

**RURAL LIVELIHOODS AND AGRICULTURAL PRODUCTION IN SMALLHOLDER
IRRIGATION SCHEMES: THE CASE OF HOXANE IRRIGATION SCHEME**

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**A mini-thesis submitted in partial fulfilment of the requirements for the degree of Master
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ABSTRACT

This mini-thesis explores rural livelihoods and agricultural production in smallholder irrigation schemes in South Africa. The study sought to determine the livelihoods of plot-holders and the various production practices employed by the farmers in Hoxane Irrigation Scheme in Mpumalanga Province. The overall objective is to contribute to the literature on government's smallholder irrigation scheme revitalization programme and the types of support required by plot-holders in order to take advantage of the opportunities that exist in smallholder irrigation schemes.

The study identified diversified production and livelihood strategies pursued by plot-holders in Hoxane irrigation scheme, with some plot-holders securing all their livelihood from outside the agricultural sector. Active farmers in the irrigation scheme supply competitive markets, which influence their degree of success, and productive assets are unequally distributed amongst the various plottolders. The study findings identified some farmers with access to production inputs that are able to achieve reasonable crop productivity and respond quickly to changing market conditions, while there are also farmers that have access to land in the irrigation scheme, but lack the necessary assets, services and production inputs to improve their agricultural production. Smallholder irrigation farmers are thus a differentiated population. Consistent agricultural production in Hoxane irrigation scheme requires farmers to have secure land access, reliable access to water, reliable mechanization services, access to input and output markets, and access to extension support services, which the majority of the plot-holders in the irrigation scheme do not have.

The study argues that revitalization of smallholder irrigation schemes should not only be limited to provision of irrigation water infrastructure, but should include comprehensive farmer support services which include secure access to land, availability of mechanisation services, availability of production inputs, provision of the necessary farming skills and access to markets. This mini-thesis concludes that revitalization of smallholder irrigation schemes has real potential for improving agricultural production, but only when accompanied by a comprehensive farmer

support programme that takes into account the diverse nature of production practices amongst plot-holders.

Keywords: smallholder irrigation schemes, ploholders, revitalization, livelihoods, agricultural production, farmer support services, production inputs, farming, access to land.



DECLARATION

I declare that *Rural Livelihoods and agricultural production in smallholder irrigation schemes: The case of Hoxane irrigation scheme (2017)* is my own work, that it has not be submitted before for any degree or examination in any other University, and that all the sources I have used or quoted have been indicated and acknowledged in the reference list.

Pretty Mabel Maluka

December 2017



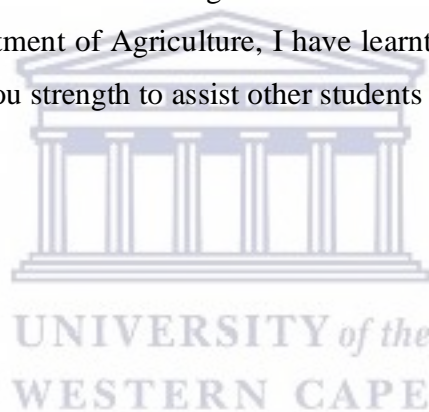
Signed:.....

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LIST OF ACRONYMS

- ARDC-Agriculture, Rural Development Corporation. □
- DAFF - Department of Agriculture, Forestry and Fisheries.
- DTI - Department of Trade and Industry.
- FAO - Food and Agriculture Organisation.
- GEAR- Growth, Employment and Redistribution strategy.
- IDP- Integrated Development Plan.
- LED - Local Economic Development.
- MASDT- Mobile Agri-skills Development and Training Company.
- NDP - National Development Plan.
- NGOs- Non-Governmental Organizations.
- NPDALE- Northern Province Department of Agriculture, Land and Environment.
- PTO - Permission to Occupy. □
- RESIS- Revitalisation of Smallholder Irrigation Schemes.
- RDP - Reconstruction and Development Programme.
- SPSS - Statistical Package for the Social Sciences.



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1 CHAPTER ONE: INTRODUCTION

1.1 Background

Success in South Africa's agricultural sector appears to be largely dependent on access to irrigation. This is based on the premise that South Africa is characterized as a water deficit country, receiving an average annual rainfall which is below 450mm/year, and with variable weather conditions (Tewari 2009). Cousins (2013) indicates that crop production in most parts of the country is very risky, due to unreliable rainfall and regular droughts. The water scarcity in the country limits crop production, and therefore makes dry-land farming very risky. In a study conducted on smallholder irrigation schemes in Limpopo province, Machete *et al.* (2004) argued that 'the development of smallholder irrigation schemes is critical, as it can benefit the rural poor through reduced food prices resulting from increased production, and increased on-farm and off-farm employment leading to income generation for the poor; hence contributing to food security'. Similar arguments are noted in Van Averbek 2008 and Aliber *et al.* 2009, whereby smallholder irrigation schemes are regarded as assets or resources, which enable farmers to improve or diversify plant production, which in return can result in improved livelihood outcomes for both plot-holders and non-plot-holders, in the form of income and food. The significance of smallholder irrigation schemes is also evident in South Africa's agricultural policies, particularly in the large-scale investments made in the revitalization of smallholder irrigation schemes around the country.

A review conducted on South Africa's smallholder irrigation schemes identified 302 such schemes in South Africa in 2010, covering 47 667 hectares, with a plot-holder population of 34 158 (Van Averbek, Denison & Mnkeni 2011). The review indicates that not all the smallholder irrigation schemes are performing at their optimal level. Instead, the majority of the irrigation schemes experienced varying socio-economic constraints, with agricultural production performing below potential and plot-holders not being able to take advantage of the opportunities presented by the irrigation schemes. Such findings require that research studies be conducted to determine

how the plot-holders secure their livelihoods and the policy gaps that exist in terms of provision of support to farmers in smallholder irrigation schemes.

Recent government policies on smallholder farmer development regard the revitalization of smallholder irrigation schemes as an important initiative, improving agricultural production within an overall objective of contributing towards rural development (National Development Plan 2011). Revitalization efforts are highly significant, given variable weather conditions in South Africa (Backeberg 2005). The revitalization and development of smallholder irrigation schemes in South Africa, therefore, remains an important component of agricultural policy. Key challenges are to consider how smallholder irrigation scheme revitalization policy should take into account the diverse livelihoods that exist within smallholder irrigation schemes, and how to improve the competitiveness of farmers within agricultural value chains. Another challenge is how policy makers can seek to utilize the opportunities that scholars identify in smallholder irrigation schemes by making more effective provision of agricultural support available to farmers.

1.2 Research Problem and Justification of the Study

This study explores rural livelihoods and agricultural production in Hoxane Irrigation Scheme, located in the Bushbuckridge area of Mpumalanga Province. Hoxane Irrigation Scheme is one of the six smallholder irrigation schemes in Bushbuckridge that government has sought to revitalize, after floods destroyed irrigation infrastructure during the year 2000. Substantial investments have been made in the repair of the irrigation infrastructure, which used to support over 300 smallholder farmers from around the Mkhuhlu area. Such interventions, however, have had little success in improving the agricultural productivity of the irrigation scheme to date. Observations made in Hoxane Irrigation Scheme are consistent with research in other smallholder irrigation schemes around the country, whereby plot-holders engage in a wide range of livelihood activities, both on-farm and off-farm (van Averberke 2008; Cousins 2013). Studies conducted in smallholder irrigation schemes around Limpopo Province, however, revealed that, ‘despite the diversified livelihood strategies pursued, agriculture is still regarded as an important livelihood activity amongst plot holders’ (van Averbeke 2008). This study seeks to determine the contribution of agriculture to the livelihood of plot-holders in Hoxane Irrigation Scheme.

Plot-holders in most smallholder irrigation schemes are somewhat diverse in their overall farming operations, suggesting that a blanket approach towards farmer support services will not yield the expected results if implemented. One scenario is identified in Dzindi Irrigation Scheme, where plot-holders use different approaches in relation to securing access to markets, and the overall objective of their farming varies substantially, being either for household consumption or for the market (van Averberke and Mohamed 2006a). Such situations confirm that farmers in smallholder irrigation schemes are heterogeneous in terms of their livelihood strategies, aspirations, and capabilities (Tapela 2008). A study conducted in Tshiombo Irrigation Scheme also revealed socio-economic differentiation amongst the plot-holders, resulting from unequal access to and control over land, labour and capital (Lahiff 2000). This study seeks to identify the pattern of socio-economic differentiation amongst the plot-holders in the Hoxane Irrigation Scheme. Exploring the implications of these findings could help enable the design of policy proposals aimed at supporting farmers in Hoxane Irrigation Scheme.

Most studies conducted on smallholder irrigation schemes concluded that the performance of smallholder irrigation schemes is far below expectations (Fanadzo, Chiduzza & Mnkeni 2010a; Machethe *et al.* 2004; Bembridge 2000). Issues such as poor maintenance of infrastructure and equipment; high energy costs where pumping is involved; lack of institutional support in terms of credit, marketing, and draught power; lack of extension and farmer training; conflict amongst farmers; and weak local organization were identified as key challenges which affect the performance of smallholder irrigation schemes. They have negative impacts on yields received and the ability of plot-holders to generate income and thus enhance rural livelihoods. This study seeks to identify and analyze the different institutional arrangements that affect production in Hoxane irrigation scheme. In addition, the study will identify key opportunities and constraints that can be addressed in efforts to improve crop production and returns from farming in the irrigation scheme. Finally, the implications of the study's findings for agricultural policy and programmes will be explored.

1.3 Rationale and significance of the research

Expansion of the number of smallholder farmers engaged in irrigated agriculture is regarded as critical for job creation and poverty alleviation in South Africa's rural areas (National

Development Plan 2011). The National Development Plan further views agriculture as a sector that has potential to create close to 1 million new jobs by 2030, and suggests that supporting smallholder farmers will result in improved rural livelihoods. This is despite the influential view that small-scale agriculture in South Africa contributes very little to the total household income, and is combined with a range of other livelihoods sources (Cousins 2010; Lahiff and Cousins 2005). Small-scale agricultural production in South Africa is mostly undertaken to supplement household food supply, and only a small proportion of the product is sold (Cousins 2010). The possibility of achieving the targets set in the National Development Plan seems uncertain, as studies conducted on smallholder irrigation schemes in South Africa reveal that existing smallholder irrigation schemes have failed to fulfill their intended objectives (Fanadzo Chiduzo & Mnkeni (2010a); Bembridge 2000; Van Averbeke *et al.* 1998).

Promotion of the smallholder-farming sector is based on the premise that small-scale farmers are efficient users of resources as compared to commercial farmers. In relation to the objective of promoting greater equity, smallholder farming sector increases returns on assets held by poor people and puts foodstuffs and cash income directly into the hands of the poor (Kydd 2002; IFAD 2001). Scholars suggest that the provision of effective agricultural support that includes production inputs, equipment, and marketing is crucial for the creation of a smallholder commercial farming sector (Lahiff and Cousins 2005). This is because most of the rural poor are found in communal areas and they continue to rely on land-based activities for their livelihoods. The basis for this argument is, however, criticized by scholars who suggest that there are no surveys of existing smallholder farms in South Africa to support the equity and efficiency arguments (Sender and Johnston 2004). Moreover, it is sometimes suggested that fewer black people want to farm than is generally acknowledged, and that most regard jobs and housing in urban areas as key priorities (CDE 2005). Finally, these skeptical scholars suggest that small-scale farming has limited opportunities in South Africa in the foreseeable future, so agricultural support should focus on larger commercial farmers that can produce enough for the growing population. These are important debates, and this study seeks to contribute towards them.

The objectives of this study are:

- To contribute to key academic debates on agricultural development in South Africa by determining the extent to which people in Hoxane irrigation scheme are involved in agricultural activities, assessing the contribution of these agricultural activities to their livelihoods, and analyzing patterns of social differentiation amongst smallholders at Hoxane;
- To contribute to the literature on the revitalization and development of smallholder irrigation schemes in South Africa, by identifying best practices in relation to technical and institutional support which could contribute to increased productivity and income generation;
- To produce rigorous empirical research findings that can inform relevant agricultural policies and programmes aimed at farmers in smallholder irrigation schemes.

1.4 Research questions

The central research question that this study explored is: ‘What is the contribution of small-scale irrigation farming to the livelihoods of farmers at Hoxane Irrigation Scheme’.

The key research questions explored in this mini-thesis are as follows:

- What are the socio-economic characteristics of plot holders in the Hoxane Irrigation Scheme?
- What livelihood strategies are pursued by plot-holders in the irrigation scheme, and how do these contribute to household income? What is the contribution from agriculture, and how significant is it?
- What is the pattern of socio-economic differentiation amongst the plot holders in the irrigation scheme?
- What are the institutional arrangements that exist in the scheme, in relation to water supply, operation and maintenance of irrigation infrastructure, inputs supply, marketing and extension support, and how effective are these? How can they be improved to better support smallholder farming in the scheme?
- What are the policy implications of the research findings for smallholder irrigation development and revitalization, and provision of support to smallholder farmers?

1.5 Research design

1.5.1 Research methods

This study is an exploratory case study. Given the small and statistically unrepresentative nature of the sample, mixed methods were used in order to achieve the research objectives. Data were gathered using both qualitative and quantitative research methods. In this study, quantitative data were collected and analyzed first, followed by the collection and analysis of qualitative data, and then the data were integrated when the findings were interpreted. Creswell *et al.* (2003) emphasized the importance of using both research methods, which allows for interpreting and explaining relationships among variables. The data were collected over a period of five months, from September 2014 to January 2015, and I had the assistance of three key informants in the field site. Before actual data collection, the study conducted a detailed literature review of various studies conducted on smallholder irrigation schemes and smallholder development in South Africa. The literature review allowed for the study findings to be compared with findings from other smallholder irrigation schemes.

The review sought to understand the rural livelihoods on smallholder irrigation schemes in South Africa, the implementation of land reform policy and also the constraints inhibiting smallholder irrigation scheme farmers from generating a livelihood from farming. The focus on smallholder irrigation schemes helped to understand the various production practices and their impacts on yield or crop productivity in these schemes. Theories on definitions of smallholder farming and rural livelihoods and farming styles have been reviewed to understand the farming trajectories in smallholder irrigation schemes.

1.5.2 Sampling

A total of 35 households in the Hoxane research site was selected and interviewed for purposes of quantitative data collection. The study used purposive sampling, which is based entirely on the judgment of the researcher, in that a sample is composed of elements that contain the most characteristics, representative or typical attributes of the population (Singleton *et al.* 1993). Based on the nature of the irrigation scheme plot-holders' list which comprise farmers that are actively involved in farming and plot-holders that had land rights but were not actively involved in farming, purposive sampling seemed appropriate for the study, as it allows for selection of

information-rich cases for in-depth study. The study used extension officers as key informants who helped identify farmers that could provide information-rich cases relevant to the objectives of the study. Amongst the nine sections of the irrigation scheme, eight sections of the irrigation scheme were selected for study. This is because the ninth section had no cases of people actively involved in farming activities, due to severe water constraints. Within the other eight sections of the irrigation scheme, only farmers that had the characteristics of (a) actively utilizing the allocated plots; or (b) not actively farming, but holding land use rights and attending farmers' meetings called by the cooperative. The selection of non-active plottolders was necessary to understand changes in their livelihood strategies, such as the shift from farming to non-farming activities. Such data would provide policy options that could assist plot-holders who have resorted to non-farm activities. Data was purposively collected from the eight sections of the irrigation scheme, as per the table below.

Table 1: Sampled sections for household survey in Hoxane irrigation scheme

Ward name	Frequency	Percentage (%)
Lower Cork	15	42,8
Upper Cork	1	2.85
Big Bend 1	4	11.4
Siholokoane	7	20
Big Bend 2	3	8.57
Mkhuhlu East	2	5.7
Mkhuhlu West	1	2.85
Ten Farm	2	5.7
Total	35	100

Table 1 above indicates that the majority of surveyed plot-holder households were from the Lower Cork section, followed by households in the Siholokoane section and then Big Bend 1. There are few active farmers in the other sections when compared to the Lower Cork section, which uses a canal system to draw water from the river to the fields. The Extension Officer provided a list of farmers in the irrigation scheme indicating active and the non-active farmers.

The Extension Officer and Irrigation Scheme Committee explained the operations of the irrigation scheme and the distribution of farmers and resources in the irrigation scheme.

1.5.3 Household survey

Quantitative data were collected by administering a household questionnaire survey to 35 plot-holders in the irrigation scheme. The questionnaire comprised both open-ended and close-ended questions. Five of the interviewed plot-holders are not actively farming in the irrigation scheme, but have access to land. The survey was administered to both plot-holders and tenants of plot-holders that were available on site. The questionnaire sought to capture information on the demographic features of a household, income sources, asset ownership, land use, crops grown and amount of crops harvested and marketed, type of markets used, selling price and livestock ownership.

The respondents were at first reluctant to respond to some of the questions asked that were related to income sources, but were reassured during the interview that the data collected was solely for research purposes. Data on crops harvested and marketed were based largely on estimates, as few farmers keep records of produced and marketed crops. Books were provided for the farmers to record the production information required, but upon return in December 2013 it was found that the farmers lacked the requisite knowledge, e.g. what precisely was to be recorded before planting, during production and after harvesting.

The study administered crop record sheets to 30 households that were surveyed to obtain data for each crop they grew such as the area planted, planting and harvesting dates, tillage costs, inputs used (seed, fertilizer, and pesticides), type of labour used, yields obtained and marketing. The five surveyed households which were not actively planting any crop in the irrigation scheme were excluded from the crop record sheet interviews. Majority of the respondents within the 30 interviewed households could not recall the agronomic details of the crops planted and harvested. Most of the responses were based on estimates which were inaccurate for consideration in the study. As a result, such crop record sheets were discarded and only 48 crop record sheets were considered in the study. The crop production data was collected between November 2013 and

January 2014, through interviews with individual farmers and were conducted soon after the completion of the final harvest of the crop. Crop record sheets were compiled for the following crops: green maize (8), tomatoes (10), cabbages (8), butternut squash (8), dry maize (2), green peppers (2), okra (2), sweet potato (2), spinach (1), green beans (1), pumpkin leaves (1), chilies (1), groundnuts (1) and roundnuts (1).

The study used multiple regression to analyze the relationship between the distribution and use of assets against a set of variables which includes the total assets owned, number of hectares held, number of hectares used, tractors owned, vehicles owned, water pumping engines owned, and total agricultural assets owned. The dependent variable which is the distribution and use of assets was statistically significant with the independent variables at the ($p < 0.05$) level. Based on the strong correlation results, the households were then grouped into five with 'group 1' being farmers that use 100% of the allocated land in the irrigation scheme, while 'group 5' farmers do not use the allocated land in the irrigation scheme. The grouping procedure confirmed the results of the household survey conducted in the Hoxane Irrigation Scheme which showed marked inequality in terms of agricultural assets ownership amongst the irrigation scheme households, and this greatly influences the number of hectares used by a farmer in a year. Access to production resources, which includes a tractor, a water pumping engine, as well as access to a market, seem to be key enabling factors for the farmers to use more hectares of land per production season. The farmers were grouped as group 1, group 2, group 3, group 4 and group 5 based on their potential to utilize the allocated land in the irrigation scheme.

1.5.4 Qualitative data collection.

A total of 13 plot holders were selected from the list of surveyed households for in-depth interviews on agricultural production, institutional arrangements, and life histories. These interviews, using a semi-structured questionnaire, were conducted in order to understand the farming trajectories of the plot-holders. They included describing the history of the irrigation scheme operations, the support previously provided to farmers in the scheme, current trends in the scheme, farmer's farming knowledge, and income sources. Data from the life history interviews helped to understand the family history, including its, relocation, land tenure regimes, farming history and agricultural experience. Appointments for interviews were made with the

selected plot-holders, but due to their busy schedules it was difficult to honour these appointments. As a result, data collection was finalized only in January 2014.

The data from in-depth interviews complemented quantitative data, by providing farmers' in-depth understandings of the current situation observed in the irrigation scheme. The respondents provided similar responses in terms of the history of the irrigation scheme, which was very useful because such information is not documented in the literature. Tape recorders were used to record the data, and most of the respondents used the siSwati language, which was also convenient for data capturing.

Semi-structured interviews were also conducted in focus group sessions, and discussions with individuals and key informants in the irrigation scheme. A total of 13 individual interviews were conducted. Qualitative data gathered by means of observations and in-depth interviews enabled a detailed description of agricultural production and marketing in the irrigation scheme. Key informant and focus group interviews were conducted with committee members of the scheme, officials from the Local Department of Agriculture, and other stakeholders, and facilitated the collection of detailed information on the institutional aspects of the scheme.

1.5.5 Key informant interviews.

This study conducted key informant interviews with three Extension Officers responsible for Hoxane Irrigation Scheme from the Department of Agriculture, Rural Development and Land Administration in Mpumalanga Province. The Extension Officers provided information on extension support services provided to the irrigation scheme farmers. The Department's Local Office is located close to the irrigation scheme offices, which made it easier to identify other key informants. The current and previous Irrigation Scheme Chairpersons were also interviewed to understand the institutional arrangements in relation to irrigation scheme management. Overall, the study conducted five key informant interviews, which include two Chairpersons of the Irrigation Scheme Committee, and three officials from the Local Department of Agriculture.

1.5.6 Focus group discussions.

Focus group interviews were conducted with the irrigation scheme committee members. This involves two focus group meetings conducted with the irrigation scheme committee members and members of the Hoxane Secondary Cooperative. The focus group interview with the irrigation scheme committee involved three committee members and was aimed at understanding the institutional constraints facing the irrigation scheme. Members of the secondary cooperative were also interviewed to understand the various organizational arrangements that exist in the scheme. The focus group interview with the secondary cooperative involved four members of the cooperative. The focus group interviews were used to draw out ideas, thoughts, feelings and recommendations on how smallholder farmers in the scheme can begin to ‘accumulate’ and perhaps participate in the mainstream agricultural value chain.

1.5.7 Data Analysis.

Quantitative data were coded, captured, cleaned and analyzed using Statistical Package for the Social Sciences (SPSS) software. The analysis focused largely on descriptive statistics and comparison of means and proportions. The study also used multiple regression analysis to determine the relationship amongst variables. Data were compared with national findings published by Stats SA, data from household surveys, and other research conducted on smallholder irrigation schemes

Qualitative data were analyzed through constructing thematic areas, using key ideas drawn from the conceptual framework of the study. The analysis sought to capture key findings on the thematic areas, trends, frequencies, and strong opinions.

1.6 Study limitations.

In conducting the study, a number of limitations were encountered. This includes farmers not keeping records of crop information, and thus relying on memory alone to respond to questions.

Four of the crop record sheets had to be disregarded, as the participants provided information that was clearly based on rough estimates. The distance between the farmers is very wide, requiring long distance driving which is time consuming. The non-availability of farmers on scheduled interview days, delayed the study.

1.7 Overview of the thesis.

This thesis is organized into seven chapters. The first chapter provides background to the study, indicating its rationale and the research questions that the study seeks to address. Chapter 2 presents a background on the overall Bushbuckridge area and Hoxane irrigation scheme. Chapter 3 presents a literature review on smallholder farming and smallholder irrigation schemes in South Africa. Chapter 4 presents the socio-economic characteristics of plot-holders and their households in Hoxane irrigation scheme, and patterns of socio-economic differentiation. Chapter 5 discusses the crop production practices that are pursued by the farmers in the Hoxane irrigation scheme. Chapter 6 discusses the institutional arrangements that exist in Hoxane irrigation scheme. The study then concludes with Chapter 7, which first presents a summary of key research findings, and a discussion on the wider policy implications for smallholder irrigation schemes and smallholder farming in general.

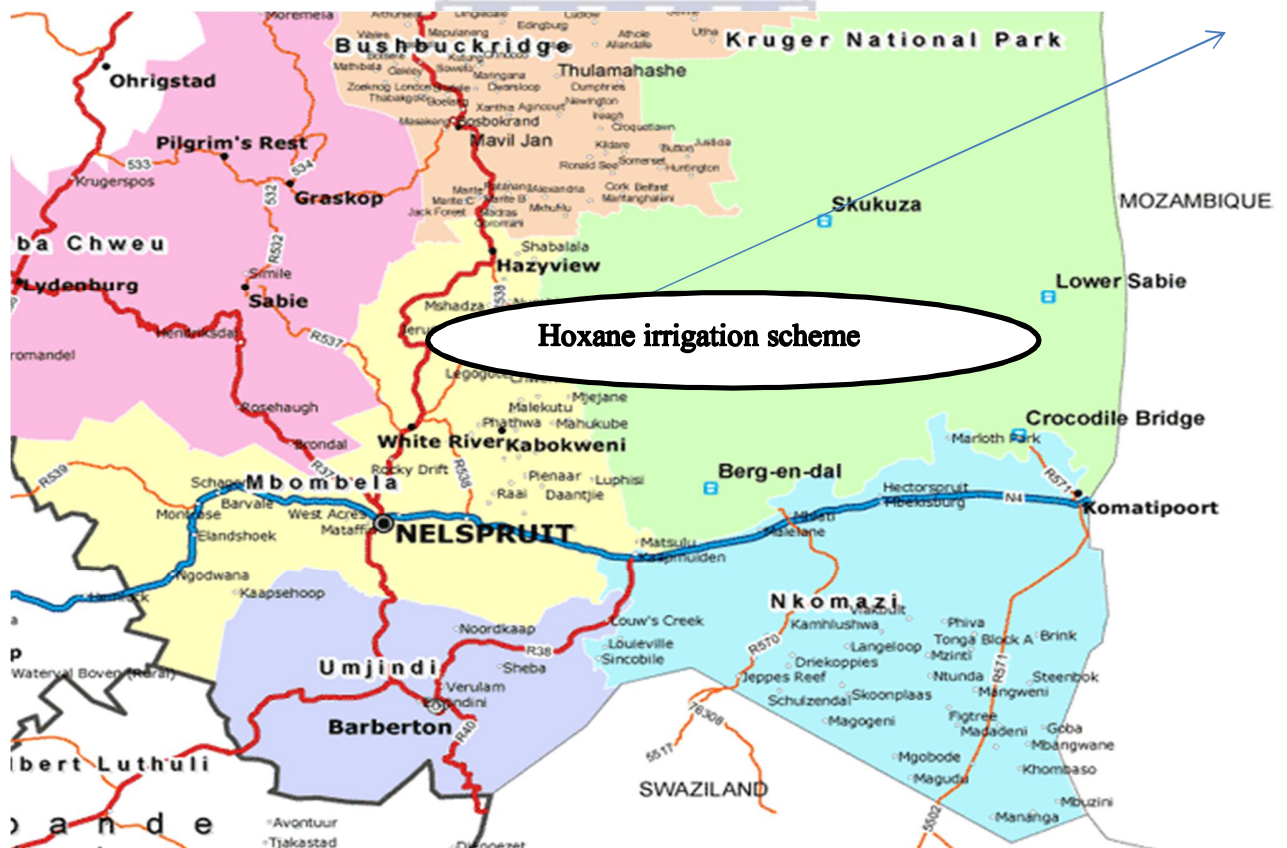
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2 CHAPTER TWO: DESCRIPTION OF THE RESEARCH SITE- HOXANE IRRIGATION SCHEME

2.1 Introduction.

Chapter Two focuses on the description of the research site, Hoxane irrigation scheme and its wider context. Provincial and district-level data focusing on the socio-economic and environmental profile of the area are also discussed. The historical background on irrigation scheme development in the municipality and also in the Mkhuhlu area will also be described. Key issues relating to irrigation scheme production and management are also explored in this chapter.

Figure 1: Map of Bushbuckridge local municipality



Source: http://ntataiselowveld.org.za/operational_area

2.2 Historical background.

Population groups in the Bushbuckridge area faced repeated raids during the process of colonization in the 19th Century, when Europeans first settled in the area (Ritchken 1995). Forced removals continued in the region to create space for nature reserves, protected watersheds and commercial agriculture (Pollard *et al.* 1998). Furthermore, racial segregation policies led to the creation of two apartheid-era 'homelands', or Bantustans, in Bushbuckridge, namely Gazankulu and Lebowa, as well as parts of what was then 'white South Africa', consisting of white-owned farms and state land, including military reserves and a large air base (Thornton 2002). The two 'homelands' were further divided into Tribal Trust Lands ruled by Tribal Authorities '(also known as 'Chiefs'- Makgoshi in Sotho, Mahosi in Tsonga)' and the land belonging to black Africans was to be held 'in trust' by the South African state. Pollard, Biggs & Du Toit (2008) confirm that the forced removals in the Lowveld area, resulted in the Bantustans, existing on land with low agricultural potential combined with high densities of people, and this rendered an agricultural-based livelihood virtually impossible. Studies conducted in the Lowveld area revealed that agriculture was a mainstay until the mid-1930s, but by the 1940s a rural economy had been created that forced the black population to depend heavily on migrant remittances and state pensions (May 2000; Pollard, Shackleton & Carruthers 2003). The apartheid government developed agricultural schemes and forestry, not so much as viable enterprises, but rather for job creation purposes (for some), which threatened the livelihood security of black people, whilst that of white people flourished (Pollard *et al.* 1998).

2.3 Location and Socio-Economic profile of the area.

2.3.1 Demographic Profile.

Statistics South Africa (2011) provides a description of the municipality and its demographic profile, indicating that the Bushbuckridge Local Municipality (MP325) is one of the five local municipalities under Ehlanzeni District municipality (DC32) in Mpumalanga Province. Bushbuckridge is located in the Lowveld part of Mpumalanga province and is one of the biggest municipalities in the district at 10 249 km² in extent. It is reported as a municipality which has the second highest population of 541 248, which is 32.1% of the district's population. It is

further indicated that the municipality has a total of 134 197 households with 37 wards, and Hoxane Irrigation Scheme falls within Ward 3 in the Mkhuhlu area.

The 2011 census data indicates that households in the municipality consists of four people per household on average, which shows a decline in household size when compared with the 1996 and 2001 census data, at 4.76 and 4.48 respectively (Statistics South Africa 2011). Mpumalanga Department of Finance (2013) found more female-headed households at 53.3%, with 2% being child-headed households between the ages of 10 and 17. Bushbuckridge Local Municipality is predominately rural, with 127 570 dwellings made of bricks or concrete on a separate stand or yard or on a farm, and 3 634 traditional/ hut structure dwellings (Bushbuckridge Local Municipality- Integrated Development Plan: IDP 2014- 2016).

2.3.2 Racial Profile.

Thornton (2002) describes Bushbuckridge as one of the most culturally diverse region in South Africa with people speaking Pedi (the 'Northern Sotho' of the highveld), Pulana (a mixture of Pedi, Swazi and Tsonga), Tsonga and Swazi all living together. The population of Bushbuckridge municipality is dominated by black Africans at 99.5%, followed by whites at 0.2%. Coloureds and Indian/Asian groups are at 0.1% and the other populations are at 0.06%. The population of black African and coloured females outweighs that of black and coloured males, with 294 553 females to 244 798 males (Statistics South Africa 2011).

2.3.3 Age Profile.

Cronje (2014) provides a description of the age profile amongst the Bushbuckridge population and indicates that a high proportion of the population, at 58%, is between the ages of 15 to 64 years. The second largest proportion of the population, aged between 0-14 years, represents 37%. The least proportion of the population is at 5.3% representing people who are 65 years and above.

2.3.4 *Employment and income profile.*

Bushbuckridge Local Municipality has a poverty rate of 79.8%, which is the highest in the district, and the highest unemployment rate of 52.1% in the province. The unemployment rate for females is at 56.2% and at 47.2% for males, with a youth unemployment rate of 64.6%. The municipality has 312 255 people who are within the working age population and only 60 459 people are employed (Mpumalanga Department of Finance 2013). Many employed people (5.5%) are employed by private households or other, while 3.9% of the employed population is employed in the community/social/personal services sectors. The wholesale/retail trade sector employs 2.4% of the population, and the manufacturing sector employs 2.3% of the population with only 1% of the population employed in the agricultural sector (Cronje 2014).

The Bushbuckridge Local Municipality's IDP (2014-16) argues that lack of investment has marginalized the tourism and agricultural sectors as potential employers. The average annual household income is the lowest in the district, at R36 569, with 46.4% of the households receiving an income which is between R1-R1600 and 0.1 % of the households receiving R102 401 or more per month (Cronje 2014). In terms of social grant recipients, it is indicated that many are old age grant recipients, at 34 069, with child support grant recipients at 98 683. Disability grant recipients number 11 760, with 3 219 foster care grants recipients and only 1 659 care dependency recipients.

2.4 *Agricultural Potential of Bushbuckridge.*

Bushbuckridge area has summer rainfall, with dry winter seasons. The area has an annual rainfall average of 650mm, with temperatures reaching a maximum of 35° C in summer and a drop to a low of 7° C in winter. The soil type is characterized as sandy loam and is associated with a dark coloured base. Woodhouse (1995) describes farming in the former Bantustan areas of Bushbuckridge as 'poorly developed,' due to a number of constraints which include soils with lower potentials, and the low and irregular rainfall pattern in the Lowveld area. Irrigated farming by black farmers along the Sabie River in the Bushbuckridge area is limited to 650 ha, dividing into holdings of 10 ha each near the village of Cork.

The Bushbuckridge Local Economic Strategy (2010) described the agricultural sector in Bushbuckridge and identified six types of primary production that are found:

- i. Scattered micro-enterprise broiler production;
- ii. Smallholder vegetable producers who are situated on the four irrigation schemes in the area, selling fresh produce primarily to the hawker trade and to some extent to the local retail outlets;
- iii. Small-scale fruit growers – formally outgrowers participating in the former development corporations’ irrigated orchard estates – who trade informally in mangos (for the hawker trade);
- iv. The municipality also includes some small scale macadamia growers established under the Mpumalanga Department of Agriculture’s ‘Greening Mpumalanga’ programme;
- v. Dryland farmers producing maize and sugar beans, with low productivity levels and primarily for subsistence purposes, but also to a certain extent for sale to the informal market;
- vi. Dryland farmers have proliferated over the two years from 2008- 2010, with the expansion of the Mpumalanga Department of Agriculture’s ‘Masibuyele Emasimini’ project, and also cattle farming. The latter is not beef production *per se*, since these small, scattered herds serve primarily as a store of wealth and not as a commercial asset, with herds which graze throughout the municipality and provide meat for funerals, festivals and ceremonies.

2.5 History of irrigation scheme development in Bushbuckridge: An overview

Smallholder Irrigation Schemes in Bushbuckridge are located in the former homelands, namely, Lebowa and Gazankulu, the members of which were subjected to forced removals during the Apartheid era (Weiner and Harris 1999). Agterkamp (2009) explains that the implementation of ‘Betterment’ policy placed restrictions on livestock and agricultural production in smallholder irrigation schemes, and ensured that African traditional conservation and farming practices were abandoned in the homeland areas. This was evident in the Dingleydale, New Forest and Orinoco Irrigation Schemes which were developed in the 1960’s for local people that were moved to the

area. In the Champagne Irrigation Scheme, the community that occupied land as far as 1914 were turned into labour tenants in return for a right to continue residing on the farm, when a citrus plantation was developed.

Discussions with the surveyed plot-holders in this study revealed that other irrigation schemes were developed along the Sabie River catchment, including Saringwa irrigation scheme and the Lower Cork section of Hoxane Irrigation Scheme, and were used for commercial farming purposes. The irrigation schemes were managed through the Agricultural Development Corporation and land ownership remained with the Tribal Trust. The Corporation provided support to the farmers through Extension Officers, who were responsible for water management, tractor ploughing services, and canal maintenance. The farmers were also provided with marketing and financial related support. Things changed after the implementation of the new agricultural policy in 1994, which handed over the irrigation schemes to the Northern Province Department of Agriculture, Land and Environment (NPDALE). This Department managed the irrigation schemes together with its parastatal, the Agriculture and Rural Development Corporation (ARDC). During the liquidation of ARDC in 1996, government withdrew from any form of support to the farmers. The schemes remained dilapidated with few productive activities in evidence (Perret and Geysler 2008). It was during this period when production on the irrigation schemes was negatively affected.

2.6 Hoxane Irrigation Scheme.

Focus group interviews conducted in the course of this study provided a description of Hoxane Irrigation Scheme in the context of its historical development. The irrigation scheme is situated in Mkhuhlu area on the border of Kruger National Park along the main road to the Kruger Gate entrance. The scheme covers villages such as Belfast, Cork and Culcuta, and is divided into nine sections, namely, Siholokoane, Mkhuhlu West, Mkhuhlu East, Big Bend 1, Big Bend2, Belfast, Ten Farms, Lower Cork, and Upper Cork. Estimates from extension officers in the Department of Agriculture, Rural Development and Land Administration indicate that the scheme is about 750ha in extent with 131 plot holders producing crops and using pumps to draw water from the Sabie River.

Water in the Lower Cork section is stored in a storage dam which was established during the apartheid era when the scheme was used by commercial farmers. Plot-holders in the other sections of the irrigation scheme draw water from the river directly to the fields through furrow, sprinkler and drip irrigation system. Farmers use either diesel or petrol pumps to draw water from the river. The Sabie River is located within the boundaries of the Kruger National Park, but the park authorities respect black farmers' rights to pump water from the River (Woodhouse 1995). The irrigation scheme is not utilized to its full potential. This was confirmed by the Local Extension Officer from the Department, who estimated that more than half of the plot-holders are no longer actively farming in the irrigation scheme, since the collapse of infrastructure during the year 2000.

Interviews on the history of the irrigation scheme revealed that farming by black irrigators in Hoxane Irrigation Scheme started as early as 1949, being undertaken by at least by five families at that time, then increasing during the 1980s when former labour tenants were allocated 6ha of land each in the Lower Cork section. The Lower Cork section of the irrigation scheme was used by commercial farmers for production of sub-tropical fruits (mango and citrus) until the 1980s, when the land was given to the Nkuna Tribal Authority, which then issued Permissions to Occupy (PTOs) to the former labour tenants who were working on the farm. Some of the former labour tenants left the irrigation scheme and sold their land to other tenants, while others sold the land to people coming from different parts of country. People who resettled in the area were also given PTOs by the Tribal Authority, under the Mhala Magisterial District, and were allowed to occupy as much land as they could access.

As in many communal areas, land ownership in the scheme is controlled by the Nkuna Tribal Authority (now Traditional Council) under the chief, whose responsibilities include allocating land, upholding 'culture' and mediating in local disputes (Thornton 2002). The surveyed households in many cases reported that they received their irrigation scheme land from the chief (34.5%) and paid a registration fee to Mhala Magisterial District, which then issued a 'Permission to Occupy' (PTO)¹ to provide proof of land rights. One farmer, Collen, recalled that in 1970 when he obtained his land use rights, the PTO was named a 'Mampuru'. Currently,

¹ PTO refers to a paper issued by the magisterial district on behalf of the chief to prove that a household has a permission to occupy the land.

farming in the scheme is conducted by both plot-holders and tenants. Plot-holders have PTOs from the Traditional Council, while tenants have been lent land for free or have rented it from the plot-holders for cash.

Interviews with plot-holders further revealed that the scheme was established to assist people in the former homeland areas to derive a livelihood from farming. Government provided support services, which include extension support and subsidized mechanization services. The plot-holders in the scheme have access to different plot sizes (ranging between 1 and 42 hectares) which is used to produce cabbages, butternuts, tomatoes, okra, sweet potatoes, mangoes, green mealies, dry maize, ground nuts, round nuts, chilies, green papers and green beans. Some crops are used for household consumption and some are sold to hawkers, bakkie traders, the school nutrition programme, supermarkets, or at pension pay points. Some farmers keep livestock in the irrigation scheme for sale and household consumption. The irrigation scheme farmers receive support from the Department of Agriculture, Rural Development and Land Administration in the province, namely extension, training, mechanization, provision of production inputs, and agricultural infrastructure development and maintenance. Some farmers in the irrigation scheme are supported by an Embassy of Israel, and others are supported by an NGO named Lima Rural Development. The department is presently encouraging plot-holders to register as cooperatives in order to receive support as a registered entity.

2.6.1 Irrigation scheme management.

Discussions with plot-holders revealed that in the past the irrigation scheme had been registered as an entity through the assistance of the local Extension Officer who was concerned about the long distance travelled by the farmers to access inputs and output markets. It was reported that the Extension Officer at the time organized the farmers and registered them as an agricultural cooperative called the 'Ngonini' cooperative. This reportedly happened in 1968, when the initial scheme committee was established. The name of the cooperative was changed to 'Pfukani' cooperative in the 1980s. In 2010, a sub-committee representing young farmers was established in the irrigation scheme, and registered as a primary cooperative. During the interview it was indicated that the youth committee was established after realizing that they shared different visions with the older farmers that have been in the scheme for some time. The key

responsibilities of this cooperative, known as Hina, include tractor management on behalf of the department, facilitating skills development for young farmers, facilitating stakeholder management, and developing business plans for the members.

The irrigation scheme is managed by a scheme committee, composed of, a Chairperson, Deputy Chairperson, Treasurer, Secretary, Deputy Secretary, and two Additional Members. Interviews with the scheme committee revealed a lack of stability amongst the scheme committees that have been elected in the past. Since 2012, the scheme has had three scheme committees, all being haphazardly changed before the end of their terms. One of the plot-holders, who once held a position of a Chairperson in the irrigation scheme, cited limited support from the department as one of the key issues which limits the ability of the committees to execute their responsibilities. Lack of training on how the scheme committee should execute its functions was also cited as a challenge. The plot-holders felt that the Department of Agriculture should train the scheme committee to understand and execute its mandate in a proper manner, as they now relied on their own experience to manage the scheme. Similar issues were noted in the Dzindi irrigation scheme in Limpopo, where organizational decline was found to be negatively affecting the scheme's management (van Averbeké 2008).

2.6.2 Irrigation scheme sub-committees.

The irrigation scheme has only one sub-committee in the Lower Cork section, which is responsible for maintenance of both the canal system and the fence. The sub-committee's management structure consists of a Chairperson, Deputy Chairperson, Treasurer, Secretary, Deputy Secretary, and two additional members. The farmers in this section pay monthly contributions of R250 which are used for maintenance of the dam and the canals when there are leakages. Maintenance of the irrigation system and farm infrastructure in the other sections of the scheme remains the responsibility of each farmer, as there are no sub-committees in these sections. The Department of Agriculture in the province, however, supports some of the farmers who request fencing material.

2.6.3 Production in Hoxane Irrigation Scheme

Production in Hoxane Irrigation Scheme was badly affected by floods during the year 2000, which Denison and Manona (2007) refer to as 'Cyclone Conny'. This affected many areas in both Mozambique and Limpopo Province. Most farmers lost their water pumping engines, pipes and crops to floods and have not been able to recover from that loss to date. Hoxane Irrigation Scheme was part of Limpopo Province until the year 2008, when Bushbuckridge area was officially demarcated as part of Mpumalanga Province. At the time of transfer to Mpumalanga Province, the irrigation scheme was under the Revitalization of Small Holder Irrigation System programme (RESIS), implemented by the Department of Agriculture in Limpopo province, and had achieved 3% of its revitalization targets by the end of 2007/8 financial year, when it was transferred to Mpumalanga Province. The Department of Agriculture in Mpumalanga continued with the revitalization of the scheme from 2008 to date.

In 2009/10 the provincial Department of Agriculture allocated R1 400 000 to the scheme for installation of pumping engines in different sections. The installation was completed in 2010/11 as part of phase 1, but all 19 engines were then stolen from the river bank, and could not benefit any of the plot-holders. The department continued with the installation of pumping engines in the 2012/13 financial year, with two pumping engines were erected then. In the 2013/14 financial year the department installed this irrigation system in the Siholokoane section of the scheme, benefiting at least two farming households.

2.7 Conclusion

This chapter has described how Hoxane Irrigation Scheme was developed during the apartheid era, when much of the productive land in the Lowveld was freed for commercial farming and tourism run by whites, and areas of black occupation were designated in the crowded Bantustan areas. The Hoxane irrigation scheme present a unique case of land occupation, where the amount of land allocated based on an individual's ability to debush land. This differs from the situation in other smallholder irrigation schemes in the municipality, such as New Forest and Dingleydale, where plot-holders were allocated between 1 and 6 hectares of land. The various technologies used to take water from the river to the fields, and the widely varying land sizes of each plot

holder, shows the internal diversity of Hoxane irrigation scheme unlike many other irrigation schemes that were developed in the Bushbuckridge local municipality.



3 CHAPTER THREE: LITERATURE REVIEW OF SMALLHOLDER FARMING AND SMALLHOLDER IRRIGATION SCHEMES IN SOUTH AFRICA.

3.1 Introduction.

This chapter reviews the literature on smallholder irrigation schemes in South Africa, focusing on the key features of smallholder farming and the history of smallholder irrigation development. The chapter first describes the history of smallholder farming in the South African context, discussing the agrarian structure within which smallholder farmers exist. Secondly, the chapter discusses the history of smallholder irrigation schemes development, focusing on the performance of smallholder irrigation schemes in the past, and the contribution of agriculture to the livelihoods of plot-holders in such schemes. The chapter then concludes with a discussion on the diverse relations amongst the farmers in smallholder irrigation schemes.

3.2 Smallholder farming in South Africa.

3.2.1 History of smallholder farming in South Africa.

Smallholder farming in South Africa is regarded as a form of economy that thrived before the colonial era. Bundy (1979) and van Averbeke (2008) provide the history of smallholder farming that indicates that in pre-colonial times different African tribes in South Africa had livelihoods that were exclusively land based. Three categories of African peasants that existed by the beginning of the final third of the 19th century are as follows: those that existed in areas designated as reserves, those in areas owned by whites as tenants (paying rent – in cash, kind or in labour service), and those who held some form of individual tenure on mission stations (Bundy 1979). These peasants possessed certain advantages over white producers, in such a way that they were more efficient in land use than the white producers, and responded more effectively to economic opportunities and pressures than contemporary white pastoralist-cultivators.

The African peasantry was placed under an enormous amount of pressure during the years 1890 to 1913, when there was severe competition for labour in the mining sector. Legislative pressure

was brought to bear to limit their access to land; taxes, rents and other fees were raised; the control of various forms of 'squatting' was intensified; and 'squatter' peasants were evicted or offered land on terms that favoured commercial white agriculture. At the same time, the state offered considerable aid for the development of agriculture, through the provision of credit facilities, and especially the development of modern economic infrastructure in 'white' areas. The purpose was to ensure that it becomes difficult for African homesteads to maintain their agrarian livelihoods. Van Averbeke (2012) indicates that the 'land dispossession, segregation and separation policies in the country disturbed traditional African agriculture during the 19th century, by restricting the area where Africans held farm land'.

3.2.2 Rural livelihoods of smallholder farmers.

Van Averbeke (2008) argues that the role of farming in the livelihoods of rural African people has changed substantially over the past century, due to the political and economic shifts which took place in the country. Such shifts forced Africans to remain in the 'Native' or 'Bantu' areas which had small allotments of arable land and shared access to rangelands. In response to the lack of room to reproduce their land-based lifestyles, African homesteads were forced to diversify their livelihoods (Van Averbeke 2012). African farmers remained with only 13% of land, which limited the space to farm. Tshuma and Monde (2012) argued that as a result agriculture in most rural households hardly ever constitutes their main rural livelihood activity to secure income and household food security.

Van Averberke *et al.* (2011) indicate that since around 1950, smallholder farmers in rural homesteads have failed to meet their subsistence production requirements. Rural African homesteads withdrew from cultivating their arable allotments after 1950 (van Averbeke 2012), and many South African rural households adopted migration as a livelihood strategy (van Averbeke 2008). As a result, the livelihoods of African households became heavily reliant on non-farm sources of income. Ntsebeza and Hall (2007) argue that land dispossession in the country forced a large number of rural residents to leave the rural areas for urban areas in search for work. The structure of the livelihoods of homeland residents was influenced by the

employment created in the civil servants of the homelands, particularly in the education and health sectors.

3.2.3 Agrarian structure in South Africa in the 21st century.

After the 1994 elections, government inherited a dual agrarian structure comprising a large-scale commercial farming sector alongside a small-scale farming sector in communal areas. Lahiff (2010) and Lahiff and Cousins (2005) indicate that black people exist on 13% of the land in the country, which is over-crowded. White commercial farmers, estimated to number 60 000 in 1994, owned the majority of the agricultural land in the country, which is estimated to be around 82 million hectares. In addressing such inequalities government introduced policies aimed at transforming the agricultural sector, which include the deregulation of the agricultural marketing system, abolition of certain tax concessions, and reduction in expenditure from the national budget, land reform, trade reform and new labour legislation (Goenewald and Nieuwoudt 2003).

In the 21st century, smallholder agriculture in South Africa is regarded as a farming sector found in a wide range of locations, including 'deep rural' areas of the former homelands, in townships and cities, and on commercial farms, and consists mainly of the production of staple foods for household consumption (Lahiff and Cousins, 2005). The smallholder farming sector's main distinguishing features includes the fact that few products that find their way into local or other markets. Aliber *et al* (2009) indicate that the smallholder-farming sector performs a much more limited employment role in South Africa as a result of the past policies that dispossessed them of land and coerced rural populations into migrant labour. In addition to the forced 'de-agrarianisation', the former Bantustans areas where the majority of smallholder farmers are found were deprived of investment in infrastructure, services and human capital.

In addressing the land ownership inequalities that existed post apartheid in the country, government has implemented a land reform programme comprising of three pillars, namely:

- i. ***Land restitution*** - *provided for those who had been dispossessed of their rights to land to lodge claims either for the restoration of that land or for financial compensation*

- ii. **Land redistribution** - provided for previously disadvantaged individuals and communities to foster improved livelihoods and quality of life through acquiring commercial farm land
- iii. **Tenure reform** - aimed at addressing what was reputedly the main problem facing the people in the former Bantustans, their insecure rights to land.

The land reform policies adopted by government include a market -led approach to land reform, which aims at gradually deracializing the agrarian structure, through removing barriers to racial ownership and encouraging de-racialization of the commercial farming sector. Cousins and Scoones (2009) argues that these policies resulted in the revitalization of colonial-era modernization narratives that see ‘viable’ small-scale farms as a scaled-down version of large-scale commercial farms. Some critics of the market-led approach to land reform are that it has led to the preservation of the dual agrarian structure without changing the racially skewed pattern of land ownership (Hall 2009). Sender and Johnson (2004) argue that the market-led approach has made little impact on the livelihoods of the rural poor. Moyo (2007) views the land question in South Africa as unresolved, because the peasant question (or even the small farmer development trajectory) is underestimated by official policy and denied its potential significance by both intellectuals and civil society. Cousins (2013) argues that the implemented land reform policies in the country have not created enabling conditions for smallholder farmers to succeed. In the international literature, and arguing in favour of smallholder farming, Griffin, Khan & Ickowitz (2002) suggest that land policies that promote smallholder farming will reduce poverty in the urban areas since fewer people will migrate from the countryside to the city.

3.3 Defining smallholder farmers.

In South Africa, there are two broad categories of farmers that exist namely, small-scale and large-scale farmers. Muchara *et al.* (2015) define large-scale farmers as commercially oriented farmers, and further suggest that there are many definitions that are used for the smallholder farmers. Fanadzo *et al.* (2010b) and Machete *et al.* (2004) indicate that smallholder farmers in South Africa are characterized according to farm size, and are categorized as subsistence, emerging and small-scale commercial farmers, but there is no clear criteria of assigning

smallholder farmers to the different categories. Cousins (2010), argues that defining the term smallholder tends to obscure inequalities and significant class-based differences within the large population of households engaged in agricultural production on a relatively small-scale. Cousins and Chikazunga (2013) assert that the term smallholder farmer has no single, agreed meaning, as it is often used to refer to farmers who are distinct from ‘subsistence farmers’ on the one hand, and from ‘commercial farmers’, on the other hand. In distinguishing smallholder farmers from commercial farmers one needs an understanding of some key variables, namely,

- Objective of farming,
- Proportion of output that is marketed,
- Contribution of farming to household income,
- Use of family labour or hired labour,
- Degree of mechanization,
- Capital intensity, and
- Access to finances.

Using the variables above, Cousins and Chikazunga (2013) developed a typology of four small-scale farmers found in South Africa, namely, (subsistence-oriented smallholders, market-oriented smallholders in loose value chains, market-oriented smallholders in tight value chains, and small-scale black capitalist farmers), which helps in identifying the general patterns and tendencies, and the underlying forces and processes around smallholder farming.

Table 2: Typology of smallholder farmers in South Africa today.

Key variables	Subsistence-oriented smallholders	Market-oriented smallholders in loose value chains	Market-oriented smallholders in tight value chains	Small-scale black capitalist farmers
Objective of production	Household consumption of additional food	Household consumption + cash income	Cash income + some home consumption	Profit
Proportion of marketed output	None or insignificant	50% or >	75% or >	100%
Contribution to household income	Reduces expenditure on food	Variable from small to significant	Significant	Significant
Labour	Family	Family + some hired	Family + significant numbers hired	Hired
Mechanization	Very low	Low	Medium to high	High
Capital intensity	Very low	Low	Medium to high	High
Access to finance	Absent	Some	Significant	Very significant
Numbers in South Africa	2-2.5 million households	200-250 000 households	5-10 000 households	5-10 000 households

Source: Cousins and Chikazunga (2013).

Based on the typology above, smallholder farmers are, therefore, defined as small-scale farmers who use farm produce for home consumption to a significant degree, and use family labour within the farming operation to a significant degree. This definition show that they are clearly distinct from small-scale capitalist farmers, whose farming objective is profit making, and such differences should be considered when policies or programmes are designed to support smallholder farmers in the country (Cousins and Chikazunga 2013).

3.4 Smallholder irrigation schemes in South Africa.

3.4.1 Smallholder irrigation schemes development in South Africa.

The history of irrigation development in South Africa dates back to the arrival of European settlers (Perret 2002; van Averbeke *et al.* 1998). In 1875, irrigation policy in the Cape Colony of South Africa was introduced, and prompted fundamental changes in water legislation (Backeberg 2005). The review on the water rights regimes over the last 350 years in South Africa indicates that colonial rules favoured the minority group and ignored the overall development of the country (Tewari 2009). As a result, water rights policies created inequalities between white and black irrigation schemes that were established in the country. Van Averberke (2008) estimates that out of 1.2 million hectares of irrigated land in South Africa, the average size of irrigated plots is 1.5 hectares for smallholder irrigation schemes and 42 hectares for the large-scale commercial sector. In outlining the history of smallholder irrigation development, (van Averbeke *et al.* 1998) indicate that irrigation scheme development in the former 'Bantustans' or 'Bantu Areas' was minor before 1950, but most irrigation schemes were established after the publication in 1955 of the report of the Commission for the Socio-Economic Development of the Bantustans, also called the Tomlinson Commission. Most small-scale irrigation schemes in South Africa originated from considerations of a food security perspective (Machete *et al.* 2004). Van Averbeke *et al.* (2011) categorize smallholder irrigation farmers into four groups based on their water supply, namely,

- *Famers on irrigation schemes;*
- *Independent irrigation farmers*
- *Community gardeners; and*
- *Home gardeners.*

A total of 302 irrigation schemes were found in South Africa in 2010, covering 47 667 hectares, with a plot-holder population of 34 158 (van Averbeke *et al.* 2011). This study is focusing on farmers in irrigation schemes, which are defined as, agricultural projects larger than 5 hectares in size, that involve multiple holdings that depend on a shared distribution system for access to irrigation water, and in some cases, on a shared water storage or diversion facility (van Averbeke 2013).

Histories of smallholder irrigation development in South Africa identify four main eras, namely, the peasant and mission diversion irrigation schemes era; the smallholder canal scheme era; the independent homeland era; and the irrigation management transfer (IMT) and revitalization era (van Averberke and Mohamed 2006a; Fanadzo *et al.* 2010b; van Averberke 2012; van Averbeke *et al.* 1998; van Averbeke 2008).

i. *The peasant and mission diversion irrigation schemes era.*

This era represents the early smallholder irrigation development in the country which occurred during the 19th Century in the Cape Colony, as a result of technology transfer from colonists to the local people. These irrigation developments were mostly private or mission station initiatives and involved river diversion. The irrigation schemes established during this era ceased to function by the end of the 19th Century.

ii. *Smallholder canal scheme era.*

The canal irrigation scheme era lasted from about 1930 until about 1960. The canal irrigation schemes were aimed at providing African families residing in the 'Native or Bantu Areas' with a full livelihood based on farming. Plot sizes ranged from 1.2 ha to 1.7 ha. Trust tenure was imposed on the farmer, and plot-holders held their plots by means of Permission to Occupy permits. Irrigation water was obtained from a river or a storage dam and brought to the field edge by means of concrete canal conveyance system.

iii. *The independent homeland scheme era.*

The independent homeland scheme era occurred between 1970 until 1990. These irrigation schemes were initiated when political and administrative 'independence' of the Bantustans was encouraged. The smallholder irrigation schemes constructed during this period were developed as part of economic development of the homeland areas. They were characterized by an ideology of 'modernization', functional diversion, and centralization of scheme management. Pumping and overhead irrigation became a norm on the schemes era.

iv. *The irrigation management transfer (IMT) and revitalization era.*

The fourth era of smallholder irrigation development commenced in 1990. The objective of the schemes established during this era was focused on food security at community or group level, favoring the establishment of small schemes. It is indicated that the Independent Development Trust played an important role in funding these irrigation projects from 1990 to 1994. In 2006 Dennison and Manona (2007) identified 62 smallholder irrigation schemes that were established during this era. Mechanical pump and sprinkler technology was used to extract and apply irrigation water. When GEAR superseded the RDP as the economic development policy of South Africa, existing irrigation schemes were identified as important resources of economic development, but required revitalization first (van Averebeke and Mohamed 2006a). The revitalization was linked to Irrigation Management and Transfer (IMT), which refers to the transfer of the responsibility of managing, operating and maintaining irrigation schemes from the state to farmers. Van Averebeke (2012) indicates that the emphasis of the first phase of the RESIS programme (between 1998 and 2005) was primarily on rehabilitation of the existing scheme infrastructure and on sustainable irrigation management and transfer. The impact of Cyclone Conny, which affected Mozambique and the Limpopo province in 2000, resulted in the scope of the irrigation scheme rehabilitation being broadened. Through the RESIS programme, the Limpopo Province planned to revitalize all smallholder schemes in the province (Denison and Manona 2007). From 2005 onwards, the RESIS programme favoured commercialization, transforming the canal irrigation schemes in order to use modern irrigation technologies, such as micro-irrigation, centre pivot and floppy sprinkler systems.

3.4.2 *Smallholder irrigation management.*

Bembridge (2000) asserts that existing smallholder irrigation schemes in South Africa conform to one of the five types of irrigation scheme management categories discussed below, namely,

- v. ***Top down bureaucratically managed smallholder schemes*** – *fully administered by government or an agency of government. All farming activities are carried-out by the management on behalf of farmers, and usually there is no selection of participants on the basis of farming ability. The majority of schemes in South Africa conform to this in varying degrees.*

- vi. **Jointly managed schemes** – some functions are performed by the irrigation development agency, while others are the function of project participants. Such schemes are usually aimed at eventually developing farmers to produce their own food and a surplus for sale.
- vii. **Community schemes** - are usually small in size, operated and maintained by the water users themselves and or their representatives.
- viii. **State or corporation financed schemes** - schemes such as those developed for sugar cane production, where farmer participants are selected on entrepreneurial and farming ability, as well as on their financial and other sources.
- ix. **Large estate schemes** - which are state or private sector financed, often managed by agents aimed at maximum use of resources through production of high return cash crops.

This study focuses on smallholder irrigation schemes that are jointly managed where some functions are performed by the irrigation development agency, while others are the function of project participants. Development of smallholder irrigation schemes in the country was based on a set of institutional arrangements imposed by the state, which regulated water allocation, land use, choice of crops, and the provision of technical advice and marketing assistance for the crops as per the recommendations of the Tomlinson Commission report (van Averbeke 2012). Fanadzo *et al.* (2010b) described the impact of the management approaches adopted and suggest that the Trust tenure system imposed during the canal scheme era provided the state with the necessary powers to prescribe land use and expel and replace farmers where practices did not comply with the prescriptions. The design of smallholder irrigation schemes during the homeland era was based on an approach that allowed the state to regulate the overall management of the schemes through a central unit. Van Averberke (2008) indicates that the irrigation schemes that were developed catered for commercially oriented farming, also called mini-farms (5-12ha), as well as food security oriented farming, on plots ranging from 0.1 to 0.25ha in size, on which farmers had to produce approved commodities according to specific instructions (van Averberke *et al.* 1998). The infrastructure used was expensive and sophisticated, given local conditions. The small-scale commercial farmers were introduced to farming systems that were foreign to them, and the central unit would perform many functions which include financial management, performance monitoring and input levels.

Machete *et al.* (2004) argues that the support system that was provided to smallholder irrigation schemes at the time created impoverishment and dependency in smallholder irrigation projects. This was noted when the agricultural homeland parastatals were dismantled in 1994 and production in the smallholder irrigation schemes nearly collapsed (Cousins 2013). The effects of the dismantling were that smallholder irrigation schemes remained highly authoritarian in character, but with control shifting from the state to the private sector. This refers to the period where the irrigation schemes were managed by strategic partners, and in some old gravity-fed irrigation schemes farmers were left to manage as best as they could, without much external support.

3.4.3 Performance of smallholder irrigation schemes.

Studies conducted on smallholder irrigation schemes in South Africa concluded that the performance of the majority of the schemes was below the potential. Bembridge (2000) cited a number of factors contributing to the poor performance of smallholder irrigation schemes and this includes poor maintenance of infrastructure and equipment; high energy costs where pumping was involved; lack of institutional support in terms of credit, marketing and draught power; lack of extension and farmer training; conflict; and weak local organization. Machete *et al.* (2004) view the poor performance of smallholder irrigation schemes in South Africa as due to the expensive sophisticated infrastructure and equipment expected to be shared between farmers. Moreover, the management of irrigation schemes by government is attributed to the creation of plot-holders that were neither farmers nor entrepreneurs. This is also supported by the survey results of a study conducted in 2010 on 164 of the 302 smallholder irrigation schemes, which found that poor management topped the list of problems, followed by infrastructural problems, water inadequacies, conflict and theft (van Averberke *et al.* 2011). Machete *et al.* (2004) also identify unreliable water supply caused by persistent breakdown of irrigation pumps and excessive leakages in pipes, as well as low soil depth, poor soil structure and low levels of soil fertility, as the main reasons for low crop productivity.

3.4.4 Crop Productivity.

A review on farmer crop production practices in smallholder irrigation schemes of South Africa cited inappropriate management practices such as planting density, nutrient and water

management, and inadequate crop protection practices as key constraints to crop productivity in smallholder irrigation schemes (Fanadzo *et al.* 2010a). Machete *et al.* (2004) also noted that in Limpopo, plot-holders in the irrigation schemes generally alternated summer and winter cropping for both field and vegetable crops. A study conducted at Zanyokwe irrigation scheme in the Eastern Cape demonstrated poor management of basic practices such as weed, fertilizer, and water management as well as late planting, low plant populations and use of inappropriate varieties, which compromised yields received by farmers (Fanadzo *et al.* 2010a). The study found weed management to be a serious challenge in butternuts due to lack of registered post-emergence herbicides for leaf weed control. In terms of fertilizer application, the study revealed that farmers tended to apply low and blanket amounts of the inorganic fertilizer, especially at planting. Machete *et al.* (2004) revealed that the fertilizer application rates in Limpopo irrigation schemes were not based on soil fertility analysis and recommendations. Farmers applied blanket amounts of inorganic fertilizer, which are usually marginal, especially for field crops. Monde *et al.* (2005) in the Eastern Cape revealed that farmers applied fertilizer once in two or three years due to lack of cash. In terms of plant population density, (Fanadzo *et al.* 2010a) showed that farmers in Zanyokwe irrigation scheme planted maize at a low targeted population rate, thus resulting in lower yields. Poor weed control, insect pests and disease are cited as the major cause of poor yields in smallholder irrigation schemes.

3.4.5 Water use and management.

The importance of irrigation water management is important in crop production for improving of water productivity by increasing crop yield per unit of irrigation water applied. Research reveals that farmers using a sprinkler irrigation system in Zanyokwe irrigation scheme applied constant irrigation schedules regardless of crop type and growth stage, usually resulting in over-irrigation during the early crop growth stages, and under-irrigation during the advanced growth stages (Fanadzo *et al.* 2010a). Machete *et al.* (2004) revealed that farmers in Limpopo irrigation schemes tend to apply as much water as they can due to uncertainty about the availability of irrigation water and the belief that application of more irrigation water leads to increases in crop

productivity and production. Moreover, the farmers applied the same amount of irrigation water regardless of plant growth stage.

3.4.6 Institutional Constraints.

Van Averbeke *et al.* (2011) indicate that farmers in irrigation schemes are dependent on each other, because they share the water distribution system, which requires a willingness on the side of farmers to work together towards achieving individual objectives. Moreover, the rules to govern collaboration (institutions) and structures to enforce these rules (organizations) are necessary for effective and sustainable functioning of collective action. Machete *et al.* (2004) indicate that smallholder irrigation farmers in Limpopo province are affected by the Marketing Act of 1996, the National Water Act of 1998, the Land Bank Act of 2002, and Communal Land Rights Act of 2004, all of which which changed the institutional framework governing agriculture. Van Averbeke (2008) identified institutional governance as key for the improved crop productivity in smallholder irrigation schemes. A study conducted in Dzindi irrigation scheme found weak enforcement of institutional rules and an organizational system unable to manage water effectively. Moreover, the study found weaknesses on the institutional system for maintenance of irrigation infrastructure. The institutional system of collective action was imposed, monitored, and enforced by the state. As a result, the institutional structure was weakened by the absence of a higher authority, which the scheme leadership could call upon to deal with persistent deviants.

Van Averbeke (2013) describes different tenure systems that apply on South African smallholder irrigation schemes. Poorly functioning land exchange markets were found to be preventing plot-holders from adapting the size of their farm enterprise to their capacity to produce, resulting in the co-existence of demand for land and land surplus. Machete *et al.*, (2004) revealed that the smallholder irrigation farmers in Limpopo held land through a Permission to Occupy permit and had limited tenure security, which hampered the exchange of land for productive use. Lahiff (1999) found that 91% of smallholder farmers in Tshiombo were satisfied with the current tenure arrangements, despite their limitations. Evidence from the study conducted in Dzindi, Khumbe

and Rabali irrigation schemes revealed that tenure trust impacts primarily on transfer rights, with particular reference to renting out land (van Averbeke 2008).

3.4.7 Market constraints.

Jari & Fraser (2009) argue that in South Africa, less developed rural economies and smallholder farmers find it difficult to participate in commercial markets due to a range of technical and institutional constraints. This includes factors such as poor infrastructure, lack of market transport, dearth of market information, insufficient expertise on grades and standards, inability to have contractual agreements and poor organizational support. It is also suggested that smallholder farmers often lack access to profitable markets, and as result even those farmers who can produce a surplus remain trapped in poverty (Magingxa, Alemu & Van Schalkwyk 2009). In Dzindi irrigation scheme, access to markets remains the responsibility of individual farmers (Mohammed 2006). Markets are accessed through street traders who purchase fresh produce from farmers in small quantities on a daily basis and retail the produce to the public in areas characterized by heavy pedestrian flows. Other farmers in the irrigation scheme sell their produce to residents nearby the scheme, to mobile street traders, who retail door-to-door, and to bakkie traders. This is reportedly due to the remoteness of smallholder irrigation schemes from the main urban centres, which results in farmers focusing more on producing for own consumption and local markets (van Averberke 2012). Research findings from the Tugela Ferry irrigation scheme revealed various forms of crop marketing channels used by farmers, which include crops that are purchased in large quantities by traders, or transported by farmers using taxis or hired vehicles to small towns for sale to hawkers (Cousins 2013). The use of cellphones to liase with potential buyers is also noted as a common marketing strategy in the Tugela Ferry irrigation scheme. There are also reported cases of farmers that sell produce directly on the roadside to hawkers, and also supply local consumers from areas of settlement close to the scheme.

3.4.8 Contribution of agriculture to the livelihoods of smallholders in irrigation schemes.

Estimates suggest that at present about 200 000 to 230 000 rural black people are dependent on smallholder irrigation schemes, at least partially, for a livelihood (Perret, 2002). Van Averberke

et al. (2011) argue that the plots of 1.28 hectares no longer provide homesteads with adequate income, as has been the case in the past.

Mohamed and Van Averbeke (2006a) conclude that livelihoods of plot-holder homesteads on small-scale canal irrigation schemes in South Africa are diverse and dynamic, and the importance of farming in the livelihood portfolio of these homesteads also varies. This was based on a survey conducted in 2003 in Dzindi irrigation scheme, which revealed high levels of livelihood diversity amongst the 97 plot-holder homesteads. The study revealed that all the homesteads farmed their plots but only 20 of the 97 homesteads obtained more than half of their income from farming. The income derived from agriculture contributed 29.7% to mean total household income in 2003 and was by far the most important local economic activity. Van Averbeke (2008) asserted that there were occasions where farming was once a central livelihood activity for the plot-holders, but this proved difficult, as farmers once more engaged in off-farm activities. Survey results of a study conducted in Tugela Ferry irrigation scheme in Kwazulu Natal in 2010, identified farming as one of several sources of livelihoods amongst the 171 households involved (Cousins 2013). Other important sources of income in the Tugela Ferry irrigation scheme include child support grants, jobs and old age pensions, with few remittances in cash or in-kind. Findings of a study conducted in Rabali, Khumbe and Dzindi irrigation schemes in Limpopo revealed that households engage in a wide range of livelihood activities, both on farm and off farm, and obtain a substantial portion of their income from claiming against the state (van Averbeke 2008). Agriculture was recorded as an important livelihood activity amongst the plot-holders at these three irrigation schemes. A livelihood typology of the three irrigation schemes mentioned above classified plot-holder households in terms of their main source of income:

- welfare dependent households,
- skilled wage earner households
- unskilled wage earner households,
- households active in the informal sector,
- market oriented farming households,
- farmer households, and
- diversified income household.

The findings of a study conducted at Zanyokwe irrigation scheme revealed that between 2005 and 2007 farmers continued to depend on both farming and non-farming activities, with farming activities contributing more to household income (Tshuma and Monde, 2012). In Tshiombo irrigation scheme, farming contributed only half of the total household income, with other incomes derived from wages, remittances, old age pensions and petty trading (Lahiff, 2000).

3.4.9 Socio- economic differentiation on smallholder irrigation schemes.

Mohamed and Van Averbeke (2006a) observed that the farming objectives in smallholder irrigation schemes are diverse, ranging from food production solely for own consumption to full market oriented production. Guided by the Van der Ploeg's theory of farming styles (Van Averbeke and Mohame 2006b) analysed the diverse characters of farming styles that exist in Dzindi irrigation scheme. A farming style is defined as a "specific pattern of tying together land, labour, cattle, machines, networks, knowledge, expectations, and activities, in a goal oriented and knowledgeable way" (Van der Ploeg 2010). Using the farming style theory (Van Averbeke and Mohamed 2006b) identified three styles of farming in Dzindi irrigation scheme and characterized the plot-holder households as food farmers, employers, and profit markers. A fourth farming style, referred to as "others" was identified and found to be sharing the characteristics of both food farmers and profit makers. The identified farming styles differed in terms of choice of crop, crop husbandry, attitude towards risk, allocation of produce and marketing practices. Van Averbeke (2008) identified farming styles typology of farmers in Dzindi irrigation scheme as per the table below:

Table 3: Farming styles of smallholder irrigation scheme farmers.

Farming styles of smallholder irrigation scheme farmers. Farming style	Definition	Characteristics
Profit makers	They farmed mainly for marketing purposes (> 50% of the annual value of their production is sold) Produced cabbages in summer and winter- and actively marketed their production.	least risk averse made use of quality inputs and services Mainly provided own labour from households, but used temporary labour during peak demand periods.
Employers	Hired one or more full time farm workers main objective was household food security	These often resulted in negative gross margin similar levels of risk taking as Type 2 food farmers, but able to cultivate larger plots because of hired help
Food farmers type 1	Subsistence farmers farmed mainly for home consumption (>50 % of total annual value of production consumed) produced maize for grain in summer that was stored at home or delivered to a commercial farmer or a commercial mill for credit notes limited winter production mainly traditional vegetables on home plots.	Limited scale and output Household food security the primary objective Limited use of purchased inputs cash sales of produce a minor source of household income Aimed to limit expenditure and avoid risk (e.g using cheap tractor service even though it delayed planting)
Food farmers type 2	Similar to Type 1 food farmers but were prepared to take risk and grow cabbages and white maize on a small-scale Less conservative than Type 1 food farmers More inclined to sell surplus grain	They achieved high returns from expenditure on variable cost of production.

Source: Adapted from van Averbek (2008)

A study conducted in three irrigation schemes in Limpopo province which are Hereford, Phetwane and Makuleke have shown that there is some degree of socio-economic differentiation within and amongst the farmer households in the irrigation schemes (Tapela, 2008). The socio-economic differentiation was noted in the diversity of livelihood strategies, aspirations, and capabilities of the farmers. In Tshiombo irrigation scheme, the degree of socio-economic

differentiation amongst the farmers resulted from unequal access to land and control over land, labour and capital (Lahiff 2000). The farmers in Tshiombo Irrigation Scheme were then categorized by Lahiff as small producers and large producers. The small producers consumed most of their produce, while large producers concentrated on high value crops and planted larger areas of over 0,5ha or more. The large producers comprised mostly of men who owned their own vehicles and sold to formal and informal markets within large geographic areas. In terms of labour, the large producers hired three to five workers at once. In Tugela Ferry Irrigation Scheme, the results of the study conducted in 2010, revealed a class stratification, which exist amongst the smallholder farmers in the scheme indicating differences in ownership of the means of agricultural production and increased farm income amongst the plot-holders (Cousins 2013).

3.5 Conclusion

This chapter has reviewed the literature on smallholder farming in South Africa and found that smallholder farmers have a long history of existence before colonization in the country. The review showed the importance of smallholder farming to rural livelihoods and the role of land reform in attempts to restructure South Africa's agrarian structure. The definition of the concept smallholder farmers in South Africa seems cumbersome for many scholars due to the varying types of smallholder farmers found in the country. The review noted a typology of smallholder farmers in South Africa which identifies the general patterns and tendencies, and the underlying forces and processes around small-scale black farmers, who are categorized into four types, namely, subsistence-oriented smallholders, market oriented smallholders in loose value chains, market-oriented smallholders in tight value chains, and small-scale black capitalist farmers.

Regarding smallholder irrigation development, the review noted that irrigation policy in the country was influenced by racial segregation and separation policies. As a result, the objective of using smallholder irrigation schemes to contribute towards rural development was not achieved; instead, irrigation schemes performed below their potential. This was mainly caused by the controlling and dictatorial role of the state in smallholder irrigation schemes, which undermined the entrepreneurial potential of the smallholder farmers. The use of sophisticated technology and

centralization of management during the independent homeland era created dependency amongst the plot-holders. Smallholder irrigation schemes are currently faced with a number of challenges related to crop productivity, institutional arrangements, social arrangements which include water management, and marketing of crops. The review revealed that the livelihoods of plot-holders in smallholder irrigation schemes are diverse and dynamic, and the importance of irrigated farming in the livelihood portfolio of plot- holders also varies.



4 CHAPTER FOUR: SOCIO-ECONOMIC STRUCTURE AND LIVELIHOODS IN HOXANE IRRIGATION SCHEME.

4.1 Introduction.

Chapter four focuses on the socio-economic characteristics of households participating in Hoxane Irrigation Scheme, their demographic features and the livelihood strategies pursued by its members. The chapter reports empirical findings obtained from intensive data collection, which was both qualitative and quantitative in nature. The chapter highlights how the smallholder irrigation scheme's household members derive a living from a wide range of livelihood strategies. Key demographic and socio-economic data are summarized and compared to findings from other studies undertaken in Bushbuckridge and in smallholder irrigation schemes around South Africa. The chapter also presents a section which discusses the patterns of diversity amongst the plot-holders in the irrigation scheme. Interviews on historical data are presented to indicate how accumulation took place amongst the plot-holders in the irrigation scheme.

4.2 Household composition.

Table 4 below summarizes some of the key demographic features of the 35 households surveyed in Hoxane Irrigation Scheme. The mean household size for the irrigation scheme is six, and comprised on average, two generations, with six household members present most or all nights. The mean number of household children, defined as those household members under the age of eighteen, is two. Data for Weverdiend village, which is close to Hoxane irrigation scheme households, reports an average household size of 6.2 and an average of 5.5 household members that are always present most or all nights (Hughes and Matsika 2009), and are therefore consistent with the findings that Hoxane households are often large and include household members that are not always present most or all nights. The male to female ratio of 0.87 in the irrigation scheme households, which is consistent with the 2011 Census data, which reports a male to female ratio of 0.83 in Bushbuckridge. This confirms that irrigation scheme households consist of more adult females (n=77) than men (n=67).

The mean household size of six in my study is higher than the four that is reported by Stats SA (2011), and the Bushbuckridge local municipality’s IDP. This is because Stats SA defines a household “as a group of persons who live together and provide themselves jointly with food or other essentials for living, or a single person who lives alone”. In this study, my definition of a ‘household’ excluded people who have established their own households and was extended to include not just people who are present most or all nights, during working days, and during weekends, but also those present about once a month, present one or two periods a year and present during school holidays. This was done in order to include people who are temporarily migrating to other areas to look for work, and to gain access to better education, since Bushbuckridge is regarded as an area that has a high number of temporary migrants who spend six months or more in a year away from home (Collinson 2010). These temporary migrants, however, continue to share economic benefits with the households in terms of remittances and benefit from the overall income generated by the household. The Hoxane Irrigation Scheme survey showed that most adult members who are not always present in the household, usually come back during holidays, are studying at tertiary institutions or working in Johannesburg or Durban, and have not yet established a separate household.

Table 4: Household Composition at Hoxane Irrigation Scheme

	Household size	Total Members Present Most Nights	Number of generations in household	Total Adult Males	Total Adult Females	Number of Household Children
Mean	6	6	2	2	2	2
Median	6	5	2	1	2	2
Mode	6	3	2	1	1	0
Maximum	19	19	3	7	6	14
Minimum	1	1	1	0	0	0
Range	18	18	2	7	6	14
Sum	226	199	77	67	77	82

4.3 Marital status at Hoxane Irrigation Scheme.

The study recorded a high proportion of both adult males, at 57% (n=38) of all adult men, and women, at 44% (n=34) of all adult women, that have never been married (see Table 5). Large

proportions of the people who are married, are married under customary law and are generally older, being married either through lobola payments only or lobola payment followed by a cultural ceremony, which is often referred to as ‘mthimbu’ in Shangaan. A total of 9% (n=6) of males and 19% (n=15) of females have been married under ‘lobola’ payment only and their spouses are still alive. Marriage under customary law with spouse still alive was recorded for 10% (n=7) men and 10% (n=8) women. There is a significant proportion of men 12% (n=8) and women 8% (n=6) who are living together with their spouses without any form of recognized marriage. This seems to confirm the Agincourt survey results, which suggest that traditional marriage is in sharp decline as women settle at the groom’s residence even before ‘lobola’ is paid (Zwang & Garenne 2008). An equal proportion of males, at 4% (n=3) and females, at 4% (n=3) are married under civil marriage in church. This indicates that civil marriages have not become a substitute for customary marriage in the irrigation scheme. Widowed women represent 8% (n=6) of the adult women in the irrigation scheme, and this confirms the Agincourt survey results, which indicated that there are a high number of female-headed households in Bushbuckridge (Collinson 20010; Cousins T *et al.* 2007).

Table 5: Household member’s marital status at Hoxane Irrigation Scheme.

Marital status	Males		Females	
	N	%	N	%
Number of adults never married	38	57	34	44
Number of adults living together	8	12	6	8
Number adults married under lobola payment only and spouses still alive	6	9	15	19
Number of adults married under customary law and spouses still alive	7	10	8	10
Number of adults married in church	3	4	3	4
Number of adults married under customary law, spouses deceased	1	1	3	4
Number of adults married through lobola payment only, spouses deceased	1	1	6	8
Number of adults divorced or separated	3	4	2	3
	67	100	77	100

4.4 Sources of income.

Table 6 below presents data on the livelihood strategies employed by members of households in Hoxane irrigation scheme. A total of 57% (n= 86) of income sources are from social grants and

43% (n= 67) are from non-social grant income sources. There are few instances of employment amongst irrigation scheme households, with permanent, temporary and casual jobs together comprising only 42% (n=27) of total non-social grant incomes. This corresponds with the high unemployment rate in Bushbuckridge more broadly, which was 52% in 2011, and most employed people working in the community services sector, as security guards, teachers, or working in the tourism sector (StatsSA 2011; Collinson 2010; Cousins, T *et al.* 2007). Similarly, in the Hoxane Irrigation Scheme people who had permanent employment or temporal employment were working as teachers, traffic officers, and drivers and also in the surrounding tourism sectors in Mkhuhlu and Hazyview.

In the absence of jobs, many income sources are accounted for by child support grants (n=67) and old age pensions (n=17). Although the child support grants are many, they provided a low income of R300.00 per child per month in 2013 as compared to the less common but more substantial old age grant which accounted R1200.00 per person per month (National Treasury 2013). Land rental is used as a source of income by 3% (n= 2) of the households, and is not widespread amongst the irrigation scheme households. The Hoxane Irrigation Scheme household survey revealed that farming accounts for 52% of the instances of non-social grants income sources for the households, and is received by n=21 males and n=12 females.

Table 6: Sources of income at Hoxane Irrigation Scheme.

Income types	Number of income sources	Sum	%
Income Types	Number of income sources in household	150	100%
	Number of non-social grant income sources	64	43
	Number of social grant income sources	86	57
Non-social grant income sources	Number of permanent jobs in household	10	16
	Number of temporary jobs in the household	4	6
	Number of casual jobs in the household	3	5
	Number of self-employed without employees in household	6	9
	Number of self-employed with employees in household	5	8
	Number of remittances	1	2
	Total number of incomes from land rental	2	3
	Total number of incomes from farming	33	52
Social grant income sources	Number of old age pension in the homestead	17	20
	Number of disability grants in homestead	2	2
	Number of child support grant in homestead	67	78

4.5 Income source rankings.

Noting the different income sources per household, a respondent from each of the surveyed households was requested to rank the income sources in order of importance. The different income sources were categorized as Rank 1; Rank 2; Rank 3 and Rank 4. Rank 1 is the most important source of income, while Rank 4 is the least important source of income for the households. The most important income sources within Rank 1 involved farming on homestead land for 69% (n=24) of respondents; old age pension from government for 17% (n=6) of respondents; and employment in permanent job for 9% (n= 3) of the respondents. Income sources in Rank 2 involved child support grants for 21% (n=7) of the respondents; old age pension for 24% (n=8) of the respondents; and farming on homestead land for 15% (n=5) of the respondents. Income sources in Rank 3 comprised casual work for 20% (n=4) of the respondents; child support grant for 40% (n=8) of the respondents and old age pension for 15% (n=3) of the respondents. The main income sources in Rank 4 consisted of child support grants for 57% (n=4) of the respondents; farming on homestead land for 14% (n=1) of the respondents and self-employed in non-agricultural activities for 14% (n=1) of the respondents. Apart from the prominence of income from farming in Rank 1, the importance of social grants represents a similar trend with findings from around the Agincourt area, where it was found that government pensions are an important source of income for many families in Bushbuckridge (Collinson, 2010). The Hoxane irrigation scheme survey found that child support grants are mostly used as an additional source of income for consumption purposes, such as buying food and paying for school fees, electricity and medication. The reason for child support grants being ranked second and third may be influenced by the fact that they are mostly received by women and are used as additional source of income for consumption, while the irrigation scheme household heads are dominated by men.

Table 7: Income source rankings at Hoxane Irrigation Scheme.

Income sources.	Income Source Rank							
	1		2		3		4	
	N	%	N	%	N	%	N	%
Employed in permanent job	3	9%	4	12%	0	0%	0	0%
Do casual work	0	0%	1	3%	4	20%	0	0%
Farming activities on homestead's land	24	69%	5	15%	1	5%	1	14%
Self-employed in non- agricultural own/ family income earning activity without employees	0	0%	3	9%	3	15%	0	0%
Self-employed in non-agricultural own/ family income earning activity with employees	1	3%	3	9%	0	0%	1	14%
Old age pension from government	6	17%	8	24%	3	15%	0	0%
Disability grant	1	3%	0	0%	1	5%	0	0%
Child support grant	0	0%	7	21%	8	40%	4	57%
Remittances in cash	0	0%	1	3%	0	0%	0	0%
Land rental	0	0%	2	6%	0	0%	1	14%
Total	35	100%	34	100%	20	100%	7	100%

4.6 Asset Ownership.

Table 8 below shows the ownership levels of various assets owned by households in Hoxane Irrigation Scheme. Domestic assets comprise electric stoves, microwave ovens, sewing and knitting machines, washing machines, lounge suites, and fridges/freezers. There are no farmers who reported owning gas stoves or paraffin stoves. Electronic/communication goods include radios, CD players, televisions/DVD players, and computers. Transportation assets include bicycles and motor vehicles that are in running order. There were no cases of reported motor bicycle ownership in the Hoxane Irrigation Scheme. Tractors, ploughs, wheelbarrows, knapsack sprayers, garden spades, garden forks, hoes, pumping engines, pipes and Jojo tanks are categorized as agricultural assets. There were no cases of donkey cart ownership reported in the irrigation scheme.

The mean number of domestic durable goods owned per household is 5.9 and the mean communication goods owned is 3. The level of domestic durable and communication goods ownership amongst the irrigation scheme households seems to be dependent on access to electricity. Households that did not have access to electricity reported no ownership of electric stoves, microwave ovens, washing machines, fridges and the electronic communication goods.

These households seemed to own radios or lounge suites. Most of the domestic and communication assets seemed to be owned by households that have access to electricity. It is therefore possible that there might be an understatement of the domestic or durable assets and electronic or communication assets ownership, especially on the households that have established houses outside of the irrigation scheme fields.

Table 8: Asset ownership of households at Hoxane Irrigation Scheme (n=35).

	Total Assets (n= 35)					
	Mean	Median	Maximum	Minimum	Range	Sum
Number of Domestic Durable Goods Owned.	5.9	7.0	10.0	.0	10.0	207.0
Number of Electronic/ Communication Goods Owned	3.0	3.0	4.0	1.0	3.0	105.0
Number of Transportation Assets Owned	.9	1.0	3.0	.0	3.0	31.0
Number of Motor Vehicles Owned	.9	1.0	3.0	.0	3.0	31.0
Number of Knapsack Sprayers Owned	1.5	1.0	6.0	.0	6.0	54.0
Number of Tractors Owned	.2	.0	2.0	.0	2.0	7.0
Number of Water Pumping Engines Owned	.6	1.0	2.0	.0	2.0	21.0

The mean number of agricultural assets owned by the surveyed irrigation scheme households is 18.2, with a minimum of one asset and a maximum of 53 assets owned amongst the various households. The 35 households that participated in the survey own a total of 636 agricultural assets. Ownership of agricultural assets such as tractors and water pumping engines amongst the 35 households ranged up to a maximum value of 52, with an average of 0.6 water pumping engines owned, and average of 1.5 knapsack sprayers owned. Notably, two of the surveyed households in the Lower Cork section (n=15) reported ownership of one water pumping engine, which is not prevalent amongst Lower Cork farmers as they use canal irrigation system. Ownership of water pumping engines seemed to be prevalent amongst the surveyed households operating in Siholokoane, Mkhuhlu East and West, Big Bend 1 and 2, Ten Farm and Upper Cork. Ownership of knapsack sprayers ranges up to a maximum of six, with some farmers who do not have a knapsack sprayer. One of the assets that were common in all the 35 surveyed

households is the ownership of a hand hoe. Tractor ownership is skewed in the irrigation scheme with a mean of 0.2 tractors and a median of 0. This is despite the fact that a tractor is a key agricultural asset that is required for production in the scheme, as the majority of the households have access to more than two hectares of land.

4.7 Livestock ownership and production.

Table 9 below shows livestock ownership in the irrigation scheme and it indicates that cattle, goats, chickens and pigs were the most significant types of livestock held by the households in the sample. The survey found only six households that own cattle, and the mean number of cattle owned by them was 17. The six households own a maximum of 27 cattle and a minimum of only three cattle. Goat ownership is also prevalent in the scheme, with 5 households owning a maximum of 15 and a minimum of 5 goats. The mean number of goats owned is 10. Where sales did occur, for both cattle and goats, this was to local residents only. Households keeping chickens and pigs have a mean number of 23 and 4 respectively. Chickens and pigs are kept only for own consumptive purposes and there were no instances of sales. Households farming with pigs indicated that they are kept to feed on the damaged crops that are harvested from the fields, and are slaughtered for ceremonial purposes or when there is a need for domestic consumption.

Livestock serve multiple functions within the surveyed households in the irrigation scheme, as assets or as a form of investment. Some farmers use the dung and urine deposits from the livestock in maintaining or improving soil fertility. Since there was no widespread livestock farming in the scheme, the benefits of keeping livestock within the scheme could not be further speculated on. There are, however, no dedicated grazing camps within the scheme, as households allow their livestock to graze anywhere in the fields. These results in conflicts amongst the farmers who did not fence their land as the livestock end up grazing on the crops planted.

Table 9: Livestock Ownership at Hoxane Irrigation Scheme (n=35)

Livestock ownership.	Valid n	Mean	Median	Max	Min	Range	Sum	Instances of Sale	Total number of livestock sold
Number Cattle Owned	6	17	17	27	3	24	99	2	5
Number Goats Owned	5	10	9	15	5	10	49	3	10
Number Chickens Owned	5	23	22	30	15	15	117	0	0
Number Pigs Owned	3	4	4	6	3	3	13	0	0

4.8 Socio-economic differentiation, accumulation and livelihood trajectories at Hoxane Irrigation Scheme.

This section discusses key differences amongst Hoxane Irrigation Scheme farmers. Differentiation was explored using three different approaches. Firstly, multiple regression analysis was conducted to determine the relationship between the distribution and use of assets against a set of variables which includes the total assets owned, number of hectares held, number of hectares used, tractors owned, vehicles owned, water pumping engines owned, and total agricultural assets owned. The dependent variable which is the distribution and use of assets was statistically significant with the independent variables at the ($p < 0.05$) level. Based on the strong correlation results, the households were then grouped into five with ‘group 1’ being farmers that use 100% of the allocated land in the irrigation scheme, while ‘group 5’ farmers do not use the allocated land in the irrigation scheme. Secondly, farmers were characterised as ‘successful’ or ‘unsuccessful’, using criteria drawn from interviews with farmers. Thirdly, a number of different livelihood trajectories were identified, using data from life history interviews with 13 farmers, using a conceptual schema drawn from (Dorward 2009 and Scoones *et al.* 2012).

4.8.1 Farmer differentiation at Hoxane Irrigation Scheme.

The household survey conducted in the Hoxane Irrigation Scheme shows that there is marked inequality in terms of agricultural assets ownership amongst the irrigation scheme households, and this greatly influences the number of hectares used by a farmer in a year. Access to

production resources, which includes a tractor, a water pumping engine, as well as access to a market, seem to be key enabling factors. This therefore means that, for poorly endowed farmers to continue farming in the scheme, there needs to be more focused support, other than simply revitalizing the irrigation infrastructure. Provision of start-up capital is key for these groups, as they are unable to access funding from any financial institution without ownership of other capital assets to serve as collateral.

Table 10 below explains how groups of farmers are differentiated from one another. Some land holders, particularly Group 1 farmers, are able to use all the plots that they have access to, while Group 4 and 5 farmers struggle to plough even a quarter of the land they have access to in the irrigation scheme. The quantitative data showed a huge differentiation in relation to both the distribution of land held and patterns of land use by the farmers in the scheme, and this differentiation was further explained through the analysis of qualitative data, which enabled the grouping of farmers to be undertaken. Five groups of farmers emerged through the grouping procedure. Table 10 below shows that Group 1 farmers are the successful farmers in the irrigation scheme and owned more agricultural assets than others. Group 1 farmers also owned other enabling resources such as a tractor and a motor vehicles used to gain market access, which the farmers in other groups did not own. The five groups of farmers are discussed below:

i. Group 1 farmers.

One of the key distinguishing characteristics of Group 1 farmers is that a tractor, a motor vehicle and a water pumping engine are all owned by each of these households. The mean number of agricultural assets owned in this group is 28.5 and the median is 27. The farmers in this group plough all the land they own and some rent in additional land. Most of these farmers own a motor vehicle, and own more than one water pumping engine. They use electric pumping engines and hire permanent and temporary labour, and only in rare cases use family labour. The farmers in Group 1 purchase production inputs, and in no cases have they reported using any production inputs supplied by government. The farms are well fenced, and there were no reported cases of livestock grazing on the crops. The crops produced by Group 1 are distributed to formal markets such as supermarkets, and feeding schemes. Other crops are personally distributed to bakkie traders and hawkers in town and sold at pension pay points.

In addition to capital for production, some farmers develop production plans indicating what they will produce and the types of market that is going to be supplied. This was noted in farmers such as, Collen, who had a clear production plan on the crops that are going to be produced and the targeted market. The farmers in the other groups produce both cabbage and tomatoes in winter, when the market is well supplied, and as a result they are forced to sell a crate of tomatoes at R70.00 and cabbages at R6.00 per head. Moreover, the farmers in the other groups wait for customers to come to the farm and buy their produce. Notably some of the farmers have been able to buy tractors and vehicles through the additional sources of income which exist in the households, such as permanent employment or self-employment.

ii. Group 2 farmers.

The key distinguishing characteristic of Group 2 farmers is that they do not own a tractor. The mean number of agricultural assets owned in this Group is 23 and the median is 25. The farmers in Group 2 use most of their allocated land through the assistance of stakeholders such as Mpumalanga Agricultural Skills and Development Trust (MASDT) and the Embassy of Israel. Most farmers in this group use tractors from (MASDT) and the Embassy of Israel, while others hire private tractors for land preparation. The farms of plot-holders in this group are usually well fenced. Production inputs are mostly purchased through the Mpumalanga Agricultural Skills and Development Trust. The use of production inputs from government is prevalent in this group, especially fertilizers. These farmers own water pumping engines and some are using a drip irrigation system. Most of the farmers do not own motor vehicles and depend on hired vehicles for marketing their produce. The group sells produce to feeding schemes, bakkie traders, hawkers and the local market.

iii. Group 3 farmers.

The key distinguishing characteristic of Group 3 farmers is that they depend on government support services for continued production in the irrigation scheme. The mean number of agricultural assets owned in this Group is 23.6 and the median is 23. There are also some farmers who are using privately hired tractors when they have some capital available. The use of

production inputs from government is widespread amongst this group, and they rarely purchase production inputs from input suppliers, except for those affiliated to Mpumalanga Agricultural Skills and Development Trust (MASDT). Ownership of a motor vehicle is not common, but an average of at least one water pumping engine is owned by farmers in this group. The farmers in the group hire one or two permanent labourers, but they also hire temporary labourers. Employment of permanent labourers is common, as most of the farmers go to their farms in the afternoon hours and during weekends. There is no specific market targeted by the farmers in the group, and they usually sell harvested crops to the local community, hawkers and bakkie traders.

iv. Group 4 farmers.

The key distinguishing characteristic of Group 4 farmers is that they plough only small portions of land, much less than the total area of land in the irrigation scheme allocated to them. The mean number of agricultural assets owned in this Group is 10.7 and the median is 10.5. The farmers in the group depend heavily on government tractors for ploughing their land. If government tractors are not available, farmers end up not ploughing any land in the irrigation scheme. Two farmers in this group use hand hoes to cultivate small portions of land, just to keep themselves active in the fields. Most of the farmers in this group do not own motor vehicles, but own a water-pumping engine which in most cases is old or not in good condition. Most households in this group have household members that have temporary employment, receive old age grants or child support grants, and use land rental as a source of income. The use of family labour is common amongst the farmers in the group, and they rarely purchase production inputs from input suppliers. They do not have specific targeted markets for the crops they produce, and usually sell to the local community, the hawkers, and bakkie traders. The major crops produced by farmers in the group include green maize, dry maize, round nuts and groundnuts which are mostly produced under dry-land conditions.

v. Group 5 farmers.

The key distinguishing characteristic of Group 5 farmers is that they have access to land, but have not cultivated the land for the past five years. The plot-holders in this group generally own less than five agricultural assets. The mean number of agricultural assets owned in this Group is 8 and the median is 6. None of the households in this group own a water pumping engine, but

their farms are located in sections where irrigation requires a pumping engine to draw water from the river. The majority of the farmers in this group lost their farming resources during the year 2000 when floods affected the area. Most of the surveyed household members in this group reported that they never returned to the fields after floods which washed away pipes, water pumping engines and the crops. The common reason provided for this is the lack of start-up capital to reinvest in the development of the farm. This group is mostly comprised of household members who are dependent on temporary employment, self-employment without employees (spaza shops), old age pensions, and child support grants, in some cases women being the only people receiving income in the household.



Table 10: Grouping of farmers at Hoxane Irrigation Scheme by assets and their use

		Number of hectares in use	Number of hectares owned in irrigation scheme	Total Assets	Number of agricultural assets owned	Number of tractors owned	Number of water pumping engines owned	Number of motor vehicles owned
Group 1 (n=3)	Mean	14.1	11.4	40.75	28.5	1.5	1.0	1.8
	Median	12.0	10.8	40.00	27.0	1.5	1.0	1.5
	Sum	56.5	45.5	163.00	114.0	6.0	4.0	7.0
Group 2 (n=6)	Mean	10.2	10.8	35.60	23.0	.0	.6	.6
	Median	6.0	6.5	36.00	25.0	.0	.0	1.0
	Sum	51.0	43.0	178.00	115.0	.0	3.0	3.0
Group 3 (n=8)	Mean	5.6	16.2	34.55	23.6	.1	.8	1.2
	Median	6.0	13.0	32.00	23.0	.0	1.0	1.0
	Sum	61.5	161.5	380.00	260.0	1.0	9.0	13.0
Group 4 (n=13)	Mean	2.8	9.4	17.90	10.7	.0	.4	.4
	Median	2.5	8.0	15.50	10.5	.0	.0	.0
	Sum	28.0	85.0	179.00	107.0	.0	4.0	4.0
Group 5 (n=5)	Mean	.0	18.8	19.80	8.0	.0	.2	.8
	Median	.0	11.0	18.00	6.0	.0	.0	.0
	Sum	.0	94.0	99.00	40.0	.0	1.0	4.0

4.8.2 'Successful' and 'unsuccessful farmers' at Hoxane irrigation scheme.

One of the questions in the questionnaire administered asked the respondents to identify *successful farmers* and their characteristics. The respondents were also requested to identify the successful farmers and the number of farmers known to have such characteristics in the irrigation scheme. The quality of outputs produced by the farmers came first, followed by a 'clean' farm, a

large quantity of produce harvested, knowledge of farming, fields that are always green, and supplying a reliable market. The study identified 23% (n=8) of the surveyed farmers with the reported characteristics, as follows: *Vincent, Gugu, Siphon, Lungile, Promise, Surprise, Collen and Xolani*. Another question asked was about the characteristics of *unsuccessful farmers* in the irrigation scheme. The respondents indicated underutilized land, poor quality crops produced, fields that are full of weeds, and farmers dependent on government production inputs. The majority of the surveyed farmers, 77% (n=27), were categorized as 'unsuccessful farmers'. Based on the responses provided, it was imperative to understand the underlying reasons for these differences amongst the surveyed farmers. The study used life history interviews to understand the livelihood trajectories of farmers on the irrigation scheme and the drivers of change.

4.8.3 Life history interviews of 13 farmers and livelihood trajectories.

Collen

Collen was born in 1942 in Maputo, Mozambique. He arrived in South Africa in 1972 and has three wives and 21 children. Only three of the children are still living in the household, and the others have established their own households. Collen used to farm at a very young age while in Mozambique and continued to farm under dry-land conditions for three years when he first came to South Africa. He approached the chief to get access to land in the irrigation scheme. The chief allowed him to clear as much land as he possibly could, and he managed to gain access to 21 hectares of land. He then went to pay the registration fee at the magisterial district office and was issued a PTO. On his first year in the irrigation scheme, he planted green maize, tomatoes and cabbages and sold crops to bakkie traders who used to come to the farm. He made a profit from the sales of these crops over the years, and reinvested the money in the development of the farm. This involved purchasing a tractor, a bakkie, a diesel pump and other farming equipments. The reinvestments in the farm were made possible by other sources of income that Collen has, which includes an old age pension, and self employment in a small business that he also manages. His wives and grandchildren usually provide labour on the farm, including weeding, irrigating and harvesting. His farm is always green, and he specializes in crops such as tomatoes, cabbages, green peppers and field crops which includes maize and groundnuts. After

harvesting, he distributes his crops to supermarkets, pension paypoints and hawkers in town, using his own bakkie.

Lungile

Lungile was born in 1963 in Mkhuhlu. She was married at the age of 20 and has 3 children. Her parents-in-law had farmed in the irrigation scheme since 1949. They were very successful farmers, and had access to over 42 hectares of land in the scheme. When her husband and parents-in-law passed on she inherited the land, and was allowed to change the names on the PTO in 2007. She had no experience of farming, and approached the Department of Agriculture to assist in developing her farming skills. The department linked her with the Mpumalanga Agri-skills and Development Trust, which provided her with accredited training for a period of three years. She received certificates, and continued to affiliate with the Mpumalanga Agri-skills and Development Trust. She then approached the Land Bank for a loan. The bank approved the production loan using her PTO as collateral. The production loan was used to purchase a tractor, an electric water pumping engine and other production inputs. In the first year she ploughed 2 hectares and planted tomatoes. The harvested tomatoes allowed her to generate a profit of R150 000. She is now specializing in tomato, cabbage, butternuts and green beans. She indicated that the training that she had received assisted her to gain knowledge of the basics of agricultural production, including the application of fertilizers and chemicals, and record keeping. In 2012 she ploughed 28 hectares of the land and produced good yields. The Department of Agriculture also supports her project with production inputs mostly fertilizers and chemicals. She hires both permanent and temporary labourers. The harvested crops are sold to feeding schemes, supermarkets such as Pick 'n Pay in Hazyview, and bakkie traders. She derives income from farming and child support grants, and considers farming as a vitally important source of income for the household.

Promise

Promise was born in 1964 in Bushbuckridge. She used to live with her grandparents, who worked for commercial farmers in the Lower Cork section of the irrigation scheme, and later owned 6 hectares of land when the land was given back to the labour tenants. When her grandparents passed on, she inherited the land and was allowed to change the names on the

PTO. She gained farming skills from her grandparents. She started farming on 6 hectares of land, and now ploughs 18 hectares of land, which are always green. Her husband is permanently employed and invests most of his income in the development of the farm. She also invests the income received from farming in the further development of the farm. She owns a truck and a bakkie, and also owns a tractor. She specializes in tomatoes, green maize, butternuts and cabbages, which she delivers directly to hawkers, pension pay points and supermarkets. She hires both permanent and temporary labour.

Gugu

Gugu was born in 1964 in Mozambique. She came to South Africa after marriage to her husband at the age of 25. She is a widowed woman with five children. She began farming as a subsistence farmer in 2004, growing crops in her backyard. In 2008 she approached the chief, who allowed her to debush as much land as she could. She managed to debush a quarter of a hectare and started farming on that portion of land. Currently she owns 7 ha of land, and indicates that this is because of the love that she has for farming. Her children are also involved in the farm, and two of the older children manage plots on behalf of their mother. Her most successful year was in 2010, when she planted 4000 cabbages and earned R24 000. She is also receiving support from the embassy of Israel, the MASDT and the Department of Agriculture. She reinvests most of her income in the development of the farm and also supports her family from farming income. She also receives child support grants, but regard the income from farming as an important source of income. After harvesting her crops, she hires a vehicle which collects the crops from the farm to sell to supermakets in Hazyview. She also hires temporary labour and one permanent labourer, but mostly depends on family labour for production. She specializes in cabbages, tomatoes and butternuts.

Surprise

Surprise was born in 1960, in Thulamahashe. He works as a teacher and owns 4 hectares of land, which he inherited from his grandparents. His farm is located at Big Bend 2 section. He once served in the irrigation scheme committee as a Chairperson during the year 2010. Surprise hired two permanent labour in his farm who manage the farm on a daily basis. He usually visits the farm once or twice a week. He produce crops such as cabbages and butternuts, but does not

make profit from the farming activities. He does not reinvest in the development of the farm, but depends on government support services such as mechanization services and production inputs. The harvested crops from the farm are sold to the surrounding community and bakkie traders.

Sipho

Sipho was born in 1963 in Nyongane. His household comprises himself, his wife and six children. As a young boy he used to sell fruit and vegetable in the surrounding community to generate income for his family. He continued with the business until he bought a bakkie, and used it to sell crops to various hawkers in town and at pension pay points. He used to buy crops from the farmers in the irrigation scheme and sell to customers in different areas, as a bakkie trader. In 2006, he decided to join the irrigation scheme and inherited his grandfather's land. Although his land is 18 hectares, he only ploughs 2 hectares. He hired two permanent labour who are responsible for the daily farm activities. He visits the farm once or twice in a week, as he is busy with other businesses outside farming. He does not make profit from the farming activities and does not reinvest his income on the development of the farm. Sipho also depends on government support services such as mechanization services and production inputs. Crops such as cabbage, butternuts and green peppers are produced in the farm. The harvested crops from the farm are sold to bakkie traders, hawkers and surrounding community members.

Karabo

Karabo was born in 1934 in Mahushu Trust. His father was a farm labourer in Kiepersol. He joined his father and began to work on the farm at the age of 16. He started his own garden in the white farmer's fields, and these crops were harvested by the white farmer. In 1970 he moved to Mkhuhlu, where he started farming in Saringwa under dryland conditions. His success in the farming business was recognized by surrounding commercial white farmers, who arranged for him to be allocated land in the irrigation scheme. He obtained 42 hectares of land which was fully utilized during the 1980s. This was enabled by the support that was provided by the then government, which subsidized farmers through provision of diesel, production inputs and extension support. He sold his crops in various destinations such as Malelane, and Tzaneen, with the support of extension officers. In 1991 the Farmers Weekly magazine recognized him as one of the most successful black farmers in the country. He had a herd of cattle, bakkies, tractors, water pumping engines, and other farm equipment. He reported that things started to change in

1994, when the subsidies were no longer provided to the farmers. The situation became worse in 2000 when he lost his farming equipment in the floods that affected the area. Ever since then Karabo has been struggling to plant even 2 hectares on the farm. He now depends on government services for production inputs and tractor ploughing. He owns a water pumping engine. His main source of income is now his old age pension. He uses family labour, and sometimes hires temporary workers for weeding. Before the year 2000, his main source of income was farming. He now specializes in tomatoes, cabbages, butternuts and chillies. He uses his old bakkie to transport harvested crops to the street for marketing to surrounding communities. Bakkie traders also visit the farm to purchase crops.

James

James was born in 1983 in Barberton. He purchased land nearby the irrigation scheme in 2009, where he also built his house. His wife has a permanent job in one of the provincial government departments, and provides income for the household. The income is reinvested in the farm development. He owns a diesel water pumping engine. He specializes in maize, beetroot, and butternuts. He sometimes purchases production inputs from agricultural cooperatives, but mostly depends on government support for production inputs, which include seeds, fertilizers, chemicals and tractor services. He uses family labour and sometimes hires temporary workers for weeding. The harvested crops are sold to hawkers and local community members. Sometimes he does not irrigate his crops due to lack of funds to purchase diesel, and as a result his yields are low and harvested crops are of poor quality.

Dorothy

Dorothy was born in Tzaneen in 1963. She came to Hoxane in 1974 while she was still a young girl to stay with her grandparents who were working for white farmers in the Cork section of the irrigation scheme. She used to help her on the farm on a daily basis. Before her grandmother passed on, she was requested take over the farm and continue with production.

In 2007 she went to the chief to change the owner's name on the PTO. She used to farm all her land before the year 2000 and hired permanent and temporary workers. Presently she is struggling to even hire a tractor to plough the fields, and rents out most of the land a source of income. Without assistance from government, Dorothy is unable to plough. In 2013 she did not

plough because she did not have any money to pay for diesel, which was required before the tractor service could be rendered. As a result she ploughs a very small portion of land using a hand hoe, and plants the seeds distributed by the department of . Although there is water in the fields, farming is difficult without the required capital to hire a tractor, hire people, and purchase production inputs.

Mary

Mary was born in Bushbuckridge in 1956. She was married to her husband in 1975 and gave birth to eight children. Her husband was a successful farmer in the scheme during the 1980s. He passed on in 2006, and Mary inherited the land. She used to help him in the farm and as a result gained farming skills. They had a great deal of farm equipment before the floods of 2000, such as pumps and pipes. They used to hire workers to assist on the farm, but today she is working alone since she cannot afford to pay even temporary workers. Today she is farming only 2 hectares of groundnuts and maize under dry-land conditions because she does not have a water pumping engine. She is now dependent on her pension and child support grants for her grandchildren income. Her farm is far away from the river and she is unable to buy pipes that will deliver water to the farm.

Susan

Susan was born in 1950 in Mahushu and was married to her husband in 1978. They have four children, of which two have established their own households and two are staying with her. She retired as a nurse in 2004, and now survives on an old age pension. Her husband used to farm in the irrigation scheme and generated an income from crop production. The income was reinvested in the development of the farm, which included buying a tractor, bakkies, pumps and pipes. All this farming equipment is now old and need to be replaced. Her husband no longer goes to the farm due to poor health, and the land is lying fallow. Two of Susan's children have temporary jobs and one has a permanent job.

Billy

Billy was born in 1964 in Mariti. He inherited the farm from his father. He used to farm in the scheme together with his father and earned considerable income from ground nuts. Income from

farming was reinvested in the developmnt of retail businesses such as small supermarket,s and his children's education. During the floods in 2000, most of the farming equipments were washed away and his father passed on in 2002. He found it difficult to replace all the farming equipments lost to the floods, and he never went back to farming, given the expense of replacing fences and purchasing fertilizers, other production inputs, pipes and a water pumping engine. He is now focusing on his shops as a source of income, and also on his wife's income, since she is permanently employed. The support offered by government is inadequate since it does not cover all the items that he requires to continue with farming in the scheme. He indicates that he sometimes goes to the farm to see what is happening, but it becomes painful because he does not have the required resources to continue with farming in the irrigation scheme.

Cynthia

Cynthia was born in Mkhuhlu in 1981. Her mother owns eight hectares in the irrigation scheme, which she inherited from Cynthia's father when he passed on in 2006. Cynthia has two siblings who live at home with her mother. Her mother recieves an old age pension and her two sisters receive child support grants. Cyntia works as a security guard and generates income from that temporary job. When her father passed on, her mother tried to continue farming in the scheme but she failed within a year due to the high costs involved. The farm is situated in the Ten Farm section of the irrigation scheme, which is far from the river. She used to spend more than R50 per pay for fuel for a diesel pump. The work involved in farming was difficult for her mother, and as a result she started to farm n a small scale in the backyard at home. Since her father passed on, the land in the farm has been lying fallow. They tried to rent land to other people, but without success. Cynthia stated that 'given the required resources and training, I can become a farmer and work on my father's land'.

Analysis of quantitative data collected in the survey of 35 households showed clearly that differentiation exists in the scheme, and qualitative data collected through in-depth interviews and life histories shed light on varied processes of accumulation amongst the plot-holders, and also on their livelihood trajectories over time. Some accumulated capital through a combination of successful farming and support from external donors. Others accumulated through using other sources of income, such as wages from permanent employment, or from self employment

without employees, and then reinvesting profits in the farming enterprise. There are other farmers who had been successful before the year 2000, but experienced huge challenges after the floods in that year, and are finding it difficult to recover even a decade after the disaster. Some farmers diversified their livelihoods to other options, such as self-employment in small businesses, wages from permanent jobs, pensions and child support grants. Some rent out land in the irrigation scheme as a way of generating income for household's survival. The processes of accumulation, as well as the strategies used to secure cash income and livelihoods, differ greatly and can be very complex.

Drawing on a schema suggested by Dorward (2009) and Dorward *et al.* (2009), a generic typology of livelihood trajectories in relation to agriculture have been identified in Hoxane Irrigation Scheme, , categorised as 'dropping out', 'hanging in', 'stepping out' and 'stepping up'. This livelihood typology was used to interpret data from the household survey of 35 households, as well as the 13 individual interviews. The results are shown in Table 11 below:



Table 11: Livelihood trajectories of households with plots in Hoxane Irrigation Scheme.

Category	Livelihood strategies	N	%	Description
'Dropping-out'	<ul style="list-style-type: none"> • Dependent on other sources of income • Own few farming assets • Keep the plot, but the fields remains fallow 	n =6	17%	This category contains farmers who abandoned their plots after the floods of 2000; they hold ownership rights to the land, but are not renting it out. Have diversified their income sources for the survival of the household members. They own few agricultural assets
'Hanging-in'	<ul style="list-style-type: none"> • Keeping the plot, but farming only a small portion of the land. • Renting out some plots of land • Highly dependent on government support services such as tractors and production inputs • Limited farming resources 	n=14	40%	Limited agricultural assets. Dependent on other sources of income for household survival. Farm a small portion of land to keep active in the irrigation scheme. Depend on government support for ploughing and production inputs. Hire tractors to plough only a small portion of land.
'Stepping-out'	<ul style="list-style-type: none"> • Keeping the plot, and farming only a few portions of the land. • Rely on government support services. • Have other sources of income outside farming. • Not reinvesting in the farm. • Part time farmers 	n=7	20%	Heavily reliant on different sources of income. Only farming in order to keep active in the irrigation scheme. Have permanent workers on the farm. Reinvest farming income in other sectors, not in the farm development. Household members earn wages in permanent employment. Visits the farm once or twice in a week. Have many agricultural assets but these are either old or not in good condition.
'Stepping-up'	<ul style="list-style-type: none"> • Plough all the allocated portions of land in the scheme • Farmers reinvesting in the farm development • Generates income from different sources • Receives support from private institutions. 	n=8	23%	Receive support from private sectors. Reinvest in the development of the farm. Spend most of their time on their farms. Have many agricultural assets that are in good condition. They sell to various markets. Have other sources of income, which assist in ensuring sustainability of the farm. Have acquired farming skills through both training and farming experience.

Table 11 above shows the distribution of households across the livelihood categories. It shows a high percentage of farmers at 40% (n = 14) in the 'hanging in' category. Based on the life history interviews, farmers such as *Karabo, James and Dorothy* are within the 'hanging in' category. Such farmers are not producing much in the fields, but plough small portions of land just to keep themselves active in the irrigation scheme. Farmers such as *Karabo* were once successful in the irrigation scheme before the year 2000. Presently, these farmers are struggling to keep the land under full production in the irrigation scheme. They usually rely heavily on the Department of Agriculture's support services, which include assistance with production inputs such as tractors, seeds, fertilizers and chemicals. The farmers in this category produce on relatively small portions of land, depending on the available resources. They have other sources of income, which mainly comprise of pension and child support grants. Most of the agricultural assets owned by these farmers are worn out and have not been replaced or maintained for some time. Some of the farmers in this category such as *Dorothy* do not have money to hire a tractor, buy production inputs or hire labour to assist in the farm. As a result she rents out some of the allocated land for income generation purposes.

The 'dropping out' category comprised 17% (n=6) of the surveyed farmers. Farmers such as *Mary, Susan, Cynthia and Billy* are classified within this category of 'dropping out'. This category includes farmers that own land in the irrigation scheme, but are not actively involved in the daily farming operations. Their land has not been cultivated for the past five years, and has been neither sold nor rented out. Although these households have diversified into other sources of income outside of agriculture, they still consider their land as an agricultural asset that should be preserved for the benefit of the household. Members of the households in this category have permanent jobs, operate small businesses, and receive old age pensions as income sources. Many hope that one day they will have funds to reinvest in the farm or, that government will provide funding so that they can purchase production inputs and continue with agricultural production in the irrigation scheme.

The 'stepping out' category comprised 20% (n=7) of the surveyed farmers. Farmers such as *Sipho and Surprise* are classified within this category of 'dropping out'. These are part-time farmers that come to the farm once, or twice a week. They have full-time employment or other sources of income that they spend most of their time on. They employ permanent workers who

look after the farm on a daily basis. These farmers are not reinvesting in the development of the farm, but instead they rely on government support for farming resources. They have many agricultural assets as compared to the farmers in the 'hanging in' category, but they do not plough all of their land in the scheme.

The fourth category ('stepping-up') involves farmers that are active in the irrigation scheme and use all of their land. The farmers in this category make up 23% (n=8) of the surveyed farmers in the scheme. Farmers such as *Lungile, Collen, Promise and Gugu* are classified within this category of 'stepping-up'. These farmers often reinvest farm profits in the development of the farm. This is noted amongst farmers such as *Promise* and *Collen* who managed to buy tractors using the profit from the farm. Farmers such as *Gugu* also receive support services from private institutions, such as the Embassy of Israel and MASDT, in accessing production inputs and markets. They have acquired farming skills either through training or farming experience. They do not rely on government support services for production inputs, and sometimes use their other sources of income for this purpose. They have many agricultural assets, and often own more than one water pumping engine. They also own bakkies that they use to supply markets. One of the respondents, *Collen*, indicated that he had had access to other income sources ever since 1980, and has been reinvesting some of his farming income into the development of the farm, purchasing tractors, water pumping engines, bakkies and pipes. Other farmers in this category, such as *Promise*, said that income from the permanent jobs of other household members enabled her to invest in the development of the farm. She explained that her husband is permanently employed, and profits from the farm are re-invested in agricultural infrastructure.

The survey has shown that the farmers within the 'stepping up' category are not only dependent on farming as a source of income, but also receive income from the permanent employment of other household members as well as from self-employment in small enterprises. The farmers in the 'stepping up' category have comparative advantage over the farmers in the 'hanging in' category in terms of crop production and marketing. The farmers in the 'stepping up' category produce crops for a specific targeted market. This involves producing tomatoes and cabbage in summer, while the farmers in the 'hanging in' category produce these crops only in winter. The farmers in the 'stepping up' category produce butternut and green mealies in winter, when the demand for these crops is very high.

4.9 Conclusion.

The chapter discussed the socio-economic characteristics and livelihood strategies of the plot-holders in Hoxane Irrigation Scheme. The study found that households tend to be large, with a mean household size of six. In terms of gender, it found more female household members than males. The study found few instances of employment amongst the surveyed irrigation scheme members, confirming the high incidence of unemployment reported in Bushbuckridge by other sources. Instead, a high proportion of income sources are social grants (57%, n = 86), while 43% (n = 67) of the income sources are not from social grants. The bulk of social grant income sources is accounted for by child support grants, at 87% (n=67) with old age pensions at 20% (n=17). The study also found a higher proportion of males (n=23) with income from farming than females (n=12).

The farming operations in the irrigation scheme were found to be diverse and differentiated, influencing even the ownership of agricultural assets. Farmers in Lower Cork section owned fewer water pumping engines than farmers in the other sections of the irrigation scheme. Despite the large number of hectares of land held by households in the irrigation scheme, ownership of tractors is not common; only 5.7% (n=2) of the 35 surveyed households own tractors.

The farmers were grouped into four livelihood categories. Those in the 'stepping up' category are engaged in capital accumulation, by reinvesting profits to improve their production capacity. The 'hanging in' category comprises farmers unable to reproduce themselves from their own production alone, and have become increasingly dependent on other forms of petty enterprise, or on receiving assistance from the state. Other farmers are 'stepping out' into other forms of livelihood, and engage in a range of other strategies in addition to agriculture, which is often part-time in character. Farmers who are 'dropping out' are not using their land at all.

5 CHAPTER FIVE: AGRICULTURAL PRODUCTION IN HOXANE IRRIGATION SCHEME.

5.1 Introduction.

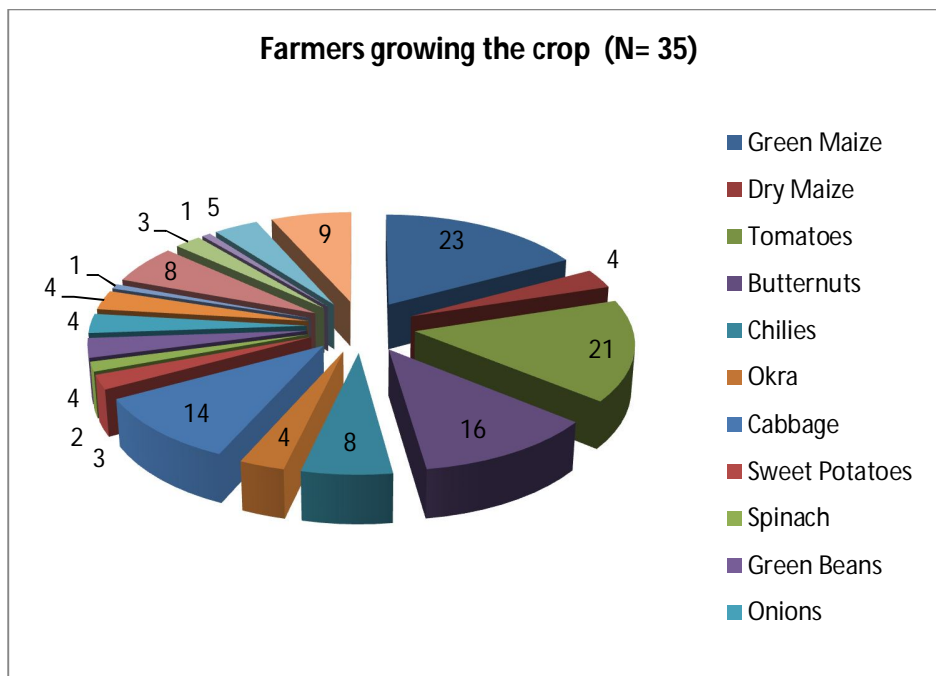
This chapter discusses agricultural production at Hoxane Irrigation Scheme. It first describes the various crop production and management practices evident in the irrigation scheme. Household survey data will be presented, along with information from individual crop sheets, which allow the various farming systems employed in the irrigation scheme to be described. Detailed production and marketing data were collected on 48 individual crops between November 2013 and January 2014, through interviews with individual farmers that were conducted soon after the completion of the final harvest of the crop. The small sample in this study resulted from the high number of farmers that do not keep crop records, and this means that generalisation should be treated with caution. Record sheets were compiled for the following crops: green maize (8), tomatoes (10), cabbages (8), butternut squash (8), dry maize (2), green peppers (2), okra (2), sweet potato (2), spinach (1), green beans (1), pumpkin leaves (1), chilies (1), groundnuts (1) and roundnuts (1). Research findings in relation to the following issues are discussed in the chapter: the area planted to different crops, soil fertility management, crop protection mechanisms, labour use, crop marketing information, and gross margin analysis.

5.2 Crops grown by Hoxane Irrigation Scheme farmers.

Figure 2 below indicates the variety of crops that are grown at Hoxane Irrigation Scheme. Farmers grow a variety of crops, which include green mealies, dry maize, ground-nuts, round nuts, and okra. Vegetable crops produced include tomatoes, butternut squash, cabbages, green peppers, lettuce, chillies, sweet potatoes, spinach, beetroot, onions and pumpkin leaves. Production of mangoes is widespread in the scheme, with 25.7% of the surveyed households reporting that they harvest and sell mangoes between November and January every year, either green or ripe fruit. Maize production is common in summer, with most farmers producing it under dryland conditions. Green maize and tomatoes are the dominant crops produced in the irrigation scheme, by 65.7% and 60% of the surveyed farmers respectively. The vegetables and

field crops are grown in rotation, throughout the year. Lettuce is the least grown crop in the scheme, with only one household growing the crop, for household consumption only. The farmers generally produce more than three crops per year, with some producers concentrating on green maize, tomato, cabbage and butternut squash production twice a year. Other farmers produce fewer crops during winter due to water shortages, especially in Lower Cork, where the water level in the storage dam drops greatly during the winter season. Maize is either marketed as green cobs, or used as grain for processing into mealie meal for household consumption. All crops are marketed locally, while a few farmers sell to supermarkets and feeding schemes.

Figure 2: Crops grown in Hoxane irrigation scheme.



5.3 Area planted to crop in hectares.

Crops are grown on a variety of land sizes depending on the availability of production inputs, which include mechanization services, water, fertilizers, chemicals, seeds or seedlings, and labour. The mean area planted to green maize was 1.063 hectares, with 1.5 hectares for dry maize, 0.8 hectares for tomatoes, and 0.5 hectares for cabbages and sweet potatoes. As shown in

Table 12 below, most of the farmers growing green maize and dry maize plant more than one hectare of land to these crops. Cabbages and tomatoes and sweet potatoes are generally planted on less than one hectare of land. Very few farmers plant a hectare or more of tomatoes and cabbages. Crops such as groundnuts and roundnuts have a mean area of 3 hectares and 2 hectares respectively, and are grown in summer under dry-land conditions. The other crops grown, such as green maize, tomatoes, cabbages, sweet potatoes, butternuts squash, green peppers, okra, green beans, pumpkin leaves, and chilies are planted throughout the year. The smallest mean area planted to a crop was 0.25 hectare for spinach, which is mostly grown in winter. As noted above, sample sizes were very small, and these findings should be treated with caution.

Table 12: Area planted to crops, in hectares.

Crop Grown	Mean	Median
Green Maize (n=8)	1.10	1.00
Dry Maize (n= 2)	1.50	1.50
Tomato (n=10)	.800	.50
Cabbage (n= 8)	.547	.38
Sweet Potato (n=2)	.500	.50
Butternut (n=8)	.625	.50
Spinach (n=1)	.250	.25
Green Beans (n=1)	1.5	1.5
Green Pepper (n=2)	.750	.75
Okra (n=2)	1.250	1.25
Pumpkin Leaves (n=1)	.500	.50
Chilies (n=1)	1.00	1.00
Groundnuts (n=1)	3.00	3.00
Round Nuts (n= 1)	2.00	2.00

5.4 Soil fertility and pest management.

Fertilizer application is common in the production of the four major crops produced in the scheme, namely, maize, cabbage, tomatoes and butternuts. Although in small quantities, fertilizer application has been reported in crops such as spinach, green beans, okra, pumpkin leaves chillies, ground nuts, roundnuts, and sweet potatoes. The use of organic fertilizer from kraal manure was also reported by some three farmers who produce crops such as dry maize, sweet potato and tomato crops, and is applied before planting. Two farmers (n=2) reported applying

organic fertilizers to butternuts but losing all the crops afterwards. The farmers seemed to understand the importance of fertilizer application, but said that it is expensive, and available fertilizer is therefore used for major crops such as tomatoes, green maize and cabbages.

The majority of the farmers applied pesticides to crops such as maize, tomatoes, cabbages and butternuts. There were no reported cases of pesticide use in crops such as sweet potatoes, spinach, groundnuts and roundnuts. Farmers see pesticide application as less important than fertilizer application on summer crops such as sweet potatoes, groundnuts and round nuts.

Table 13: Soil fertility and pest management at Hoxane Irrigation Scheme.

Crop (number of farmers producing crop)	Proportion applying fertilizer	Proportion applying pesticides
Green maize (8)	100%	100%
Dry maize (2)	100%	100%
Tomato(10)	100%	100%
Cabbage (8)	100%	100%
Butternut (8)	100%	100%
Sweet potato (2)	50%	0%
Spinach (1)	100%	0%
Green beans (1)	100%	100%
Green Pepper (2)	100%	100%
Chilies (1)	100%	100%
Groundnuts (1)	100%	0%
Roundnuts (1)	100%	0%

Nitrogen (N), Phosphorus (P) and Potassium (K) are the primary plant nutrients that play a major role in the growth of agricultural crops. The most common fertilizers applied by farmers in the

Hoxane irrigation scheme are KAN, 2:3:2, 4:3:4 and Ammonia (28). The most commonly applied type on before planting is 2:3:2, while KAN is often applied as a top dressing. More than three types of fertilizers are used on tomatoes and cabbages, with some farmers citing the importance of nitrogen for cabbages.

Table 14: Percentage of farmers applying fertilizer type.

Crop	Percentage of farmers applying fertilizer type.
Green maize (n= 8)	2:3:4 (30) – 62.5% 2:3:1 (25)- 25% 21.0 – 12.5%
Dry maize (n=2)	2:3:4 (30) – 100%
Tomatoes (n=10)	KAN – 10% 2:3:4 (40) – 10% 2:3:4 (30) –50% 2:3:1 (25)- 20% 18.1- 10%
Cabbages (n=8)	KAN – 12.5% 2:3:4 (30) –12.5% 123 (22) -25% Other -12.5% 21.0- 12.5% 28.0- 12.5%
Butternuts (n=8)	2:3:4 (30) –50% 2:3:1 (25)- 38% 21.0 – 12%

The importance of fertility management cannot be understated in the Hoxane Irrigation Scheme, noting that the majority of the farmers are using flood irrigation methods, which wash away most of the soil nutrients from the top-soil. In trying to help improve the soil fertility at the irrigation scheme, the provincial Department of Agriculture supplies chemical fertilizers to the Hoxane Irrigation Scheme farmers. Observations indicated that fertilizer application practices in the scheme are not based on soil analyses, but on a farmer’s knowledge and the availability of fertilizers. This was noted at Lungile’s farm, when she applied 2000 kg of fertilizer to produce tomatoes on a field of 3 hectares, while some farmers applied only 400 kg of fertilizers to a field

of one hectare. These quantities are much more than the 250 kg/ha recommended for tomatoes by the Department of Agriculture. One possible explanation for these differences in fertilizer application is poor soil quality, as the land in the scheme has been used continuously for more than 40 years. Some farmers said that the slope of the land in the scheme makes it susceptible to floods, thus requiring more nutrients to be applied. The need for soil tests was suggested by some of the interviewed farmers in the irrigation scheme.

Table 15: Fertilizer application rates at Hoxane Irrigation Scheme.

Crop	Fertilizer application rate Kilogram per hectare (mean)	Fertilizer application rate Kilogram per hectare (median)
Green Maize (n= 8)	2:3:4 (30) – 300Kg 2:3:1 (25)- 450Kg 21.0 – 600Kg	2:3:4 (30) – 200Kg 2:3:1 (25)- 450Kg 21.0 –600Kg
Dry maize (n = 2)	2:3:4 (30) – 200Kg	2:3:4 (30) – 200Kg
Tomato (n = 10)	KAN – 600Kg 2:3:4 (40) –450Kg 2:3:4 (30) – 270Kg 2:3:1 (25)- 1100 Kg 18.1- 600Kg	KAN – 600Kg 2:3:4 (40) – 450Kg 2:3:4 (30) – 300Kg 2:3:1 (25)- 1100Kg 18.1- 600Kg
Cabbage (n = 8)	KAN – 600Kg 234 (30) –400Kg 123 (22) -500Kg Other -125Kg 21.0- 800Kg 28.0- 1400Kg	KAN – 600Kg 234 (30) –400Kg 123 (22) -500Kg Other -125Kg 21.0- 800Kg 28.0- 1400Kg
Butternut (n = 8)	2:3:4 (30) –200Kg 2:3:1 (25)- 300Kg 21.0 – 300Kg	2:3:4 (30) –200Kg 2:3:1 (25)- 200Kg 21.0 – 300Kg

The quantity of fertilizer applied per crop is higher for cabbage, tomatoes and green maize than for other crops. The application of Ammonia (28) is very high for cabbages at almost 1400 kg per hectare on average. Observations indicated that the farmer who applied Ammonia (28) had received it from the Embassy of Israel for free, thus making it easy to apply in large quantities. The application of 2:3:1(25) fertilizer on tomatoes is also very high, at 1100 kg per hectare on

average. The farmers indicated that reducing the application of fertilizers on these crops tends to lead to lower yields, given poor soil quality.

5.5 Crop protection.

Table 16: Pest and diseases affecting crops and crop protection chemicals used.

Crop	Pest or Disease Attacking Crop	Crop Protection Chemicals Used
Green maize (n=8)	Maize stalkborer- 7	Stalkborer- 5 Bulldock- 3
Dry maize (n=2)	Maize stalkborer – 1	Chlorophyphos- 1 Antlakon- 1
Tomatoes (n=10)	Worms or cut worms – 3 Snails- 1 Aphids- 2 Red spider mite- 4 Blight 1 Other fungus disease- 1	Diten - 2 Bravo- 1 Lenet -4 Bulldock - 5 Magnetic- 1 Chlorophyphos- 1 Agromectin - 1 Copper Count- 6 Agtap- 1 Biomectin-2 Cypemethrins- 3 Biometrin- 1 Methomex – 1
Cabbage	Worms or cut worms – 2 Snails – 1 Insects -1	Diten -1 Lenet- 2 Bulldock - 5 Melt- 2 UZET- 1 Metamodophos - 2 Chlorophyphos - 4 Agtap- 4 Other- 1
Butternut (n=8)	Worms or cut worms – 2 Snails – 1	Tamaron- 1 Bulldock - 3 UZET- 1 Metamodophos - 2 Chlorophyphos- 1 Copper Count- 5 Other -1

Table 16 above reports the various pests or diseases affecting crops planted in the irrigation scheme. The hot weather conditions, the heavy rains in summer, and the location of the scheme nearby the Kruger National Park make the area susceptible to pests. Most of the farmers reported pest problems from maize stalk borers, worms or cutworms as major pests affecting maize, tomato, cabbage and butternut squash. Red spider mite was reported as another major pest affecting tomato crops.

The farmers reported using a number of different chemicals to treat these pests. The use of Bulldock was prevalent in most crops, including tomatoes, cabbages, butternut squash, green beans, green peppers and chillies. In relation to maize, the farmers reported the use of Bulldock Granules to treat the stalkborer pest before planting. Tomato and cabbage crops were reported as the major crops treated with various chemicals, especially during summer when pests are prevalent. The methods of chemical application differed amongst the farmers; some reported that all the chemicals are mixed together at once in a large container, while others reported the application of one chemical at a time until the crop is harvested. Most of the chemicals used by the farmers are received from the Provincial Department of Agriculture. The Extension Officer indicated that the chemicals are provided because most of the farmers are reluctant to purchase chemicals on their own, leading to poor yields and affecting the quality of the crops produced.

Observations indicated that farmers supported by the MASDT had thorough knowledge of the pests affecting the crops and chemicals applied. The farmers using chemicals from the department of Agriculture recalled the names of the chemicals as easily as those supported by MASDT.

5.6 Labour use.

Table 17 below indicates the use of labour for the various crops produced in the scheme. Hoxane Irrigation Scheme farmers hired permanent labour, temporary labour and also used family labour for the farming activities in the scheme. The farmers who planted small portions of land to crops such as spinach, okra, and sweet potato relied on family and temporary labour. Farmers planting large portions of land for crops such as green maize, dry maize, cabbages, tomatoes, cabbages

and butternuts used all three types of workers - permanent, temporary and family labourers. Land preparation was undertaken using tractors, and labour was used mainly for planting, weeding and harvesting. Production activities on crops such as green maize, butternuts, tomatoes, cabbages, green beans were generally carried out by permanent labour, temporary and family labour. In most instances, family labour was involved in weeding and watering, undertaken either by a farmer, or their spouse, or in some cases their children. The use of temporary labour was common in activities such as planting, weeding and harvesting. Farmers producing groundnuts, roundnuts, spinach, pumpkin leaves and dry maize used both temporary and family labour. This was mainly because these crops are not as labour intensive as cabbages and tomatoes, and in most cases are not irrigated, as they are produced during rainy season in summer. Overall, Hoxane irrigation scheme farmers tended to hire more temporary labourers as compared to permanent workers.

Table 17: Type of labour used on each crop produced.

Crop type	Mean of family labour used.	Sum of family labour.	Mean of temporal labour used.	Sum of temporal labour used.	Mean of permanent labour used,	Sum of permanent labour used.
Green Maize (n=8)	1.3	10.0	3.3	26.0	.9	7.0
Dry Maize (n=2)	.0	.0	2.0	4.0	.5	1.0
Tomato (n=10)	1.0	10.0	3.1	31.0	1.6	16.0
Cabbage (n=8)	1.1	9.0	3.0	24.0	1.5	12.0
Sweet Potato (n=2)	.5	1.0	2.5	5.0	1.0	2.0
Butternut (n=8)	.6	5.0	2.3	18.0	1.6	13.0
Spinach (n=1)	.0	.0	2.0	2.0	2.0	2.0
Green Beans (n=1)	4.0	4.0	6.0	6.0	1.0	1.0
Green Pepper (n=2)	.0	.0	1.5	3.0	2.5	5.0
Okra	.5	1.0	1.0	2.0	1.5	3.0
Pumpkin Leaves	.0	.0	.0	.0	2.0	2.0
Chilies	.0	.0	3.0	3.0	1.0	1.0
Groundnuts	.0	.0	3.0	3.0	2.0	2.0
Roundnuts	.0	.0	3.0	3.0	2.0	2.0

5.7 Labour costs in four main crops.

Table 18 below shows that labour was hired for all of the four major crops produced in the scheme namely, (green maize, tomatoes, cabbage and butternut squash). The hired labour was involved in at least six activities, which include planting, weeding, watering, spraying, harvesting and marketing. The cost of temporary labour was R50 per day, while permanent labour cost R1500 per person per month. The temporary labour was hired for specific activities and received payment the same day. The permanent employees undertook all activities on the farm for the whole month, from planting to marketing. Some farmers felt that the use of temporary labour is expensive, as money to pay workers is not always available, whereas the permanent labour is paid only once a month. The permanent employees also get in-kind payments, which include harvested crops and also small portions of land to plant either cassava roots or sweet potatoes.

Family labour is used mostly for weeding and watering. One of the farmers who hires his children for weeding and watering reported that he pays them cash, i.e. he treats them as temporary workers. The availability of temporary and permanent workers on tomatoes and cabbages results in the mean cost per crop of hired labour, for purposes of weeding, watering, spraying, harvesting and marketing, being more than R1000. The mean cost of using hired labour is very high during weeding and harvesting of crops such as tomatoes and cabbages. The farmers mostly use permanent labour and household labour in marketing operations, with the mean cost of using hired labour during marketing being below 40% in relation to all four major crops.

Table 18: Labour costs in four main crops.

		Green Maize (n=8)	Tomato (n= 10)	Cabbage (n= 8)	Butternut squash (n=8)
Planting	Hired Labour Used	100%	100%	88%	88%
	Cost (Mean) R'	325	531	479	299
Weeding	Hired Labour Used	100%	90%	88%	88%
	Cost (Mean) R'	869	1008	1343	680
Watering	Hired Labour Used	75%	50%	63%	50%
	Cost (Mean) R'	1500	1500	1200	1125
Spraying	Hired Labour Used	63%	50%	63%	50
	Cost (Mean) R'	1500	1500	1200	1125
Harvesting	Hired Labour Used	75%	90%	75%	63%
	Cost (Mean) R'	1500	1678	1184	960
Marketing	Hired Labour Used	38%	30%	25%	25%
	Cost (Mean) R'	1500	1000	1500	1500

5.8 Crop marketing of four main crops.

Table 19 below indicates the various outlets that are used by the farmers when selling the four main crops. The farmers market crops to the local community, hawkers, traders with bakkies, feeding schemes, shops such as Shoprite, Boxer, Spar and Pick n Pay, and also pension pay points (for farmers with their own bakkies). Farmers selling green maize to traders with bakkies receive as much as R 37 374 per hectare on average, as compared to those selling to hawkers and the local community, who receive R3 671 and R1 717 per hectare respectively, on average. The tomato crop provides R14 528 per hectare for farmers selling to traders with bakkies and R5 064 per hectare to farmers selling to feeding schemes, which is more than the R4 333 received when selling to the local communities and hawkers. Tomato sales at pension pay-point is also popular for farmers who have their own transport, and provides returns as high as R22 000 per hectare on average.

The cabbage crop also provides returns as high as R44 532 per hectare to farmers selling to bakkie traders and lower returns of R9 860 per hectare to farmers selling on the local market.

This is mainly because the average price of a cabbage, both in the feeding scheme market and to bakkie traders, is R12, while it is R5 in the local community market and also in the supermarkets. Butternut squash crops provided returns of up to R 23 458 per hectare for farmers selling to feeding schemes and lower returns to those farmers selling to the local community and to shops, with returns of R3 300 and R7 700 per hectare respectively. This is because the shops and local community members buy a bag of butternut squash at R35 per bag from the farmers, while in the feeding scheme a bag of butternuts is sold at R60 per bag. The findings above indicate that the market distribution used by the farmer directly impacts on the returns that will be received. Furthermore, they reveal that the market distribution channel used largely depends on the availability of transport in the household, and on the farmer's communication channels with the bakkie traders. Some farmers call their customers when crops are ready to be harvested. Farmers without transport end up depending on the local market and hawkers to sell the harvested crops.

Table 19: Crop marketing.

Crop Sales To Local Community in (Rands)			Crop Sales To Hawkers In Rands		Crop Sales To Traders With Bakkies In Rands		Crop Sales To Feeding Scheme In Rands		Crop Sales To Shops In Rands		Crop Sales To Pension Pay Points In Rands
Crop Grown	Mean	Sum	Mean	Sum	Mean	Sum	Mean	Sum	Mean	Sum	Mean
Green Maize	3671	22 029	17 173	137391	37374	14 9499
Tomato	1020.0	2 040	433	39 000	14 528	130 760	12 660	50 640	.	.	22 000
Cabbage	381.8	1 527	9 860	49 300	8 906	44 532	24 207	96 829	57 166	171 500	.
Butternut	3200.0	3 200	2 496	12 480	8 108	24 325	23 458	70 375	7 700	7 700	.

5.9 Gross margin analysis.

5.9.1 *Input cost for crops.*

The crop record sheet used during data collection captured data for all recorded information on crops that were produced by the farmers. The farmers provided information on the variety of crop planted, the area planted, the date planted, the date harvested, the ploughing method used and the cost of ploughing, types and quantities of fertilizer applied, types and quantities of pesticides applied, the costs of fertilizer used, the costs of chemical fertilizer applied, the costs of seeds or seedlings planted, the costs of labour used, yields obtained, and marketing costs. There were instances where farmers did not sell the harvested crops, but used them in their households, and others donated to people. This study considered the farm gate price of such crops to determine the overall returns that the farmer received after harvesting. Farmers producing butternuts incurred packaging costs, as they purchased bags to hold the butternuts.

The costs were analyzed according to their contribution to total costs. Calculating marketing costs was difficult, as some farmers reported the cost of hired labour which assisted during marketing, while others reported the cost of hiring transport. The farmers using their own transport to distribute to the marketing outlets reported the cost of fuel incurred at the time. The farmers that reported 'no marketing costs incurred' includes those who sold to the local community and hawkers as a marketing channel, and thus did not incur labour costs during marketing. Farmers using the feeding scheme market but who do not have transport, incurred transport costs during marketing using hired vehicles.

The farmers purchased seeds and seedlings in different areas as far away as Nelspruit and White River. Other farmers used the seeds from the Department of Agriculture, and as a result incurred no costs in relation to seeds and seedlings planted. This is similar to the cost of fertilizer, chemicals and land preparation for some of the farmers. The cost of labour varied for each crop, depending on the number of people hired. There were instances where some temporary workers were hired for R35/day, others for R45/day and yet others were paid R50/day. The price paid to most of the permanent workers was constant at R1500 per month for most of the crops produced.

In order to estimate the total labour cost per crop, I had to calculate the number of people hired and the number of days worked on each crop.

Table 20: Main production costs for crops produced in Hoxane Irrigation Scheme, in rands.

Crop Grown	Seeds/ seedlings costs (in rands)	Cost of ploughing (in rands)	Crop protection chemicals applied (in rands)	Cost of labour (in rands)	Total cost of fertilizer (in rands)	Total marketing costs (in rands)
Green Maize	Mean =2 425 Median=2 500	Mean= 940 Median= 960	Mean= 369 Median=271	Mean= 2968 Median= 2550	Mean=2 336 Median= 2 580	Mean = 0 Median= 0
Dry maize	Mean =2 400 Median= 2 400	Mean= 1650 Median= 1650	Mean= 85 Median=100	Mean= 1020 Median=2040	Mean=1320 Median= 1 320	Mean= 130 Median=130
Tomato	Mean =3 150 Median=0	Mean= 900 Median=590	Mean= 1 286 Median=609	Mean= 4 488 Median=3 230	Mean= 3 435 Median= 2 666	Mean= 450 Median= 425
Cabbage	Mean = 2646 Median=0	Mean= 576 Median=445	Mean= 1055 Median=775	Mean= 3493 Median=3450	Mean= 4 104 Median= 4 248	Mean= 320 Median= 350
Butternut	Mean =711 Median= 785	Mean= 685 Median=575	Mean= 284 Median= 246	Mean= 560 Median=560	Mean= 1 402 Median= 1067	Mean= 553 Median= 370
Green Pepper	Mean= 0 Median = 0	Mean=0 Median=0	Mean= 732 Median=1060	Mean= 1725 Median=1725	Mean= 3606 Median= 3606	Mean= 0 Median= 0

The table above indicates the high cost of fertilizer and labour for tomato, cabbage and green pepper crops. It shows that producing these crops is very expensive as compared to the cost of producing maize and butternuts. Fertilizer application and the labour used for weeding seemed to be factors determining the level of profit made by each farmer. There were no marketing costs incurred on green maize, as most of the buyers purchase directly from the farm. The cost of crop protection chemicals contributes more to the total costs of producing tomatoes and cabbages.

5.9.2 Gross margins.

The study calculated gross margin for the major crops grown in Hoxane Irrigation Scheme. The gross margin was determined by subtracting crop production costs from income received from the particular crop. The total gross margin per crop was aggregated to determine the overall mean gross margin per farmer. The gross margin obtained was applicable to the specific production cycle and the area planted to crop. The gross margin obtained allowed for identification of crops that were profitable and identification of crops that caused farmers to make a loss. Overall, 79% of the growers obtained a positive gross margin as compared to the 21% of the farmers who obtained a negative gross margin. This indicates that more smallholder farmers in Hoxane irrigation scheme farmers made profit than the few farmers that made a loss.

Table 21: Positive gross margins (n= 38).

Gross Margin In Rands –Positive (Profit)							
Crops Grown	Number of growers making a profit	Profit makers as a proportion of all growers	Mean gross margin	Median gross margin	Maximum	Minimum	Range
Green Maize	8	100%	36 237	36 679	69 270	160	69 110
Dry Maize	2	100%	1640	1640	3010	270	2740
Tomato	5	50%	30 867	16 876	102 193	6 880	95 313
Cabbage	8	100%	34 448	11 523	116 712	1 421	115 291
Sweet Potato	2	100%	1 867	1867	2975	760	2215
Butternut	5	63%	16 278	5 758	48 685	760	47 925
Spinach	1	100%	2 225	2 225	2 225	2 225	.0
Green Beans	1	100%	561	561	561	561	.0
Green Pepper	1	50%	1593	1593	1593	1593	.0
Okra	1	50%	1650	1650	1650	1650	.0
Pumkin Leaves	1	100%	4940	4940	4940	4940	.0
Chillies	1	100%	1661	1661	1661	1661	.0
Groundnuts	1	100%	4170	4170	4170	4170	.0
Round Nuts	1	100%	4005	4005	4005	4005	.0

Table 22: Negative gross margins (n= 10).

Gross Margin In Rands–Negative (Loss)							
	Number of growers making a loss	Loss makers as a proportion of all growers	Mean	Median	Range	Maximum	Minimum
Tomato	5	50%	6 980	3 868	20 110	21 420	1 310
Butternut Green Pepper	3	37.5%	889.5	420	1 853	2 051	197.5
Pepper	1	50%	5 370	5 370	.0	5 370	5 370
Okra	1	50%	2 205	2 205	.0	2 205	2 205

Gross margins, both positive and negative, are shown for the crops represented in the sample in the tables above (n=48). The tables show that green maize and cabbage are more reliable crops than tomatoes and butternut squash. Of the 15 crops represented in the sample, 79% are profitable, while 21% of the crops cause farmers to incur a loss. This includes crops such as tomatoes, butternut squash, green pepper and okra. Cabbages, tomatoes, green maize and butternut squash remain profitable crops in the scheme if produced in larger quantities and sold to a specific market that offer more returns, such as bakkie traders, feeding schemes and pension pay points. Farmers producing maize and cabbages made profit from these crops. The cost of fertilizer and labour had a huge bearing on the negative gross margin incurred by farmers producing tomatoes, butternuts green pepper and okra. The high cost of fertilizer was observed when some of the farmers continue to apply fertilizer to the crops such as tomatoes and green peppers. This indicates that more farmers at Hoxane irrigation scheme made profit from production of green maize, cabbage, butternut and tomatoes. Few farmers made loss from production of crops such as tomatoes, okra, green pepper and butternuts. The range of loss is high for tomatoes at R20 110, which are highly perishable and easily spoil when a market is not found timeously. The loss on butternuts is at R1 853.00 and is also influenced by the type of market accessed by each farmer. The farm gate selling price varies for butternuts in the irrigation scheme, with some farmers selling at R35/bag while others sell at R60/bag. The farmers accessing the feeding scheme market managed to make profit from the harvested butternuts, while those waiting for the local community to buy made a loss.

5.10 Conclusion.

The plot-holders in Hoxane Irrigation Scheme produce a variety of crops which include green-mealies, dry maize, groundnuts, round-nuts, pumpkin leaves and okra. Vegetable crops produced in the scheme include tomatoes, dry maize, butternut squash, cabbages, green peppers, lettuce, chillies, sweet potatoes, spinach, beetroot, lettuce, and onions.

Fertilizer application is common amongst the four major crops produced in the scheme, namely, maize, cabbage, tomatoes and butternuts. The importance of fertility management cannot be understated in Hoxane Irrigation Scheme, noting that the majority of farmers are using flood irrigation, which washes away soil nutrients from the topsoil. Observations indicated that the fertilizer application practices in the scheme are not based on soil requirements, but on a farmer's knowledge and fertilizer availability. The farmers reported using a number of chemicals to treat the pests affecting the crops in the scheme. The use of Bulldock liquid was prevalent in crops such as tomatoes, cabbages, butternut squash, green beans, green peppers and chillies. The study identified discrepancies in the farmer's knowledge of pesticide application. In terms of labour use, the study found that the Hoxane Irrigation Scheme farmers hired permanent labour, temporary labour and also used family labour for various farming activities in the scheme. Farmers planting large portions of land for crops such as green maize, dry maize, cabbages, tomatoes, cabbages and butternuts used permanent, temporary and family labour. In terms of marketing, the farmers supply the local community, hawkers, traders with bakkies, feeding schemes, shops such as Shoprite, Boxer, Spar and Pick n Pay, and also pension pay points (for farmers with their own bakkies).

The study found that 79% of the growers obtained a positive gross margin as compared to the 21% of the farmers who obtained a negative gross margin. The positive gross margin was obtained from crops such as green maize, cabbage, butternut and tomatoes. The crops that led farmers to incur a loss include tomatoes, okra, green pepper and butternuts. The farmers who obtained a negative gross margin are affected by the type of market accessed for tomatoes and butternuts. The loss on green pepper was influenced by the high maintenance costs involved, as in most cases green peppers are not replanted, but maintained. The maintenance costs on the green pepper crop include the high costs of fertilizers and pesticides that are applied to obtain good quality yield.

6 CHAPTER 6: INSTITUTIONAL ARRANGEMENTS THAT EXIST IN HOXANE IRRIGATION SCHEME.

6.1 Introduction.

This chapter discusses institutional arrangements at Hoxane Irrigation Scheme. The chapter focuses on land tenure, the timing of land acquisition, marketing arrangements, mechanization services, water management, cooperative development and agricultural extension services. Together these show how the irrigation scheme is managed by a range of different actors.

6.2 Land tenure in Hoxane Irrigation Scheme.

As in many communal areas, land ownership in Hoxane Irrigation Scheme is controlled by what was formerly known as a 'tribal authority', now a Traditional Council, under (Chief Nkuna). As shown in Table 23 below, some of the surveyed households reported that they had received land on the irrigation scheme from the chief (34.5% of respondents) and paid a registration fee to Mhala Magisterial district, which then issued a 'permission to occupy' (PTO)² permit used to provide proof of land rights. In the 1970s, the document was referred to as a 'Mampuru', as recalled by one of the surveyed farmers in the scheme. However, the main form of land acquisition was through inheritance from relatives (46% of respondents), many of whom had comprised the first members of the scheme. For example, one of the farmers recalled that when his father passed on, he went to the Tribal Authority in 1970 to get a guarantee that we could inherit his father's plot and was issued with a PTO by the local municipality office. Notably, those who had inherited land include widowed women, some of whom have been able to maintain production on the fields of their deceased spouses. An example is that of a female farmer, Lungile, who inherited land from her parents-in-law in 2007, and then went to the Traditional Council to transfer the PTO into her name.

² A PTO refers to a piece of paper issued by the magisterial district, on behalf of the chief, to record that a household has permission to occupy the land.

In a few cases, the surveyed households reported lending land to other people who wanted to plough land either for free or for a cash payment. As indicated in the discussion of income sources in Chapter 4 above, two households (or 3% of the surveyed households) derive income from land rental, and another three pay monthly or yearly rental fees to the main owner of the land. There were also three cases where land was sold to people who are interested in farming, either for R2000 or R6000 per hectare, and the customary form of ownership embodied in the PTO is transferred to a new land user. A respondent from one of the surveyed households, which bought land in the irrigation scheme, indicated that land sales are prevalent where the main owner is deceased and the descendants are no longer interested in farming.

As in other communal areas in South Africa, land tenure insecurity is often experienced, especially when development projects are proposed. Land tenure rights are rendered insecure in the course of development planning, and this is common in the Lower Cork section (close to Kruger National Park). Evidence of tenure insecurity amongst the Lower Cork farmers emerged when one of the surveyed households reportedly lost 15 hectares in 2012, through a tourism development project, and was offered R5000 in compensation. Household members indicated that when development projects are proposed, they are informed that the irrigation scheme is on communal land, which belongs to the chief, not the plot holders.

Table 23: Land tenure at Hoxane Irrigation Scheme (n = 35).

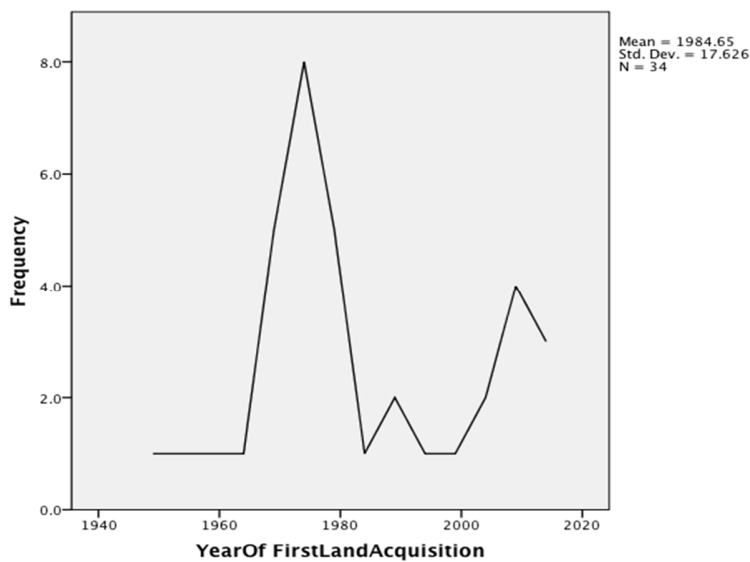
	Frequency	Percent
Land from chief	12	34.3
obtained inherited/ given from relatives	16	45.7
borrowed from another farmer (free)	1	2.9
rented from another farmer (cash)	2	5.7
purchased from another farmer	3	8.6
Other	1	2.9
Total	35	100.0

6.3 Timing of land acquisition.

Figure 3 below shows that many of the irrigation scheme plot holders in the sample first acquired their land in the 1960s. Many of the irrigation scheme plot holders began to acquire land in the

1970s and the 1980s. Few plot-holders acquired land in the 1990s, and it is evident from the graph that there has been an increase in the number of people acquiring land from the scheme since the year 2000. Most of the plot holders who acquired land after the year 2000, bought their land from plot-holders whose farming resources were washed away by floods during the year 2000. People who acquired land from the chief through the PTOs after the year 2000, generally accessed land that is far from the Sabie River, from which irrigation water for the Hoxane scheme is drawn.

Figure 3: Year of first land acquisition



6.4 Distribution of land held and in use.

Table 24 below summarizes the pattern of household land ownership on the irrigation scheme, revealing a slightly skewed distribution with a mean number of hectares owned in the irrigation scheme standing at 13.4 hectares, and a median of 10.5 hectares. The mean number of hectares in use is far lower at six hectares, with a median of five hectares. The household survey revealed that land ownership in the scheme is skewed, with few people owning many of hectares of land and many people owning less than 10 hectares of land, with different reasons explaining how this came about in the various sections of the scheme.

One key outlier on the higher end of the scale is a household that holds 42.5 hectares, while other households have access to only two hectares of land in the irrigation scheme. Most of the farmers in the Lower Cork section of the scheme are former labour tenants, who were working under commercial farmers producing sub-tropical fruits such as mangoes, citrus, and bananas, and were allowed to acquire the land in 1980. This explains the reason for most of the Lower Cork farmers being aged people who are former labour tenants in the scheme, and were given six hectares of land per household. There are some labour tenants who decided to relocate to the nearby township, and sold their land to other former labour tenants who remained in Hoxane Irrigation Scheme to people who were coming from outside the scheme. This explains the reason for some households owning six hectares, while others own 12 to 18 hectares in the Lower Cork section.

Life history interviews which sought to understand how the scheme operated in the past revealed that five families occupied land along the Sabie River from around 1949. Today, these families have access to more than 20 hectares of land in Big Bend 1, Siholokoane, Ten Farm, Mkhuhlu West, and Belfast. Different scenario exists for other farmers who joined the irrigation scheme after 1970, such as Karabo, who explained that the chief allowed people to clear as much land as they could, and then issued them a PTO. As a prominent local farmer, Karabo approached the chief, and in 1982 was also provided with a grader and labour by a white commercial farmer to assist him to clear land in the irrigation scheme. In the process he managed to clear 42.5 hectares of land, which today he uses for both livestock and crop production. This is more than the size of land owned by any other farmer in the scheme. Moreover, accessing land was not easy for Karabo, as he was not originally from the surrounding areas of Mkhuhlu; as a result one of the white commercial farmers from the area had to request land on his behalf from the chief.

These findings suggest that acquiring a larger area of land in the irrigation scheme required access to additional capital and labour. Differential access to capital has resulted in the unequal distribution of land ownership, given that, in joining the irrigation scheme, households were required to pay a once-off registration fee and were then permitted to occupy and cultivate as much land as they could physically clear of wild bush.

The sum of the land owned by the sampled households in the survey is 429 hectares, but the sum of the land used by surveyed household in the irrigation scheme is only 197 hectares, with 54% of the land in the irrigation scheme lying fallow. The latter includes land that is utilized by the households for livestock grazing. The household survey revealed there are a number of prominent farmers who are using the total area of land that has been allocated, but also that there are land owners who are not farming at all.

Table 24: Number of hectares held and used at Hoxane Irrigation Scheme (n=32).

	Number Of Hectares Owned In Irrigation Scheme	Number Of Hectares Rented Out	Number Of Hectares Rented In	Number Of Hectares Lent Out	Number Of Hectares Borrowed In	Number Of Hectares In Use
Valid N	32	2	3	3	3	35
Mean	13.4	3.0	6.2	2.2	1.5	5.6
Median	10.5	3.0	6.0	2.0	2.0	5.0
Range	40.5	4.0	11.5	3.5	1.5	28.0
Maximum	42.5	5.0	12.0	4.0	2.0	28.0
Minimum	2.0	1.0	.5	.5	.5	.0
Sum	429.0	6.0	18.5	6.5	4.5	197.0

6.5 Impact of type of land tenure.

Extension officers confirmed that more than half of the irrigation scheme's land is lying fallow, with most of the initial PTO holders now deceased. The PTOs are now held by their descendants, who are not willing to sell the land or rent it out to other people. Interviewed households that hold PTOs, but not actively involved in the irrigation scheme, cited 'lack of capital' as the main reason for not utilizing the allocated land. One of the surveyed descendants with a PTO revealed the dangers of renting out or leasing land to other people, saying that leasees might not be willing to return back the land on expiry of the agreed time frame. Presently, people are selling and renting out land on their own, and there is no formal arrangement governing how people secure their land rights. The land used by tenants through lease, borrowing and renting, is the most insecure in the irrigation scheme.

Insecure rights to land by irrigation farmers minimizes the chances of these farmers investing in the farm, either through soil improvement or infrastructure development. At least one of the plot-

holders reported that she had used the PTO to access funding from Land Bank, in order to purchase a tractor. Accessing funding for investments is difficult for land tenants and land borrowers in the irrigation scheme, as they do not have ownership rights to the land. One of the tenants reported that he always checks with the land owner if he can continue renting the land before planting crops in the farm. This is because there is no signed agreement governing the terms of his use of the land. Such instances prove that borrowing, leasing, and renting are the most insecure land ownership in the irrigation scheme, which then affects production.

6.6 Market access.

Van Tilburg & van Schalkwyk (2012) describe market access as the ability of farmers to obtain necessary farm inputs and farm services, and the ability to deliver farm products to buyers. Observations indicate that accessing markets seems to be a mammoth task for smallholder farmers in South Africa. This is due to a number of constraints, including lack of transport, absence of storage facilities, remoteness, poor roads, lack of market information, lack of organized bargaining power, absence of dedicated governmental support, and discrimination in the market (Makhura & Mokoena 2003). According to some analysts, market access was not a challenge in the past, as smallholder black farmers used to access markets through marketing boards (van Tilburg & van Schalkwyk 2012). The marketing boards provided essential farm inputs such as seeds, fertilizers and ploughing services, farm services such as extension and credit, and output market services such as collection of the harvest, quality assessment and buying. Marketing boards tended to issue pan-seasonal and/or pan-territorial product prices, and purchased from farmers and traders at several central locations. The consequence of this approach was that the decisions made by producers, processors, transporters, traders and consumers were not fully guided by free market principles and prices, as indirect subsidies were involved. When the marketing boards were abolished, the smallholder farming sector especially in smallholder irrigation schemes suffered in terms of market access. Magingxa & Kamara (2003) indicated that this was because the smallholder farmers were used to the role played by the parastatal organizations relating to the overall management of the irrigation schemes in the country from financing of all farming activities to marketing of the produce.

Van Tilburg & van Schalkwyk (2012) also argue that:

... “the abolishment of parastatals in South Africa in the ‘nineties’ was a serious drawback notably for smallholders. During the abolishment, emerging farmers operating in the former homelands of South Africa were deprived of substantial support. Despite, quite a number of emerging farmers given access to land, they did not usually receive a title deed, thus preventing them from using their land as collateral for both investment and working capital. Farmers, especially those operating in the former homelands, generally encountered high transaction and transport costs to access markets”.

Vink and Kirsten (2000), found empirical evidence that the deregulation of agricultural marketing in South Africa brought net welfare gains for commercial agriculture, and therefore for the entire nation. Food prices declined, investment in agriculture increased, higher production per hectare was achieved, and farmers began producing higher value crops. However, they caution that this does not necessarily mean that smallholders have enjoyed these gains because of a number of constraints that inhibit smallholder access to agricultural markets in South Africa. Some of the constraints that inhibit the smallholder’s access to agricultural markets include poor infrastructure, access to credit, organizational structures, and suitability of technology and managerial capacity of the farmers.

6.6.1 Input markets at Hoxane Irrigation Scheme.

Van Averbeke (2008) regards smallholder irrigation schemes as being amenable to forms of collective action in relation to both market access and input acquisition. However, in contrast, smallholder farmers in Hoxane irrigation scheme tend to engage in marketing on an individual basis, and purchase production inputs in only small quantities.

Farmers use production inputs such as tractors, water, seeds and seedlings, fertilizers, pesticides, labour and equipment (e.g. knapsack sprayers and hoes). Most of these production inputs are not available within the immediate vicinity of Hoxane irrigation scheme or from shops in Mkhuhlu, and instead are purchased in urban areas as far away as Hazyview, White River and Nelspruit. These are more than 20km away from the irrigation scheme, requiring transport, using a taxi, a

hired bakkie or their own transport. Most of the production inputs are procured from more than one area. Some farmers revealed that in the past they would buy production inputs as far away as Bushbuckridge and Tzaneen.

The Provincial Department of Agriculture plays a crucial role in providing crop production inputs to the Hoxane farmers through the Masibuyele Emasimini programme. A majority of the farmers in the scheme benefit from programme, and in particular subsidized access to pesticides, fertilizers, seeds, seedlings and tractor services, which involves the ploughing of a one hectare field. Farmers affiliated with MASDT purchase their production inputs through the MASDT extension officers in Nelspruit. Buying crop inputs through MASDT is advantageous for farmers, since prices do not include VAT and are therefore cheaper; in addition, there are no transport costs involved. The six farmers affiliated to the Embassy of Israel are also supported with production inputs, such as fertilizers and irrigation infrastructure.

Most of the surveyed Hoxane farmers do not have access to motor vehicles. This means that MASDT vehicles used by the extension officers, and public transport, are the main modes of transportation for crop production inputs. Extension officers reported that when the Irrigation Scheme Committee was active in the past, an input supply outlet was located in the Hoxane irrigation scheme offices, where farmers used to purchase production inputs. The farmers using hired or public transport to transport production inputs reported that this increases the costs of production inputs and thus affects profitability. As a result they end up not applying fertilizer.

6.6.2 *Output markets at Hoxane Irrigation Scheme.*

Magingxa and Kamara (2003) noted that smallholder farmers in South Africa employ diverse tactics in trying to supply different output markets. The marketing tactics used by the farmers were categorized as follows:

- a. *Semi-active marketing*, as a result of hypothesized constraints that include lack of transport, and long distances from markets, amongst others.

- b. *Farm gate sales*, where buyers are attracted to the farming area. Buyers range from re-selling small and medium entrepreneurs from the village and surrounding areas, as well as individuals buying produce for household consumption.
- c. *Organised transportation and active sales*, where farmers actively organize marketing of their produce, not only in selling but also transporting the produce to the potential buyers.
- d. *Contracted growers*, who have pre-arranged markets and prices before the produce is harvested. They are sometimes even contracted to other large -scale producers with assured markets.

Marketing of agricultural products in the Hoxane Irrigation Scheme is the responsibility of the individual farmer, as there is no coordinated marketing system in the scheme. Similar to the observations made in other smallholder irrigation schemes in the country, farmers owning vehicles in the Hoxane Irrigation Scheme deliver their products to different formal markets, such as Pick n Pay, Boxer and Spar supermarkets in Hazyview. Other vehicle-owning farmers deliver their products to informal market outlets such as pension paypoints, and street vendors. Direct sales to consumers at the farm gate appear to be quite frequent in the scheme. with bakkie traders, hawkers and individual consumers coming to purchase products at the farm.

The six farmers affiliated to the Embassy of Israel deliver their products to Freshmark in Mkhuhlu, and then a truck from Freshmark collects the produce. For farmers to supply Freshmark, they have to meet certain stipulated conditions, including that farmers plant certain seeds, apply certain fertilizers and produce a definite quantity of produce. In cases where the farmer has not supplied the expected quantity, it was observed that direct selling amongst the farmers takes place. This enables one farmer to at least sell some of his or her products, and at the same time, enables the other farmer to deliver the quantity expected by Freshmark.

The main markets in which the crops produced in the irrigation scheme are sold are: the local community, hawkers, bakkie traders, supermarkets and schools feeding scheme programmes. Bakkie traders, hawkers and the local community began to buy produce from farmers in the scheme during its early days. During the 1970s, other farmers sold produce at the local train

station, delivered produce to the packhouse in Hoxane Irrigation Scheme, and some crops were sold in distant areas as far away as Tzaneen and Malelane.

Marketing of crops is regarded as a major challenge facing the farmers. Some of the group of farmers receiving support from the Embassy of Israel market their crops to a Shoprite supermarket, and others have contracts with Pick n Pay and other supermarkets in Hazyview. Most of the surveyed farmers indicated that there is a need for a pack-house in the irrigation scheme in order to minimize the losses that are experienced by farmers. Some farmers, however, felt that a pack-house might not be a solution, as the problem is created most fundamentally by the quality of the crops produced. The surveyed Hoxane Irrigation Scheme farmers suggested that pack house might assist the farmers if extension advice could also focus on marketing strategies that would benefit the farmers in the irrigation scheme. Qualitative interviews showed that the major challenges affecting crop production and marketing in the scheme relates to poor extension advice, a poor and costly irrigation system, limited tractor services from government, poor irrigation scheme committee management, and poor quality fencing.

6.7 Access to mechanization services.

The survey identified only two (5.7%) of the surveyed farmers who use hand hoes for land preparation. The majority of the farmers in the scheme are dependent on government-owned tractors for land preparation, while some have their own tractors and others hire private tractors. Some farmers are ploughing using a tractor donated to the group of farmers assisted by the Embassy of Israel (n=6), while others are using a tractor belonging to Mobile Agri-skills Development and Training company (MASDT) and supporting affiliated members (n=7). The mean cost of ploughing in 2013 was R884.00 per hectare for farmers using government-owned tractors, while some farmers using MASDT tractors paid R240.00 per hectare. The tractor from the Embassy of Israel provides mechanization services specifically to members of the group they work with, which comprised 17% (n=6) of the respondents in the survey. One of the surveyed farmers, Karabo, indicated that before 1994, farmers on the irrigation scheme were assisted with tractors from government and farmers paid R4.00 for the diesel needed to plough a hectare of

land. The continuous withdrawal and reintroduction of tractors in the scheme since 1994 has had negative impacts, as farmers are forever adapting to the changes brought by public service mechanization policies.

6.8 Water management.

6.8.1 Access to irrigation water.

The life history interviews revealed that Hoxane Irrigation Scheme farmers have unlimited access in terms of the amount of water that each farmer can draw from the dam in Lower Cork or the Sabie river in other sections. One of the longest serving farmers in the irrigation scheme, Karabo, indicated that accessing irrigation water was difficult in the apartheid era, as the Kruger National Park fenced off the river banks and people were arrested if they were found drawing water from the river. This has since improved, as Woodhouse (1995) indicates, since the Park authorities ensure that black farmers' rights to pump water from the Sabie River are respected, even though water rights, according to the Water Act, belongs to the Park, not the farmers. Maintenance of pipes and pumping engines remains the responsibility of each farmer, while in the Lower Cork there is a sub-committee dealing with maintenance of the dam and the electric pumps. Farmers situated at a long distance from the river spend more money on fuel compared to farmers situated closer to the river.

As indicated in Chapter 2, the scheme is divided into nine sections, namely: Siholokoane, Mkhuhlu West, Mkhuhlu East, Big-Bend 1, Big-Bend 2, Belfast, Ten Farms, Lower Cork, and Upper Cork. Water in the irrigation scheme is pumped from the Sabie River using pumps fuelled by electricity, petrol or diesel. Allocation of water remains the responsibility of an individual farmer. The surveyed farmers reported that there is no policeman or committee member responsible for allocation of irrigation water. This is evident in the number of hectares irrigated by different farmers in the scheme. Water is pumped using an electric pump in the Lower Cork section, then transported to a storage dam, and then moves through canals to the fields. In the other sections of the scheme, water is pumped from the river to fields through pipes and then reaches the crops through furrows. Only two surveyed farmers are using a drip irrigation system in the fields. The farmers using the drip irrigation system received this as a

donation from the Embassy of Israel, which also assists with the provision of marketing and mentorship services to the farmers. The majority of the farmers in the different sections, with the exception of those in the Lower Cork section, are using diesel fuel to pump water from the river to the fields. The amount spent on irrigation water differs amongst each farmer with farmers in the Lower Cork paying R250 per month for electricity, while petrol and diesel pump farmers in other sections pay R14.00 per litre of petrol, with electric pumps farmers paying more than R1500 per month.

6.8.2 Water challenges in Hoxane Irrigation Scheme.

Accessing water remains a challenge for most of the farmers in the irrigation scheme. Accessing water in the different sections requires a pump, pipes and fuel. Farmers in Lower Cork find it difficult to access water in winter due to the drop in water level. The farmers expressed the need for the department to complete the installation of water pumping engines in different sections of the scheme, so that the fuel cost can be reduced. This view is however, overshadowed by the high rate of theft of transformers in the scheme, which affects the operationalization of the pumps. Another recommendation is that the department should promote ownership of transformers by installing them within a farmer's plot.

The water challenges in Hoxane Irrigation Scheme affect production, as some crops receive less than the required amount of water. As a result farmers do not adhere to irrigation scheduling, but irrigate on the basis of the availability of water. This is similar to research findings from Limpopo, where crops are over- irrigated during the early stages of crop growth, and under-irrigated during advanced growth stages (Machete *et al.* 2004).

6.9 Cooperative development in Hoxane Irrigation Scheme.

Although Hoxane Irrigation Scheme is registered as a primary cooperative, the Department of Agriculture in the province has embarked in a process of registering more agricultural cooperatives within the irrigation scheme. These cooperatives are developed in line with the DAFF framework for the development of smallholder farmers, which identifies cooperatives as

one of the central pivots of strategies to reduce poverty, unemployment and high levels of inequality and to accelerate empowerment and development for the benefit of the previously disadvantaged majority (DAFF, 2012). Some of the surveyed households in the irrigation scheme reported that they have been encouraged by the provincial department of Agriculture to register as cooperatives, and stand a chance of receiving infrastructural support from the department. As a result many cooperatives have been registered in 2013 and 2014, leaving the main irrigation scheme cooperative (Pfukani Cooperative) with little or no role at all. It was indicated that Pfukani cooperative would now be registered as a secondary cooperative. The major challenge in Hoxane irrigation scheme is that farmers seem not to understand the role of primary and secondary cooperatives. The farmers more often access production inputs directly from the provincial Department of Agriculture's offices than from the Pfukani Cooperative's offices. This leaves the Pfukani Cooperative with little or no role at all. In Dzindi irrigation scheme, Van Averbek (2008) found that a cooperative model was imposed on the farmers' association and did not suit the smallholder communities. A similar situation is noted in Hoxane Irrigation Scheme, where smallholder farmers are encouraged to register into cooperatives just to gain access to government support services, without allowing the farmers to learn about the new concept first.

In addressing the marketing constraints faced by the farmers in Hoxane Irrigation Scheme and other irrigation schemes in the Bushbuckridge Local Municipality, the Provincial Department of Agriculture established a secondary cooperative representing all the farmers in the municipality. The role of the secondary cooperative was to coordinate the marketing of all the agricultural produce in the municipality, and supply the school nutrition programme (i.e. feeding scheme) in the municipality. Through this initiative, most of the farmers in Hoxane Irrigation Scheme sold their harvested crops at a higher price than they could secure in other marketings, such as to members of the local community and hawkers. As an example, farmers would sell a cabbage for R12/head to the feeding scheme, while the normal price at the farm gate is R6/head. The feeding scheme arrangement enabled a number of farmers to gain access to a market for their produce during the year 2013, although it worked only for a short period of time. This suggests that the marketing constraints faced in the irrigation scheme can be resolved if farmers can secure access to an alternative market where they can distribute their produce.

6.10 Agricultural extension service.

The DAFF Extension Recovery Plan (2011) defines an extension service as the provision of information, knowledge and skill development to enhance the adoption of improved agricultural technologies, and the facilitation of linkages with other institutional support services (input supply, output marketing and credit). Liebenberg (2015) describes the history of agricultural extension in South Africa and indicates that it dates back to the ‘reconstruction years’ that followed the end of the Boer War in 1902, when scientists were imported from England to assist in the development of local agriculture. In 1925, a separate Division of Extension was established to act as the link between farmers and the specialist technical services of the Department, with only 6 scientists to serve all four provinces. Jacobs (2003) describes South Africa’s extension service as a two-track extension system, consisting of a well-developed extension support for large-scale commercial agriculture existing alongside extension services for small-scale producers in the former homelands. This extension design allows commercial farmers to be served by relatively few, well-qualified staff with tertiary education qualification, while black smallholder are served by large numbers of less qualified staff. The commercial farmers also received extension services from the private sector, including co-operatives, input suppliers, commodity organizations and farmer unions (Machete and Mollel, 2010). Machete *et al.* (2004) indicate that research on agricultural technology development has in the past focused on commercial agriculture, which was the domain of white farmers, and this approach has deprived smallholder farmers of appropriate technologies for their farming systems. This was observed in smallholder irrigation schemes in Limpopo, where farmers were unable to adopt new technologies due to the design of irrigation infrastructure in the schemes. The history of extension service in South Africa suggests that the extension service was developed to fit within the dual agriculture economic structure that existed in the country.

Williams *et al.* (2008) argue that agricultural extension in the homeland areas was implemented with the purpose of regulating production and land use in the reserves and the homelands. Furthermore, a variety of measures that were promulgated, most of which served to undermine rural production and land based livelihoods. Even the Native Agricultural and Lands Branch that was established within the Department of Native Affairs had a tiny budget and focused on soil

conservation and the regulation of livestock numbers.

6.10.1 Weaknesses of the current system of extension support.

Machete and Mollel (2010) argue that the current set of linkages between the agricultural extension service and research in South Africa is weak and ineffective. This is supported by various scholars who argue that the current support provided by the government to smallholder farmers promotes the adoption of new technologies, but does not pay attention to the diversity of farmers in a range of circumstances. Moreover, in order for the new technologies to work, farmers need access not only to land, but also to education, technologies that suit their farming needs and appropriate agricultural extension support (Hart & Aliber 2012).

Jacobs (2003) describes the extension support provided to land reform farms in Free State Province, North West Province and Northern Cape Province. The study revealed that 69 extension officers in the Free State rendered services to 186 projects at least once a month. The extension officers in the North West Province visit a minimum of 20 land reform projects at least once a week. In the Northern Cape, Extension Officers were found to be visiting projects twice a month. These findings revealed the inconsistencies that exist in terms of provision of extension support to land reform farmers and other small-scale black farmers in some parts of the country. Similar findings in relations to this literature were identified in Hoxane Irrigation Scheme whereby farmers, few extension officers are allocated to support a wide range farmers within and outside the irrigation scheme.

6.10.2 Extension services in Hoxane Irrigation Scheme.

A female extension officer is permanently stationed at Hoxane in order to provide extension support to the irrigation scheme. The extension officer is also responsible for other projects such as Saringwa irrigation scheme, which is few kilometres away from Hoxane Irrigation Scheme. The extension officer is also providing support to dryland farmers around the Mkhuhlu and Belfast areas which surround the irrigation scheme. The extension officer has a bakkie that is used to provide transport to all the areas with extension services. In terms of qualifications, the extension officer is qualified as a crop specialist, but has limited training on irrigation scheme

management. There is also a graduate appointed on a contract basis to assist the farmers with extension advice in the irrigation scheme. The graduate does not have working resources such as a bakkie or a computer. As result, he does not reach most of the farmers that need extension advice on a daily basis.

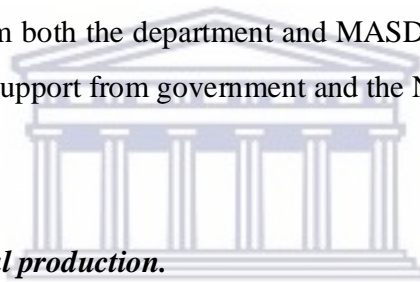
My questionnaire asked about the frequency of visits by the Extension Officers to the fields, and 80% of the respondents (n=28) reported these to take place at least once a month. Only one of the surveyed farmers was happy with the extension support provided by the department. The surveyed farmers reported that visits by the extension officer are usually not for providing extension advice, but for sharing information in a meeting held in the department's offices. The provision of extension advice seemed unequally distributed amongst the farmers, as farmers that occasionally visit the department's offices reported to have seen the extension officer twice in a month. Overall, the extension officer rarely visits the farmers in their fields, but is mostly consulted by the farmers when they visit her in the office.

Some farmers reported that the extension officers from the department are not assisting with the daily challenges they face in the fields, and take a long time to come to the fields and address the challenges that the farmers face. The irrigation scheme management committee also suggested that they do not even understand their role, because no training on leadership is provided by the department. Observations suggest that most of the farmers rely on each other's advice, such as in relation to pesticide use.

Discussions with the extension officer revealed that most of the farmers do not want to adopt the methods that are recommended to them. For example, in relation to the use of pesticides, some farmers do not want to spray according to the stipulated schedules, while others mix all the chemicals together and spray at once - which is not the recommendation of the extension officer. Such views were verified with the farmers concerned, and they reported that the methods recommended by the extension officer are not effective in addressing the problems faced in the fields. This is one reason why the farmers do not rely on the extension services offered by government in the irrigation scheme.

6.10.3 External extension services.

To complement its own extension services in the irrigation scheme, the department appointed MASDT to assist the farmers. The challenge with the extension service provided by MASDT is that farmers have to pay a once-off affiliation fee of R500 before they can be provided with extension support. As a result there are farmers that have not affiliated to the MASDT. These kinds of external extension support service cater to different populations of farmers in the irrigation scheme. Farmers receiving extension support from the Embassy of Israel are well resourced in terms of mechanization services and production inputs, and also gain market access. Part of the internal arrangement between the farmers receiving extension service from the MASDT is that they easily gain access to production inputs, as the extension officers deliver them directly to the farmers. This has resulted in most of the farmers in the irrigation scheme trying to receive support from both the department and MASDT. The farmers affiliated to the Embassy of Israel also receive support from government and the NGO, Lima.

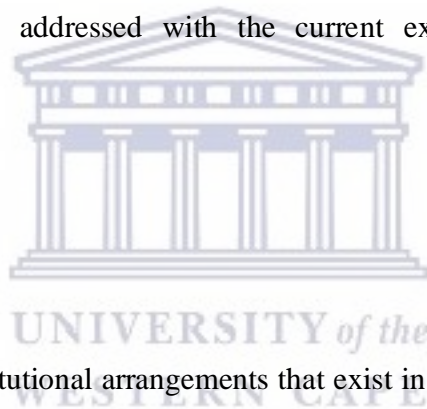


6.10.4 Training on agricultural production.

During the interviews, farmers were asked to indicate the training that was provided by the extension officer and also to indicate when this training was provided. Most of the farmers responded that no training was provided by the extension officer in the fields. The farmers indicated that most of the farming skills have been acquired through their own experience, or through the sharing of experience by other farmers in the irrigation scheme. The survey identified only two (5.7%) of the farmers who had received training from the department through SEDA. These farmers were trained for two months and received certificates of competency in crop production, fertilizer application, weeding, and the use of pesticides.

Although the farmers in the irrigation scheme are faced with a marketing challenge, there seems to be not any training provided in this regard, with the extension officer also being trained in crop production, but not on crop marketing. Similar findings are reported by Jacobs (2003) in the Free State and Northern Cape, where land reform farms were only visited once a month by

extension officers Lack of capacity seems to be a challenge in Hoxane Irrigation Scheme. The Extension Officer responsible for the irrigation scheme is expected to provide extension service to the farmers in Hoxane Irrigation Scheme, Saringwa Irrigation Scheme and also the dry land farmers in the surrounding areas. The extension officer is also expected to prepare reports and attendance registers for every farmer that visited, which seems to be time consuming for the daily activities. The continued revitalization of infrastructure in Hoxane irrigation scheme also requires the extension officer to monitor progress and prepare reports to the agricultural Municipal Manager. The extension officer also distributes production inputs to farmers and ensures that the tractors reach the intended beneficiaries. Being responsible for all these activities make it impossible for the extension officer to visit each farmer once a week, and as a result, the farmers interact with the extension officer only once a month or once every two months. This provides clear indications that the production challenges faced by the farmers in the irrigation scheme are not likely to be addressed with the current extension support provided by government.



6.11 Conclusion.

This chapter described the institutional arrangements that exist in the Hoxane Irrigation Scheme. It has noted that land ownership in Hoxane Irrigation Scheme is controlled by a traditional authority now known as a Traditional Council, through the issue of ‘permission to occupy’ document (a PTO). Extension officers confirmed that more than half of the irrigation scheme’s land is lying fallow with most of the initial PTO holders deceased. Insecure access to land by irrigation farmers minimizes the chances of farmers investing in the farm through soil improvement or infrastructure development. At least one of the plot-holders reported that she used her PTO to access funding from the Land Bank, which was used to purchase a tractor. Accessing funding for investments is difficult for land tenants and land borrowers in the irrigation scheme as they do not have ownership rights to the land. Marketing of agricultural products in the Hoxane irrigation scheme is the responsibility of the individual farmer, as there is no coordinated marketing system in the scheme. The majority of the farmers in the scheme are dependent on government-owned tractors, while some have their own tractors and others hire

private tractors for land preparation. The survey identified only two (5.7%) of the surveyed farmers who use hand hoes for land preparation. The Hoxane irrigation scheme farmers have unlimited access in terms of the amount of water that each farmer can draw from the river.



7 CHAPTER SEVEN: SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS.

7.1 Introduction.

This chapter presents a brief summary of findings from this study of Hoxane Irrigation Scheme, and discusses their wider analytical and policy implications. The chapter begins by providing a summary of key findings identified in each chapter, and compares the findings with those of studies conducted in other irrigation schemes in Limpopo, Eastern Cape and Kwa-Zulu-Natal. The broader implications for policy are also be presented in the chapter.

7.2 Summary of key research findings.

This thesis sought to contribute to key academic debates on smallholder irrigation farming in South Africa by investigating rural livelihoods and agricultural production in Hoxane Irrigation Scheme. Attention was placed on the rural livelihoods of the smallholder farmers in the irrigation scheme, and the diverse relations that exist amongst the farmers, with a particular focus on agricultural production. Moreover, the study also focused on the range of institutional arrangements that exist in the irrigation scheme, in relation to irrigation scheme management and agricultural support services. Overall, the study sought to determine the contribution of small-scale irrigation farming to the livelihoods of farmers at Hoxane Irrigation Scheme.

The first chapter discussed the background to the study and the research methodology employed while conducting the study. Chapter two described the research site, focusing on the wider area of Bushbuckridge Local Municipality, where the irrigation scheme is located. Chapter three reviews the literature on smallholder irrigation schemes, and also key debates on smallholder farming, in South Africa. Chapter four discussed the socio-economic structure and the livelihoods of households within Hoxane irrigation scheme. The chapter also discussed patterns of socio-economic differentiation that exist amongst the plot-holders in the irrigation scheme. Chapter five discussed agricultural production in Hoxane irrigation scheme, focusing on crop production practices and marketing. Chapter six discussed the institutional arrangements that

exist in the irrigation scheme focusing on land tenure, irrigation scheme management, extension support, cooperative development, market access and overall support services. This final chapter presents a summary of the key findings and their policy implications, and in particular what they mean for support services provided to farmers in smallholder irrigation schemes.

The socio-economic structure of the surveyed households in Hoxane Irrigation Scheme revealed that households, with a mean household size of six, are somewhat larger than in other areas. The study found more female household members than males amongst the irrigation scheme household members. The study also recorded a high proportion of adult males, at 57% (n=38) and adult women at 44% (n=34) that have never been married. The study found few instances of employment amongst the surveyed irrigation scheme members, confirming the high incidence of unemployment that exists in Bushbuckridge. People who held permanent employment or temporary employment were working as teachers, traffic officers, and drivers, and were also employed in the tourism sectors in Mkhuhlu and Hazyview. As a result, a high proportion of the household members at 57% (n = 86) derive their incomes from social grants, while 43% (n = 67) derive their incomes from non-social grant income sources. The bulk of the social grant income sources are accounted for by child support grants at 87% (n=67) and old age pensions at 20% (n=17). Moreover, farming accounted for 52% of the instances of non-social grants income sources for the households. In terms of their ranking, farming is regarded as one of the most important sources of income for the households farming in Hoxane Irrigation Scheme.

The households in the Hoxane Irrigation Scheme were also found to be diverse in terms of asset ownership. The mean number of domestic durable goods owned per household is 5.9, and the mean communication goods owned is 3. The level of ownership of domestic durables and communication goods seems to be dependent on access to electricity. Households that did not have access to electricity reported no ownership of electric stoves, microwave ovens, washing machines, fridges and electronic communication goods.

In terms of agricultural assets, the study found the mean number of agricultural assets owned by the surveyed irrigation scheme households to be 18.2, with a minimum of one asset and a maximum of 53 assets owned by different households. Households farming in the Lower Cork

section of the scheme owned fewer water pumping engines than farmers operating in Siholokoane, Mkhuhlu East and West, Big Bend 1 and 2, Ten Farm and Upper Cork sections. Tractor ownership is skewed in the irrigation scheme, with a mean of 0.2 tractors and a median of 0. The study found only two households that own tractors. This is despite the fact that a tractor is a key agricultural asset that is necessary for land preparation in the irrigation scheme. The study found six of the surveyed households who keep livestock (cattle, goats, pigs, and chickens) in their households. These livestock are sometimes sold to local community members as an additional source of income. This is not unusual, as the plot holders in Tugela Ferry Irrigation Scheme were found to have similar features, owning few tractors but often keeping small herds of livestock.

The land in the irrigation scheme is communally owned, with farmers having a Permission to Occupy document (a PTO) as proof of the land rights recognized by the former tribal authority, now traditional council. The majority of the surveyed households inherited this land from their parents and grandparents who first occupied the land in the irrigation scheme. Inheritance also allowed women to own land in the irrigation scheme. Informal land sales, borrowing, and renting are also taking place amongst the surveyed households in the irrigation scheme. Land tenure insecurity remains a key challenge affecting most of the plot-holders and inhibiting investment in the development of their farms. The same problem was noted in smallholder irrigation schemes around Limpopo whereby farmers could not use their land as a collateral for access to loans from registered financial service providers (Machete *et al.* 2004). Only one of the surveyed farmers successfully used their land as collateral for a loan from the Land Bank. This is part of the reason why many of the farmers who have access to land, do not have the resources needed to utilize the land.

The plot-holders in Hoxane Irrigation Scheme produce a variety of crops which include green mealies, dry maize, groundnuts, roundnuts, pumpkin leaves and okra. Vegetable crops produced in the scheme include tomatoes, dry maize, butternut squash, cabbages, green peppers, lettuce, chillies, sweet potatoes, spinach, beetroot, lettuce, and onions. Mango production is widespread in the scheme, with 25.7% of the surveyed households reporting that they sell green and ripe

mangoes between November and January every year to either juice or achaar processing factories.

The area planted to crops in Hoxane Irrigation Scheme depends on the availability of production inputs, which include mechanization services, water, fertilizers, chemicals, seeds or seedlings, and labour. The mean area planted to green maize was 1.1 hectares, and 1.5 hectares for dry maize, 0.8 hectares for tomatoes, and 0.5 hectares for cabbages and sweet potato. Crops such as groundnuts and roundnuts have a mean area of 3 hectares and 2 hectares respectively, and are grown in summer under dry-land conditions. The other crops such as green maize, tomatoes, cabbages, sweet potatoes, butternuts squash, green peppers, okra, green beans, pumpkin leaves, and chillies are planted throughout the year.

Fertilizer application is common in the production of four major crops produced in the scheme, namely, maize, cabbage, tomatoes and butternuts. The majority of the farmers also applied pesticides to crops such as maize, tomatoes, cabbages and butternuts. The importance of fertility management cannot be understated in Hoxane Irrigation Scheme, noting that the majority of the farmers are using flood irrigation, which washes soil nutrients from the topsoil. Observations indicated that the fertilizer application practices in the scheme are not based on soil requirements, but on a farmer's knowledge and fertilizer availability. The farmers reported using a number of chemicals to treat the pests affecting the crops in the scheme. The use of Bulldock liquid was prevalent in many crops such as tomatoes, cabbages, butternut squash, green beans, green peppers and chillies. The study identified discrepancies in the farmer's knowledge of pesticide application. The farmers receiving pesticides from government did not have much knowledge of pesticide use, compared to the farmers that purchased their pesticides through MASDT.

In terms of labour use, the study found that the Hoxane irrigation scheme farmers hired permanent labour, temporary labour and also used family labour for farming activities in the scheme. Farmers planting larger portions of land for crops such as green maize, dry maize cabbages, tomatoes, cabbages and butternuts used permanent, temporary and family labor. Land preparation was undertaken using tractors, and labour was used mainly for planting, weeding and harvesting. In terms of marketing, the farmers supply the local community, hawkers, traders

with bakkies, feeding schemes, shops such as Shoprite, Boxer, Spar and Pick n Pay, and also sell at pension pay points (for farmers with their own bakkies). Farmers selling green maize to traders with bakkies receive as much as R37 374 per hectare on average, as compared to those selling to hawkers and the local community who receive an average of R3 671 per hectare and R1 717 per hectare.

The study found that 79% of the growers obtained a positive gross margin, while 21% of the farmers obtained a negative gross margin on crops such as tomatoes, okra, green pepper and butternuts. The positive gross margin was obtained from crops such as green maize, cabbage, butternut and tomatoes. The farmers who obtained a negative gross margin were affected by the market used when selling tomatoes and butternuts. The loss on green pepper was influenced by the high maintenance costs involved when applying fertilizers and pesticides on the crop to obtain good quality yield.

In terms of land ownership, the study revealed that the sum of land owned is more than the sum of land used in the irrigation scheme. The surveyed households own an estimated 429 hectares, but only 197 hectares is under production. Moreover, there are farmers who abandoned their plots for over 5 years, but still have PTOs to prove that they own the land. The quantitative data showed significant differentiation in the distribution and use of assets by the farmers in the scheme, and this differentiation was explained through multiple regression analysis, which enabled a grouping of the farmers according to asset ownership. Five groups of farmers in the surveyed household emerged through the grouping, which showed Group 1 farmers as successful and owning more agricultural assets. Group 1 farmers also had other enabling resources, such as motor vehicles for marketing of harvested crops. The farmers in Group 5, on the other hand, owned less than five agricultural assets.

The farmer categories identified in Hoxane Irrigation Scheme show that a class differentiation exists in the irrigation scheme. The farmer categories also show that agricultural production in Hoxane Irrigation Scheme is influenced by participation in competitive markets, and productive assets are unequally distributed. The 'stepping-up' category includes farmers who engage in capital accumulation, by reinvesting the surplus income in the development of the farm. The

'hanging in' category includes farmers unable to reproduce themselves from their own production alone, and increasingly dependent on other forms of petty enterprise or on receiving assistance from the state.

The study shows that private investments have contributed towards the increased production amongst some farmers in the irrigation scheme. This relates to farmers receiving support from private agencies in terms of production inputs, advice and also markets. Most of these farmers have been able to withstand the inherent risks involved in production, and maintained the level of production required by the market. There are also farmers who 'accumulated from below', by reinvesting most of their surplus income into the development of the farming enterprise.

7.3 Institutional.

The irrigation scheme is divided into nine sections, namely: Siholokoane, Mkhuhlu West, Mkhuhlu East, Big-Bend 1, Big-Bend 2, Belfast, Ten Farms, Lower Cork, and Upper Cork. In the Lower Cork section water is pumped directly from the river to a storage dam, then directed through canals to the fields. Farmers in the other eight sections of the irrigation scheme pump water using electric, petrol or diesel pumps directly from the Sabie River. Allocation of water use rights remain the responsibility of an individual farmer. Drawing irrigation water from the river remains a challenge for most of the farmers, as they must always have money to purchase either diesel, petrol or pay their electricity bill first. This affects production, as some crops end up receiving less than the required amount of water. Farmers are forced to irrigate on the basis of water availability, rather than not the irrigation schedules stipulated for each crop.

Addressing such challenges remain the responsibility of individual farmers, despite the availability of an irrigation scheme management committee. The initial irrigation scheme management committee was established in 1968, and its duties involved organizing production inputs and market for all crops produced in the irrigation scheme. The changes that occurred over time, which includes lack of stability amongst the scheme committees, led to individual farmers taking responsibility for all production and marketing needs in their farms. An interview with one of the surveyed farmers, who once chaired the irrigation scheme management committee, cited limited support from government as one of the key issues that make it difficult for the

committees to execute their roles and responsibilities. The expectation of the farmers is that the irrigation scheme committee should work closely with the department in providing agricultural support to the members, but this is not forthcoming. The interviews also revealed that no training is provided to the irrigation scheme committee members, thus making it difficult for the committee members to execute their expected functions.

The irrigation scheme has a sub-committee in Lower Cork section, which is responsible for maintenance of the canal system. The farmers in the other sections do not have sub-committees and when a water-pumping engine breaks down, repairs remain the responsibility of each farmer. Fencing is also the responsibility of each farmer in the scheme. In 2010, a sub-committee representing young farmers was established in the irrigation scheme, and registered as a primary cooperative. The youth committee was established to cater the needs of young farmers in the irrigation scheme.

Although Hoxane Irrigation Scheme is registered as a primary cooperative, the Department of Agriculture in the province has embarked on a process of registering more primary cooperatives in the irrigation scheme. The registration of the cooperatives seems to be a directive from government, whereby farmers are provided with agricultural infrastructure as registered cooperatives, not as individual farmers. As a result, many cooperatives have been registered between 2013 and 2014, leaving the main irrigation scheme cooperative (Pfukani Cooperative) with little or no role at all. In Dzindi Irrigation Scheme it was found that the cooperative model was imposed onto the farmers' association, but did not suit the smallholder communities (Van Averbek 2008). A similar situation is noted in Hoxane Irrigation Scheme, whereby smallholder farmers are forced to register into cooperatives just to access government support services, without first adapting to the new concept.

Smallholder farmers in Hoxane Irrigation Scheme access markets individually and purchase production inputs in small quantities. The production inputs are not available within Hoxane Irrigation Scheme or in shops around Mkhuhlu, and instead are commonly accessed in areas as far away as Hazyview, White River and Nelspruit. The provincial Department of Agriculture plays a crucial role in the distribution of crop production inputs to the Hoxane Irrigation Scheme

farmers through the Masibuyele Emasimini programme. The production inputs distributed to the farmers include pesticides, fertilizers, seeds, seedlings and tractors services, which involves ploughing of a one hectare field. Although the production inputs are distributed to all the farmers in the irrigation scheme, there are some farmers who do not prefer the production inputs from the government, but instead they purchase directly from the shops. The MASDT assists the affiliated farmers with transport service when they purchase production inputs in Nelspruit. The six farmers affiliated to the Embassy of Israel (17% of the sample) receive production inputs such as fertilizers and irrigation infrastructure.

Marketing of agricultural products in the Hoxane Irrigation Scheme is the responsibility of each individual farmer, as there is no coordinated marketing system in the scheme. Farmers owning vehicles in the Hoxane Irrigation Scheme deliver their products to different formal markets such as Pick n Pay, Boxer and Spar superstores in Hazyview. Other vehicle-owning farmers deliver their products to informal market outlets such as pension pay-points, and street vendors. Direct sales to consumers at the farm gate appear to be quite frequent in the scheme with bakkie traders, hawkers and individual consumers coming to purchase products at the farm. The six farmers affiliated to the Embassy of Israel access markets such as FreshMark where products are delivered to a central area in Mkhuhlu and the truck from FreshMark collects the produce for distribution to various Shoprite stores.

The majority of the surveyed households emphasized the need for a pack-house in the irrigation scheme to minimize post-harvest losses. There are, however, some farmers who felt that a pack-house might not be a solution, as the quality of the crops produced by some of the farmers in the scheme could not be accepted by major markets. The surveyed Hoxane Irrigation Scheme farmers suggested that a pack house would assist the farmers if the extension advice that is provided also focuses on marketing strategies and provision of sound advice on the quality of crops produced. The qualitative interviews showed that the major challenges affecting crop production and marketing in the scheme relates to poor extension advice, expensive water pumping methods and the flood irrigation system, which affects soil quality, as well as limited tractor services from government, poorly functioning irrigation scheme committees, and no or poor quality fencing in most farms.

The majority of the farmers in the scheme are dependent on government-owned tractors, with a few farmers owning their own tractors and others hiring private tractors for land preparation. The six farmers affiliated to the Embassy of Israel have their own tractor that they use. The other seven farmers affiliated to Mobile Agri-skills Development and Training Company (MASDT) receive mechanisation services from the NGO, at an average cost of R240.00 per hectare. The mean cost of ploughing a hectare in 2013 was R884.00 per hectare for farmers using government-owned tractors.

A female Extension Officer is permanently stationed at Hoxane Irrigation Scheme to provide extension support to the irrigation scheme farmers. The Extension Officer is also responsible for another irrigation scheme and for dry-land farmers surrounding the two irrigation schemes. The surveyed farmers were asked about the frequency of visits by the extension officers to the fields, and 83% (n=29) reported it to be at least once a month. The farmers reported that the visit by the extension officer is usually not for extension advice, but for information sharing. To complement the government extension service in the irrigation scheme, the farmers also get extension support from MASDT. The challenge with MASDT service is that farmers pay an affiliation fee of R500. Overall, there are vast differences amongst the farmers in the irrigation scheme in relation to extension support. Farmers receiving extension support from the Embassy of Israel are well resourced and have market access. Farmers receiving extension service from the MASDT have easy access to production inputs in the shops. As a result, most of the farmers in the irrigation scheme receive support from both the department and MASDT. The farmers affiliated to the Embassy of Israel also get support from government.

During the interviews, farmers were asked to indicate any type of training that was provided by the Extension Officer and also to indicate when the training was provided. The majority of the farmers reported that no training was provided by the Extension Officer in the fields. The farmers indicated that most of their farming skills have been acquired through their own experience, or experience of other farmers in the irrigation scheme. The farmers in the irrigation scheme are faced with a marketing challenge, but there seems to be no training provided in this regard. Similarly, Jacobs (2003) identified irregular visits by Extension Officers in land reform farms, due to lack of capacity, as a major problem. A similar trend has been observed in Hoxane

Irrigation Scheme, with the farmers reporting that they are not frequently visited by the Extension Officer. The Extension Officer is also expected to prepare reports and attendance registers for every project visited on a daily basis. The revitalization of irrigation infrastructure taking place in the scheme requires the Extension Officer to monitor progress and prepare reports. The Extension Officer also distributes production inputs and ensures that the tractors reach the intended beneficiaries timeously. This shows the need for more extension officers to be allocated specifically for farmers in the irrigation scheme.

7.4 Implications of research findings for policy.

7.4.1 Irrigation policy.

Empirical evidence suggests that smallholder black farmers can achieve reasonable levels of crop productivity and respond quickly to changing market conditions when they have access to production resources and markets (Cousins, 2013). The study identified diversified livelihood strategies pursued amongst the smallholder irrigation scheme farmers in Hoxane, with some farmers having secured livelihoods from sources outside the agricultural sector. The study also identified that farmers with access to production inputs are able to achieve reasonable crop productivity and respond quickly to changing market conditions. The study also found that farmers have access to land in the irrigation scheme, but lack the necessary agricultural support to improve agricultural production. Improved agricultural production in Hoxane Irrigation Scheme require farmers to have access to production inputs which include secure land access, reliable access to water, reliable mechanization services, access to input and output market, and also access to extension support services. These findings suggest that the revitalization of smallholder irrigation schemes should not only be limited to irrigation water infrastructure provision, but should include farmer support services that would ensure that irrigation scheme farmers have access to production resources that can enable the production of good quality crops. Moreover, the provision of farmer support services should consider the diverse characteristics of the farmers that have access to land in smallholder irrigation schemes, and not use a one blanket approach amongst all the farmers in the scheme.

7.4.2 *Secure access to land.*

Land in the Hoxane Irrigation Scheme is held through a PTO, which was obtained through inheritance, informal rental or informal borrowing. These types of land ownership are the most insecure for the farmers, as it has been the case in other smallholder irrigation schemes around the country such as Tugela Ferry, Thabina and Dzindi irrigation schemes. This type of land ownership discourages the ability of the farmers to invest in the development of the irrigation scheme land. Majority of the farmers in Hoxane Irrigation Scheme inherited land and changed the PTO's into their names, but generally do not use all the portions of the land allocated. Others have abandoned farming in the irrigation scheme but do not lease or rent out their land to other people that are willing to farm in the irrigation scheme. Informal trading of land is also widespread in the irrigation scheme through informal renting, borrowing, and selling. Farmers using rented or borrowed land are reluctant to invest in the development of the land, as they feel that they do not have guaranteed future land use. The study also identified the problem that inactive plot-holders are reluctant to rent or lend out the land as they believe that the borrower might not be willing to give back the land when it is wanted back. The farmers require to be assisted with secure land access, so that they can freely invest in the development of the irrigation scheme land. The local Traditional Council and the Extension Officer should take an active role in managing the irrigation scheme land leases, to enable continued production in the irrigation scheme. Addressing the land ownership challenges could enable increased profits even for farmers operating on borrowed or rented land.

7.4.3 *Access to water.*

Although the Hoxane Irrigation Scheme is surrounded by the Sabie River, gaining access to water for the irrigation scheme is very difficult for the farmers. Farmers situated in sections with a canal irrigation scheme are better off than the farmers in the other sections of the irrigation scheme. Accessing water from the river in the other sections of the irrigation scheme requires farmers to have a water pumping engine, using either fuel or electricity. Farmers without access to the water pumping engines are unable to achieve improved production in the farm. The farmers require assistance with a consistent water supply that would not be as expensive as the

water pumping engines. Moreover, the prevalent irrigation system used in the irrigation system which is flood irrigation remains unsustainable for improved production in the farms. The flood irrigation system also washes away the soil nutrients. Government should at least construct canal water storage systems where water can be stored for ease of access to the fields. The irrigation systems must be improved into sustainable irrigation systems which can ensure improved crop productivity.

7.4.4 Access to production inputs.

The Department of Agriculture provides production inputs which includes seeds, seedlings and fertilizers to the farmers in the irrigation scheme. In-depth interviews with the farmers revealed that the farmers have a poor opinion of the quality of the production inputs offered by the department. As a result, the majority of the farmers purchase production inputs from various markets in Hazyview, White River and Nelspruit. There is no market nearby the irrigation scheme location. Purchasing of production inputs from input supply shops involves transport costs, which are expensive for farmers that do not have access to their own transport. This suggests that for responsible stakeholders such as the Department of Agriculture, the Local Municipality, and the Hoxane Irrigation Scheme farmers themselves, should make arrangements and establish a shop nearby, where farmers from the irrigation scheme can readily purchase production inputs.

7.4.5 Access to mechanization services.

Most of the farmers in Hoxane Irrigation Scheme are dependent on the tractor services from the Department of Agriculture. The tractors are not readily available, however, and are only made available during peak production seasons in summer. There are instances where the tractors are grounded and cannot leave the government department's offices, thus affecting the production schedule of the farmers. In instances where the tractors are not available the farmers end up not ploughing the land, given that private tractors are expensive. Farmers with their own tractors manage to adhere to production schedules and achieve increased productivity. The unavailability

of mechanisation services in Hoxane Irrigation Scheme results in similar challenges encountered by farmers in Dzindi, Rabali and Khumbe irrigation schemes in Limpopo which include reduced land use intensity and most farmers leaving part of their plots fallow. It is critical that government develops a mechanization strategy that would enable the Hoxane farmers to have consistent access to the mechanization services.

7.4.6 Access to extension support.

Extension support service in the irrigation scheme is scarce. There is one Extension Officer responsible for both the irrigation scheme farmers and other farmers outside the irrigation scheme. This makes it cumbersome for the extension officer to provide consistent extension support to the farmers. As a result, the majority of the farmers interact with the Extension Officer only once in a month. The other graduate extension officer does not have the necessary resources to reach all the farmers in the scheme. The extension advice provided to the farmers does not include marketing advice, which is urgently required in the irrigation scheme. Most of the farmers reported that they receive extension advice on crop production, fertilizer application, production inputs purchasing and crop harvesting from the private extension officers (MASDT). The other farmers affiliated to the Embassy of Israel receive effective marketing advice. These discrepancies in extension services leave the majority of the farmers not knowing exactly how to restructure their production plans. Government should create links with all the private institutions operating in the irrigation scheme to ensure that farmers receive coordinated extension services, which can assist in improving agricultural productivity. Extension support should focus on strategies that can ensure that farmers produce good quality crops and access profitable markets.

7.4.7 Access to markets.

Marketing of agricultural products in the Hoxane Irrigation Scheme is the responsibility of the individual farmers, as there is no coordinated marketing system. In terms of output markets, farmers owning vehicles in the Hoxane irrigation scheme are able to access formal marketing channels, such as delivering their products to various retail shops such as Pick n Pay, Boxer and Spar supermarkets in Hazyview. Vehicle-owning farmers also take advantage of the informal markets, such as selling harvested crops to pension pay-points, and hawker stalls. Direct sale to consumers at the farm gate appears to be quite frequent in the scheme, with bakkie traders, hawkers and individual consumers coming to purchase products at the farm. The six farmers affiliated to the Embassy of Israel access markets such as Freshmark where products are delivered to a central area in Mkhuhlu and the truck from Freshmark collects the produce.

In terms of input markets, farmers purchase production inputs individually. Farmers with own transport purchase production inputs in areas as far as Nelspruit and White River. Farmers without access to own transport hire transport or pay public transport to reach the shops where production inputs can be purchased. The role played by MASDT of purchasing production inputs for the farmers and delivering in the farm provides good lessons that can be learned from, and integrated into the department's extension support services. Government should assist the Pfukani Cooperative to resume its role of managing the input and output market for the farmers. The Pfukani Cooperative must ensure that farmers access production inputs easily and have a market for their products.

7.5 Conclusion.

In conclusion, this study argues that revitalization of irrigation scheme infrastructure does not guarantee improved agricultural production. Irrigation scheme revitalization policies should include rigorous farmer support services that can enable farmers to produce good quality crops and access profitable markets. Based on the study's findings, it is clear that smallholder farmers are diverse in terms of their resource ownership, farming objectives and livelihood trajectories. The diverse nature of the farmers suggests that support services rendered to farmers in the

smallholder irrigation scheme should consider their different needs. Support services should improve water accessibility, help secure access to land, and improve the availability of mechanisation services, availability of production inputs, the farming skills required and improve access to markets. The role of the extension support services is key to the overall development of smallholder irrigation scheme farmers. They should consider restoration of the irrigation scheme cooperative and management committee, so that they can resume a role in actively managing the irrigation scheme. This would improve collective action by the farmers in terms of market access, and improve the effectiveness of overall support services from government and private institutions.



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Appendix 1.

Hoxane Irrigation Scheme: Crop Recording Sheet

Date: **Farmer:** **Irrigation scheme section:**

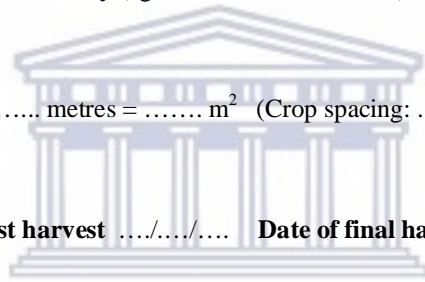
No. of hectares in farmer's own name ('owned'): **No. of additional hectares** (rented or borrowed):
.....

Rented or borrowed from whom? In return for:

Crop (eg tomatoes): **Variety** (eg Florodade, Heinz 1370)

Area planted to crop: metres x metres = m² (Crop spacing: cm x cm)

Date planted .../.../.... **Date of first harvest** .../.../.... **Date of final harvest** .../.../....



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How was the plot **ploughed** (eg. hoe, donkeys, tractor)? Cost: R

Chemical fertilizers applied before planting:

Name/type	Amount in kg	Cost
<i>Total</i>		

Chemical fertilizers used as **top dressing**:

Name/type	Amount in kg	Cost
<i>Total</i>		

Seeds: were seeds kept from last year or purchased?

If purchased, amount in grams: Where purchased? Cost: R

Seedlings: number purchased: Where purchased? Cost: R.....



Chemicals used to control pests and diseases:

Pest or disease	Name of chemical	Amount (grams/kg) purchased	Cost	Amount applied on this crop	Cost for this crop
<i>Total</i>					

Labour: how many people worked on this crop?

<i>Operation</i>	<i>Family labour</i>	<i>Hired labour</i>	<i>Payment / cost in R</i>
Clearing the plot			
Ploughing			
Weeding			
Watering			
Spraying			
Harvesting			
Marketing			
Other operations			
<i>Total</i>			

Yields and marketing (NB the unit of measurement will vary with crop eg crates, buckets, kg, bags, etc)

	Number	Measure (eg bags, buckets, etc)
Used in farmer's home		
Given to others as gifts		
Used to pay workers		
Sales for cash		

If sales took place, to whom was the crop sold?

	Number	Measure	Price per measure	Amount received
Directly to consumers				
To hawkers				
To traders with bakkies				
To shops				
Others				

<i>Total</i>			<i>Total</i>	
--------------	--	--	--------------	--

Marketing costs

<i>Costs</i>	<i>Number x measures (eg taxi fares, bags)</i>	<i>Costs</i>
Travel		
Materials (eg bags)		
	<i>Total</i>	

Calculating the gross margin:

Costs:

Ploughing		Gross margin (profit) is income less total costs $(A - B = C)$	A. Income from crop	
Fertilizers			B. Costs	
Seeds				
Chemicals			C. Gross margin	
Labour				
Marketing				
Other				
<i>Total</i>				

Appendix 2.

Institutional aspects on Hoxane Irrigation Scheme: semi-structured interview questionnaire.

Introductions.

Land tenure

1. How many hectares do you own? How did you come to own them? Did you inherit them? Did you ask the *Chief* for them? What year did you first acquire these hectares of land?
2. Do you have any document that shows you are the rightful owner of these hectares of land? Which authority issued the document? When were you issued with this document?
3. If not, do you ever feel insecure in your ownership? Could anyone take your land away from you?
4. Have you borrowed or rented any hectares of land from others? How many? Who have you borrowed or rented land from?
5. For how many years have you borrowed these hectares? Is there any time limit, after which you have to give them back to the owner?
6. What do you provide to the owner of the land that you borrow or rent - cash, or services? How much cash? What kind of services?
7. Have there ever been any tensions or conflicts with other people over the terms of borrowing or renting land?

History of the irrigation scheme

8. When was the Hoxane Irrigation Scheme first constructed (i.e. in what year)? (approximately)
9. When did your family first begin to farm on the scheme (in what year)?
10. Please describe how the scheme used to operate in the old days, or tell me any stories about the scheme told to you by your parents or relatives.
11. When did farmers on the scheme first begin to grow crops for sale for cash, rather than for home consumption? (approximately)

12. When did the first traders with trucks (*bakkies*) begin to come to the scheme to buy crops from the farmers? Who were the first traders, and where did they come from? Where did they sell the crops they bought?
13. Are the same traders coming today, or are they different ones? Where do they sell the crops they buy? If no, ask why.

The role of the scheme committees

14. Is there a committee for this irrigation scheme or this section of the irrigation scheme at the moment? If yes, who is on this committee? Who is the chairperson? How were the members selected? In what year was that?
15. What are the roles and responsibilities of the scheme committee? Are they fulfilling these roles and responsibilities at present? If not, why not?
16. What are the challenges and difficulties for the scheme committee on the irrigation scheme? Do farmers support them in their efforts? Do the officials of the Dept of Agriculture support them? Have they ever received training for their role as committee members?
17. Does the scheme committee ever organise for the fencing around the scheme to be repaired? Does it ever organize for leaking canals/pumps/pipes to be repaired?
18. Does the scheme committee ever help farmers to buy crop inputs such as fertilizer, chemicals or seedlings? Has it ever suggested that farmers come together as a group to buy these inputs in bulk, so that they buy them at a cheaper price?
19. Does the scheme committee ever help farmers to market their crops? If so, how?
20. Does the scheme committee play any role in making sure that all farmers get the water they need? In resolving any conflicts or tensions between farmers over water supply?
21. What other sub-committees exist in the scheme?
22. What is the role of the sub-committees in the scheme?

Water supply issues

23. How is the supply of water to farmer's beds organized? Are there agreed times when farmers can take water from the furrow or the river? Who decides on these times?

24. Is there a 'policeman' for water supplies in this block? If yes, who is it? Who pays the policeman for doing this job?
25. If not, was there a policeman in the past? When was that? Who was it? How was this person paid for doing this job?
26. Are there ever conflicts or tensions between farmers over water? Please describe one such conflict that you know about. How was the conflict resolved?

Extension services

27. Who is the extension officer at the Dept of Agriculture responsible for this section?
28. How often do you interact with this extension officer? Once a week? Once a month? Every three months? Less often?
29. Does the extension officer ever visit farmers while they are working on their beds? When was the last time you were visited by an extension officer while working on your beds?
30. Does the extension officer ever call farmers to meetings? Please describe the last meeting you attended – what was discussed? When was that?
31. You seem to know a lot about planting vegetables and other crops – for example, you know how far apart to plant the crops, what fertilizers to apply, what chemicals to spray, etc. How did you acquire this knowledge? Did you acquire it from another farmer, or from an extension officer?
32. Please describe any training you received from extension officers – when did it take place? Who did the training? On what topic was the training?
33. Have extension officers ever organized farmers to buy crop inputs together? If yes, when was the last time that took place? What inputs were purchased? Was it beneficial for you, or not?
34. Have extension officer ever helped farmers to market their crops? If yes, how? When did this take place? Was it successful or not?

Extension services from private institutions

35. What is the name of private sector/NGO providing extension support to you?
36. What other type of extension support do you receive from other extension officers who are not working for the Department of Agriculture?

37. Please describe any training you received from private sector/NGO? When did it take place? Who did the training? On what topic was the training?
38. Have the private sector/NGO ever organized farmers to buy crop inputs together? If yes, when was the last time that took place? What inputs were purchased? Was it beneficial for you, or not?
39. Have the private sector/NGO ever helped farmers to market their crops? If yes, how? When did this take place? Was it successful or not?
40. Are there any specific guidelines set by the private sector/NGO in relation to your production? If yes, describe the guidelines?

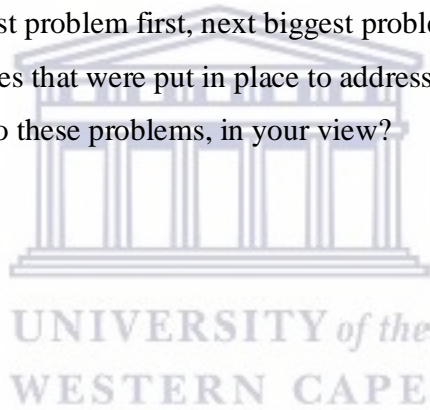
Livelihoods and income sources

41. What are the different sources of income in your household at the moment? (Please state whether children are still part of the household or if they have set up their own households.)
42. What are the most important income sources in your household, and why are they important to your family?
43. What was the most important source of your family's income 10 years ago? 5 years ago?
44. What will be the most important source of income for your family in 5 years' time, do you think?
45. How important is income from farming to your family? What do you use this income for?
46. Where do you get the money from in order to buy seed, fertilizer, chemicals (or any other farming inputs)? Do you use profits from crops to buy inputs? Do you ever use income from your livestock (e.g. from selling a goat) to buy inputs?
47. Have you ever borrowed money to buy inputs, e.g from a bank, or a stokvel, or from family members? If yes, at what rate of interest? Were you able to repay the loan without any problem? Would you ever borrow money again?
48. Which assets do you use as collateral when accessing finance?
49. Do you ever have to choose between buying crop inputs, or buying food for family members to eat? If you have to choose between these, what influences your decision?

50. Do you ever make a compromise (e.g. does your family sometimes eat a little less than they would like to, in order for you to spend the money on buying seed or fertilizers instead?)
51. How can income from your farming be increased (i.e. what do you need in order to make more money from farming?)
52. Do you think a packhouse at Hoxane, which takes crops from farmers in order to sell in Johannesburg, would succeed and help farmers earn more income? If not, why not?
53. Is there any other way to improve the marketing of crops from Hoxane irrigation scheme?

Farmer's problems and possible solutions

54. Please describe the main problems faced by farmers at Hoxane irrigation scheme, in order of magnitude (i.e. biggest problem first, next biggest problem second, period when the problem started, measures that were put in place to address the problem since it started).
55. What are the solutions to these problems, in your view?



Appendix 3.

Life history interviews on Hoxane Irrigation Scheme- semi-structured interview.

Introductions.

Family history

1. Where did you grow up? Whose home was it (e.g. your father's, your mother's, another relative)? How many wives did your father have? Did he pay full lobolo for his wife or wives (*traditional* marriage) or were they married? Or something different?
2. How many brothers and sisters do you have? Where do they live now? How often do you see them? How do they support themselves – Jobs? Grants? Farming? Businesses?
3. Who is living at the family homestead (*muti*) at the moment? Do you ever return there? Is anyone engaged in any kind of farming there? If not, why not?
4. Thinking back to your childhood, was life different then from how it is now? Was it better or worse? In relation to farming, how are conditions for farming today different to how it was then?
5. Did you receive any form of formal education?

Marriage history

6. When did you get married – i.e. what year? How old were you at the time?
7. Was it a *traditional* or a *tekiwe/ganiwile* marriage? Or something different?
8. Where did you live after you were married? Did you leave your parent's home to live with your husband (or wife)? How far was your first home from your parent's homestead (*muti*)?
9. How did life change for you after getting married? What were the biggest differences?
10. If you moved to your husband's homestead (*muti*), how did you get along with his mother? His father? Other people living at the homestead (eg *makoti*)?

Children

11. How many children have you had in total? How many boys, how many girls? Are they all still alive?
12. How many of your children are at school (or are pre-school)? How many are 18 years old or older?
13. How many of your children are married? Traditional or a Tekiwe/Ganiwile marriage? How many have children without being married?
14. Does the fact that some are unmarried affect their relationship with you as a parent? (E.g. do they provide more support to you as a result of not being married?)
15. Of those of 18 years or more, how many have jobs? Can you describe what each of them are doing at the moment, and where they live?
16. Do any of your children send money to you? Do they help out in any other way (e.g. by bringing home food or other goods)?
17. Are any of your children interested in farming? Have they learned any farming skills by working on your beds? Will any of them take over your beds when you cannot use them? If not, why not?

History of farming

18. When did you begin farming?
19. When did you first begin to earn income from farming? What year was that? How old were you then?
20. Have you ever grown crops elsewhere than here at Hoxane ? Can you please describe where this was and how you farmed at that time.
21. What were the first crops you planted here at Hoxane? Were they successful or not? Were you encouraged or discouraged to go on farming?
22. How did you first learn about how to grow crops? Did you learn from: your parents? Other relatives? Neighbours? Government extension officers? Others? Did you learn by doing it yourself and learning from your own mistakes?
23. How many beds did you start off with here at Hoxane ? How many are you using now? Please describe the reasons for the changing numbers of plots you have been able to farm.

24. In what year was your farming most successful, for example, in the amount of money you earned? Why was that year so successful?
25. In what year was your farming least successful? Why was that year so unsuccessful?
26. What tools and equipment does a farmer at Hoxane need in order to be successful? Do you yourself own the tools and equipment you need to be successful?
27. If you do not own the tools and equipment you need, why is that? Have you ever tried to save the money you need to buy them? Is the income from your crops not large enough to allow you to buy them?

Successful and unsuccessful farming

28. What are the characteristics of successful farmers here at Hoxane , in your view? How many farmers do you know with these characteristics? Who are they?
29. What are the characteristics of unsuccessful farmers here at Hoxane, in your view?
30. What should government be doing to promote successful farming?

