys also contributed minimally to household income. Donkeys were only sold when households were in dire need of income while pigs were often sold for quick income. Despite this, 10% of respondents in Shiloh and 31.7% of those in Zanyokwe

asserted that pig rearing contributed an average of R3001 – R4000 towards their income over the last two years. Generally, both small and large livestock were sold to purchase food for household, for the payment of tuition fees and for the purchase of other household requirements.

Findings reveal that over the last two years, 4 cattle in Shiloh and 3 in Zanyokwe were consumed in 2012/2013. The total consumption of small stocks (sheep, goats and pigs) was higher in both Shiloh and Zanyokwe. In Shiloh, a total of 8 sheep and 3 goats were consumed in contrast to 11 sheep and 2 for goats in Zanyokwe. The consumption of small stocks was more pronounced during festivals and ceremonies. However, goats were mostly used during the initiation (circumcision) season, usually, in the month of December. Pigs' consumption amounted to 10 in Shiloh and 6 in Zanyokwe.

In Shiloh, 96.7% of households produced less than one ton of maize from the irrigated plots of land under cultivation while in Zanyokwe 38.3% of households produced less than one ton of maize. About twenty six percent of the household produced an average of 3 – 4 tons of cabbage in Shiloh while 41.7% of households managed this yield in Zanyokwe over the last two years. The yield from carrot was less than one ton for twenty six households (46.7%) in Shiloh and eleven households (18.3%) in Zanyokwe. In Shiloh, 40% of households produced between 3 and 4 tons of spinach while 46.7% of households produced an average of 3 – 4 tons in Zanyokwe. Beetroot production in the schemes registered a yield of 3 – 4 tons for sixteen households (26.7%) in Shiloh and twenty four households (40%) in Zanyokwe. In Shiloh and Zanyokwe, potatoes yield was less than one ton for 21.7% of households and 8.3% of households respectively. Overall, there was low cropping intensity in both Shiloh and Zanyokwe irrigation schemes which resulted in low yield. Crop production in Shiloh is minimal as the majority of the

plot holders rented out their allocated plots to the dairy project situated close to the scheme. There were low yields of almost all crops cultivated in both schemes over the last two years. In Zanyokwe, some of the plot holders were old and could not fully cultivate their irrigated plots of land. Respondents also asserted that late arrival of farm inputs and infrastructural deficiencies exacerbated by inadequate maintenance, contributed to low yields in both schemes.

Results revealed that 86.6% of respondents in Shiloh consumed less than one tonne of maize while 44.4% of respondents in Zanyokwe consumed less than one ton of maize. Households who consumed between 1 and 2 of total maize produced for the two years were 13.4% and 56.6% in Shiloh and Zanyokwe respectively. Cabbage consumption was a little higher than maize consumption in both schemes. Fourteen percent of the respondents consumed a total of between 1 and 2 tonnes in Shiloh. This figure was 45% for Zanyokwe were. In Shiloh and Zanyokwe, the percentage of farmers who consumed 1 to 2 tonnes of carrots was 45% and 55% respectively. In Shiloh, results revealed that 85% of the respondents consumed less than 1 ton of beetroot while 83.4% of respondents in Zanyokwe did so. The percentage of farmers that consumes between 1 and 2 tons of potatoes in Shiloh and Zanyokwe were 47.2% and 33.6% respectively. Farming in both schemes has been on subsistence level and almost all farm produce was for consumption rather than sale.

In Shiloh, 98.4% of respondents sold less than one tonne of maize while in Zanyokwe 70% of respondents sold less than one tonne of maize over the last two years. Overall, Shiloh and Zanyokwe households that sold between 1 and 2 tons of maize accounted for 1.6% and 30% respectively. About 28.3% of household in Shiloh sold between 1 and 2 tons of cabbage while in Zanyokwe 49% of respondents sold that much cabbage over the last two years. The percentage of households that sold between 1 and 2 tons of carrots were 16.6% for Shiloh, and 23.4% for

Zanyokwe while the sales of spinach between 1 and 2 tons were 51.6% of households for Shiloh and 63.8% of households for Zanyokwe. Households in Shiloh sold less than 1 ton of beetroot while 24.2% of households in Zanyokwe sold less than one ton of beetroot over the last two years. In Shiloh, 50.0% of respondents sold less than one ton of potatoes while in Zanyokwe 30.0% of household sold less than one ton of potatoes over the last two years. It should be noted that farmers only sell surplus farm produce when they experience bumper harvests in a season. This sale of excess farm produce often increases household income and food security.

Findings revealed that in Shiloh, 50% of the respondents earned an average of between R500 and R1000 from maize production while in Zanyokwe 45% of the household earned within this range from maize. 3.3% and 15% of households earned between R2500 – R3000 for Shiloh and Zanyokwe were respectively. The income from cabbage over the last two years was between R1500 and R2000 for 35.5% of Shiloh households while 50% of Zanyokwe households earned in this range. Carrot earnings of between R500 – R1000 were realised by 33.3% of households in Shiloh while in Zanyokwe 46.7%, received incomes in this range. In Shiloh, 30.0% of the respondents earned between R1500 – R2000 from the production of spinach while 31.7% of households in Zanyokwe had average earnings of between R1500 – R2000 over the last two years. Forty five percent of households in Shiloh earned between R500 and R1000 from the production of butternut while in Zanyokwe, 50% of household earned between R500 and R1000 over the last two years from butternut.

In Shiloh, 23.0% had average earnings of between R1500 and R2000 from the production of beetroot while in Zanyokwe, 35.0 % of respondents received an income of between R1500 and R2000 from the production of beetroot. The average incomes from potatoes production were between R1500 – R2000 for 25.0% of households in Shiloh while 48.3% of households in

Zanyokwe had an average income in this range from the production of potatoes. Overall, farmers earnings from crop production were poor in both schemes. The low income derived from the irrigation schemes was attributed to poor tillage services, late arrival of farm inputs and the dilapidated irrigation infrastructure.

8.2.4 Farm asset available in the study areas

Findings revealed that in Shiloh and Zanyokwe, simple farm assets which were easily afforded by farmers were the most common implements. These include hoes, shovels, spades, watering cans and knapsack sprayers. More sophisticated farm implements like farm machines and tractor mounted implements were owned by the government but under the control of the scheme management. Zanyokwe scheme has more farm assets than the Shiloh scheme does. As of the time of this report, the respondents asserted that only 2 of the 5 tractors available for use in Zanyokwe were in good working condition. In Shiloh the situation was similar as 2 of the 3 tractors were in good working condition. In Zanyokwe, 2 produce vehicles (trucks) were donated to the scheme by Sector Education and Training Authority (SETA). In both schemes, the respondents raised serious concerns over the inadequate condition of and dearth of farm assets. These difficulties have hampered farmers' productivity in the schemes. Access to farm assets will definitely increase smallholder farmers' potential for reinvestment of their profits and enhance their food security status.

8.2.5 Governance and institutions

The scheme management committee is the main organ of governance for the schemes. It is where major decisions are discussed and implemented. Findings revealed that in the Shiloh scheme, 40% of farmers did not consistently attend meetings convened by the scheme management while 35% of respondents in Zanyokwe did not attend these meetings regularly. An insignificant

number of respondents (6.67% for Shiloh and 9.17% for Zanyokwe) attended meetings regularly. Meetings are the only opportunity farmers have to cross fertilise ideas and thus improve the quality of their decision making. The failure of plot holders to attend and participate in meetings will invariably not only affect their participation in decision making processes, but also hinder access to agricultural development initiatives. Meeting resolutions are the declarations and adopted motion that emerge from sessions with farmers. In Shiloh, findings revealed that 25.83% of farmers received meetings resolution from other plot holders *via* informal group meetings while 10.83% of respondents in Zanyokwe received meeting resolution in this way. The formation of groups in the schemes is essential not only for giving out meeting resolutions but also for social interactions creating collaboration towards the achievement of specific goals. Plot holders in the scheme also pass on meeting resolutions to each other on an informal basis outside the group context. In Shiloh, 18.33% of farmers received meeting resolutions from other farmers while in Zanyokwe, 24.17% of farmers received meeting resolutions form other farmers.

Findings revealed that in Shiloh, 24.17% of the farmers agreed that meetings were arranged on an adhoc basis and 14.7% of those in Zanyokwe felt this way. Meetings in both schemes were irregular and when they did happen, attendance was poor. In some instances the agenda of proposed meetings was either unclear or unknown to participants. When the purpose of a scheduled meeting is unclear it tends to create low participation levels from the farmers who attend.. The farmers complained of the total absence of regulatory policies for the governing of the management committee that runs the schemes on a day to day basis. From the focus group discussions held with farmers, it was evident that the management committees that were informally nominated had no defined tenure of office. In Shiloh, 8.33% of the farmers asserted that meetings were held bi-annually while 10% in of those in Zanyokwe suggested this. Five

percent of farmers in Shiloh asserted that meetings were scheduled monthly while 2.5% in Zanyokwe spoke of monthly meetings. Scheduling regular meetings should be considered an administrative strategy that will enhance collective participation and improve the quality of farmers' decision making. In Shiloh, 4.17% of respondents concurred that meetings are scheduled fortnightly while 5% of those in Zanyokwe indicated that fortnightly meetings took place. Overall, 4.17% of respondents in Shiloh posited that meetings were scheduled quarterly while 13.33% of those in Zanyokwe spoke of quaterly meetings.

The results of the study show that majority of plot holders in the scheme asserted that they have had PTO certificates since they joined the scheme. The PTO certificates are an important aspect of tenure security, allowing the bearer to confidently assert the rights it lays out. The rights associated with land tenure include land user rights, transfer rights and exclusion rights (Adams *et al* 1999). In Shiloh, 33.33% of respondents felt that their possession of PTO certificates did not only make their tenure secure, but also generated increased interest in them to participate in decision making, 30% of farmers in Zanyokwe also held this view. Interestingly, 16.67% of respondents in Shiloh and 20% of respondents in Zanyokwe held the opposing view that PTO had led them to limited plots of land, thereby discouraging them from further investment decision making.

8.2.6 Decision making about training

The provision of support services in the form of training for plot holders is necessary to change the trend towards low yield levels and to enhance good scheme management. Findings revealed that in Shiloh, 10% of respondents participated in crop planting training. This figure was 21.67% for Zanyokwe. Training in harvesting was carried out with 23.33% of respondents in Shiloh and 13.33% of respondents in Zanyokwe. The training of plot holders in fertiliser application was not

very encouraging as only 15.83% of respondents in Shiloh and 11.67% in Zanyokwe participated in the training. In Shiloh, 0.83% got training in diseases and pest control while 3.33% in Zanyokwe participated in this training. Adequate empowerment of farmers will give them the necessary skills to assume responsibility for the management of their farms and thus become less dependent on public extension for assistance (Backeberg, 2005). Evidence from the focus group discussion reveals that most farmers had not reached the required level of competence to optimally take advantage of the irrigated plots of land allocated to them. Lopsided sector interventions such as focusing almost exclusively on repairing scheme infrastructure, is unlikely to achieve the desired goal of food security for households. Smallholder farmers require support systems that encompass comprehensive training in a variety of agronomic practices. As posited by (Denison and Manona 2007), funds allocation for training of smallholder farmers needs to be 40 to 50% of the total intervention budget of the government. The positive effects of training farmers have long been established in many places where production of crops and cash generated have increased due to higher crop yields. The training of smallholder farmers promotes learning activities and also helps to strengthen weak farming communities. The basic strategy for a good extension work is to develop a platform for rural livelihood development through training. Findings show that in Shiloh, 34.17% of respondents had training for 1 to 2 days. 25% of respondents in Zanyokwe had this duration of training. The percentages of farmers who had 3 to 5 days training were 10.83% and 12.50% for Shiloh and Zanyokwe respectively. Some farmers complained of short duration and periods scheduled for training. There was general satisfaction with training offered even though training was rarely conducted by extension officers. As a practice, the training of farmers should be an on-going process tailored to the needs of farming households. In spite of the training offered by extension staff, significant gaps in training still

exist, which became obvious when farmers were asked during the focus group discussion to mention the areas in which they needed training. As highlighted by the respondents, the need for training was in the areas of pest control, infrastructure maintenance, and marketing.

The decisions to empower farmers through training must be in consultation with farming households in order to obtain measurable benefits or outcomes. Farmers should be guided and accorded avenues to pursue their own development and decide their own future, rather than expected to be unquestioning recipients of extension programmes. Very often, smallholder farmers have little or no say in the planning and design of extension training programmes. The tendency towards overlooking the participation of farmers in programme decision making raises discontentment amongst them since it means that extension officers often focus on programmes that are not relevant to the felt needs of the farmers. From the results, 12.50% of farmers in Shiloh asserted that decisions about training needs were made by extension officers. 18.33% of farmers in Zanyokwe reported this. In Shiloh, 29.17 % of the respondents agreed that they do not know how decisions on training are reached with 24.17% in Zanyokwe also being in the dark about decisions made. In all, 8.33% of respondents in Shiloh and 7.50% in Zanyokwe asserted that decisions about training are made by the scheme management committee.

Regarding participation, the Likert-scale variables were used to elicit responses from farmers. In both Shiloh and Zanyokwe, 3.33% of farmers responded 'most often' when asked how often they felt they took participated in the decision making process about training. Overall, the 'less often' category of respondents in Shiloh and Zanyokwe were 32.50% and 30% respectively. From the results, it is evident that decisions made about training involve little or no involvement or participation from farmers. The amplification of smallholder farmers' voices through social mobilisation and structures like farmers' cooperatives is expected to bridge the gap between

government agricultural institutions and smallholder farmers. Social mobilisation entails the building of local structures that have the necessary competencies to analyse and solve problems collectively. Such structures, when put in place, will not only improve farmers' bargaining ability with institutions and government but also help them in accessing resources like farm infrastructure, farm inputs and access to credit. In South Africa, irrigated land is considered a valuable asset but regrettably, irrigated land on smallholder irrigation schemes is not optimally used for farming. Smallholder access to land and security of tenure affects investment decision making. The results revealed that 38.33% of respondents in Shiloh agreed that the scheme management committee makes decisions on plot/land allocation while 40.83% of those in Zanyokwe reported this to be the case. In Shiloh, 10% of households asserted that extension officers also take decisions on land allocation compared to 7.50% for Zanyokwe. As far as representation goes, 40.83% of respondents in Shiloh posited that they were not usually represented in plot/land allocation while 35% of respondents in Zanyokwe felt unrepresented. The percentages of households that were represented in plot/ land allocation decision making were 9.17% for Shiloh and 15% for Zanyokwe. Non-representation and restricted access to land will invariably hinder investment decision making and expansion opportunities of households. In order to utilise optimally the available land, farmers need to be fully represented in land allocation forums and other policy options associated with land allocation. This will help to realise their potential towards sustainable livelihood and food security. Findings indicated that in Shiloh, 30.83% of the respondents rented out their plot of land either on a sharecropping or land rental basis which stood in stark contrast to Zanyokwe, where only 4.17% of farmers did this. The strategic partner in sharecropping and renting in Shiloh was the owner of the dairy project located close to Shiloh irrigation scheme. The majority of the plot holders were initially involved

in plot renting or sharecropping for dividends but over time, the contract terms have changed. At the time of this study, plot holders in the scheme did not wait for dividends but collected annual rental income for their rented out plots. The plot holders whose plots of land were located closer to the dairy project received more annual rental income than plot holders whose plots of land were far from the dairy project. In Zanyokwe, very few sharecropping arrangements were practiced; however, renting of plots did occur with rental income being paid annually. Households that rented plots in Zanyokwe used them mainly for crop production. The majority of the farmers in Shiloh scheme were dissatisfied with the differential rental income arrangement. In the opinion of most of the farmers in Shiloh, the same plot size should attract the same rental income. The majority of plot holders in Shiloh, at the time of this study had been reduced to mere land owners whose business was to watch the on-going farming activities at the dairy project while waiting for annual rental income.

Land tenure arrangements that are not backed up by legislation will invariably, not only reduce access to available land but also weaken farmers' interest in and dedication to, farming in the long run. Results of the study showed that 10% of the respondents in Shiloh rented out their plots of land for two years in Shiloh and 18.33% of respondents in Zanyokwe rented out their land for such duration. The majority of respondents in Shiloh and Zanyokwe rent out their plots of land for durations of 5 to 6 years. This group made up 21% of respondents from Shiloh and 15.83% of respondents from Zanyokwe.

8.2.7 Farmers' perception of irrigation scheduling

Irrigation scheduling guarantees that crop water requirements are met, while avoiding water stress and water logging resulting from excess irrigation. In schemes where scheduling arrangements are practiced in South Africa, the majority of farmers do not assess soil water

content and the acceptance of objective scheduling practice is below expectation. Subsequent to the focus group discussions conducted on the chosen schemes, almost all participants agreed that irrigation scheduling was a good option to ameliorate water shortages. Despite their apparent enthusiasm, participants were hardly ever ready for irrigation scheduling at the time of this study. In Shiloh, findings revealed that 85% concurred that irrigation scheduling remains a good option for efficient water management in the scheme while 90% in of those in Zanyokwe felt this way. Fifteen percent of household in Shiloh and 10% of those in Zanyokwe held a contrary opinion.

Limited water supply to crop fields has inadvertently affected yield levels of vegetables. The pressure of irrigation water from the dam serving Zanyokwe scheme reduces as it moves further away from the dam and towards crop fields. The pressure sometimes gets so low that there is no water available at all. The original plan was that water from storage reservoirs would move to crop field by the simple process of gravitation, but the reservoirs were not always well positioned enough to generate the necessary pressure required to operate the water application system. Therefore, at Kamma-Furrow and Lenye North, access to irrigation water is obtained by pumping water directly from the river (van Averbeke, et al 1998). Since 2012, two of the six villages served by Zanyokwe irrigation scheme, Kamma-furrow and Lenye North have been forced to use electricity to pump water to their crop field. The results of the study indicated that the high cost of electricity, not only put strain on farmers but also increased their cost of crop production. About 20% of the respondents in Shiloh asserted that the water supply in the scheme was sufficient from January through December while 13.3% of those in Zanyokwe reported this. On the other hand, 80% of respondents in Shiloh and 86.6% of respondents in Zanyokwe posited that the water supply was insufficient from January through December.

8.2.8 Maintenance of available infrastructure

Irrigation maintenance activities should be logically planned by deciding what actions should be done, who should carry out the actions, and the specified time frame in which the actions should be carried out. The participation of farmers in routine maintenance tasks such as the repair of linking pipe sand the removal of vegetation from embankments, canals and drains, enhances water delivery and lengthens the life span of water distribution system in the scheme. According to Shah *et al* (2002), inadequate daily maintenance of irrigation infrastructure is the primary cause of low performance that has characterised smallholder irrigation schemes in South Africa. The research findings revealed that in Shiloh, 45% of farmers participated in the maintenance of irrigation infrastructure while 46.6% of those in Zanyokwe did this. In Shiloh, 4.17% of households were 'most often' involved in maintenance decision making while only 0.83% of respondents in Zanyokwe were in that group. The respondents who were very often involved in maintenance decision making in Shiloh made up 6.67% of respondents while this figure was only 3.33% of respondents for Zanyokwe. The percentage of households who admitted to being less often involved was 23.33% for Shiloh and 32.50% for Zanyokwe. From these findings, it is evident that a negligible number of respondents were 'most often' involved in maintenance decision making process.

The need for training of farmers in maintenance of infrastructure is very important in light of the deteriorating scheme infrastructure. The periodic practical training of smallholder farmers in the maintenance of scheme infrastructure must be systematised. From study results, it is evident that only 6.67% of farmers in Shiloh and 5% of farmers in Zanyokwe had training in the maintenance of scheme infrastructure over the past two years. In contrast, 43.33% in Shiloh asserted that they were not involved in any form of infrastructure maintenance training. This figure was 45% for

Zanyokwe. From the interaction with farmers during the focus group discussion, information days were the avenue for briefing them on maintenance. This was unfortunate because farmers concurred that such days were not formally organised.

8.2.9 Decision making on production

The stated objective in setting up smallholder irrigation projects was to achieve local food self-sufficiency in South Africa (Kirsten, *et al* 1990). In many instances smallholder farmers are marginalised and their needs are often not prioritised. The findings revealed that in Shiloh 15% of respondents asserted that their primary objective in cultivating crops on their allocated food plots was the retention of their land holding. About 10%of respondents in Zanyokwe reported this to be the case. In Shiloh, 58.3% also concurred that they utilised their food plot primarily for subsistence (household consumption) while 46.6% of Zanyokwe farmers fell into this bracket.

8.2.10 Irrigation and food security

Farmers were seldom able to produce vegetables from January through December in the irrigation scheme because of water constraints. In Shiloh, findings revealed that 80% of farmers do not produce vegetable throughout the year (January through December) while 75% of farmers in Zanyokwe declared this to be the case. Only 20% and 25% of respondents in Shiloh and Zanyokwe respectively produce vegetables from January through December. Given that the production of certain vegetables all year round was not possible, it stands to reason that the majority of households are rendered food insecure. The effective management of basic farm practices like fertiliser application, weed control, crop/plant populations, and crop spacing are central to increasing crop yields. In Shiloh, results show that 88.3% of respondents applied fertiliser to their crops while 93.3% of farmers in Zanyokwe did so. All things being equal,

farmers who apply fertiliser to their crop field are likely to obtain increased yield and greater cash income. Therefore, with increased yields, households are expected to become more food secure. While the study showed that the majority of farmers in Shiloh and Zanyokwe applied fertiliser to their crops, it did not examine the timing of application and the quantity of fertilizer applied for each crop.

In Shiloh, findings revealed that 8.3% of farmers were able to sustain themselves and their family with production output till the next production season compared to 15% in Zanyokwe. The majority of respondents in Shiloh (45.83% of respondents) and Zanyokwe (91.6%) and (85%) agreed that their production output did not last them till the next production season. Four main short term food-based coping strategies were highlighted as possible coping strategies in periods when farm production was insufficient to sustain their households till the next farming season. Farmers' responses on which strategies they employed were obtained. Engaging in off-farm activities appears to be the coping strategy ranked highest by farmers. In Shiloh, 66.6% of respondents asserted that their short term food coping strategy was to perform menial jobs for wages and 55% in Zanyokwe claimed to do the same. The exchange of farm produce for other food items (barter system) was not a common practice in the area as only 15% and 16.6% mentioned this category in Shiloh and Zanyokwe respectively. The farmers asserted that it was easier to sell their farm produce than to search for other farmers who required them for exchange. The percentages of respondents who borrowed food or money as a coping strategy amounted to 8.3% in Shiloh and 18.3% in Zanyokwe. Borrowing money may lead smallholder farmers to increasing levels of debt, thus potentially putting their households in a vulnerable position in the long run. The patterns adopted by households in dealing with food shortages showed clearly that the majority of households are not food secure.

8.2.11 Extension services

The 5-point *Likert* scale was used to determine the frequency of extension visits. The findings from the study revealed that 10% of respondents in Shiloh agreed that extension visit took place often as did 3.3% in Zanyokwe. The percentage of farmers who asserted that extension visits were 'very often' was 13.3% for Shiloh and 15% for Zanyokwe. However, in Shiloh 61.6% of respondents asserted that extension visits were infrequent compared to 60% in Zanyokwe Overall, 60% of the respondents in Shiloh and 71.6% of those in Zanyokwe concurred that the services provided by extension were relevant to their situation. From the focus group discussion, it was ascertained that Shiloh and Zanyokwe irrigation schemes had one extension officer assigned to each scheme at the time of this study.

Farmers should be given the opportunity to decide and pilot their own development initiatives and settle on what they want for their future, rather than becoming passive recipients of various aid and training programmes. Farmers' participation in decisions making on issues that influences their well-being, is important and enhances collective responsibility for the outcome. Smallholder farmers are often marginalised and they lack the platform to lobby government for investment in areas of needs such as infrastructure and services, improvements to rural roads, market facilities and the type of extension services and programmes they receive. The results of the study revealed that 60% of respondents in Shiloh asserted that extension officers made unilateral decisions about which type of extension programmes to offer as did 25% in Zanyokwe. However, 21.6% and 45% of respondents in Shiloh and Zanyokwe respectively, confirmed that the scheme management committee determined the type of extension programmes to provide. The percentage of respondents who concurred that farmers were involved in deciding the type of extension programme was 13.3% for Shiloh and 5% for Zanyokwe. From the study results, it is

explicit that most extension programmes intended for farmers in both Shiloh and Zanyokwe, were poorly focused and largely irrelevant to the needs of the farmers because farmers' had little say on the type of extension programmes offered.

8.2.12 Marketing information

Most smallholder irrigation schemes are located in areas that are not linked to main roads and transport facilities and therefore, farmers scarcely send their farm produce to the market. Most farmers lack marketing and technical skills, as well as information that would assist them in meeting the quality requirements of consumers and buyers such as SPAR Shoprite and other supermarkets. In the focus group discussion, farmers asserted that they had marketing arrangements with conventional sales outlets such Shoprite and SPAR but that the contractual arrangements often failed. In Shiloh, 25% of respondents posited that they had sufficient market information compared to 16.6% in Zanyokwe. Overall, 75% of respondents in Shiloh and 83.4% in Zanyokwe did not have sufficient market information. The determination of farm produce prices was not well defined since farmers sold to buyers who offered what they described as 'reasonable prices. Results of the study also revealed that 23.3% of farmers in Shiloh and 21.6% of farmers in Zanyokwe sold most of their farm produce within their villages. In Shiloh, 71.6% of the respondents sold their farm produce at their farm gates while 63.2% of farmers did so in Zanyokwe. The percentages of respondents who sold their farm produce in the local market were 18.3% and 8.34% for Shiloh and Zanyokwe respectively. Although, farmers had sales arrangements in place, they often decided to sell their farm produce to farm gate customers even though these often offered prices that were below production costs. The advantages inherent in the sales of farm produce at the farm gates was obvious; farmers asserted that the sale of produce

at farm gates or in the community virtually removed the inconvenience and cost incurred in transportation of farm produce to the market for sale.

8.2.13 Variation in yield gap over 2012/2013

The percentage of farmers who posited that yield performance decreased was 56.6% for Shiloh and 43.3% for Zanyokwe. Respondents whose yield performance remained unchanged were 33.3% in Shiloh and 50% in Zanyokwe. Diverse reasons where adduced for the decrease in yield amongst households in the schemes. From the focus group discussion, respondents stated that at critical times, the non-availability of farm inputs such as water, tractors, credit, affordable transportation and marketing created constraints.

8.2.14 Determinants of decision making

In the binary logistic model, seven variables (farm experience, size of farmland, land rights/PTO, water sufficiency, farm asset, market information and production variation) out of the twelve predictor variables were found to have significant impact on influencing household decision making in Shiloh smallholder irrigation scheme, while five variables (gender, age, education, road distance and extension access) were not significant (Table 7.1). Of the seven significant variables, four had positive signs (land rights/PTO, water sufficiency and market information); which means that an increase in either of these variables may be associated with an increase in household decision making in Shiloh. The other three predictor variables (farm experience, farm asset and product variation) had negative signs; this means an increase in either of these variables may be associated with a decrease in decision making as illustrated in Table 7.1.

In Zanyokwe, six variables (farm experience, land rights/PTO, water sufficiency, farm asset, market information and production variation) out of the twelve predictor variables were found to have significant impact on influencing household decision making, while six variables (gender, age, education, size of farm land, road distance and extension access) were not significant (Table 7.2). Of the six significant variables, two had positive signs (water sufficiency and farm asset); which means that an increase in either of these variables may be associated with an increase in household decision making in Zanyokwe. The other four predictor variables (farm experience, land rights/PTO, market information and product variation) had negative signs; this means an increase in either of these variables may be associated with a decrease in decision making as illustrated in Table 7.2

8.3. Policy implications

From the results of the study, certain key determinants of decisions made by households impact on households' participation in smallholder irrigation schemes. The majority of households depend on farming as a means of livelihood but many have resorted to renting out their food plots because of the apparent dearth of farm infrastructures and low yield performance. The policy implication is that smallholder farmers should be encouraged to develop a culture of regular maintenance of farm infrastructure. Training in farm infrastructure maintenance is can be achieved by planning regular seminars and workshops. Irrigation maintenance activities should be logically planned out by deciding what actions should be done; who should carry out these actions and the specified time frame in which actions should be done. The average size of most household plots, especially those in Shiloh were grossly inadequate for households to achieve food security. Consequently, we expect a marginally positive effect of increasing landholding

size on the likelihood of farmers remaining in the schemes. This is despite the fact that most farmers rent out their allocated land. When landholding is too small, farm mechanization is hindered as it is not cost effective in use of tractors and other mechanized equipment. This encourages farmers to rent out their plots rather than labouring through crop cultivation. There is therefore a decreasing likelihood of farmers remaining in the scheme and in the long run farmers become more dependent on off-farm activities. The implication here is that empowerment of farmers through proper land allocation procedures should be put in place. Farmers or households who actually have a passion to go into farming should be considered for food plots. The idea of establishing new irrigation schemes when existing ones are under-utilised is counter-productive. However, the local communities require linkages and social structures that will boost collaboration and meet farmers' needs terms of plot allocation.

At the time of this study, the production of various types of vegetables in Shiloh and Zanyokwe schemes was not achievable throughout the year because most farmers abandoned their food plots for other off-farm activities during winter. From the findings, the majority of households in the scheme were not food secure. The implication is that the effective management of basic farm practices like fertiliser application, weed control, managing plant populations, and plant spacing which are central to increased yield should be put in place to enhance food security. Farmers who adopt the right timing and methods of fertiliser application are likely to obtain increased yields and as a result boost cash income. Therefore, with increased yields, households are expected to become more food secure.

Low levels of crop yield in many smallholder irrigation schemes in South Africa have been attributed to low water use efficiency, amongst other factors. With the growing shortages of water and the inefficient use of water, the need to increase water productivity is paramount and

must come from good agronomic practices. Irrigation scheduling, which will enhance water use efficiency should be implemented.

The effective and well-coordinated extension programme remains the key to agricultural development and yield performance. Farmers should be given the opportunity to make decisions, guide their own development initiatives and settle on what they want for their own future, rather than becoming unquestioning recipients of various aid and training programmes. Farmers' participation in decisions making regarding issues that influences their well-being, is important to enhance collective responsibility. Therefore, it is recommended that farmers be involved in the programme planning cycle for sustained adoption of innovation and technologies. For this to happen, it is important that the government should institutionalize participatory extension approaches in order to increase farmers' participation. In most instances, bringing farmers together to interact with other agencies will enhance informed decisions and promote empowerment. The strengthening of community based organisations (CBO's) to represent farmers' interest during agricultural policy initiatives should be considered for smallholder agricultural development in South Africa.

Regular information on farm input and output prices are likely to motivate households to participate in small-scale irrigation schemes. Furthermore, market information will assist households in the purchase of farm inputs at the right time and at reasonable cost. It is recommended that there be regular networking by smallholder farmers with commercial farmers and other relevant agencies *via* instruments that connect them to social media such as mobile phones. This will be helpful in obtaining market information.

In conclusion, smallholder agriculture is essential for employment generation and food security of households. It is apparent that household food security will not be achieved without giving

attention to the role played by, and decision making competence of smallholders' farmers in South Africa. It is pertinent to promulgate an efficient policy programme to address the diversity of smallholders' situations and identify the main constraints on investment. These constraints can be viewed in terms of infrastructures (roads, water); institutions (land tenure, PTO,); market information (inputs, output price); assets (tractors and other implement); and low yield performance and training. Therefore, all spheres of government, the private sector and NGOs should consider investment in smallholder agriculture through coordinated strategies and political support. As a result, this study recommends and encourages the government to develop a strategic Smallholder Investment Plan which would improve investments in smallholder agriculture.

8.3.1 Future research direction

- The findings of the study could be used as a base to understand, promote and enhance decision making of households in smallholder irrigation schemes in South Africa. The research only centred on Shiloh and Zanyokwe schemes. Further research would be necessary in order to apply findings to a wider spectrum or geographical area.
- The study was based on the contention that members of a household have identical preferences and a central decision maker who acts or represent all family members. However, critics raised concerns on the validity of the unitary household model. They argue for approaches like the collective household model as a better alternative since it caters for intra-household differences in decision making (Fisher *et al* 2000). South Africa rural households seem to be consistent with unitary model. Nevertheless, we suggest further research in decision making of smallholder irrigation households that is based on collective household model in order to examine the intra-household differences.

It is likely that the determinants of decision making in smallholder irrigation schemes in other parts of South Africa may resemble those of Shiloh and Zanyokwe schemes.

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APPENDIX 1

UNIVERSITY OF FORT HARE
DEPARTMENT OF AGRICULTURAL ECONOMICS, EXTENSION AND RURAL DEVELOPMENT

QUESTIONNAIRE/ INTERVIEW GUIDE FOR FARMERS

Topic: Analysis of Decision making in Smallholder Irrigation practice: A case study of Shiloh and Zanyokwe Irrigation Schemes in Central Eastern Cape

This questionnaire is prepared to collect data which will be used in the study of the above topic. The findings will help in providing necessary information and guidelines for improving Smallholder irrigation practice. Your name is required but you are assured that information collected here will be treated confidentially.

Agholor, A. Isaac

Researcher

Instruction

- Please supply the information required by ticking the appropriate column/space provided.
- Do not mark against each statement more than once.

Background information

Interviewer's name	
Date	
Name of Irrigation scheme	
Interviewee/respondents name	
Reference number	
Name and first name of respondent (in full)	

Section 1: Household Demographic (characteristics)

1. Fill in the blank spaces in the column below. You may include your name.

Gender of household head	**Age**	**Marital status**	**Level of Education**	**Farm experience**	**Employment status**	****Time Spent at home**

** Code: Mostly Present (MP), Very Often Present (VOP), Undecided (UD), Often Present (OP), Less Often Present (LOP)

Composition of household

2. Fill in the blank spaces in the column below. Please you may include name of household member

Number of persons staying with household head	**Number that assist in farm labour**

Section 2: Household income (external sources)

3. How much do you realize from the following external sources of income?

Source of income	Monthly [in Rand]	Yearly [in Rand]
Salary and wages		
Pension		
Grants		
Remittance in kind		
Remittance in cash		
Other specify		

4. Specify which non-agricultural activity that you undertake and the estimated annual or monthly income received?

No	Internal sources of income (non-agric)	Estimated annual or monthly income in Rand
1	Spaza shop	
2	Hawking	
3	Selling of liquor/sheben	
4	Other specify	

Section 3: Land and Agriculture (farm characteristics)

5. What is the size of your farm land in hectares? [……]

6. On whose land are you farming?
   [ ] Family land
   [ ] Communal land
   [ ] Personal land
   [ ] Leasehold
   [ ] Other (Specify)

7. How far is your farmland located from
   14.1 the nearest access road? _____ km
   14.2 the nearest town? _____ km

8. How many grazing camps are available for your use? If not divided please write one (1) e.g. in the case of communal grazing land […...]

9. How many of the farm animals below do you rear?

Type of livestock	Code	number
Cattle	1	
Sheep	2	
Goats	3	
Horses	4	
Pigs	5	
Donkey	6	

Code: [1-20 = 1] [21- 40 = 2] [41-50] = 3 [51- 60 = 4] [61-70 = 5] [71-80 = 6] [81 & Above = 7]

10. From the table below indicate the quantity of livestock sold, quantity consumed estimate income earned in Rand for the last 2 years.

Type of livestock	**Quantity sold**	**Quantity consumed**	**Estimate income earned**
Cattle			
Sheep			
Goats			
Pigs			
Donkey			

11. From the table below tick (√) the crops you cultivate and write down the quantity produced, quantity consumed, quantity sold, and quantity feed to animals and estimate income earned in Rand for the last 2 years.

Crops	**Total produced in kg**	**Quantity consumed in kg**	**Quantity sold in kg**	**Quantity feed to animals in kg**	**Estimate income earned (R)**
Maize					
Cabbage					
Carrot					
Spinach					
Butternut					
Beetroot					
Potatoes					
Other					

Section 4: Scheme Asset

12. A number of farm asset are listed below. Please tick (√) the one that you privately owned/owned by scheme management/ hired/ borrowed/ and quantity available

Infrastructure/asset	**Quantity privately owned**	**Quantity owned by scheme mgt.**	**Quantity hired**	**Quantity borrowed**	**Available quantity for use**
Operation tractor					
Disc plough					
Disc harrow					
Cultivator					
Planter					
Harvester					
Produce transport vehicle					
Hoe					
Shovel					
Spade					
Knapsack prayer					
Other (specify)					
1.					
2.					
3.					
4.					

Section 5: Governance and institutions

13. How often do you attend the scheme management meetings?

Attendance at management meetings	**Most often (MO),**	**Very Often (VO)**	**Undecided (UD),**	**Often (OP),**	**Less Often (LOP)**
Tick (√)					

14. How many persons make up the scheme committee? ……
15. Explain how decisions made in the scheme are shared among plot holders/members
    ……
    ……
16. How often do you hold meetings in your scheme?

Period of meeting	**Committee meetings (√)**
Weekly	
Fortnightly	
Monthly	
Quarterly	
Bi-annually	
Annually	
Ad-hoc meeting	

17. How long is the tenure of office of the committee?

18. Do you have Land Rights or Permission To Occupy (PTO) for the plots allocated to you?
    Yes [ ]
    No [ ]

19. In what ways has the PTO changed your attitude/decisions with respect to cultivating crops and or rearing of livestock?

    a) [ ] It has enhanced my attitude positively (increased interest in the scheme)

    c) [ ] It has altered my attitude negatively (decreased interest in the scheme)

Section 6: Decision making on training

20. Please indicate in the column provided below the type of training that you or your household has participated in for past 2 years and specify the duration of training.

Type of training	**Duration of training**

21. Who decides on your training needs? Please tick the box below.
    1= Extension officers [ ]
    2= Management committee [ ]
    3= Others [ ]

22. How often do you participate in the training decision making process? (Tick the appropriate column)

Participation in decision making.	**Most Often**	**Very Often**	**Undecided**	**Often**	**Less Often**
Tick **(√)**					

Section 7: Decision making on land tenure arrangement

23. Who decides on how plots/land is allocated?
    [ ] Extension officers
    [ ] Scheme management committee
    [ ] Other specify

24. Are you usually contacted or represented in land allocation decision process?
    YES [ ]
    NO [ ]

25. What type of land tenure system are you adopting?

No	**Type of tenure system**	**Tick (√)**
1	Freehold (land owners)	
2	Communal (under traditional leadership)	
3	Quitrent(pay rent to magistrate)	
4	Leasehold	
5	Others (specify)	

26. Have you rented out and/or have given out any of your plot(s) to other farmer on a Sharecropping basis?
    [ ] Yes
    [ ] No
    (If "Yes", continue to with 29. If "No", go to question 30)

27. Please indicate the estimated area of land that you have rented out in hectares..... ha.
28. What is the length/duration of the contract or sharecropping in years? .....

Section 8: Decisions making on irrigation scheduling

29. From the following irrigation methods tick (√) the one adopted in your scheme.
    [ ] Sprinkler
    [ ] Micro
    [ ] Furrow
    [ ] Underground
    [ ] Other [specify]

30. Irrigation scheduling entails the timing of irrigation event and the control of the amount of irrigation water. Do you carry out irrigation scheduling in your scheme?
    Yes [ ]
    No [ ]
31. Do you have on-farm storage facility for water during irrigation event?
    Yes [ ]
    No [ ]

32. Do you pay water tariff?
    Yes [ ]
    No [ ]
33. How much do you pay per month? …….. in Rand
34. Do you consider irrigation scheduling necessary in your scheme?
    Yes [ ]
    No [ ]
    If 'yes' give reasons for your answer
    .....

35. Do you receive sufficient water supply for your crops/livestock throughout the year?
    [ ] Yes
    [ ] No

Section 9: Decision making on facility (infrastructure) operation and maintenance

36. Do you participate in the maintenance of farm infrastructure/facility (e.g. electricity, leaking pipes, nozzles and other fittings) available in the farm?

[ ] Yes
[ ] No

37. To what extent are you involved in maintenance decision making process? (Tick [√] the appropriate box)

Extent of involvement in maintenance decision making	**Most Often**	**Very Often**	**Undecided**	**Often**	**Less Often**

38. Do you have any formal training on the maintenance of irrigation infrastructure?
[ ] Yes
[ ] No

Section 10: Decision making on irrigation and food security

39. Please indicate the primary objective of cultivating crops and rearing of animals by inserting a tick (√).

Crops and Animals		**Primary objective of growing crops/rearing animals**				
		1	**2**	**3**	**4**	**5**
Crops						
Animals						

Code: Primary objectives of growing crops/rearing animals
(1= Income in the form of cash); (2= Subsistence/household consumption) ; (3= Occupation /livelihood) ; (4= Retain my landholding) ; (5=other).

40. Do you produce vegetables throughout the year January to December?
Yes [ ]
No [ ]

41. Do you apply fertilizer to your crops?
Yes [ ]
No [ ]

42. During the last farming season 2011/2012, did you produce enough grain/crop to last until next harvest season?
Yes [ ]
No [ ]

43. From the table below please indicate how you deal with food shortages in your household by ticking (√) the appropriate box provided.

Strategies for cushioning household food shortages	**Most Often (MO)**	**Very Often (VO)**	**Undecided (U)**	**Often (O)**	**Less Often (LO)**
Engage in off-farm activities					
Exchange of farm produce for other food items					
Borrowing food/money					
Selling of farm produce to neighbours					

Section 11: Decision making and Extension services

44. Provide the following information about Extension services.
Do you have access to Extension services in your scheme?
[ ] Yes
[ ] No

45. How often do Extension officers visit your Farm/household? Please tick (√) the appropriate column below.

Most Often	Very Often	Undecided	Often	Less Often

46. Are the services provided by Extension relevant to your needs/situation?
Yes [ ]
No [ ]

47. Who decides on the type of extension programme offered?
[ ] Extension officers, [ ]scheme management committees

48. Briefly explain how Extension services in the scheme influence/affect your decision making.
……
……

Section 12: Decision making on marketing of produce

49. Explain how price fixing of your produce are done

.....

50. Do you easily obtain market information on your farm produce?

Yes [ ]

No [ ]

51. Where do you mostly sell your farm produce? Please tick (√) one option.

[ ] Inside your village, [ ] In the farm gate, [ ] Other market (specify).

52. What is the distance from your farm to the nearest market…… (in km)
53. How has your annual rate of crop/animal production varied over the last 2 years?
[ ] Increased [ ] decreased [ ] unchanged
54. Do you intend to remain in the irrigation scheme?
Yes [ ]
No [ ]

Question guide for focus group discussion

Introduction

- Introduction of participants and facilitators
- Objective of the focus group interview
- Confidentiality of views and comments
- Ethical considerations (permission to record/write/and or take photographs)

1. Trend of irrigation

1.1 What is the current trend of irrigation in Zanyokwe/Shiloh smallholder irrigation scheme over the last 3years? Are there changes? If there are changes, please explain?

1.2 My recent reconnaissance survey shows that some farmers in the scheme rent out their plots of land. What are the reasons? (Probe further)

2. Tenure security and land use

2.1 What is your view about the land tenure system that is operational in the scheme? Does it have any negative or positive impact on farmers' continued participation in the scheme?

3. Irrigation scheduling

What is your opinion about irrigation scheduling? Do you think that irrigation scheduling if adopted in your scheme may have implication on your yield performance?

Other issues

4. You have been in this scheme for some time now. Please mention by way of discussion some of the constraints (like government policy/institutional arrangements, extension services, supply of seedlings or other farm inputs, water availability, cultural beliefs, social [e.g. resistance/problems from neighbours] that are influences your decision) in respect to:

i. whether or not to continue with the scheme ?
ii. Whether the institutional arrangement is suitable?

6. What is your view on the future prospects of Zanyokwe/Shiloh irrigation scheme?

End of the Interview

Thanks for your participation

APPENDIX 2

Faculty of Science and Agriculture

Department of Agricultural Economics and Extension

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10 April, 2012

To whom it may concern

Dear Sir/Madam

Re: Request to collect data - Agholor A. Isaac Student No. 201003537 (Agricultural Economics Extension, and Rural Development, University of Fort Hare)

This letter serves to introduce Mr Agholor A, Isaac who is a registered Ph.D. student at the university of Fort Hare. He is at moment carrying out a research/study on the topic: Analysis of decision making in smallholder irrigation practice: A case study of Shiloh and Zanyokwe Irrigation Schemes in Central Eastern Cape.

The general objective of the thesis is to analyse and model the determinants of SIS farmer's decision making. The result of the study may be helpful in assisting government and policy makers in decision making towards improved smallholder irrigation scheme. To successfully undertake the study, Mr. Agholor A, Isaac is required to distribute structured questionnaires, make on-site observations, and hold series of focus group discussions and interviews with farmers and stakeholders in the irrigation scheme. Therefore, the Department of Agricultural Economics, Extension and Rural Development of the University of Fort Hare, request your unalloyed support and assistance to Mr. Agholor A, Isaac in conducting the study. Yours sincerely,

Prof. N Monde

Appendix 3

University of Fort Hare
Together in Excellence

SPECIAL ETHICAL CLEARANCE CERTIFICATE
REC-270710-028-RA Level 01

Certificate Reference Number:	SMON0101SAGH01
Project title:	**Analysis of Decision Making in Smallholder Irrigation Practice: A Case Study of Shiloh and Zanyokwe Irrigation Schemes in Central Eastern Cape**
Nature of Project:	PHD
Principal Researcher:	Azikiwe Isaac Agholor
Supervisor:	Prof N Monde
Co-supervisor:	

This is to confirm that as per the University Research Ethics Committee meeting held on 13th of March 2014 the application for ethical clearance condonation has been granted and the following ethical clearance reference number has been issued: **SMON0101SAGH01**

Yours sincerely

Professor Gideon de Wet
Dean of Research

08 May 2014