MAINSTREAMING OF SMALLHOLDER IRRIGATORS: THE CASE OF TAUNG IRRIGATION SCHEME, NORTH WEST, SOUTH AFRICA

by

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ABSTRACT

The majority of emerging farmers live in the former homelands where the former apartheid regime enveloped them, and it is these farmers that need to be mainstreamed into the economy. To be mainstreamed into the growing economy of South Africa, these farmers will need to overcome many challenges.

Small-scale agriculture in South Africa is associated with non-productivity and commercially unviable agriculture. The situation is complex and is largely attributable to the fact that South African small-scale agriculture has a history of generating dependency. Farmers (especially those based in the large former homeland irrigation schemes) have become accustomed to the profound support provided by the parastatal organisations that managed most of the irrigation schemes in the country. The Taung irrigation scheme is no exception.

Literature highlights constraints from an institutional and technical viewpoint faced by small-scale farmers. The issue of contract farming is explored as a means of overcoming all the constraints.

Using primary data collected from the Taung irrigation scheme, this study points out the factors that have an influence on the success potential of small-scale farmers. The

investigation focuses on the role of private sector involvement and the role they play in helping small-scale farmers improve success potential and thus mainstreaming them in to the South African economy. The study uses cluster analysis and principal component analysis techniques to perform the analysis.

The main components that have the most significant influence on success potential are highlighted and discussed thoroughly. The issues of importance raised in this study are institutional and technical in nature. Thus, the continued collaboration between small-scale farmers, government and private sector is needed to ensure sustainable successful development. The study provides a reference framework for assessing potential success in smallholder farm management. The study also reveals the embedded institutional and technical deficiencies that need to be addressed to achieve a well functioning agricultural sector.

Institutions have a critical role in reducing costs and can have an influence on the development and organisation of economic activity. The results call for a revisit of the policies and institutional framework, and enriching them with information on the factors that affect performance as found in this study. An innovative policy making process is necessary to support smallholder agriculture beyond the farm gate.

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UITTREKSEL

Die meerderheid van opkomende boere konvergeer in die voormalige tuislande waar die voormalige apartheids regering hul geplaas het, en dit is hierdie boere wat in die hoofstroom ekonomie geïnkorporeer moet word.

Kleinboer landbou in Suid Afrika word geasossieer met onproduktiwiteit en onvolhoubare komersieële landbou. Dit is 'n komplekse situasie en kan grootliks toegeskryf word aan die feit dat Suid Afrikaanse kleinboer landbou 'n geskiedenis het om afhanklikheid te genereer. Boere (veral die gebasseer in die voormalige tuisland besproeiing skemas) het gewoond geraak aan die volgehoue ondersteuning deur regerings geafiliëerde organisasies wat meeste van die besproeiingskemas in die land bestuur het. Die Taung besproeiingskema is geen uitsondering nie.

Literatuur lig die beperkinge vanuit 'n institutionele en tegniese oogpunt uit wat kleinboere in die gesig staar. Daar word gefokus op die kwessie van kontrak boerdery as 'n moontlikheid om beperkinge te oorkom.

Deur gebruik te maak van primêre data wat by die Taung besproeiingskema ingesamel is, lig die studie faktore wat 'n invloed op sukses potensiaal van kleinboere het uit. In die ondersoek word klem gelê op die rol van private instansies en die rol wat hulle speel om kleinboere se sukses potensiaal te verbeter en hul dus in die

hoofstroom ekonomie van Suid Afrika te inkorporeer. Die analise is voltooi deur gebruik te maak van 'n klusteranalise en analise van die hoofkomponente.

Die hoofkomponente wat die grootste invloed op sukses potensiaal het word uitgelig en deuglik bespreek. Belangrike kwessies wat in hierdie studie uitgelig is is institusioneel en tegnies van aard. Dus is die volgehoue samewerking tussen kleinboere, die regering en private instansies nodig vir suksesvolle ontwikkeling. Die studie verskaf 'n verwysingsraamwerk vir die bepaling van potensiële sukses met kleinboerbestuur. Terselfdertyd lê dit ook die ingeboude institusionele tekortkominge bloot waaraan aandag geskenk sal moet word om 'n landbousektor daar te stel wat goed funksioneer.

Instellings speel 'n belangrike rol in die verlaging van koste en kan dus 'n uitwerking hê op die ontwikkeling en organisasie van ekonomiese aktiwiteite. Die resultate dikteer dat daar weer gekyk sal moet word na bestaande beleid en institusionele raamwerk om dit aan te vul met inligting oor die faktore wat prestasie beïnvloed soos bevind in hierdie studie. Innoverende beleidmakende proses wat die ontwikkeling van kleinboere na die plaashek steun is nodig.

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CHAPTER 1

INTRODUCTION

1.1 Background

While past policy has contributed to rural impoverishment, new policies will create the opportunity for reforms, enabling agriculture to make a much larger contribution to poverty alleviation and the enhancement of national and household food security (NDA, 1998). An estimated 16 million South Africans are living in poverty, with its incidence highest in rural areas and among female and child-headed households. It is estimated that 72 % of poor people live in rural areas and that about 70 % of rural people are poor (Woolard, 2002). Long-term growth in agricultural production will depend on the implementation of healthy long-term strategies that will stimulate entrepreneurship and technological innovation. Agriculture is a vibrant, pulsing socio-economic system, particularly in countries where a considerable part of the annual per capita income is generated from the agricultural sector, as is the case in South Africa.

The majority of emerging farmers reside in the former homelands where the former apartheid regime enveloped them, and it is these farmers that need to be mainstreamed into the economy. To be mainstreamed into the growing economy of South Africa, these farmers will need to overcome many challenges.

The concept of small-scale agriculture in South Africa is loaded with subjectivity and has been associated with non-productivity and commercially unviable agriculture. The reality faced by small-scale black farmers must be acknowledged. In general, most emerging farmers, whether small-scale or not, have limited access to land and capital and have received inadequate or inappropriate research and extension support. This has resulted in chronically low standards of living and reliance on subsistence production, to a greater or lesser extent (Mahlangu, 2000).

Regardless of the potential that small-scale irrigated agriculture poses, there has been a reverse process corresponding to smallholder irrigators of South Africa. Unlike in some other countries, smallholders in South Africa are faced with a very large set of constraints. Productivity levels have dropped drastically, especially in the formerly state-managed smallholder irrigation schemes. This relates to the declining government support provided to smallholders in the so-called Irrigation Management Transfer (IMT) process. In the Limpopo Province, Kamara *et al.* (2002) noted that the level of production had dropped to about 20 % in schemes that were previously managed by the Agricultural Rural and Development Corporation (ARDC). This went against a generally positive growth in the country's agriculture. They also found that some farmers were producing at a loss. Making particular reference to the Eastern Cape, Bembridge (2000) argues that in spite of huge investments, the performance of most small-scale irrigation schemes in the Eastern Cape has been poor and falls short of the expectations of engineers, politicians, development agencies and the participants themselves.

The situation is complex and is largely attributable to the fact that South African small-scale agriculture has a history of generating dependency. Farmers (especially those based in the large former homeland irrigation schemes) have become accustomed to the profound support provided by the parastatal organisations that managed most of the irrigation schemes in the country (Magingxa, 2007).

Most of the smallholder schemes that were established during 1930 to 1960 were primarily aimed at providing African families residing in the 'Bantu Areas' with a full livelihood (The Commission for the Socio-Economic Development of the Bantu Areas within the Union of South Africa, 1955, hereafter referred to as The Commission, 1955). The Land Act of 1913 and the Land and Trust Act of 1936, which largely restricted land ownership by black people in South Africa to these territories, created the 'Bantu Areas'. The Commission (1955) identified "smallholdings on irrigation schemes in the north of South Africa that were supervised by Europeans" as being the most successful smallholder farm enterprises in the 'Bantu Areas'.

Agricultural land in South Africa comprises just over 100 million hectares (ha) (Agriculture and Land Affairs, 2007), of which about 1.3 million ha are under irrigation and 0.1 million ha of this irrigated land is in the hands of smallholders (Backeberg, 2006). According to Perret (2002), smallholding irrigation schemes in South Africa comprise approximately 46 000 to 49 500 ha as former Bantustan schemes and about 50 000 ha as garden schemes and food plots. In South Africa, the term smallholder or small-scale irrigation mainly refers to irrigated agriculture practised by black people. It is estimated that two-thirds of South Africa's smallholding irrigation schemes are dedicated to food plots for subsistence purposes and that 200 000 to 230 000 rural black people are dependent on such schemes, at least partially, for their livelihoods. The importance of smallholder irrigation schemes in South Africa arises primarily from the number of participants involved. Smallholder irrigators have been categorised into four groups, namely: (1) farmers in irrigation schemes; (2) independent irrigation farmers; (3) community gardeners; and (4) home gardeners (De Lange, 1994; Crosby, De Lange, Stimie and Van der Stoep, 2000; Du Plessis, Van Averbeke and Van der Stoep, 2002). This study will focus primarily on the first category, namely farmers in irrigation schemes.

For many decades smallholder irrigation schemes have generated public interest, mainly because their establishment and revitalisation were made possible through the investment of public resources. The Commission's (1955) highly positive review of the performance of these schemes has not been repeated since. More recent assessments of the sector concur that the success of smallholder irrigation has been limited (Bembridge, 2000; Crosby *et al.*, 2000). Factors that contributed to their modest performance were poor infrastructure, limited knowledge of crop production among smallholders, limited farmer participation in the management of water, ineffective extension and mechanisation services and a lack of reliable markets and effective credit services (Bembridge, 2000; Crosby *et al.*, 2000; Dannson, Ezedinma, Wambua, Bashasha, Kirsten, Sartorius von Bach, 2004; Chen, Shepherd and Da Silva, 2005; Shepherd, 2007). Another factor that constrained the economic impact of smallholder irrigation was the predominance of subsistence-oriented farming. Backeberg *et al.* (1996) reported that 37 % of farmers in

smallholder irrigation schemes were commercially-oriented, whilst the remaining 63 % were mainly engaged in subsistence production. The results of the recent survey by Gibb (2004) painted a similar picture. It should be noted that economic success through market-oriented production has not always been the objective of these projects (Van Averbeke *et al.*, 1998) and 'success' measures should not ignore the importance of ensuring food security through one's own production. As Perret (2002) points out, food security remains the major objective for many plot holders and subsistence-oriented crop production patterns have never been changed. For this reason, it is important to also assess the success of smallholder irrigation from the perspective of plot holders and to take into account whether their livelihoods meet their needs. Bembridge (1996, 2000) stated that the performances and economic success of smallholding irrigation schemes have been very poor and "fall far short of the expectations of planners, politicians, development agencies, the participants themselves, and despite huge investments".

Perret (2002) indicates that it is important to take note of the paradigm shift that occurred in smallholding irrigator schemes. Most schemes were built up for social and food security purposes during the apartheid era, in the early 1960s. From the early 1980s, the management agencies (corporations) were facing such financial and social problems that they encouraged farmers to make some profit in order for them to pay back a portion of their loans. Production patterns remained the same, while market opportunities weakened and a poor agribusiness environment resulted. At the same time, due to infrastructure degradation, consultants were hired to set up rehabilitation plans. Hence, even more sophisticated technologies (e.g., pumps and sprinkler irrigation) were introduced in certain schemes, which required even higher capital, operation and maintenance costs.

Government has set certain policies in place to address these problems, such as the Comprehensive Agricultural Support Programme (CASP) and the Accelerated and Shared Growth Initiative for South Africa (ASGISA).

The Aim of the CASP programme is to provide post-settlement support to the targeted beneficiaries of land reform and to the other producers who have acquired land through private means. CASP has six priority areas, which include:

- Information and technology management;
- Technical and advisory assistance and regulatory services;
- Marketing and business development;
- Training and capacity-building;
- On/off-farm infrastructure and product inputs; and
- Financial support.

ASGISA focuses more on the proposed 5 % economic growth, which the government wants to sustain up to the year 2014. In realising the 5 % growth rate, the social objectives require government to improve the environment and opportunities for more labour-absorbing economic activities. In essence, the government needs to ensure that the country's economic progress includes the majority of the poor so as to address the inequalities which exist in South Africa.

South Africa has come a long way since the abolishment of apartheid in 1994, but still has a far way to go in the establishment of a sustainable black farming sector. A better understanding of the institutional environment and arrangements in the Taung irrigation scheme will help to achieve sustainable rural development, increase economic growth and reduce poverty in the North West Province and ultimately, South Africa as a whole.

1.2 Study area

It was decided to initially focus on the former homeland areas of South Africa.

The Taung irrigation scheme is situated in one of these former homelands, namely the old Bophuthatswana, now part of the North West. The Taung irrigation scheme was established on land that existed under communal tenure arrangements, whereby user rights were allocated by the tribal leadership on a hereditary basis. The scheme

comprises 4000-5000 ha of communal arable land partitioned among 411 farmers (Seshoka, de Lange and Faysse, 2004).

The North West Province is characterised by high income inequalities, as revealed by the province's Gini coefficient, which is above 0.6. This elevated Gini coefficient places the province amongst the most income inequitable regions of the world. Agriculture is the second most important sector in the North West Province's economy after mining. It contributes 8.6 % to the province's GDP and 16.7 % to employment. At national level, the North West Province provides one of the important food baskets of South Africa. It provides at least a third of the country's annual maize requirements (NDA, 2004).

A detailed description of the study area is presented in Chapter 3.

1.3 Problem statement

The smallholder agricultural sector is evidently constrained both by its history of past deprivation and the contemporary focus on more macro-level reform processes, which largely bypass smallholders. Although the existence of smallholders is recognised, studies and policy actions generally exclude them, with more emphasis being given to the emerging and small-scale farmers, whose circumstances are completely different.

Putting the background of the smallholder irrigation schemes into perspective, one starts seeing the problems which generally prevail in these schemes. The main challenge with regards to smallholder irrigators is to answer the question: 'What should be done to ensure that smallholder irrigators are economically successful?' The Taung irrigation scheme in the North West Province is presently a subject of great concern. These farmers have difficulty in securing financial independence. This is also the case with most other similar schemes. In spite of the huge capital investment made in its establishment, in the form of infrastructure and huge maintenance costs borne by the Department of Agriculture (DoA) over the years, the scheme has failed to produce commercial, independent farmers (Kydd, 2002).

To find the solution to the above question, which has been the topic of many papers, both academic and practical in nature, one has to analyse the problem on different levels. On a technical and institutional level there are various problems which need to be addressed. These include problems such as extension services, infrastructure, lack of skills and experience, quality and quantity of products, distance to markets, economies of scale and access to markets.

Much of the current policy advice on smallholders focuses on the effects of policy distortions and inadequate attention is given to the serious, embedded deficiencies that limit many smallholder areas from taking advantage of market opportunities. These deficiencies include a lack of access to markets, finance, information and a lack of collective action in that the farmers seem to be incapable of taking leadership. These deficiencies require intensive and long-term attention if sustainable development is to be achieved for smallholder farmers in the Taung irrigation project. One of the most limiting constraints in the Taung irrigation scheme seems to be the issue surrounding property rights, as these farmers produce on communal land (Kotze, 2008). Most of the land falls under tribal authorities and development and investment are delayed because of the lack of efficient property rights.

Farmers in Taung do not seem to be able to achieve financial independence nor are they competitive enough to be able to compete with the commercial farmers (Erasmus, 2007). The parameters and the characteristics of a successful irrigation farmer will have to be determined and then a path will need to be devised for these smallholder irrigators to reach this success measure. The study intends to determine the extent to which small-scale farmers can share and participate in the regional economy and what institutional and other reforms are necessary to enhance their participation.

1.4 Research objectives

The main objective of this study is to incorporate the smallholder irrigation farmers into the growing economy, i.e., to mainstream these farmers so that they benefit from economic growth. The study is designed with the primary objective being to generate

information on the role of contract farming in a small-scale irrigation management system.

Secondly, the study seeks to identify and measure key determinants of success potential for smallholder irrigators. A better understanding of the key determinants affecting success potential would be useful in informing policy decisions aimed at mainstreaming small-scale irrigators into the economy.

To achieve the main objective, a few sub-objectives need to be addressed, including:

- The background to small-scale irrigation and the contribution it makes in the developing economy must be analysed by consulting the available literature.
- The technical and institutional limitations on small-scale irrigation farmers must be determined.
- The characteristics of and the differences between successful farmers and unsuccessful farmers must be determined by applying a statistical technique.
- Determine what should be done and what action plan should be set in motion to mainstream small-scale irrigators.

Enhanced small-scale farming productivity will contribute to the South African economy as a whole, as well as address the problem of food insecurity and unemployment. Thus, it is vital to identify the constraining factors influencing success potential in the small-scale farming sector and to facilitate a solution to these constraints.

1.5 Data and methodology

Data for the study was collected in five villages in the greater Taung area of the North West Province. The five villages under study are Bosele, Retuseng, Tshidiso, Ipeleng and Areageng. The dataset mainly focuses on socio-economic factors as well as factors influencing the success potential of smallholder farmers.

Following Leedy and Ormrod's example (2001), primary data was collected from a sample of 151 smallholder irrigation farmers using a structured questionnaire, which is attached as Appendix A. The lack of appropriate records by farmers presented a problem and some of the information depended on the truthfulness of the farmers' recall.

A range of methodologies was employed to achieve the set of objectives. The study uses mainly econometric analytical methods to achieve the afore-mentioned objectives. To distinguish more successful farmers from less successful farmers, a cluster analysis was done. The Principal Component Analysis (PCA) technique was applied to determine the influence of various factors on success potential. To determine factors influencing the success potential in smallholder irrigation schemes, a logit model was used. A detailed description of each of the techniques is provided in the subsequent chapters.

1.6 Chapter outline

The study is mainly concerned with the factors influencing success potential in small-scale irrigation agriculture. A review of the relevant literature is used to better understand and explain the smallholder irrigation sector in Chapter 2. It mainly focuses on what the constraints are, from both a technical and institutional point of view. The role institutions can play in smallholder irrigation farmer production will be included, looking at both local and international literature. The technical side of the production process will also be evaluated to determine the limitations it poses to these farmers. The role of contract farming and other possible solutions are also encompassed in this chapter.

Chapter 3 describes the history and structure of the Taung smallholder sector and gives a description of the study area in terms of location, main crops produced, socio-economic environment, number of smallholder farmers, etc. The data collected for the study is presented in Chapter 4. Here, characteristics of households in terms of demographics and human capital endowments are covered. The primary data used in this study was collected from 151 small-scale farmers in five villages around the Taung area.

In Chapter 5 the cluster analysis tool is used to assess the different characteristics of the 'more successful farmers' and the 'less successful farmers'. This chapter will cover and address the specific problem of their inability to access the mainstream economy.

Chapter 6 consists of a summary, conclusions and recommendations. Results from the analyses conducted in previous chapters are used to formulate the recommendations that are presented in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Development is all about growth and change in order to provide a better way of life. To achieve this in agricultural development, farmers will have to produce at a more productive level. According to Sanders, Southgate and Lee (1995), developing countries need to increase their yields (total production per hectare). In their view, many productivity-increasing technologies are more sustainable than area-expansion technologies in developing countries. Soil retention techniques, irrigation and adequate management techniques are needed in low-income countries, especially those with low-rainfall conditions. Policy reviews such as the structural-adjustment programmes, which aim to reduce price distortions and to strengthen property rights, are essential to guarantee the success of new technology adoption, which may result in a more productive and sustainable agricultural sector.

A 2008 World Bank report titled 'Agriculture for development' recognises the importance of agriculture in development. Agriculture has played a significant role in development in many developing countries during the green revolution. There is rising awareness that pro-poor growth, the key strategy to reach the First Millennium Development Goal, necessitates promoting growth in the agricultural sector, where most of the poor make their living. Acting as an engine of pro-poor growth, agriculture can make contributions to development as a source of comparative advantage and new business opportunities, also promoting development in food and nutrition security (Byerlee, Sadoulet and de Janvry, 2009).

Smallholder agriculture is practised all over the world and is more the rule than the exception in most developing countries. The term smallholder is a relative term and it is not easily defined. In this study it is used to denote individuals and households that either farm under a traditional communal basis, or on relatively small plots of land. Evidence

from elsewhere in the world, and most particularly from elsewhere in Africa, overwhelmingly demonstrates that smallholder agriculture has been the principal motor of development in rural areas (Dorward, Kydd, Morrison and Poulton, 2002). Smallholder agriculture units have achieved higher returns to land and capital over time than large-scale agricultural operations (Delgado, 1999). In rural development literature, agriculture is considered as the best vehicle to reduce rural poverty. In most developing countries, agriculture and agriculture-related activities provide most of the employment in rural areas. This means that increasing agricultural growth may have a large and positive impact on poverty (Lopez, 2002). According to a World Bank report (2003), 42 % of the total population of South Africa was situated in the rural areas of the country. Given that agriculture is the single most important source of rural livelihoods in South Africa, a smallholder-based agricultural strategy can help in reducing hunger and poverty and can promote economic growth, with the latter being one of the key focus areas of this study.

This chapter provides a review of relevant literature on constraints, success in smallholder irrigation and means of overcoming the constraints faced by small-scale farmers. Firstly, the focus is turned to institutional constraints and then technical constraints faced by rural poor. The problems of small-scale farmers are discussed in detail by making use of relevant literature. Different means of overcoming the constraints faced by smallholders are presented by using relevant literature. The chapter also presents factors that are understood to have an influence in the success potential of smallholder farmers and their projects.

2.2 Constraints faced by smallholder farmers

In an attempt to uplift smallholder irrigators to an economically viable state, it is necessary to understand the constraints that smallholder irrigation schemes have. Infrastructure deficiencies, poor operational and management structure, inappropriate land tenure arrangements and a lack of technical expertise are amongst a few of the major constraints smallholder irrigation farmers face in South Africa (Yokwe, 2004).

The rural smallholders' impoverishment has not abated, perhaps as a result of inadequate economic infrastructures and lack of access to markets where surplus output can translate into enhanced profitability for the poor rural farmer. The Government has declared that the next post-apartheid decade will be devoted to tackling this problem (Makgetla and Landsberg, 2004). This vision is consistent with the goals defined under various government programmes, including the Reconstruction and Development Programme (RDP), the Integrated and Sustainable Rural Development Strategy (ISRDS), Black Economic Empowerment (BEE), and the Broadening Access to Agriculture Trust (BATAT) initiative. Other programmes which lend support to small-scale farmers include the Comprehensive Agricultural Support Programme (CASP), the Accelerated Shared Growth Initiative of South Africa (ASGISA), the Land Redistribution for Agricultural Development (LRAD) and the Local Economic Development Network (LED). It is important to understand these programmes and the support which they lend to small-scale farmers (Madonsela, 2004).

Government and donor policies converge on the need for more effective local development efforts to fully integrate South Africa's smallholders into the mainstream development process. This study coincides with renewed concern regarding the level of policy in the country to address the problems arising from marketing liberalisation, which may have had considerable impact on information flows and a range of ancillary marketing functions including storage, transportation, financial aspects, food processing etc. (NDoA, 2000).

In general, there are two different types of constraints on smallholder farmers, namely institutional and technical. These two foremost constraints can again be divided into more detailed constraints, and if one were to address the different detailed constraints faced by small-scale farmers, the outcome would be a more successful farmer as an end product.

2.2.1 Institutional constraints

Institutional constraints can be further divided into different factors such as access to finance, access to information, access to technology, access to farm input and product output markets, lack of collective action (lack of leadership) and well defined property rights (Bembridge, 1999; Shah, van Koppen, Merrey, de Lange and Samad, 2001).

2.2.1.1 Finance

The main services required by rural households are savings, credit, insurance and money transmission. These are often closely related to each other, and also with input and output marketing services, with respect to both the problems they face (for example, low levels of activity with small and dispersed, hence high-cost, transactions), and the way that supply and demand constraints across input, output and financial service delivery interact in the vicious circles of low-level equilibrium traps (Braverman and Guasch, 1989).

Poor money transmission services contribute to this by reducing investment flows from migrant workers to rural areas, inhibiting their potential contribution to raising volumes of savings, input purchases, output sales and incomes (Hoff, Braverman and Stiglitz, 1993).

One of the great recent revolutions in developing countries has been the development of credit and savings systems for poor families. These families lack the kinds of collateral that banks typically demand, appearing to be too high a risk, and so have to rely on money-lenders who charge exorbitant rates of interest. A major change in thinking and practice occurred when professionals began to realise that it was possible to provide micro-finance to groups, and so ensure high repayment rates. When local groups are trusted to manage financial resources, they can be much more efficient and effective than banks (Pretty, 2003).

According to Poulton, Kydd and Dorward (2005), there are particular challenges in the provision of savings and credit services in poor rural areas, and in particular in providing credit for seasonal purchases of crop inputs:

- Small-scale deposits and loans lead to very high transaction costs, exacerbated by the dispersion of rural populations and poor communications infrastructure;
- The seasonality of agriculture leads to patterns of lumpy demand and repayment by all farmers, often with a period of several months without income (during which time it may be difficult to make repayments);
- Lending to agriculture in a given area faces covariant risks from adverse weather or prices affecting large numbers of farmers in similar ways. These and other risks make agriculture particularly risky, but insurance markets are usually non-existent and smallholders generally lack collateral to borrow against;
- Covariant risks (of events striking many members in a community, for example, the effects of drought or adverse price changes) and seasonal patterns of crop financing affect not only the demand for credit but also savings deposits and withdrawals by rural people; and
- There are further problems in financing input purchases for subsistence-crop production, as the financed inputs do not directly lead to sales from which repayments can be made.

These difficulties make provision of banking services costly and unprofitable in poor rural areas, hence these areas are poorly served by banking facilities. Difficult and costly access to these facilities, which are located in distant urban centres, then constrains demand even for relatively straightforward deposit or withdrawal services.

The list of commercial banks in South Africa who are public companies registered as banks in terms of the Banks Act, 1990 (Act No 94 of 1990) include the following banks: Absa Bank Ltd, African Bank Ltd, Albaraka Bank Ltd, Capitec Bank Ltd, FirstRand Bank Ltd, Habib Overseas Bank Ltd, HBZ Bank Ltd, Imperial Bank Ltd, Investec Bank Ltd, Marriott Merchant Bank Ltd, MEEG Bank Ltd, Mercantile Bank Ltd, Nedbank Ltd, Peoples Bank Ltd, Rennies Bank Ltd, Sasfin Bank Ltd, The South African Bank of

Athens Ltd, The Standard Bank of SA Ltd and TEBA Bank Ltd. These banks are, however, focusing more on the developed areas of the country.

There are also a wide range of foreign banks operating in South Africa but none are of importance for this particular study. There are three other banks operating in South Africa which operate under a different set of rules than the commercial banks. These are the Postbank, which is a saving institution operating as a subsidiary of the South African Post Office; the LandBank, also known as the Land and Agricultural Development Bank of South Africa, and the DBSA, also known as the Development Bank of South Africa, all of which are key financiers in the South African agricultural sector.

2.2.1.2 Information

Information in various sources of literature depict the transparency of a market, and how the deregulation of the agricultural marketing sector in South Africa in the late 1990s resulted in the abolishment of the marketing boards, which led to non-transparency in markets. With the abolishment of the marketing boards, the important role it played in the collection and dissemination of agricultural data went with it, leading to a decrease in the supply of agricultural data, and in some cases a discontinuation, despite a substantial increase in the need for data by decision-makers. Information economics studies show how information affects economic decisions. Information is a unique input because it is so easy to spread, but so hard to control. It is easy to create, but hard to trust. And it influences many decisions. However, the special nature of information complicates many standard economic theories. Information economics focuses on three areas: the study of information asymmetries, the economics of information goods, and the economics of information technology (Stiglitz, 2000).

Globalisation and the new information and communications technologies are fast transforming all aspects of development and how information is shared. All farming, whether large- or small-scale, requires an array of skills and knowledge. Farmers are under increased pressure to diversify their output, adopt new farming systems, and

compete in national and global markets, but according to Stiglitz (2000), one of the central aspects of less developed countries is that markets work less efficiently, including 'markets for information'. Information is an important commodity for rural people short of access to financial resources. Yet information and associated technologies, whether locally or externally sourced, are vital for making improvements to livelihoods and economies. These can take many forms, including market information, technology updates, policy signals and climate/weather summaries (Pretty, 2003).

Rural service providers also require access to relevant and timely information to support farmers. Information and communication can bring benefits in all of these areas (Treinen, 2003). Other aspects of behaviour within the rural sector of developing countries that can be explained by information-theoretic models include the interlinked transactions in labour, credit and land markets, as well as numerous features of credit markets, most particularly, the success of micro-credit schemes based on peer monitoring (Stiglitz, 2000).

However, provision of information alone does not guarantee that recipients will find it useful or even understand it. Networks that are socially and culturally contextualised thus need to be built on demand-side rather than supply-side principles (Pretty, 2003).

Decentralised networks for information technologies can therefore help in the sharing and exchange of new ideas, advance understanding of the policy connections for rural development, and build power amongst rural people to demand the information they require (Pretty, 2003).

Differential access to information is one of the major explanations for the existence of transaction costs. In this study, access to information is proxied by the average education of the household, contact with extension services, proximity to roads and thus towns, and the road conditions. Stiglitz (2000) found that proximity to the nearest town stimulated horticultural sales, but discouraged a positive decision to participate in markets for other field crops. Proximity was not significant for decision to participate in livestock and

maize markets. Proximity is important for horticultural crops though, since farmers need to make decisions about selling their produce timeously. Another aspect is that a location closer to the markets facilitates access to information. Contact with extension officers also facilitated the decision to sell horticultural products, but did not do so for the other commodities. Good road conditions were only an important factor in the decision to sell other field crops, but did not play that role with respect to other commodities.

These results suggest that farmers who are presently not participating in the markets might respond positively if they could have reasonable access to information about markets. Access to information is possible when farmers are located closer to the markets, and have appropriate contacts with their respective extension service. Information systems for promoting market access have not been very clear and accessible in South Africa. To encourage smallholder farmers to participate in high value markets, information sources must definitely be created that are within farmers' reach (Magingxa, 2007).

The other role of information pertains to the increased level of market participation. This is reflected in the existence of variable transaction costs. The role of access to information through extension officers and the ability to interpret information is limited to influencing the farmer's decision regarding whether to participate in the market. What the farmer knows about the market is not pivotal in determining the level of sales (Magingxa, 2007).

The second hypothesis of this study is that the more information these farmers have and the more access to high-quality and timely information they have regarding production and markets, the more successful they will be.

2.2.1.3 Technology

Expansion of the area cultivated or grazed was the main means of increasing agricultural production before the industrialisation era. However, agricultural growth based on the

resource exploitation model was not sustainable over the long term because of the limited supply of agricultural land and labour. Subsequently, alternative technologies were developed to substitute for the limited land and labour. Hayami and Ruttan (1998) formulated a model of agricultural development in which technical and institutional change was treated as endogenous to the economic system. According to the model, technologies are developed to substitute relatively abundant resources for scarce resources. In agriculture, this predominantly translated into the development of mechanical techniques for the substitution of labour, and biological and chemical technology for the substitution of land. Mechanical technologies were designed to substitute power and machinery for labour, and biological technology such as chemical fertilisers, pesticides, husbandry practices, management systems etc. to substitute for available land (Hayami and Ruttan, 1998).

By the early 1960s it became increasingly clear that much of agricultural technology was location-specific. Techniques developed in advanced countries are not generally directly transferable to less developed countries with different climates and different resource endowments (Ruttan, 1998), and it can be confidently stated that the same is probably true with smallholder and commercial agricultural sectors in South Africa.

More recently it has become evident that a transition to being more environmentally friendly is needed. Critics of the green revolution argue that the gains from agricultural intensification have come at too high a cost in terms of energy consumption and depletion of natural resource stocks, and that it is not sustainable (Matson, Naylor and Ortiz-Monasterio, 1998). The impact that agricultural intensification has on production itself is of great concern to many environmentalists. The impact is especially true in developing areas, such as the Taung area, where a lack of property rights and overpopulation causes overgrazing of veldt and consequently, soil degradation. Soil erosion and degradation have been widely regarded as major threats to sustainable growth in agricultural production and it is projected that it will become even more severe constraints in the future (Pimental et al., 1995a).

It is clear from the above discussions that technologies should be seen and developed endogenously. The dualism of the agricultural sector in South Africa makes it a unique case. Where the commercial sector has developed under the protection of large land areas, technologies are skewed towards high levels of mechanisation and biotechnology. The smallholder area (mainly situated in the former homelands) is, on the other hand, characterised by high population densities and low levels of investment and modern technologies. The farms are generally at subsistence level and lack the technologies to become commercial and competitive farms in a competitive global environment (Bembridge, 1999).

Relatively little research exists on traditional technology development for smallholder farmers (e.g., Louise Fresco on Cassava farming systems). In South Africa, indigenous knowledge systems are poorly understood and their integration into modern agriculture is practically non-existent. However, a few NGOs and universities in the former homelands have recognised the value of traditional methods and have sought to find ways of both developing and incorporating them into mainstream agricultural practice. While most of this technology is aimed at the large-scale farming sector, there are spin-offs for smallholders – for example, hybrid maize cultivars, bred ostensibly for large-scale farmers, are also widely used on smallholder farms. However, new developments are more likely to benefit the large-scale farming sector, as research and development focuses on their specific needs (Oettle, Fakir, Wentze, Giddings and Whiteside, 1998).

The majority of research in the past was directed at transferring technologies without acknowledging the socio-economic constraints for the environment. In the Taung irrigation scheme, the decision was made in 1973 to convert the scheme to centre pivots for various reasons, including managerial shortcomings. Subsequently, the DoA (2002) at the time labelled the transition of the irrigation system to centre pivots 'to be a mistake', because of the farmers' inability to operate the new technology. Since then the scheme has come a long way, and now most of the farmers are capable of operating the pivots.

2.2.1.4 Markets

According to Kherallah and Kirsten (2002), the universally agreed upon definition for institutions encompasses a set of formal (political systems, laws, contracts, organisations, markets, etc.) and informal (religions, norms, traditions, customs/value systems, sociological trends, etc.) rules of conduct that aid co-ordination or govern relationships between individuals or groups. In other words, institutions can be viewed as the structural framework for social interaction, and they focus on conventions and rules as coordinators of social behaviour and economic interaction. On the other hand, a market is often defined as a medium whereby change of ownership for goods and services takes place. To put it another way, markets exist to facilitate the transfer of ownership of goods from one owner to another within a particular set of rules. According to Magingxa (2007), a market can therefore be viewed as an institution.

Market access for smallholders is complicated by numerous internal and external challenges. As the previous three headings have all touched on the subject of market access, the constraints faced by small-scale farmers will be discussed in detail in the following section.

The Marketing Act of 1937 has been regulating agricultural marketing in South Africa for more than 50 years (Schmid, 1987). The Act entails that farmers were only to be concerned with production since marketing was done via control boards that monopolised the marketing process (Keegan, 1981; Murray, 1992; Simkins, 1981). The consequence of this marketing system was a disincentive for farmers to acquire marketing skills due to lack of practical opportunity to do so (Kritzinger; van Niekerk et al., 1992). Nonetheless, the year 1997 saw a turnaround of South African agricultural markets from regulated and protected status to that of free market dispensation, a move in response to globalisation of markets (Kritzinger; van Niekerk et al., 1992).

Much of the literature points to the pervasive imperfections that characterise markets in the developing world. Studies conducted by the NAMC, Makura (1994, 2001) and

Matungal et al. (2001) identified the following major obstacles to entry into markets in South Africa for smallholder agriculture:

- Management and basic business skills;
- Lack of information on prices and technologies;
- Communications;
- Roads and vehicles;
- Storage;
- Extension advice;
- Finance and credit;
- Bargaining power;
- Institutional capacity;
- Processing technology,
- High transaction costs, legislation and regulations.

In addition, with the increasing number of free trade agreements affecting both national and international commodity markets, the smallholder farmer is being forced to compete not only with their local cohorts, but also with farmers from other countries as well as domestic and international agribusinesses (Makhura and Mokoena, 2003).

From the above it can be seen that access to markets is both an institutional and technological problem and that they are mutually reinforcing.

2.2.1.4.1 Market access as a success factor

According to Magingxa (2007), various scholars focus on diverse issues that have a possible influence on the success of smallholder irrigation projects, and certain issues seem to be commonly acknowledged. A combination of factors has a role in influencing the potential success of these activities. Lipton (1996) identified four reforms that have helped many developing countries to increase growth in farm output and employment. They involve land distribution, agricultural research, rural infrastructure and markets. He

goes further to say that labour-intensive farm growth tends both to increase nearby rural non-farm growth and to improve food availability. Therefore, the four reforms advance GNP growth while reducing poverty. De Lange (1994) identifies several issues that are important for the success of small-scale irrigators in South Africa. These issues are identified as appropriate technology, organisation, sufficient irrigation, management and training.

According to Foremen and Livezey (2003) in a study conducted to determine factors contributing to financial success, the ratio of government payments to total production value, tenure, crop diversification, cost control, education, yield and debt-to-asset ratio are significant factors influencing at least one financial success measure. They propose that market access is one of the driving forces of agricultural commercialisation. Muhammad, Tegegne and Ekanem (2004) included the following factors as probably being influential in terms of the level of success achieved, namely: size and type of farm operation; sources of information; importance of farm labour and off-farm income; use of information technology; marketing practices and research, and extension and education needs. Additionally, they also examined the plans for the outlook of the respondents. Their results showed that more successful farmers use production systems that are diverse, adopt measures to control costs and use marketing strategies that seek the highest level of profit.

In Hau and von Oppen's study (2002), they present an analysis of the influence of market access on agricultural productivity. Results indicated the significance of investments in physical and institutional infrastructure of agricultural markets. It is emphasised that an upgrading in market access can help stimulate market driving forces, and in turn maximise the potential benefits of agricultural commercialisation by increasing incomes and improving living standards in the rural areas of many developing countries. There seems to be a general outlook that market access is one of the critical factors that determine success of smallholder farming projects. This is a satisfactory view, even among professionals working in developing countries. For example, presenting results of an expert survey, Gabre-Madhin and Haggblade (2001) found that the main views on

determinants of success in African agriculture include technology, collaboration, markets and a favourable policy environment and management. In this study, social scientists chose markets and a favourable policy environment as being the most prominent determinants of success.

2.2.1.5 Collective action

The concept of social capital is what best describes the term collective action. As Portes (1998) observes, "Whereas economic capital is in people's bank accounts and human capital is inside their heads, social capital inheres in the structure of their relationships". The uniqueness of social capital is that it is relational. It exists only when it is shared. Putnam (1993) therefore claims that "Social capital refers to features of social organization, such as trust, norms and networks, that can improve the efficiency of society, facilitating coordinating actions".

Social capital has been defined both at community level and at individual level. At community level, the structural component of social capital has been defined in terms of the density and diversity of associations within a community (Putnam, 1993; Narayan, 1997). The associational interactions in the community reflect the ability to coordinate, monitor and hence solve a collective dilemma. At individual level, structural definitions consider social capital as being embedded in the network of friends, relatives and acquaintances an individual interacts with, and is based on norms of reciprocity (Lin, 1999; Fafchamps and Mitten, 1999; Glaeser, Laison and Sacerdote, 2001). Individual social capital can be conceptualised as consisting of two components: (i) the private component that is embedded in friends, relatives and acquaintances, and (ii) the public or social component that is embedded in the community and flows from informal community institutions (local associations).

As the literature demonstrates, information diffusion may be a function of social capital (Conley and Udry, 2001; Collier, 1998), suggesting that potential adopters may lack access to information from early adopters, which may in turn lead to differences in

adoption rates. Social capital may influence social learning and technology adoption in a number of ways. Firstly, social capital reduces the cost of information acquisition since it can be acquired passively during social interactions or actively from people who already know each other. Secondly, social capital reduces the uncertainty about the reliability of information. Information is likely to be given a higher value if it comes from trusted people. Thirdly, social capital facilitates a willingness and cooperation in sharing information, thereby revealing tacit information that would be difficult to exchange otherwise (Yli Renko, Autio and Tontti, 2002). Social capital also reduces transaction costs in a range of markets (such as output, labour and credit markets) that are endemic in most developing economies (Fafchamps and Minten, 2001).

The economic function of social capital is to reduce the transaction costs associated with formal coordination mechanisms such as contracts, hierarchies, bureaucratic rules and the like. It is of course possible to achieve coordinated action among a group of people possessing no social capital, but this would presumably entail additional transaction costs of monitoring, negotiating, litigating and enforcing formal agreements. No contract can possibly specify every contingency that may arise between the parties; most presuppose a certain amount of goodwill that prevents the parties from taking advantage of unforeseen loopholes (Fukuyama, 1999).

2.2.1.6 Property rights

Demsetz (1967) defines property rights as the capacity to use or to control the use of an asset or resource. He maintains that for any form of human cooperation to be workable, especially those involving agreement, it requires clearly defined and enforced property rights. The neoclassical model specifies that property is privately held and property rights are exclusive and transferable on a voluntary basis. Since transaction costs are assumed to be zero, these property rights can be fully defined, allocated and enforced, and will be allocated to those uses where they yield the highest return (Royer, 1999). According to Coase (1960), externalities can be internalised if property rights are well established. In Coase's view, if property rights are well established and if there are not

transaction costs, an externality can be internalised between two private parties through bargaining and negotiations. This is the essence of what has been labelled the 'Coase Theorem'.

Keyfitz and Dorfman (1991) state that there are 14 institutional and cultural requirements necessary for the operation of an effective private market, and one of these is security of persons and property. They further state that as a requisite for a properly functioning marketing system, property rights should be clearly established and demarcated as well as the procedures for establishing property rights and transferring them.

Property rights theory, also referred to as the incomplete contracting theory of the firm, was developed by Grossman and Hart (1986), Hart and Moore (1990) and Hart (1995). It is based on the assumption that contracts are necessarily incomplete (e.g., due to asymmetric information between trading parties and bounded rationally), and thus do not "fully specify the division of value in an exchange relationship for every contingency" (Sykuta and Chaddad, 1999). Hence, ownership (the right of residual control) of the assets involved in a transaction becomes critical in deciding how value is divided when a (non-covered) contingency arises. Since transaction costs are positive, "the allocation (and possible non-transferability) of property rights may have significant consequences for economic organization, behaviour, and performance" (Sykuta and Chaddad, 1999).

There is widespread belief among development specialists that land tenure security is a necessity but not a sufficient condition for economic development. Compared with weak or insufficient property rights, tenure security (i) increases credit use through greater incentives for investment, improved creditworthiness of projects, and enhanced collateral value of land; (ii) increases land transactions, facilitating land transfers from less efficient to more efficient users by increasing the certainty of contracts and lowering enforcement costs; (iii) reduces the incidence of land disputes through clearer definition and protection of rights and (iv) raises productivity through increased agricultural investment (Prosterman et al., 1998).

Prosterman et al. (1998) state that in production, for product output to increase, tenure security become a binding constraint. At some point of production, farmers will demand high tenure security before undertaking fixed land improvements or investing in capital intensive technology. Credit supply by informal lenders becomes limiting, while formal lenders will require clear and transferable title before lending. It is doubtful whether the transition to high value crops and a high capital/labour ratio can be achieved without land tenure that confers right of sale, mortgage, and low cost transaction in the eyes of creditors.

According to Tietenberg (2003), the structure of property rights that could produce efficient allocations in a well-functioning market economy structure has three main characteristics:

- Exclusivity – All benefits and costs accrued as a result of owning and using the resources should accrue to the owner (and only the owner), either directly or indirectly by sale to others.
- Transferability – All property rights should be transferable from one owner to another in a voluntary exchange.
- Enforceability – Property rights should be secure from involuntary seizure or encroachment by others.

2.2.1.7 Transaction cost economics

With all of the institutional constraints discussed, there has been an underlying theme throughout, namely transaction costs in the respective institutions. Institutions are transaction cost-minimising arrangements, which may change and evolve with changes in the nature and sources of transaction costs. This work was pioneered by Coase (1937) in his article 'The Nature of the Firm', where he argues that market exchange is not costless. Coase underlines the important role of transaction costs in the organisation of firms and other contracts (Coase, 1937). Transaction costs have been broadly defined by Steven Cheung as any costs that are not conceivable in a 'Robinson Crusoe economy' – in other words, any costs that arise due to the existence of institutions. Cheung (1987) stated that

transaction costs should be called institutional costs. Coase explains that firms emerge to economise on the transaction costs of market exchange and that the 'boundary' of a firm, in respect to the extent of vertical integration, will depend on the magnitude of these transaction costs (Coase, 1937). Transaction costs originate typically from the following activities (Eggertson, 1990, as cited in Makhura, 2001).

- The search for information about potential contracting parties and the price and quality of the resources in which they have property rights; this includes personal time, travel expenses and communication costs.
- The bargaining that is needed to find the true position of contracting parties, especially when prices (including wages, interest rates, etc.) are *not* determined exogenously.
- The making of (formal and informal) contracts, that is, defining the obligations of the contracting parties.
- The monitoring of contractual partners to see whether they abide by the terms of the contract.
- The enforcement of the contract and the collection of damages when partners fail to observe their contractual obligations.
- Screening costs: These refer to the uncertainty about the reliability of potential buyers' suppliers and the uncertainty about the actual quality of the goods.
- Transfer costs: These refer to the legal, extra-legal or physical constraints on the movement and transfer of goods. This dimension commonly includes handling, storage costs, transport costs, etc.

Farmers engaged in small-scale agriculture have limited access to factors of production, credit and information, and markets are often constrained by inadequate property rights and high transaction costs (Lyne, 1996). Generally, transaction costs can be explicit (observable) and/or implicit (unobservable). Explicit transaction costs include transport costs, for example bus fares, while implicit transaction costs include the opportunity cost of time spent searching for new partners or customers, gathering market information, travelling and waiting time (Gonzalez-Vega, 1993). When faced with high transaction

costs, small farmers may not realise the benefits of trade and consequently persist with subsistence agriculture. The provision of physical and legal infrastructure, information and education through extension, and agricultural research may lower transaction costs. Achieving rural economic growth will require the participation of small-scale farmers in various markets (Matungul, Lyne and Ortmann, 2002). Government policies, education, knowledge and access to capital are important factors for Third World small-scale farmers to consider when participating in markets. Therefore, policies are required , which affect rural marketing institutions, property rights and both physical and legal infrastructure that deal effectively with transaction cost obstacles within the communal areas of South Africa (Delgado, 1997).

2.2.2 Technical constraints

Technical constraints can be further divided into different factors such as inadequate infrastructure, distance to markets, access to inputs, the lack of economies of scale, extension services and a general lack of skills and experience (Pote and Obi, 2007).

2.2.2.1 Infrastructure

According to Torero and Chowdhurry (2005), development of the different rural infrastructure services in Africa in the 1980s and 1990s was sector specific, with little or no emphasis on cross-sectoral strategies. The common strategy among sectors was to attract private capital and the users' contributions as the principal means of financing. Although the sector-specific strategy worked in some countries and communities, it largely failed to attract the necessary capital to build and maintain rural infrastructure. For instance, some scholars have reported that the policy of leaving the rural transport provision to the private sector was generally unsuccessful in sub-Saharan Africa. In most cases, transportation markets remained uncompetitive and disproportionately dominated by transportation unions, associations, and formal and informal cartels.

An implication for policy-making might be that investment in a good physical infrastructure is of the essence if smallholder participation in the markets is to be

encouraged. Markets should be brought closer to the farmers in order to address the problem of proximity to markets. This can be done by establishing market infrastructure that includes collection points and/or a transport system. Farmers could deliver their products to the nearby distribution points, from which the buyers or agents can collect the products. This initiative could possibly be left in the hands of the private sector, but the public sector could play a role in supporting the information transfer to farmers. There is therefore a clear need for better managing of marketing, such that it can cater for market information centres.

Better infrastructural development and effective support services (legal support for contract enforcement, extension and research), coupled with more secure access to land, are needed if small-scale farmers are to be integrated into the commercial agricultural sector (Thomson, 1996).

A study done by Torero and Chowdhury for IFPRI (2005) indicated that rural households in sub-Saharan Africa pay much higher transportation costs than rural households in developing countries in Asia. This is equally true for passenger fares and freight charges. For instance, a comparative study of rural transportation found that some African countries' transportation charges were two to two and a half times more expensive than those in Thailand, Pakistan and Sri Lanka. This makes distance to markets an important issue.

2.2.2.2 Distance to markets

Farmers near markets and on main roads could justify taking their products directly to markets because of reduced transportation costs and reduced time taken to carry the products to the market. Lyne (1996) reported that KwaZulu-Natal homeland wards furthest removed from markets and main roads were the poorest. Omamo's (1998) study in Kenya concluded that farmers' choice of food crop production with lower gross income than cotton was due to cotton's high transportation costs. The long distances to

cotton marketplaces and the bulkiness of cotton limited the transportation of large quantities.

The distance from the market to the farm gate is generally integrated as an explicit cost in the transaction cost economies discussed in 2.3.1.7. However, distance from the market also has an implicit transaction cost as there is an opportunity cost of time spent travelling to markets. The implicit costs are usually higher, suggesting that proximity to institutions such as markets and banking facilities is crucial. The extent of these costs depends on the degree of market organisation and the development of the physical and institutional infrastructure (Gonzalez-Vega, 1993).

Rural households with different asset bases are likely to have different levels and distribution of transaction costs. In regions with thin or non-existent markets, it is costly to discover trading opportunities. Also, poor market access due to lack of transport and distance, and barriers such as ethnicity, increase a household's cost of observing market prices to make transaction decisions (Goetz, 1992).

2.2.2.3 Access to inputs

There has been widespread interest in recent years in farmer organisations as mechanisms for supporting agricultural development and as an important means for smallholders to access markets and services (Chirwa, Dorward, Kachule, Kwumwenda, Kydd, Poulton and Stockbridge, 2005). Resource productivity can be improved through application of external inputs or with internal resources. Given the high costs of agrochemical inputs, poor farmers tend to rely on internal inputs (manure, fallow and cover crops). Economic performance of such low external input systems has been disappointing due to their generally high labour requirements. Only in rather remote regions with high population density and low opportunity costs of labour, may exclusive reliance on internal inputs be a feasible option. In other settings, a combination of internal and external inputs will be more appropriate for raising factor productivity (Ruben, 2005).

The inaccessibility of seed, fertilisers and plant protection inputs are reported to hinder yields. Use of poor quality seed does not enhance crop yields, while use of high yield varieties significantly increases yields (Key, Sadooulet and Janvry, 2000). Cairns and Lea (1990) reported that smallholders in KwaZulu-Natal increased their yields by 65 percent when they used improved seed as opposed to traditional seeds.

Poor access to inputs affected the supply response of agricultural markets even if smallholders had a positive perception of cash crops due to good prices, increased demand and good extension support (Havens and Flinn, 1961; Poulton et al., 1998). According to Jeje, Machungo, Howard, Strasberg, Tscherley, Crowford and Michael (1998), and Poulton, Kydd and Dorward (1998), the private sector did not emerge to take on the role of distributing inputs because of: (i) the poor demand for inputs due to high input costs; (ii) high costs of transportation and distribution of inputs in dispersed villages; (iii) lack of skilled and experienced traders to manage agrochemicals, and (iv) the seasonal nature of the business.

2.2.2.4 Economies of scale

Given increasing market instability and competition, smallholder farmers need to become more competitive, and build capacity to improve their market position. One way to enhance such productivity is through the advantages of economies of scale (Bienabe and Sautier, 2005). Developing producers' organisations can help to achieve these economies through pooling of credit, information, labour force and transportation means for selling products and buying inputs. Bienabe and Sautier (2005) point out that such aggregation of input activity, production, processing and marketing processes into larger economic units, like farmers' associations or cooperative organisations, has been shown to improve individuals smallholders' bargaining power and hence market position.

Bienabe and Sautier (2005) propose that collective marketing through rural producers' organisations can be a means to overcome constraints faced by small-scale farmers, including lack of capital, imperfect information, geographic dispersion, and poor

infrastructure and communications. These constraints are particularly apparent with State withdrawal from productive activities, concurrent with a private sector that is still underdeveloped. Acting collectively through farmers' associations, farmers can mitigate transaction costs, and therefore accrue benefits from collective marketing.

Moll's (1988) study of commercial wheat and maize farms in South Africa suggests that there are economies of scale across a range of sizes in the large-farm sectors. On grain farms there may well be a minimum size for tractors to be used economically, but the main advantage of large farms stems from owner-operators using their own labour over larger areas. Moll suggests that if land were to be divided into farms at the lower end of the large-farm range (about 50 ha), they would need support as they would be less efficient than larger farms. Other studies suggest that observed economies of scale may be attributed to 'managerial ability'; good farmers are able to acquire larger farms. Efficiency is not simply a matter of scale: "A wide range of farm sizes in both extensive and intensive commercial farming seems to be scale efficient, depending on how farmers organize their specific variable and fixed input mix, as well as the combination of outputs they produce" (Moll, 1988).

2.2.2.5 Extension services

Extension services link directly to the supply of information. It is pertinent that extension systems should be able to supply the farmers with adequate marketing information. Thus it is recommended that Government, in particular, consider introducing extension officers who are specialised in marketing into the extension system. Naturally this would require the training of these officers through formal college education and in the in-service context. With extension officers gathering and dispersing market information, the benefit of such investments would be an increased market participation of smallholder farmers (Muhammad, Tegegne and Ekanem, 2004).

Owens, Hoddinott and Kinsey (2001) examined the impact of agricultural extension on farm production in resettlement areas of Zimbabwe. Their data provided statistical

evidence that farm-level extension visits increased productivity, even after controlling for innate productivity characteristics and farmer ability. It was found that having one or two extension visits increased net crop incomes in the three non-drought years. For the drought year, one or two visits had either no effect or a negative effect on production. Farmers may have received technical advice early and thus have fertilised their crops in anticipation of early rains, only to suffer losses due to the drought. Those who received three or more visits, however, got additional advice in a later visit that advised them not to top-dress their crops and to plant additional plots of unfertilised crop following sporadic rains. The latter had higher levels of crop production.

2.2.2.6 Lack of skills, experience and education

Literacy was generally acknowledged to positively influence smallholders' agricultural market participation. Some of the reasons that helped literate households to cultivate and participate in the market were attributed to: (i) an enhanced ability to receive, decode and understand information from print and mass media channels; (ii) easy contact with outsiders; (iii) understanding of concepts related to causality, arithmetic, weights and measures that increased the ability to conceptualise abstract ideas; (iv) improved managerial ability, and v) sensibility regarding science and technology (Mook, 1981; Feder, Just and Zilberman, 1985; Masuku, Makhura and Rwelamira, 2001).

Highly literate households could access and utilise information at lower costs than non-educated households (Makhura, 2001). Mook (1981) suggested that the difference in adoption between the educated and non-educated declined with increasing extension contact or provision of information. According to Feder et al. (1985), education had no impact on adoption of crops in regions with traditional agricultural practices.

Kinsey and Binswanger (1993) presented a review of the performance resettlement programmes in Kenya, Indonesia, Malaysia and Zimbabwe. They identify critical success factors from the experiences of farmers in these countries as age, education, family labour force, marital status, capital assets, and farming experience and skills. In

terms of education, the authors say there is strong evidence that better-educated settlers in these countries are more successful. Farming experience and skills are strong predictors of good performance.

2.3 Contract farming as a means of overcoming constraints

Efforts to develop the agricultural sector in developing countries are now taking place against the background of major structural change in the world agricultural industry. The changing nature of agriculture has opened opportunities for contract farming or contractual relations in developing country agriculture. In developed countries, contracts have almost become a standard feature of agriculture. The following section presents an overview of contract farming in both developing and developed countries. Relevant literature also presents the advantages and disadvantages to both producers and institutions.

2.3.1 Background

Agricultural production in many developed countries is altering from being an industry dominated by family-operated, small-scale farms or firms to one of larger firms that are more narrowly aligned across the production and distribution value chain (Boehlje, 2000). Additionally, the trend of market-orientated reforms, following multilateral trade liberalisation and particularly structural adjustment programmes in developing countries, has led to the augmented integration of world markets (Reardon & Barrett, 2000). Thus, farmers in the developing world are now, more than ever, linked to consumers and corporations of the wealthy nations. Although most of the changes in agricultural and food markets are taking place in developed countries, they have far-reaching implications for agricultural development efforts in developing countries.

According to Kirsten and Sartorius van Bach (2002), the changes in food and agricultural markets (the so-called industrialisation of agriculture) have influenced the need for higher levels of managed coordination. This led to the introduction of different forms of vertical integration and alliances, which have become a dominant feature of agricultural supply

chains. Similarly, there has been a global increase in consumer demand for differentiated agricultural products that are relatively labour intensive (Rhodes, 1993; Royer, 1995; Pasour, 1998). However, it is mostly the skilled and well-endowed that have the ability to be part of these coordinated marketing chains and alliances. Therefore, there is a danger that the requirements, quality standards and food safety rules of the consumers and corporations (supermarkets) in the developed countries can act as effective barriers to small exporters' participation in the high-value chains and, to some extent, small producers. Only a small number of farmers in developing countries have the ability and luxury to be part of these lucrative markets and the reward for them is substantial (Kirsten and Sartorius von Bach, 2002).

Contract farming is considered to be a system that has significant potential for providing a way to integrate small-scale farmers in developing countries into export and processing markets as well as into the modern economy. In Africa, contract farming is believed to help farmers by providing new technology, ready markets and secured inputs and prices. Further, contract farming offers a mechanism that ensures self-sustained development (Glover, 1987; Weatherspoon et al., 2001).

2.3.2 Earlier experiences of contract farming

As an institution in agriculture, contract farming has a long history. Various forms of this institutional arrangement were employed by United States multinationals in Central America at the beginning of the 20th century, and by the Japanese to secure sugar production in Taiwan from 1885 (Runsten and Key, 1996; Rehber, 1998). In the period of 1930-1950, contracting was increasingly implemented in many food and fibre sectors. The fruit and vegetable canning sectors expanded in the United States and Europe (Little and Watts, 1994; Clapp, 1994), and merchants in Europe and North America entered into seed production contracts with growers in Australia, Britain, Canada, France, Holland, Hungary and the United States (Watts, 1994). From the late 1950s, Mexican growers increasingly supplied the American markets with fruit and vegetables under contract (Watts, 1994), and in the period of 1960-1980 there was a momentous increase in

contracting for vegetables, fruit, nuts and seed crops (Kilmer, 1986). By the late 20th century, contract farming was widespread across Western Europe, the United States and Japan (Rehber, 1998). Contract farming is now a common organisational structure in many developed countries.

Contract farming also spread rapidly in Asia, Latin America and Africa owing to the higher returns earned by high-value export crops and the impact of new technologies (Clapp, 1994; Eicher and Staatz, 1998). Contract farming in Latin America has been extensively promoted since 1945 in a series of import substitution programmes, and has a much longer history than it does in Africa (Clapp, 1994; Little and Watts, 1994; Daddieh, 1994; Runsten and Key, 1996). In the period of 1930-1950, contracting expanded in the fruit and vegetable canning sectors of colonial Africa (Little & Watts, 1994) and was followed by a swift increase in the period of 1975-1985, with some 60 schemes operating in 16 countries (Carney, 1988; Watts, 1994; Little, 1994; Eicher and Staatz, 1998). South Africa has a long history of farming under contract, which includes a wide range of sharecropping arrangements dating back to the early 20th century (Bundy, 1979). Vertical coordination arrangements currently exist in the tea, fruit, sugar, flower, cotton, vegetable, timber, fishing and tobacco sectors (Levin, 1988; Porter and Phillips-Howard, 1997; Van Rooyen, 1999; Karaan, 1999).

Contract farming regularly involves a large number of variations and several objectives, which include political, welfare, social and economic criteria. Generally, this organisation takes the form of a central processing or exporting unit that purchases independent farmers' harvests (Eaton & Shepherd, 2001). The terms of the purchase are arranged through contracts that vary from case to case, and they are usually signed at planting time. Often, the organisation provides inputs, credit, farm machinery and technical advice to the farmers in return for the commodity they produce (Glover, 1994; Grosh, 1994; Eaton and Shepherd, 2001).

Morvaridi (1995) states that, in some situations, the structure of the contract is based on the farmer's access to key resources such as water, while in others the producer does not

even own the intermediate product, which remains the property of the organisation. In contracts such as these, the organisation uses the facilities and labour of the farmer, who is paid a fee for the provision of the facilities and services. This type of contract can ensure that the technology incorporated in the intermediate product supplied by the farmer is retained exclusively by the organisation (Martin, 1999; Goodhue, 1999). In addition, many contracts incorporate some form of credit arrangement (Wolz and Kirsch, 1999).

Contract farming in developing countries has experienced a mixed fortune, yielding little success and many failures (cf. Little and Watts, 1994; Jaffee, 1994; Glover, 1984; Runsten and Key, 1996). Jaffee (1994), for example, talks of the 'rocky road' of contract farming in Kenya. Several studies (cf. Minot, 1986; Glover, 1984, 1987, 1994; Glover and Kusterer, 1990; Jaffee, 1994; Little and Watts, 1994; Porter and Phillips-Howard, 1997; Runsten and Key, 1996; Eaton and Shepherd, 2001) have analysed the nature and performance of contract farming schemes in developing countries. These studies contain valuable reviews of the various case study literatures regarding contract farming schemes in the developing world. Many studies on contract farming also came from anthropologists, political economists, sociologists and geographers (Grosh, 1994). This literature is mostly dominated by questions related to the reliance and world systems approach, and criticises contract farming for being an institution that leads to an increase in the marginalisation of farmers and communities that do not participate in contracting (Korovkin, 1992; Watts, 1994; Little, 1994). In this respect, it is argued that technological advances are passed on to the minority, resulting in uneven benefits that do not necessarily suit the needs of the developing country concerned (Meliczek, 2000).

According to Little (1994), there is evidence of an increase in landlessness as a result of contract farming's expanding land requirements. Contract farming in Africa has been observed to disrupt power relations within farm households, to develop an unequal power relationship with growers, and to lead to growers becoming overly dependent on their contracts (Key and Runsten, 1999).

Kirsten and Sartorius von Bach (2002) emphasise that the main lessons from the experience with contract farming reveal a number of factors that determine the success of contract farming ventures. In general, it can be argued that the chances of success will be enhanced if the following measures are taken:

- The farmer partners should be screened properly.
- The country-specific historical and institutional legacies that have shaped local conditions should be taken into account in project design.
- Commodities requiring more labour-intensive production techniques should be selected. A crop that requires low levels of mechanisation and high labour inputs may not be suited to large producers, who could have the same labour and supervision problems as plantations. The production of a commodity that is delicate, highly perishable, involves a high level of labour inputs and a low level of mechanisation, and that needs a high degree of coordination, technology inputs and tight quality specificity, is better suited to contract farming involving small farmers.
- One should select crops displaying a high value per hectare, as well as requiring post-harvest facilities that are not feasible for the farmer. Commodities with high transaction marketing and processing costs and with economies of scale higher in the marketing chain are the crops ideally suited for some form of vertical integration, such as contract farming.
- Mutual asset specificity between the contracting partners should be incorporated, thus raising the exit costs for both partners and ensuring a much more stable and sustainable relationship.
- The location and concentration of growers in relationship to the location of the organisation and other logistical factors should be optimised. If a competitive local market is present, contracted farmers may choose to sell to the fresh market instead of the contracting firm, who is often unable to legally enforce contractual obligations. Serious disruption to input supplies to farmers can result in such a situation.

- The legal system should be well-developed, strong and respected, ensuring contract enforcement at minimal costs.
- Contractual relations should be well managed and based on mutual trust. The perceived high levels of contract manipulation by agribusiness firms, distrust by farmers of the contractual relationship, and a perception of loss of autonomy have characterised contract farming in developing countries. Removing all elements of mistrust and establishing trustworthy relationships are important measures for success.
- Farmer interests should be well represented in contract negotiations. In this respect, the formation of farmer cooperatives in a contract farming arrangement is seen as the most cost-effective way to represent the interests of the contracted farmer, as well as for the integrator to deliver inputs and services to the individual farms.
- Organisations should play a key role in coordinating farmers' access to a range of inputs, services and facilities. These could include promoting literacy, improving business skills, fostering farmer links with agribusiness and banks, and establishing a facility for resolving conflicts, infrastructure development, etc.

2.3.3 Advantages and disadvantages of contract farming

2.3.3.1 Advantages to producers

Donors' interest regarding the benefits of contracting in developing countries has resulted in overstated expectations of the potential of this institution (Little, 1994). However, benefits to the farmer do exist, as discussed below. Contracting allows farmers to overcome the barriers of entry into specific sectors.

Generally, farmers enter into contract production in order to reduce cost and gain access to information, technology, marketing channels, managerial skills, technical expertise, access to plants and equipment and patented production procedures (Carney, 1988; Rhodes, 1993; Glover, 1994; Clapp, 1994; Jackson and Cheater, 1994; Little, 1994; Royer, 1995; Pasour, 1998; Delgado, 1999; Vellema, 2000).

Hudson (2000) states that contracting could improve access to capital and credit. This is a major concern for the majority of farmers and particularly so in developing countries. Farmers are prepared to surrender their self-sufficiency for the sake of being able to produce. Contracting farmers can decrease production costs and enhance production and income as a result of their use of new technology and their access to organisational inputs (Watts, 1994; Clapp, 1994). The reduction in cost is due to better technology, better collective decisions, reduced transport and marketing costs (Hennessy, 1996; Pasour, 1998), and low-cost inputs from the integrator, all of which facilitate the ability to increase economies of scale (Royer, 1995) or technology developed by the integrator (Pasour, 1998).

Contracting farmers reduces marketing risk and stabilises income, and the integrator provides a form of insurance (Featherstone and Sherrick, 1992; Watts, 1994; Jackson & Cheater, 1994; Runsten and Key, 1996; Wolz and Kirsch, 1999; Flaskerud and Klenow, 1999; Martin, 1999; Colchao, 1999; Sofranko et al., 2000). Simultaneously, contracts may simplify production and marketing decisions, thus improving the farmer's effectiveness (Hudson, 2000). The reduction of marketing risk through the demand assurance embodied in a contract is also appealing to farmers, especially those producing products for which the markets are scarce.

According to Pasour (1998), contracting farmers in developing countries can enhance profit opportunities through a larger product range and differentiated products, or by diversifying out of traditional crops in order to grow high-value crops and thereby increase their income (Williams, 1985; Levin, 1988; Korovkin, 1992; Glover, 1994; Von Braun and Immink, 1994; Kennedy, 1994; Delgado, 1999; Coulter et al., 1999). There is extensive evidence of an improvement in farmer income in developing countries as a result of contracting (Levin, 1988; Clapp, 1994), although the effect of an increase in production costs is sometimes not considered when evaluating the incidence of increased income (Little, 1994).

Conclusively, the educational experience of interacting with an institutional partner can provide a platform for farmers in developing countries who are attempting to convert from subsistence to commercial farming (Glover, 1984, 1994; Sofranko et al., 2000).

2.3.3.2 Disadvantages to producers

Kirsten and Sartorius von Bach (2002) state that the critique against contract farming schemes refers to the disadvantages incurred by the farmers entrenched in the contractual arrangements. These disadvantages include farmers' loss of self-sufficiency, increased production risk, increased market power of organisations, increased concentration of production and, in certain instances, reduced producer income.

A common loss of self-sufficiency occurs as farmers operate under a centralised control system (Schrader, 1986; Currie and Ray, 1986; Levin, 1988; Korovkin, 1992; Morvaridi, 1995; Pasour, 1998; Rehber, 1998; Wolz and Kirsch, 1999; Colchao, 1999; Sofranko et al., 2000) and the contracted farmer is sometimes reduced to little more than a hired hand (Clapp, 1994). On the contrary, it can be argued that the independent farmer who is heavily indebted has much the same status (Watts, 1994). It is also said that producers are disadvantaged by the high level of manipulation of the contract, in terms of both the legal and unspoken arrangements (Glover, 1984, 1987; Porter and Phillips-Howard, 1997), and by the fact that contracting undermines traditional structures and support systems (Korovkin, 1992). Additionally, contracting is often associated with higher levels of family conflict (Watts, 1994).

Runsten and Key (1996) state that contracting generally increases land-use intensity and can lead to higher levels of pollution. Contract farming in developing countries can result in decreased food production and increased food security problems as a result of the concentration on contract crops (Glover, 1994; Clapp, 1994; Morvaridi, 1995; Rehber, 1998).

It is generally accepted that prices paid to the contractor will be less than spot market prices because of the reduction in marketing risk to the farmer and the increased market

power of the contracting organisation, which results in reduced income for farmers (Pasour, 1998). This situation might particularly penalise a contracted farmer with high levels of capitalisation and managerial skills where an open market exists for the same crop (Runsten and Key, 1996; Rehber, 1998). Furthermore, contract production frequently involves a high-cost package of inputs that require financing facilities. The change in cost structure is especially marked in developing countries when farmers diversify out of traditional crops, and can negate the effect of increased revenue (Von Braun and Immink, 1994; Little, 1994).

Farmers incur additional cost because of the need to coordinate their production to suit the integrator, as well as to liaise for the use of company inputs and services (Glover, 1987).

2.3.3.3 Advantages to institutions

The benefits for the organisational firm arising from a contract-farming venture are mainly around cost reduction, quality control and reduced uncertainty with regard to the supply of raw material. Cost is reduced as a result of a more synchronised input-output processing function (Kilmer, 1986; Azzam, 1996) and the cost and financing of production are passed on to the farmer (Schrader, 1986) without the loss of control (Rhodes, 1993). The organisation can ensure that the quality of large volumes of the raw commodity is better controlled (King, 1992; Featherstone and Sherrick, 1992; Goodhue, 1999) and that the company's technology is adopted properly by the producer (Leathers, 1999). An additional advantage to the organisation is the ability to reduce the cost of the raw commodity supplied by the contracted farmer through assuming the marketing risk of the farmer and thus reducing related farmer marketing and transport costs (Glover, 1984; Kumar, 1995). Due to a reasonably stronger bargaining position in the contractual arrangement, the organisation is able to influence favourable farmer commodity prices (Delgado, 1999). Contracting thus removes the production risk to the farmer and eliminates the uncertainty regarding large volumes of input (raw material) supply (Levin,

1988; Korovkin, 1992). Because the quality of inputs is more consistent, the risk of displeased consumers is reduced (Pasour, 1998; Rehber, 1998; Wolz and Kirsch, 1999).

Advantages that are specific to agribusiness firms in developing countries are the substantial political economy gains as a result of involvement in national development projects, or because the government is a party to the contracting arrangement (Hayami, 1990; Binswanger et al., 1993; Watts, 1994; Little, 1994). The latter can translate into more tangible economic benefits resulting from government intervention or low-cost credit (Clapp, 1994; Morvaridi, 1995). Conclusively, organisational firms in developing countries that are not allowed to own land can overcome this constraint by contract farming with local farmers. This happened in many parts of Latin America: multinational agribusiness firms used contract farming to secure a constant flow of commodities for their processing and export ventures (Runsten and Key, 1996).

2.3.3.4 Disadvantages to institutions

The high level of transaction costs is a primary disadvantage often related with contract farming in developing countries. Transaction costs are often excessive in projects involving large numbers of small farmers who are spatially dispersed (Key and Runsten, 1999).

Excessive transaction costs are generated as a result of the structuring, administering and enforcing of the large number of contracts (Barry et al., 1992). Thus, the integrator incurs additional supervision and monitoring costs along with the costly delivery of services and inputs to farms that are small and spatially dispersed. Incidentally, it is estimated that dealing with larger farmers, who make less use of inputs and deliver in greater volumes, results in lower levels of transaction costs. Coulter et al. (1999) refer to an example of horticultural exporters in Zimbabwe who pay their smallholder suppliers 30 per cent of the price per kilogramme paid to the large-scale farmers in order to break even. Contracting firms could easily (and usually do) deal with larger growers, which makes

the relationship much more profitable, but this contributes to many smallholders being shut out from production.

Evidence is already emerging that agribusiness firms prefer to deal with larger farmers in order to reduce transaction costs and achieve greater consistency of quality and supply. In the United States, for example, contract farms are significantly bigger than non-contract farms (Sofranko et al., 2000) and, if the raw commodity offers economies of scale and is not labour intensive, large farmers have a production advantage (Glover, 1984; Runsten and Key, 1996).

2.4 Success in smallholder irrigation farming

Magingxa (2007) stated that assessment trends largely support the concept that the process of economic growth depends mainly on entrepreneurship. Within entrepreneurship literature, three main factors of capital have been recognised as essential elements of the entrepreneurial process – human, financial and social capital. From an entrepreneurial perspective, human capital consists of the skills, experience and education an entrepreneur brings to the venture; financial capital includes debt or equity funds an entrepreneur has available for venture start-up, and social capital encompasses family members, social networks, connections etc. that may potentially be helpful with respect to establishing a business (Marshall and Peake, 2005). They go further to say that human capital is the most accessible in terms of assistance strategies. As a result, those concerned with small business development spend a great deal of time developing this capital. Evidently, these components of human capital form part of essential characteristics that influence the potential success of smallholder irrigators. Rauch and Frese (2000) also support this argument when they say that human capital of small business owners constitutes an important factor of small business success. They highlight the aspects of knowledge and skills of the business owners as being helpful in running a business and learning more about it. According to Magingxa (2007), most of the literature on entrepreneurship is not specific to small-scale irrigation management but the main beliefs are applicable to them.

Contributing to this discussion, Blackman, Hurd, and Timo (2000) emphasise three characteristics that are generally found in entrepreneurial individuals. These characteristics are innovation, creativity and the need to achieve. The conclusion to their study shows that respondents who scored higher in these characteristics were more entrepreneurial than their counterparts.

Concluding the discussion, Nel, Botha and Groenewald (1998) advance that the relationship between managerial ability and farming success has been renowned ever since Agricultural Economics and Farm Management emerged as academic disciplines. They recommend that this relationship should be borne in mind when efforts are made to settle new farmers on land. They argue that it is essential for farmers established on land to farm successfully and to become financially independent. Again, this argument is as much relevant to new farmer settlements as it is to existing irrigation schemes.

2.5 Conclusion

The review displayed the constraints smallholder farmers face. A strong link exists between poverty elimination and agricultural development. Rooted in this line of reason is the acknowledgement that increased food production also leads to enhanced income generation opportunities. Thus, small-scale farmers need proper management of their farming enterprises so as to ensure the desired outcomes. Success in smallholder irrigation depends on a number of factors. On one hand it is the characteristics of individual farmers. These are mainly related to and influence the managerial ability of the farmer. On the other hand, the success of irrigation projects depends on a number of conditions that have to be favourable. These include farm level issues and the farming environment in general. Amongst these factors, market access is increasingly being realised as critical. Rural incomes will not be substantially increased by exclusive emphasis on subsistence food crop production; rather, more market-oriented production systems are needed. These require the intensification of agricultural production systems, increased commercialization and specialization in higher-value crops. And these must be built upon the establishment of efficient and well-functioning markets and trade systems

– ones that keep transaction costs low, minimize risk and extend information to all players, and that do not either exclude, or work contrary to the interests of, the poor – particularly those living in areas of marginal productivity and weak infrastructure (IFAD, 2003).

The Global Forum on Agricultural Research (2005) identified seven key success factors regarding how the poor smallholder farmers can benefit from growth in markets, and this can be generalised for most smallholder farmers in South Africa as well:

- *Willingness and capacity of farmers to organise for collective action.* It was felt that in order to overcome the challenges and risks posed by high-value markets, it is critical for farmers to organise collectively for input and output markets, advocacy and other functions, and to link with other actors of the chain, the principle being that smallholder farmers are defined by their limited assets.
- *Ability to access technical and training assistance and organisational advice.* This is a key factor that can be included in each of the other key factors listed. This explicit mentioning of the point results from its importance and the continued need for it in smallholder farmers' organisations that are involved in supply chains.
- *Credible facilitating agents (extension officers) to encourage market linkages and build trust among actors.* Third party facilitation is often required to build effective farmer-buyer linkages. This targeted short-term intervention is designed to create effective and efficient communication and coordination along the supply chain.
- *Access to credible market information and intelligence.* Small-scale farmers need to know what to produce to access markets, but they also need to know where, when and how to sell their products.
- *Access to affordable finance.* Tools to access credit which is affordable and reliable can be crucial at all stages in the chain.

- *Local motivation and entrepreneurial skills within the community.* Entrepreneurial skills are, at least to some members of the local community, a necessary requirement.
- *Consistent and supportive policies to create development.* Enabling environments entail more than governmental infrastructure issues. Pro-poor policies entail changing policies that create bottlenecks in supply chains, thus creating a socio-political environment with an emphasis on food security through rural business development.

Literature suggests that contract farming provides a basis for the development of the seven key factors mentioned. By implementing this strategy small-scale farmers can benefit from growth in markets and participate in the mainstream economy. But before embarking on analysing this task, it is important to put the study in context by describing the study area that was covered in this exercise.

CHAPTER 3

DESCRIPTION OF THE STUDY AREA

3.1 Introduction

The North West Province is one of the smallest provinces of South Africa, with a surface area covering about 11 632km^2. This makes it the sixth largest province in the country. The province was formed in 1994 after the first democratic elections of South Africa, by joining the former Western Transvaal, the Cape Province, the Vryburg district and part of the former Bophuthatswana homelands (Martin, 1999). The Province is bordered by Botswana in the North, the Free State and Northern Cape Province in the South and the Limpopo and Gauteng Province in the North-West (see Fig. 3.1). The province has four distinct ecological zones: the Highveld in the south-east, the Bushveld in the north-west, the Kalahari Desert in the west and the Middleveld, which is a narrow zone between the Highveld and the Bushveld.

Figure 3.1: Map of the North West Province

Source: ARC (2008)

The Greater Taung Municipality is located in the South of the province and is a typical rural municipality consisting of 106 villages, with only 7.2% of its 201 683 residents urbanised. The majority (53%) of its municipal population is female, and the municipality has the highest population density within the Bophirima district, which spans almost 36km^2. The current unemployment rate of 65% is very high. More than 97% of the inhabitants in Greater Taung earn less than R1600.00 per month. The minimum level to survive was determined at R1100.00 in 2005 (StatSA, 2007).

3.2 The past and present situation of the Taung small-scale farmers

A review of smallholder irrigation development in South Africa revealed the phenomenal and innovative actions taken in the North West Province to irrigate communal arable lands that were managed under a mixture of tribal tenure systems and freehold with a highly sophisticated irrigation infrastructure (Van Averbeke and Mohamed, 2006). The Bureau for Food and Agricultural Policy (2008) has completed an assessment of the scheme undertaken during that era and has produced a comprehensive document that provides insight into the scheme in terms of its objectives, scope, operational details and problems.

According to Seshoka, de Lange and Faysse (2004), the irrigation scheme was established on land that existed under communal tenure arrangements, whereby user rights were allocated by the tribal leadership on a hereditary basis. The particular scheme analysed for this study comprises of 4000-5000ha of communal arable land which has been partitioned among 411 farmers who do not have to pay anything for the user rights, which is in keeping with the precepts of the communal tenure systems prevailing in the traditional black areas of the country.

The scheme has a long and varied history. According to Seshoka, de Lange and Faysse (2004), during the nineteen-thirties and forties, almost 2000 farmers were settled on 1.7 ha plots in blocks of 25 hectares. Each of these 25 hectare blocks had its own flood irrigation dam. Subsistence farming was the order of the day on the 1.7 ha plots, and maize and pumpkins were the preferred crops. A few plot holders attempted wheat

production. Unavailability of a ready supply of inputs, lack of production credit, water logging and salinity led to many plots being abandoned and overrun by weeds. The Taung farmers were settled on the land according to a government proclamation (No. 4 of 1943) with regards to the Native Trust and Land Act (Act No. 18 of 1936). Candidate farmers were selected from the rural communities by tribal/communal leaders in cooperation with the public agencies created for agricultural development within the self-governing homeland (Seshoka, de Lange and Faysse, 2004).

In 1974, 200 hectares of unused land was developed in a project that installed pivots and gave farmers 10 ha of irrigation land under each of the pivots that covered an area of 40 hectares. There were thus four farmers under one centre pivot. The success of this project provided the impetus to revitalise the whole scheme. An agricultural cooperative named Lesedi was formed. Although Lesedi provided production credit to farmers and farmers delivered their produce to Lesedi, it had no legal status as a cooperative and became known as the Lesedi Trust among the locals. The farmers were organised as farmer associations in small, localised groups. The Lesedi cooperative and Agricor (a commercial agricultural cooperative) joined forces in 1978, and in the next decade, 244 farmers were settled on 10 ha plots under a centre pivot covering 40 hectares; 139 farmers were settled on 7.5 ha plots under sprinkler irrigation and 26 farmers under flood irrigation (Seshoka, de Lange and Faysse, 2004).

In 1984 a serious drought affected the scheme and water allocation was cut by 50%. Not only did this cause a direct loss in income but it also exposed some inherent flaws in both the conception and operation of the scheme as a whole (Seshoka, de Lange and Faysse, 2004).

Lesedi was responsible for the management and maintenance of all project activities. They determined the overall cropping programme and allocated this to the primary cooperatives. Through their section managers, they monitored the implementation of this programme. This led to a perception that the farmers were simply labourers on their own plots. Agricor took over the operational side of Lesedi's functions whilst the latter

retained responsibility for financing production, input supplies and marketing (Seshoka, de Lange and Faysse, 2004).

3.3 Taung irrigation scheme at present

The irrigation scheme currently still consists of 411 farmers, as when it started. The scheme is divided into five sections, namely Bosele, Rethuseng, Tshidiso, Ipelegeng and Areageng (aka Pudimoe). Of these five subdivisions, only Rethuseng is under sprinkler irrigation, while the others are under centre pivot irrigation. The areas under irrigation are roughly shown in Figure 3.2 below. Bosele is represented by area E in the figure and has 94 farmers on 940 hectares; Tshidiso is represented by area D and has 56 farmers on 560 hectares; Ipelegeng is represented by area C and has 35 farmers on 350 hectares; Areageng is represented in area A, and has 64 farmers on 640 hectares. Finally, Rethuseng is represented by area F and has 161 farmers on 1054 hectares. The composition of the scheme consists of 52×40 ha, 2×30 ha, 16×20 ha and 3×10 ha pivots, and the remaining hectares are comprised of sprinkler irrigation covering 987 ha and 41 ha under dragline irrigation.

Lack of ownership rights implies that the productive land cannot be used as collateral, which restricts farmers' access to credit. Agri-bank, the agricultural bank operating in the area and backed by government, stopped providing unsecured production loans to clients whose existing loan accounts were in arrears (Erasmus, 2008). Since no other South African credit provider was prepared to extend unsecured loans to the developing agricultural sector, a large percentage of the Taung farmers could not secure the credit they needed to plant barley (BFAB, 2008). Another problem caused by state ownership of the land is that it is unclear who is ultimately responsible for paying the irrigation scheme's water and electricity bill. Because the farmers are not landowners, no end user agreements could be signed between Eskom (electricity supplier) and the farmers. While the provincial Department of Agriculture is meant to facilitate the payment process by allocating the costs of electricity to the individual farmers, this process is burdened by difficulties. To determine the electricity consumed, the amount used by the individual

pivots needs to be determined and then the four farmers who share a pivot have to further allocate this expense. The net effect of this arrangement has been the non-payment of electricity by a large number of farmers and, presently, Eskom is owed substantial amounts of money (Tregurtha and Vink, 2002).

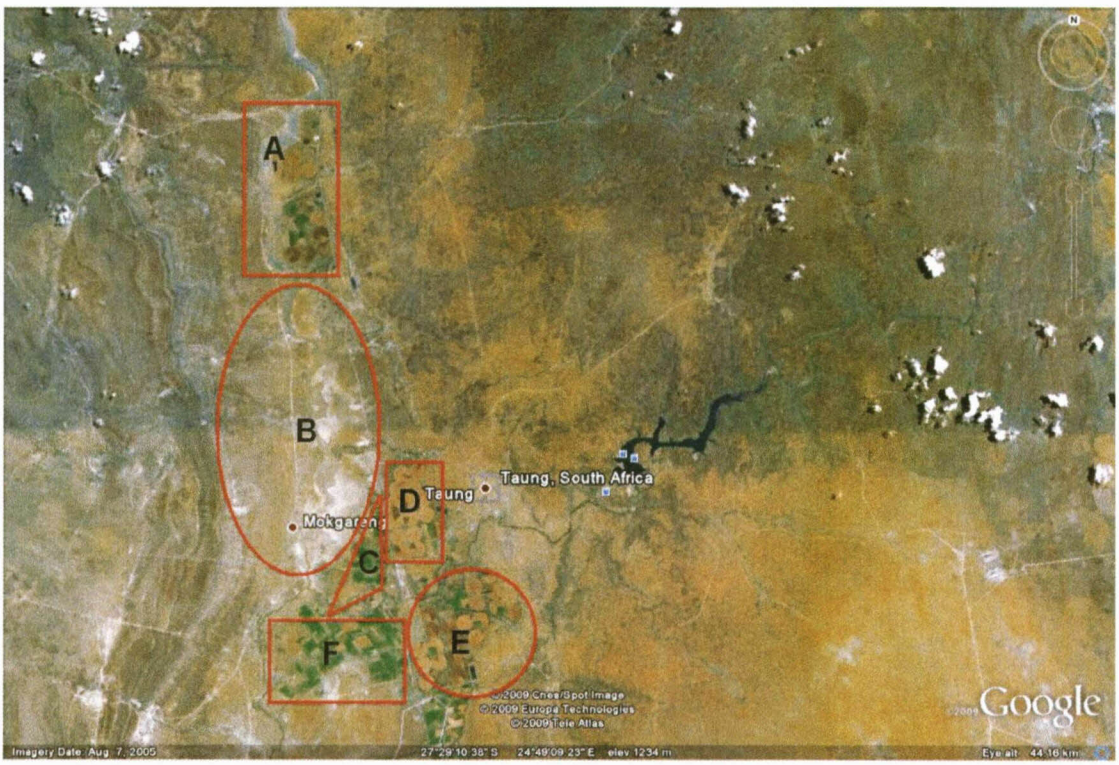

Figure 3.2: Aerial photo of the Taung irrigation scheme

Source: Google earth (2009)

According to the North West National Department of Agriculture and Environmental Affairs (NWDAEA), the lack of access to inputs has been found to be directly related to the difficulties small-scale farmers in the area have in accessing funds. Input costs were found to be high because of the difficulties in accessing funds, the distance from the source of the inputs and use of production systems that are unduly reliant on off-farm inputs. Further, poor access to inputs was also found to significantly affect the rate at which farmers are able to adopt new technologies. This has thus resulted in the farmers achieving low yields (NWDAEA, 2007). According to the NWDAEA, there is still a major problem regarding access to information that will empower communities to enter

the economic mainstream. Although all of the relevant informational structures are in place, the lack of competence exhibited by some government officials was highlighted as a major problem when it comes to servicing these farmers (NWDAEA, 2007).

Many of the centre pivots in the irrigation scheme have been unproductive for some years now. Figure 3.3 shows one of the centre pivots that have deteriorated because there has been a lack of maintenance, the electrical cables has been stolen and most of the tires are flat and have perished as a result of the sun.

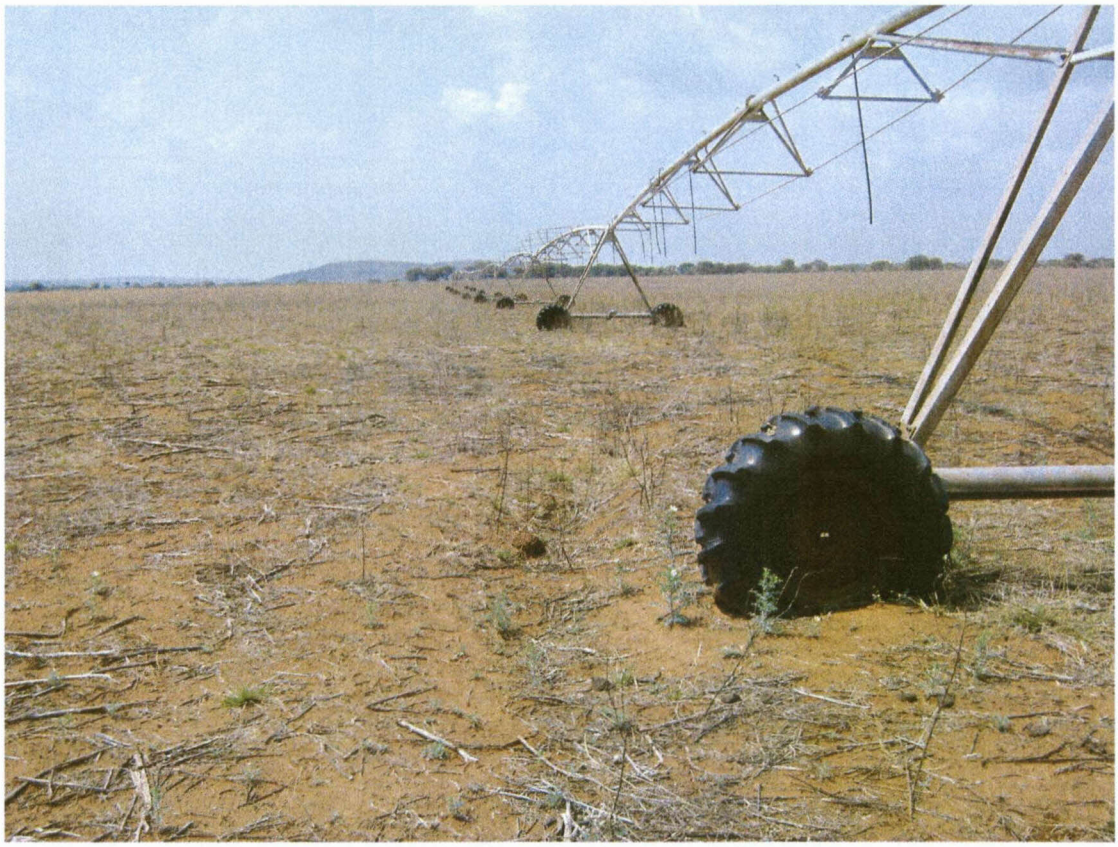

Figure 3.3: Old infrastructure and barren fields

Source: Kotze (2007)

3.4 Private sector involvement

This section presents an overview of SABMiller and their involvement in the Taung irrigation scheme since the early 1990's when SAB/SABM started collaboration with the North West Department of Agriculture to launch a barley growing project.

Established in 1895, SAB Ltd was the first industrial company to be listed on the Johannesburg Stock Exchange in 1897. The company became known as SABMiller plc in 2002 when it purchased the Miller Brewing Company in the US. SAB Ltd is the South African operation of SABMiller plc and currently produces 26 million hectolitres of beer per annum and sells 14 million hl of other beverages through its soft drinks division, ABI. SAB Ltd's operations effectively involve manufacturing, sales, distribution and marketing, supported by (among other functions) financial controls, supply chain management, human resource management and reputation management of the company as a whole (SAB, 2008). Manufacturing takes place at its seven breweries, whilst sales and distribution are efficiently managed by each region – manufacturing entails packaging, new product development, quality assurance, as well as the cultivation of raw materials such as hops and barley by SAB Malting and SAB Hop Farms (SAB, 2008).

Barley is an essential resource for SAB's beer production. Barley was traditionally grown in the Western Cape under dry land conditions. However, a combination of poor weather conditions over the years, and the growing of wheat as a competitor for land use in the region, meant that SAB was forced to increase its importation of barley. SAB, therefore, needed to reduce its geographical risk and to consider local regions that were more suited to growing new barley varieties introduced from Europe and Australia (Kotze, 2008).

In the 1990s, South African Breweries (SAB) and South African Breweries Malting (SABM) collaborated with the North West Department of Agriculture and the Department of Land Affairs, and together they established a barley-growing project in Taung (BFAB, 2008). The rationale for this initiative was to uplift the economy and the

living standards of the people residing in Taung. Endeavouring to achieve this goal, SAB agreed to pay for all producers' operating expenses, i.e., technical expertise and inputs, while the provincial government agreed to provide the necessary infrastructure for the project. This arrangement has remained unchanged until today.

The project began with 55 farmers and by the end of 2004, farmers participating in this scheme had grown to 178. At this point, 3500 ha of land is under barley production using sprinkler or pivot irrigation systems. The project can be easily expanded to cover 5200 ha (BFAB, 2008). By the end of the 2004 production season, the Taung scheme supplied 10 000 tons of barley out of the 42 000 tons that is required by SAB for malting, earning in excess of R20 million. This was a large increase in earnings considering that they earned R2.4 million in 1998 (BFAB, 2008). The economic prospects of this project are good, bearing in mind that during the 2004/2005 season, maize and groundnuts were introduced as a summer crop and yielded 5000 tons and 150 tons, respectively, spreading the chances of alleviating poverty in the area.

3.5 South African Breweries Malting as financial intermediary

Compared to most commercial banks, agri-industrial firms often have an advantage in supplying smallholders with credit. The close relationship SABM has with its contract farmers lowers the risk of default, allowing the firm to lend money to growers unable to obtain loans from commercial banks. The risk is lower for SABM for the following reasons: 1) credit is supplied in the form of inputs; 2) SABM monitors the use of inputs so that purchased inputs cannot be resold; 3) certain entry barriers to market limit the growers' ability to sell their produce in alternative markets, inclining the grower to sell his crop to SABM; 4) unlike a commercial bank, SABM has the advantage of acquiring debt directly from the crop revenue; 5) default from the farmer will result in the farmer not acquiring credit in the future. According to SABM, they, and especially the Agricultural Services Department, play an ongoing role in performing the following activities:

- Before the planting season, Information Days are held to give feedback on the previous year's crop and to recruit producers for the coming season.
- Negotiations are held with input suppliers (fertiliser, pivot maintenance and chemical companies) and contractors (soil preparation, planting, fertiliser applications, weed control etc.) in order to bargain for the best prices for the producers.
- Contracts are signed with individual producers and then captured in an electronic format.
- Just prior to the planting season, tender opportunities are given to contractor and fertiliser suppliers. After selection of the successful tenders, an agreement and working schedule is drawn up.
- One month before planting, contracts are signed for each individual farmer with the electricity supply commission (Eskom).
- Soil samples are drawn from each contracted field and are sent for analysis. On receipt of the results, fertiliser recommendations are made for each individual field.
- Soil preparation and fertiliser applications are coordinated and all equipment is checked to ensure the correct settings.
- A seed and fertiliser distribution schedule is compiled and procedures are coordinated.
- Negotiations are undertaken with Absa, ARS and Agricola (insurance companies) to update the insurance policy and to obtain the best tender.
- They coordinate the planting of all of the fields, including correctly setting all of the equipment.
- An irrigation schedule is established for each individual pivot (measuring of end wheel speed etc.) and is monitored throughout the season.
- The insurance company is issued with a list of producers and contracts are signed.
- All contractor requisitions are signed, captured in a financial system, processed, paid and reconciled.
- Negotiations with Senwes (agent) on handling and storage costs, intake procedures (grading) and upgrading of intake facilities are undertaken.

- Nitrogen topdressing is coordinated and all application equipment is checked and calibrated.
- Each individual field is checked for weeds and where necessary, herbicides are applied by a selected contractor.
- All contractor requisitions for herbicides and application costs are signed off, captured in a financial system, processed, paid and reconciled.
- Each individual field is checked for insects and where necessary, insecticides are applied by a selected contractor.
- All contractor requisitions for insecticides and application costs are signed off, captured in a financial system, processed, paid and reconciled.
- Negotiations are held with harvesting contractors in order to bargain for the best prices for the producers.
- Tender opportunities are given to harvesting contractors and after selection of the successful tenders, an agreement and working schedule are drawn up.
- Meeting with Senwes (agent) to finalise intake procedures is undertaken.
- Coordination and monitoring of the harvesting (checking of moisture content, harvester settings etc.), transport and intake processes are undertaken.
- All contractor requisitions for harvesting and transport are signed off, captured in a financial system, processed, paid and reconciled.
- Input suppliers, e.g., Eskom, and pivot maintenance contractors are captured in a financial system, processed, paid and reconciled on a monthly basis.
- Senwes (agent) is supplied with an administration intake system. Intake data of individual producers is electronically transferred to SABM and then captured in a financial system, processed, paid and reconciled.
- Marketing of feed grade barley on behalf of the individual farmers at the best possible price is undertaken.
- An advisory service is provided on a daily and ad hoc basis throughout the production season. Handling of all queries regarding sessions, payments, grading etc. is undertaken.

3.6 The producers

A typical farm unit in the Taung project produces mainly barley and maize under pivot irrigation on land provided by the North West Provincial Government. The pivots are maintained by the North West Department of Agriculture, Conservation and Environment, while the farmer is responsible for minor repairs as well as the replacement of electrical cables in the case of cable theft. SAB/SABM provides off-take contracts to the farmers for both the barley and maize, hence providing the farmers with a secure and stable market in return for acceptable quality and quantities of barley and maize. The producers have the following responsibilities:

- Attendance of Information Days to familiarise themselves with options and opportunities;
- Decisions regarding what to plant and with whom to contract;
- Signing of contracts and checking legal aspects;
- Assistance with soil sampling;
- Ordering of irrigation water for pre-soil preparation irrigation;
- Checking with SABM regarding dates that contractors will cultivate, plant and fertilise his/her land;
- Attending to all of the above-mentioned processes in order to check if it is done to his/her satisfaction and to sign it off;
- Obtain irrigation schedule programme from SABM, order water and irrigate accordingly;
- Daily inspections of his/her field, especially when irrigating, in order to rectify nozzle blockages and to report on irrigation equipment failures or breakdowns;
- Reporting of any power failures to Eskom directly or through SABM/Department of Agriculture;
- Check repairs performed on irrigation equipment;
- Signing of crop insurance contracts;
- Scouting for non-conformities in his/her planting (weeds, insects, climatic damage, e.g., frost, hail etc.) and reporting it;

- Attending to all crop protection actions (spraying for weeds and insects) in order to check if it is done to his/her satisfaction and to sign it off;
- Ensure that he/she obtains a delivery number from Senwes in order to be allowed to deliver his/her product at the Magogong silos;
- Checking field on a daily basis to decide when irrigation can be terminated;
- Checking with SABM on dates that a harvest contractor can harvest his field;
- Attending to all of the harvesting processes in order to check if it is done to his/her satisfaction and to sign it off;
- Keeping of records of all his/her input costs, yields harvested from his/her field as well as pay-outs; and
- Reconciling his/her pay-outs with all of his statements and to query any problems.

3.6.1 Agricultural production in the scheme

Taking into account the average household size of the 411 farmers in the Taung irrigation scheme (5.9 persons in a household), there are 2450 people whose livelihoods are derived from irrigation agriculture (NWDAE, 2007). Considering the number of people who are dependent on the scheme, one understands the importance of the scheme and the ramifications of whether it succeeds or not. There are basically 6 important crops which are produced in the scheme, namely Alfalfa, Barley, Maize, Groundnuts, Cotton and Wheat (Erasmus, 2008).

3.6.1.1 Alfalfa

Many of the farmers in this particular irrigation scheme produce alfalfa. There are various reasons for choosing alfalfa as a crop, ranging from income being more constant over a given time period to that there is an existing knowledge base about alfalfa. One of the main reasons or determinants of why alfalfa is planted is because the buyers travel to the plots and then buy the crop at the farm. By buying the crop on the farm, the seller (farmer) saves time, money and effort in that he or she does not need to look for and hire transport, giving them ample time to focus on the production aspect of farming (Erasmus, 2008).

Buyers of alfalfa indicate that they want to expand their purchases. The main reason for this is that a relatively strong demand exists for alfalfa, more specifically for processed alfalfa. This emphasises the importance of alfalfa in the animal feed sector in Taung (Kotze, 2008).

Figure 3.4 shows some of the fields planted with alfalfa for the livestock industry, although most of the alfalfa is exported to nearby towns and is not used for the farmer's own consumption; it contributes to the income of the farmers. As there are no processing plants for alfalfa in the Taung area, all of the produce is sold in the unprocessed form.

Figure 3.4: Alfalfa under centre pivot irrigation
Source: Kotze (2007)

According to a study by Grönum, Van Schalkwyk, Jooste, Louw, Du Plessis, Geldenhuys and Geldenhuys (2000), increasing input costs is considered to be the most important factor constraining expansion of alfalfa, and this is attested to by respondents in the

bigger Vaalharts Area. The second most important reason is increasing machinery costs, followed by water costs and water management. The transport costs, profit per hectare compared to other crops, and labour intensity of the specific crop is also considered as constraining. Although this study mainly focused on commercial farmers, the smallholder irrigators also experienced all of these constraints.

3.6.1.2 Barley

Figure 3.5: Barley under Centre pivot irrigation.
Source: Kotze (2007

Barley is produced in only three of the five parts of the scheme, namely Bosele, Tsidiso and Pudimoe. Bosele has the most hectares under barley with 760 hectares, and was followed by Pudimoe with 550 hectares; Tsidiso had the least number of hectares (280 hectares). Cumulatively there were 1590 hectares planted with barley for the 2007 season, all under centre pivots. Figure 3.5 presents one of the pivot fields that was planted with barley for South African Breweries.

3.6.1.3 Wheat

The North West Province produced 143 000 tons of wheat in the 2006/2007 production year, which accounted for 6 % of the South African total. However, wheat is not a naturally strong commodity in the North West province. Wheat is not produced on a commercial basis by the small-scale farmers in Taung, most of the wheat produced in the Taung area is consumed locally (Erasmus, 2008).

3.6.1.4 Cotton

According to Erasmus (2008), smallholder farmers have not produced much cotton in the area for the last decade, but the Cotton Growers Association at Vaalharts is in the process of expanding their production and is incorporating more of the farmers in the Taung area to supply their growing demand.

The development of the cotton sector forms the core of the Implementation Programme Plan (IPP) for the South African cotton sector. In order to achieve the industry growth objectives in the Strategic Plan, Cotton SA is focusing on expanding cotton production by established commercial farmers (large and small-scale) through enabling access to contract ginning services or forward integration into the farmers' own ginning; they anticipate facilitating emerging farmer development projects in each of the traditional cotton growing areas. As Taung was once known for its cotton growing capabilities, it is important that Cotton SA include them in their action plans (Cotton SA, 2004).

According to Cotton SA (2004), the model developed specifies the establishment of emerging cotton farmers in revived irrigation schemes (as is the case with Taung) in order to reduce the risk of adverse weather conditions and to maximise the yield per hectare. The programme will lean heavily on Government's LRAD programme as well as on the revival and/or development of general and irrigation infrastructure on mostly government-owned irrigation schemes. The main objective is to provide, where possible, emerging farmers with the opportunity to grow into commercial farmers. The model therefore suggests close cooperation between government and the developers to ensure

that the right people are selected for these initiatives and that land ownership will only be granted to farmers that have proven themselves over a specific number of seasons.

3.6.1.5 Maize

Maize production is one of the North West Province's biggest cash crops: it produced 1.7 million tons in the 2007/2008 production year, excluding the former homelands (SAGIS, 2007). It is thus important to recognise the potential maize production has in the Taung area in that it makes a significant contribution to the provincial total. When considering that Taung has the potential to produce an average yield of 12 tons of maize per hectare under irrigation, it is safe to say that if all of the farmers producing maize under centre pivots could realise 10 tons of maize per hectare, this would mean that the area would have the potential to market 24 900 tons of maize each season if all centre pivots were to produce maize as a summer crop. During the 2007/2008 production year a total of 1590 ha of maize were planted with an average yield of 10.5 tons per hectare producing a total of 16695 tons of maize.

3.6.1.6 Groundnuts

Groundnuts are mainly produced in the North West Province (61 %), Free State (24 %) and Northern Cape (11 %). The North West Province produced 14 300 tons of groundnuts in the 2007/2008 production year (SAGIS, 2007), which is less than what the province produced in the previous production season. The groundnut potential yield (3-3.5 ton/ha) in the Taung area is far above the average yield for the North West Province, which is a mere 1.09-1.25 ton/ha. However, only 200 ha are planted with Groundnuts in the Taung irrigation scheme (Erasmus, 2008). Groundnuts can be marketed in shelled or unshelled form in both formal and informal markets. Formal markets require larger quantities of produce. Table 3.1 presents a list of all of the markets for groundnuts in the vicinity of the irrigation scheme.

Table 3.1: Markets for Groundnuts in the vicinity of Taung

Firm Type	Trade Name	Town
Processor	Ambassador Foods	Hartswater
Processor	Elkana	Hartswater
Trader	Lemacor	Hartswater
Processor	Naledi Peanut Butter	Hartswater
Trader	Peanut Farm Agente	Hartswater
Processor	P-Farm Snacks	Hartswater
Trader	SA Groundnut Marketing (Pty) Ltd	Hartswater
Trader	Vaalharts Groundnuts Marketing CC	Hartswater
Processor	Vaalharts Graan	Jan Kempdorp

3.7 Irrigation infrastructure

The Taung irrigation scheme forms part of the Vaalharts Water Users Association. The total area of scheduled irrigation by the Association is some 36 000 ha. The Taung irrigation scheme irrigates 3544 ha of land by means of centre pivot irrigation, flood irrigation and sprinkler irrigation.

The Scheme receives water from the Vaalharts main canal. The capacity of the canal where the water is released from the Vaal Dam is 136 800 m^3 per hour. The Taung canal system is designed to manage 18 000 m^3 per hour. The whole canal system had an annual water loss of almost 32% due to leakages, working loss and evaporation (Harbron, 2009).

According to Harbron (2009), the Vaalharts Water Users Association turned their attention to the Water Administration System (WAS) developed by NB Systems CC to minimise losses. The WAS programme is currently in use at all the major irrigation schemes and a number of smaller irrigation boards throughout South Africa. WAS is designed to be a management tool for irrigation schemes, Water User Associations (WUAs), Catchment Management Agencies (CMAs) and water management offices that want to manage their water usage, water distribution and water accounts. WAS can handle any number of abstraction points and measuring stations on canal networks, pipelines and rivers.

According to Benade (2009), WAS is an integrated database-driven system with many water management capabilities. WAS can be implemented in a small water office that manages a few abstractions and measuring stations, or at a CMA level that manages thousands of abstractions and measuring stations.

WAS is used for the efficient administration of:

- Address information;
- Scheduled areas;
- Water quota allocations;
- Water delivery through pressure-regulated sluice gates, measuring structures and water meters;
- Water transfers between users (automatically and manually);
- Water use calculations for planted areas based on crop water usage data;
- Date and time related flow data collected from electronic loggers or mechanical chart recorders;
- Discharge tables (DT) to do conversions between water depth and flow rate for measuring structures or vice versa;
- Listing rateable areas (LRA) information;
- Calculating scheme water balances;
- Calculating water releases for water distribution through canal networks, pipelines and rivers taking lag times, evaporation, transpiration and seepage into account;
- Billing systems that link to the water usage information;
- Flexible tariff sets based on water usage, a flat rate or a scheduled area;
- Images and photos that can be linked to different types of information in the database;
- Mail merge facilities for sending letters to clients;

By implementing the WAS programme, the Vaalharts Water Users Association managed to decrease the total loss of water to 26% (Harbron, 2009). This has been achieved, however, just by managing it more accurately and loss due to leakage still exists.

3.8 Farming infrastructure

Many of the centre pivots in the irrigation scheme have been lying unproductive for some years now. Centre pivots have deteriorated from the lack of maintenance, the electrical cables have been stolen and most of the tires are flat and have perished from not being used. Due to the long and varied history of the scheme, the need for restoration is imperative. That said, there are some other irrigation infrastructures that are still in good condition and are in daily use. Generally, the irrigation infrastructure that is in working order belongs to those farmers who have acquired a contract with SAB.

SAB and the Department of Agriculture reached an agreement that SAB pay for all producers' operating expenses, i.e., technical expertise and inputs, while the Department of Agriculture replace and maintain the centre pivots.

3.9 Summary

The North West Province is a province troubled with a lot of rural poor people. Most of these rural poor make their living from agricultural activities. For any economy to develop and show growth, the first step in development is better agricultural production.

The Taung irrigation scheme is a typical example of the many irrigation schemes that were formed during the homeland era. These homeland areas were mainly developed for employment purposes and for food provision to the rural poor. Most of these irrigation schemes are redundant and only a few of them are still in working order. The next chapter describes the data collected from five villages in the Taung irrigation scheme.

CHAPTER 4

FARMING HOUSEHOLDS AND MARKETING MANAGEMENT

4.1 Introduction

The literature review in Chapter 2 has shown that there are various aspects that have an influence on the success of small-scale farmers. However, it has also been shown that small-scale farmer success is dependent on a number of variables that may be specific to households as well as relevant to the whole scheme. Literature has shown that success potential can be influenced by both technical and institutional factors. To be able to study these factors well, it is essential that information on characteristics of the farming households, their resources as well as market conditions within the existing institutional framework be obtained.

The objective of this chapter is, therefore, to give an overview of Taung in respect of the farmers, farming household characteristics and household composition. Further, human capital endowments and resources are described.

4.2 Questionnaire development

Data for the study was collected by making use of a structured questionnaire that was adopted from Magingxa (2007). Some amendments were made in order to fit the questionnaire to the particular environment and situation of the smallholder farmers in Taung. The objective was to conduct personal interviews with as many of the 411 smallholder farmers as possible. However, it was only possible to interview 151 of the small-scale farmers because the rest did not want to participate.

The questionnaire consists of ten divisions, namely: the demographic information regarding the household; human capital endowments; land and agriculture; planning and management; marketing; type of inputs used; institutions; infrastructure and capital;

resources available and finally, credit. The interviewers were trained before questioning the farmers and it was determined that everyone had the same understanding of all the aspects in the questionnaire. The smallholder farmers in the Taung irrigation scheme mostly speak Setswana. The Setswana language and the Sesotho language are very similar and all of the interviewers spoke Sesotho; ultimately, there were no major language difficulties and the farmers understood most of the questions very well. The completed questionnaires were checked after completion to make sure that everything was done correctly.

4.3 Age and household composition

4.3.1 Farmer age

Table 4.1 represents the average age of the interviewed farmers in the different areas of the Taung irrigation scheme. The number of farmers in each scheme represents a sample and not the whole population and was selected on proportional representation. The age of the farmers who were interviewed ranges from 26 years to 89 years, with an overall average of about 52 years. Rethuseng is the village with the youngest average of 49 years and Ipelegeng the village with the highest average age of farmers.

Table 4.1: Average age of farmers (n = 151)

Scheme name	Mean	Range of farmer age
Bosele (n=49)	49.65	26 - 72
Rethuseng (n=39)	49.21	30 - 80
Tshidiso (n=30)	56.13	29 - 80
Ipelegeng (n=8)	57	25 - 84
Areageng (n=25)	56.04	36 - 89

4.3.2 Household composition

Table 4.2 represents the household composition of the 5 different villages in the Taung area; households are divided into three groups, namely: children, males and females. The

age distribution displays normal and expected tendencies. In the ages of 10-18, the largest number of children occurred. Males and females were highest between the ages of 19-44.

Thus it can be seen that most of the households consist of able-bodied people who can provide labour and assist in the farming activities, which counteracts the high average age of farmers. The average household sizes range between a minimum of 2 up to a maximum of 13 people.

Table 4.2: Household composition (n = 151)

	Village name									
Age and Gender	Bosele		Rethuseng		Tshidiso		Ipelegeng		Areageng	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Child 0-4	20	8	17	7	17	9	1	2	8	6
Child 5-9	9	3	40	17	19	10	2	4	6	5
Child 10-18	72	28	36	16	54	27	22	47	27	20
Male 19-44	66	25	48	21	40	20	9	19	38	29
Male 45-64	25	10	20	9	11	6	1	2	10	8
Male >65	10	4	8	3	10	5	4	9	6	5
Female 19-44	22	8	34	15	22	11	2	4	21	16
Female 45-64	24	9	15	6	18	9	3	6	8	6
Female >65	13	5	13	6	8	4	3	6	8	6
Av. H/hold size		5.27		5.95		6.53		5.88		5.84

4.4 Human capital endowments

4.4.1 Education

The educational levels of the interviewed smallholders range from none to post-matric level. Figure 4.1 represents the educational levels of farmers, their spouses and their

children. Of all the farmers interviewed, more than 21% have never received any formal education. Generally, only 2% of all farmers have post-matric education. Considering farmer spouses, the figures were much the same as that of the farmers. The difference comes in with the children who are currently still living at home, and it seems that more of them are being educated, with more than 36% of them at a grade 12 level of education.

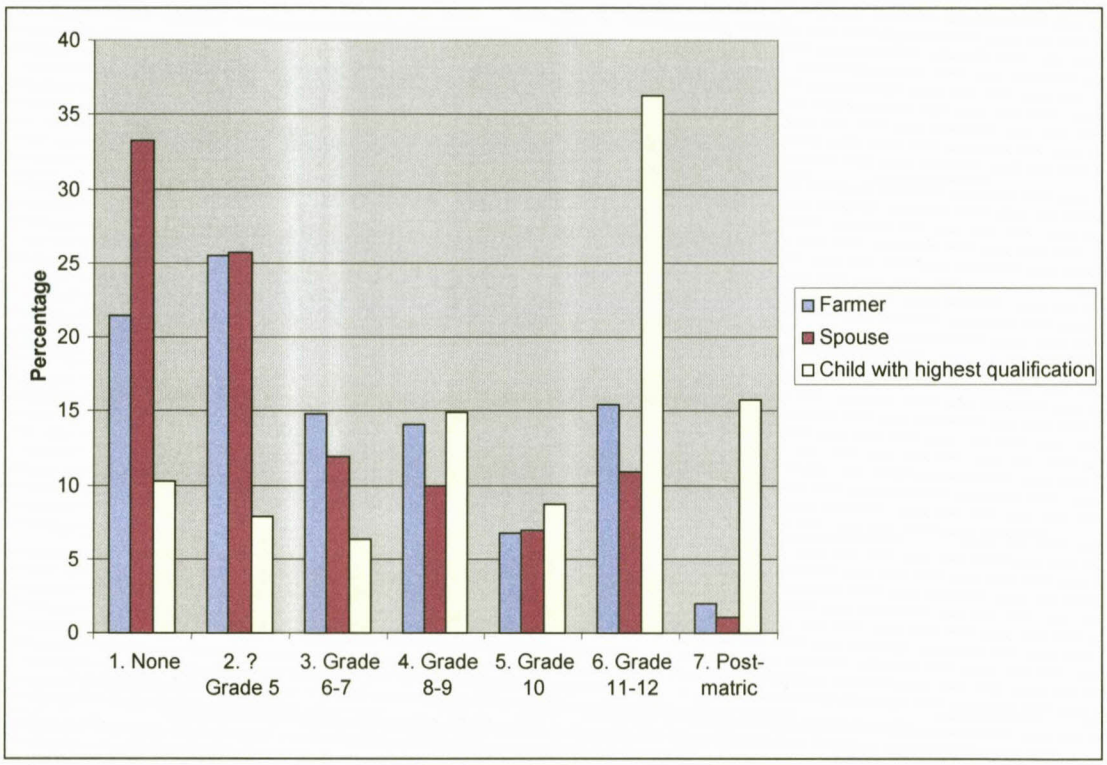

Figure 4.1 Educational qualifications of respondents (n = 151)

4.4.2 Language capabilities

Figure 4.2 shows that less than 36% of the farmers can read and less than 32% can write English. Afrikaans literacy is similarly low – less than 33% can read and less than 31% can write in the language. Greater literacy figures feature for the home language (Setswana) and only a small amount of the people cannot read or write in Setswana (about 15%). This figure closely resembles the figure for farmers who have never received any formal education, though it is slightly lower. This could be due to knowledge gained later in their lives.

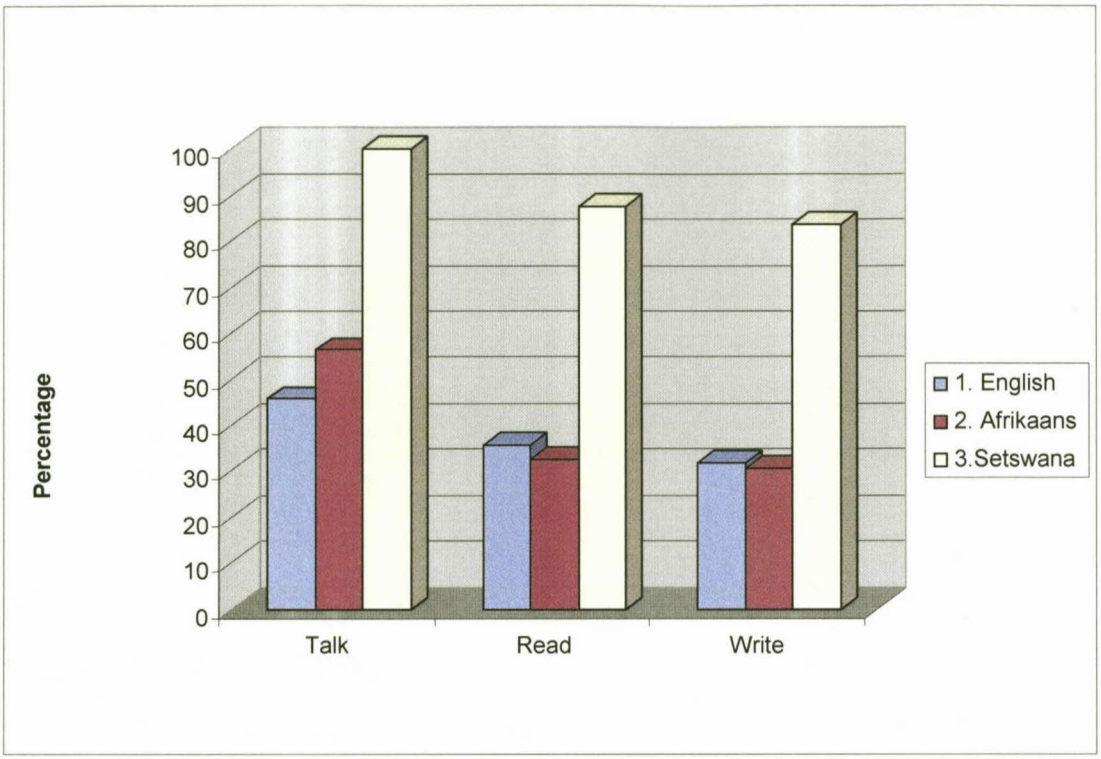

Figure 4.2: Language capabilities of the participating farmers (n = 151)

4.4.3 Farming experience

The experience referred to is farming experience that the farmers have obtained via the irrigation scheme in the years they have been part of the scheme. The average experience ranges from the lowest (12.3 years) in Rethuseng to the highest in Ipelegeng (20.4 years). This correlates with the average farmer age discussed earlier. Thus, the farmers with the most farming experience are the farmers with the highest average age and the farmers with the least farming experience are the farmers with the lowest average age. The overall mean between the 5 villages is almost 17 years of farming experience.

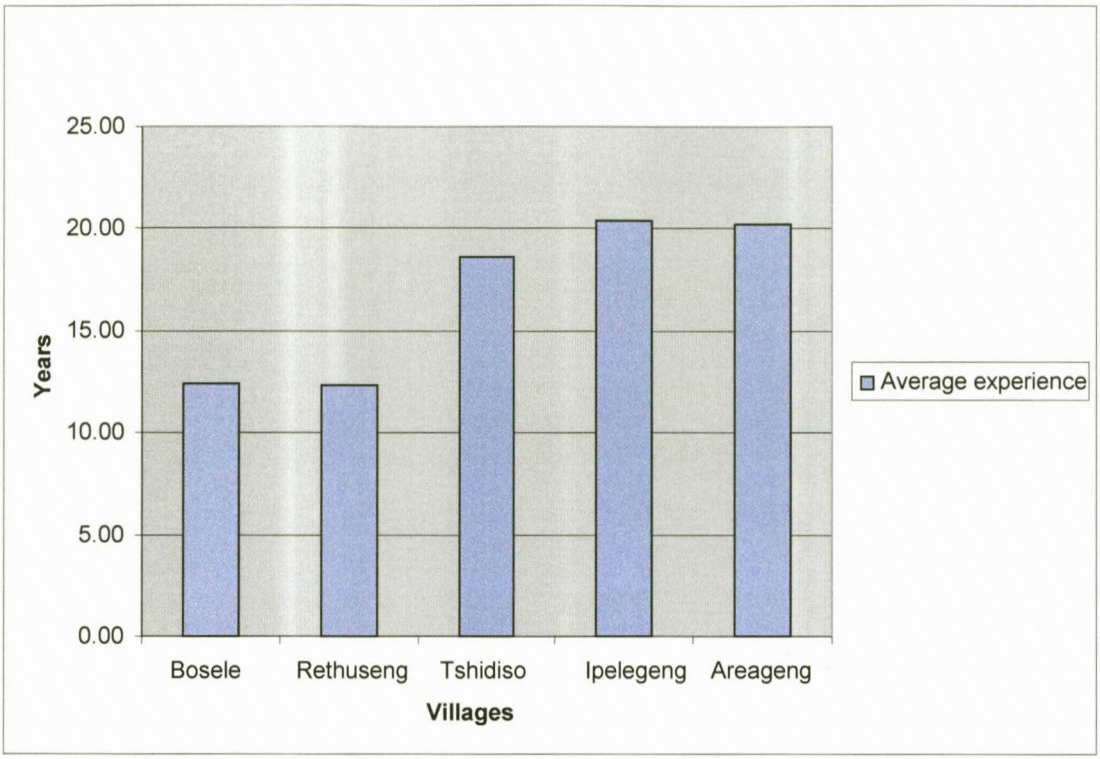

Figure 4.3: Farming experience in each village (n = 151)

4.4.4 Planning skills

The farmers in the study area had to make a selection between four categories, ranging from no planning through to thorough planning. Results of the planning skills are shown in Figure 4.4. The results indicate that almost 36% of the farmers confess to no plans whatsoever (the biggest group); almost 30% of farmers have some idea of planning; farmers that have rough or incomplete planning is at about 24%, and farmers that have thorough plans comprises a small percentage, almost 13%. Planning skills is thus an aspect which is very underdeveloped in the Taung irrigation scheme.

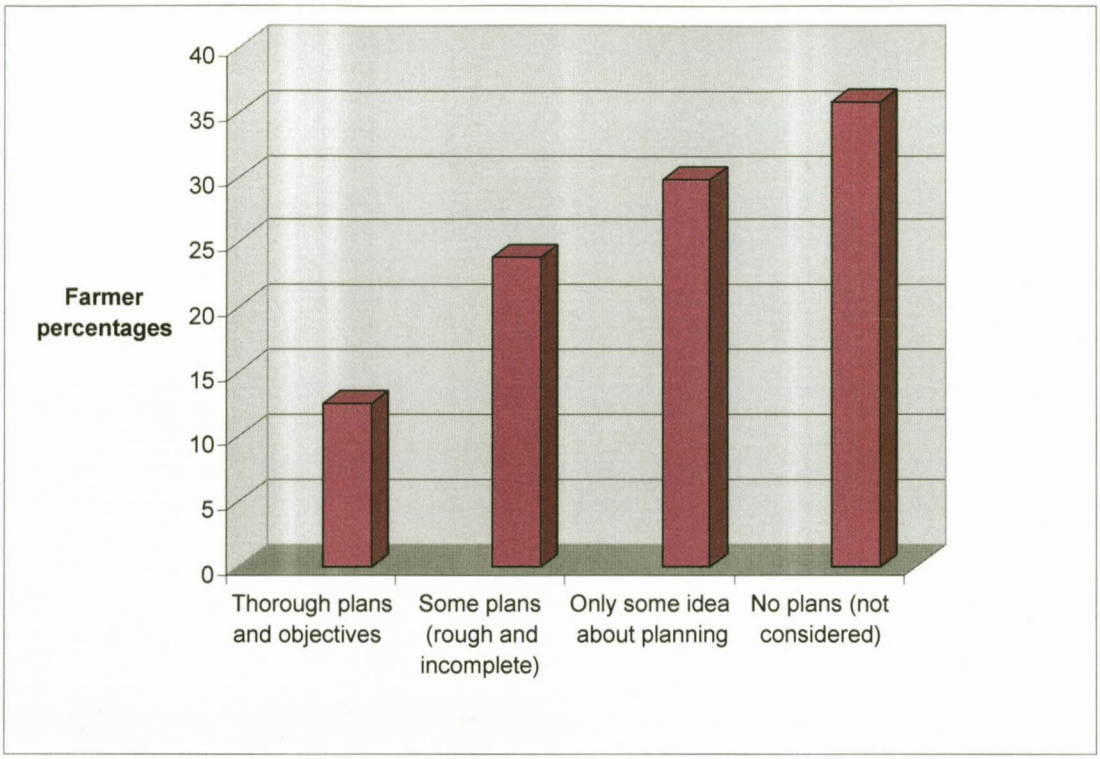

Figure 4.4: Farmer planning skills (n = 151)

4.4.5 Financial management and record keeping

Record keeping is essential in financial management and it is considered as the first step of financial management. When asking the participants if they thought that keeping financial records was important, 74.83 % indicated that it is important and the rest thought it to be less important. The farmers that answered 'yes' participated further in the questionnaire by indicating the importance of each of the following:

1) determining financial position;

2) decision-making and planning;

3) keeping the bank/co-op manager happy.

Figure 4.5 shows the results of farmer perceptions regarding record keeping. Almost 44% of the farmers indicated that keeping financial records is important to determine their current financial position, whilst 35% indicated that it is very important; the rest of the farmers did not consider it to be important.

The majority of farmers (about 52%) considered record keeping important for decision-making and planning, whilst almost 34% indicated that it is very important and 14% considered it not to be important.

The majority of farmers (68%) did not consider keeping financial records to be important with respect to keeping the bank/co-op manager happy, 23% thought it to be important and 9% thought it to be very important.

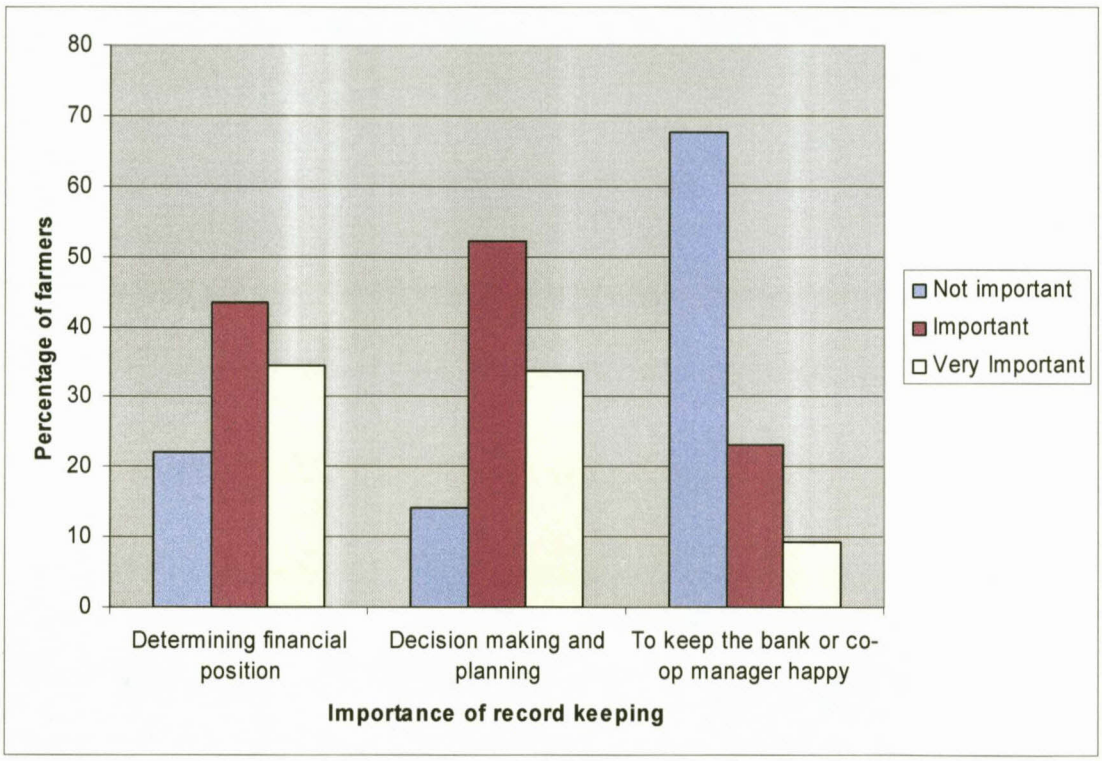

Figure 4.5: Farmer perception on the importance of record keeping (n = 53)

Most of the records that the farmers refer to are records that are kept centrally by the farmer organisations or the extension officer. Thus, farmers indicate that they do keep records when they actually do not. The main reason for the central bookkeeping system is due to the fact that some farmers are illiterate. It is a manner of assisting the farmers but it is not an accurate measure with reliable results.

4.5 Resources

4.5.1 Farm size and land use

According to Golder Associates (2005), the irrigation scheme was established on land that existed under communal tenure arrangements, whereby user rights were allocated by the tribal leadership on a hereditary basis. The development within the Taung area of the province possesses characteristics that are considered typical of what prevailed in the erstwhile Bophuthatswana Republic, as this former 'homeland' was known. The particular scheme analysed comprises 4000-5000 ha of communal and arable land which has been partitioned among 411 farmers who do not have to pay anything for the user rights, in keeping with the precepts of the communal tenure systems prevailing in the traditional black areas of the country.

Plot sizes in the different villages are indicated by Figure 4.6. All of the villages have a plot size of 10 ha except for Rethuseng, where the plot size is 7.5 ha. The plots are all under irrigation: most of them are under centre pivot irrigation while the rest are under sprinklers.

When farmers were questioned on their satisfaction regarding the size of the plots, more than 52% indicated that they were not satisfied with the size of the land, and the main reason for such dissatisfaction was because the income derived there from was perceived to be too little. Almost 48% were satisfied with the size of their plots.

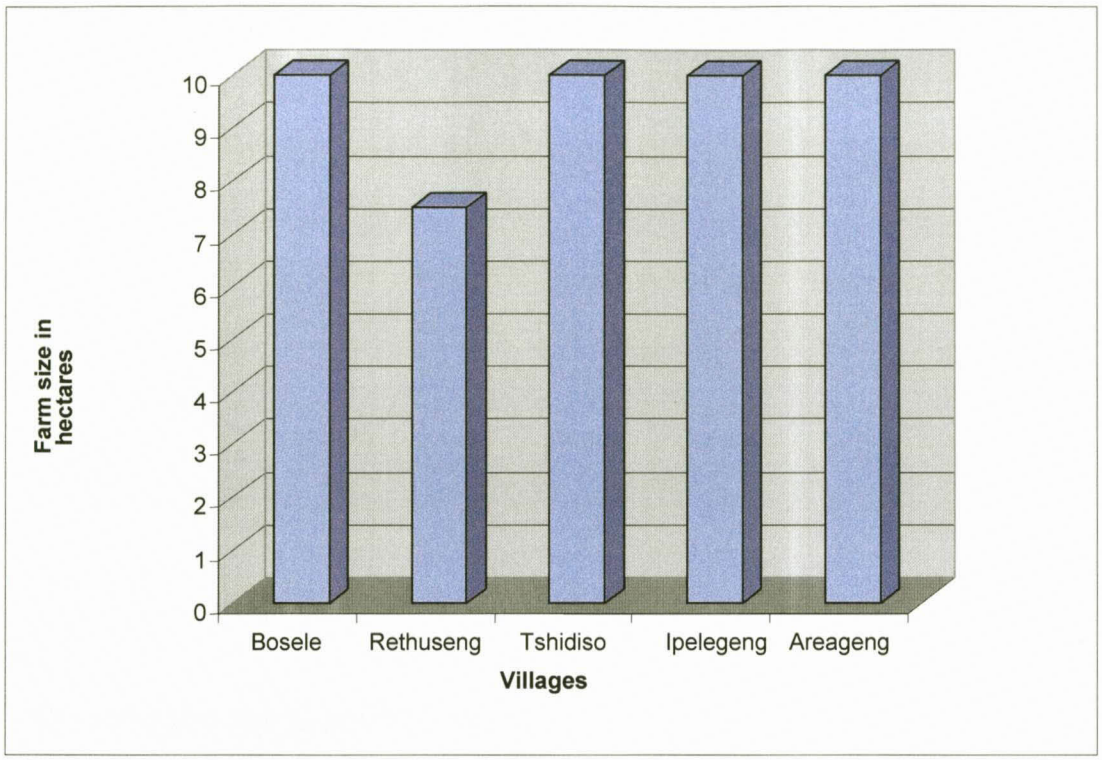

Figure 4.6: Plot sizes of the villages in Taung

4.5.2 Infrastructure

Most of the infrastructure around the major cities of South Africa is relatively well developed and has efficient transport mechanisms to reach the markets. Rural areas, on the other hand, are underdeveloped when it comes to infrastructure. Abbott (1986b, p38) stated that in order to improve marketing of smallholder farmers' produce, a marketing infrastructure that is better suited to the needs of the smallholder farmers should be implemented. This objective will be reached when easy access to markets, inputs and transport are made available to the farmers.

When farmers were questioned on the availability of certain forms of infrastructure in their area, most of them were satisfied with the infrastructure they have. Figure 4.7 indicates the availability of essential infrastructure in the Taung area.

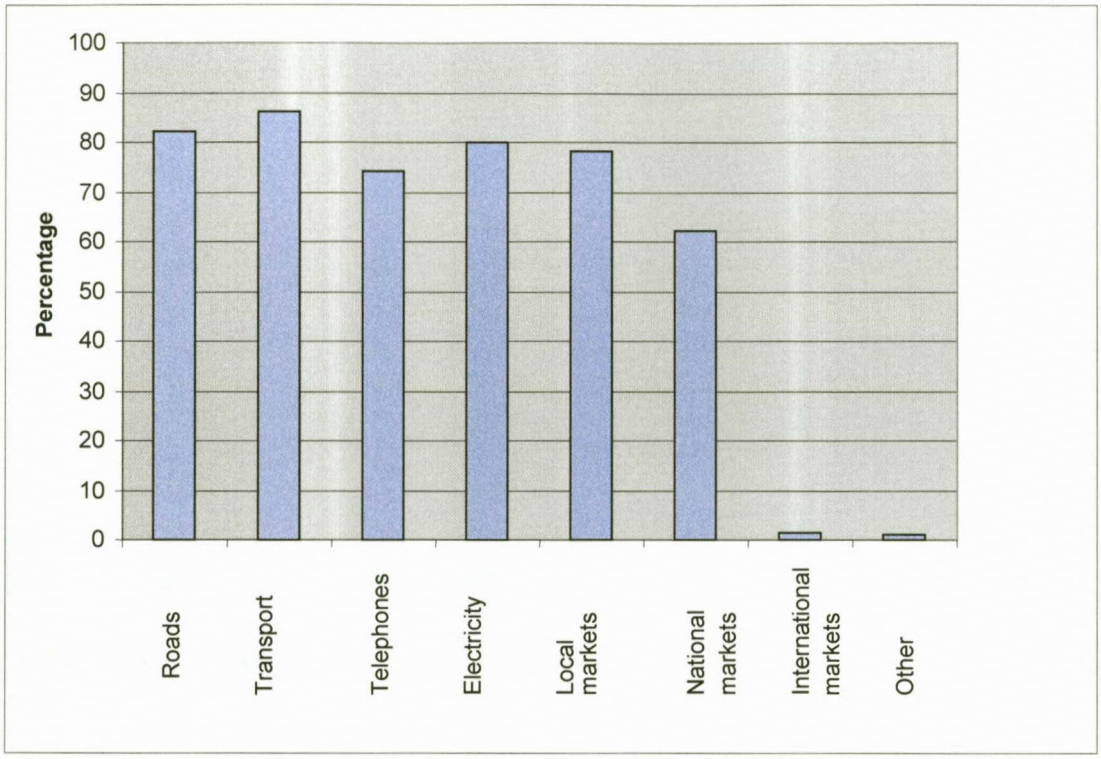

Figure 4.7: Availability of infrastructure (n = 151)

4.5.2.1 Roads

The Taung areas are serviced by a tar road running through the central parts of the region and have a series of gravel road networks that connect the villages. The national road is in good condition, while the gravel roads are in a poor condition. Even though the availability of roads is quite good, it is important that a road rehabilitation programme be implemented to upgrade the current road conditions, whereafter regular road maintenance exercises should be followed. Good road conditions are important for the extraction of produce, delivery of inputs (seed, fertiliser etc.) and to gain access to the irrigation lands.

4.5.2.2 Transport

The Taung area is serviced well by various bus operators as well as many taxi services taking the people to any destination they require.

It is clear that the passenger transport sector is well developed; on the other hand, the transport of goods is not that well developed. Farmers will have to hire contractors at a very high rate to transport their produce to the markets. However, the farmers that have acquired contracts with SAB do not have this problem as SAB supplies all of their input needs and collects the produce on the plots.

4.5.2.3 Telephones

Communication has become an inevitable part of the production process – used for enquiring about the best input suppliers, prices, production methods etc. to allocating markets and bargaining for the best price for the produce. Most of the farmers (more than 70%) indicated that they have access to a telephone or cellphone.

4.5.2.4 Electricity

The majority of farmers (80%) indicated that they have electricity available to them. Electricity provides a cleaner, healthier way of preparing food for the family. Families traditionally prepared their meals on wood fires and the excessive smoke led to various lung problems, thus this method is a health hazard to the whole family. The operation of the centre pivots also relies on electricity.

4.5.2.5 Local markets

The general feeling among the farmers was that they have sufficient access (almost 80%) to local markets; however, the structure of the local markets can vary from being an informal little shop alongside the road to the local co-op in the nearest town.

Of the 151 farmers who participated in the questionnaire, 62.25% of them indicated that they have a contract with the South African Breweries to produce barley on a yearly contractual basis. These farmers should be better off than the rest as they do not have the same problems in finding markets, inputs and transport for the whole production process.

4.6 Institutions

4.6.1 Services

One of the most important factors in agriculture is the support service that extension officers provide to the farmers. More than 85% of the farmers indicated that they need extension services, as seen in Figure 4.8.

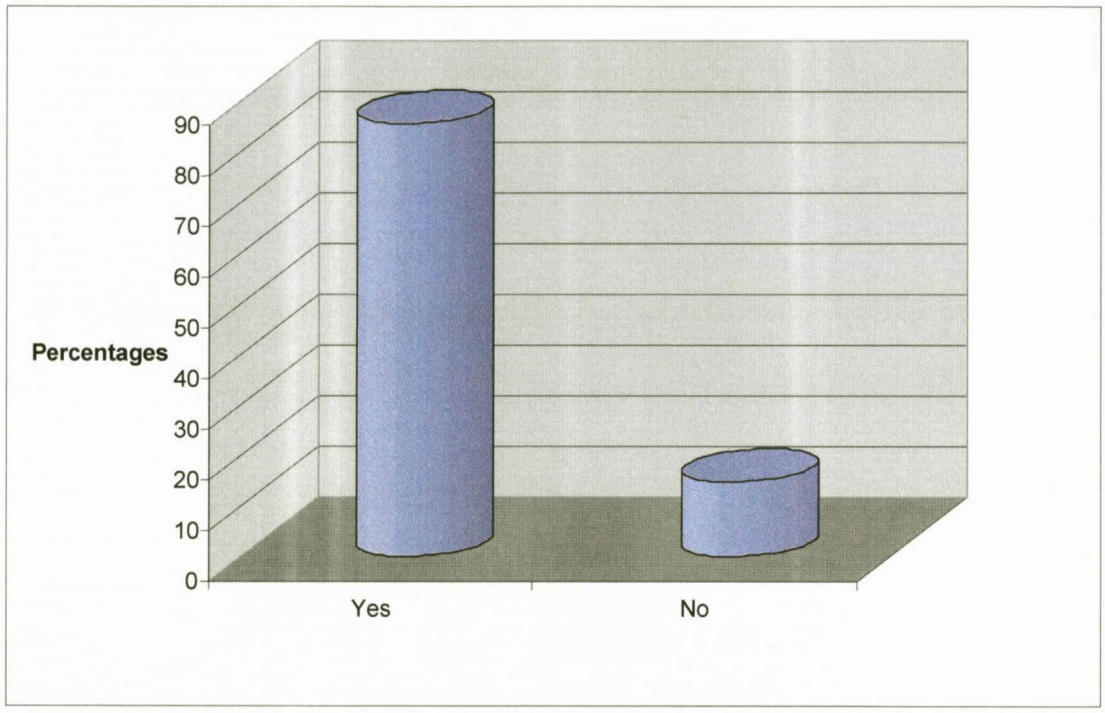

Figure 4.8: Farmers' need for extension services (n = 151)

Local government has provided extension services since their withdrawal of support to the agricultural sector. This study focused mainly on three categories of agricultural extension services: government extension services, cooperative extension services and input supplier extension services. Table 4.3 indicates the supply and demand for the extension services in the three categories.

Table 4.3: Supply and demand for extension services and farmers' perceptions (n = 151)

Accessibility and availability of extension services	**Percentage**
Government extension system	68.21
Cooperative extension system	48.34
Input suppliers	29.8
Times visited by an extension officer this year	**Mean**
Government extension officers	72
Cooperative extension officers	38
Input supplier extension officers	8
Total	118

The first part of Table 4.3 indicates the perceptions of farmers about the availability of extension services to them, whilst the second part shows the number of times that the farmers have been visited by the various extension officers throughout the year.

It is important to note that the above table is a summary of all the villages in the Taung area and that it differs from village to village, however, not on a big scale. The data was collected in 2007/2008 and it is based on what the farmers could remember. From the above table it seems that the government extension service in Taung is very active.

Table 4.4 indicates the farmer perceptions regarding to what extent they think the extension services officers can provide them with the necessary information required to make decisions regarding technical and financial decisions.

Table 4.4: Farmers' perceptions on the knowledge of the extension services officers

Extension services	**Technical**		**Financial**	
	Yes	No	Yes	No
1. Government extension officers	74	26	67	33
2. Cooperative extension officers	59	41	58	42
3. Input supplier extension officers	49	51	44	56

Results indicate that almost 74% of farmers trust government extension officers to have the necessary technical knowledge whilst 67% trust that they have the necessary financial knowledge. Considering the co-op extension officers, 59% of farmers trust that they have the necessary technical knowledge and 58% trust that they have the necessary financial knowledge. The farmers' perceptions on input suppliers show that the majority feel that they are incompetent in giving technical advice, demonstrated by a figure of 51%, and also that they are incompetent in giving financial advice, with 56% of the farmers feeling this way. This could be due to the fact that the farmers have the least contact with the input suppliers. When looking at Table 4.3 it should be noted that the input supplier scores the lowest when it comes to accessibility and the number of times they visit the farmers. This leads to a lack of trust with respect to the input suppliers.

When farmers were consulted about their need for credit, 89% of the farmers indicated that they need credit for production activities; however, only 74% of the farmers indicated that they actually do use external sources of credit. In all of the surveyed areas, a total of 72% of farmers indicated that credit is available to them as smallholder farmers. The rest of the farmers (28%) gave reasons as depicted in figure 4.9 as to why credit is not available to them.

The main reason (34%) why the farmers do not have access to credit is due to the fact that banks do not want to supply credit to farmers if they do not have any security. They reason that the farmers do not own the land they farm on, and thus it cannot be used as collateral. The next big reason (28%) is a common occurrence amongst rural people: the fact that they do not understand how commercial banks and other credit providers work and thus do not know how to organise credit for themselves. Other reasons include interest rates being too high, farmers' poor repayment abilities and some of them claim that they do not need the extra money.

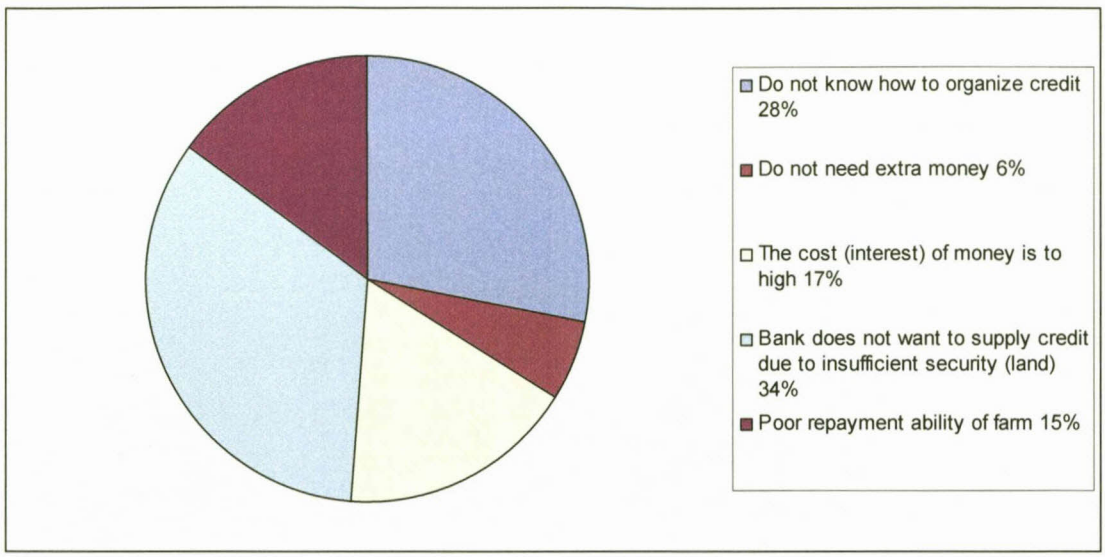

Figure 4.9: Reasons why credit is not available to smallholder farmers (n = 151)

4.6.2 Sources of information

As shown in Table 4.5, smallholders make use of various information sources that they use to make decisions concerning their farming operations and management. The decisions to be made have been categorised in Table 4.5 into technical, financial, marketing, information on new technologies and training.

Table 4.5: Information sources

Sources for decision-making and information	Technical decisions	Financial decisions	Marketing decisions	Information on new technologies	Training
Radio	14.57%	23.18%	24.5%	19.21%	7.95%
Television	17.22%	21.19%	16.56%	20.53%	8.61%
Extension publications (leaflets etc.)	3.31%	3.31%	4.64%	5.3%	2.65%
Co-farmers/neighbours	9.93%	11.92%	15.89%	11.92%	10.6%
Department of Agriculture Extension officers	47.68%	51.66%	49.67%	53.64%	47.68%
Co-operative extension officers	19.21%	20.53%	19.87%	17.22%	15.89%

No one: use own physical or technical records	0.66%	0.66%	0.66%	0.66%	1.32%
No one: use own financial records	-	-	-	-	0.66%
Bank manager	1.32%	0.66%	1.32%	0.66%	1.32%
Supplier of inputs	2.65%	1.99%	3.97%	3.97%	3.97%
Sell to the buyer who is the closest to my farm	-	-	0.66	-	-
Market agents	-	0.66%	-	0.66%	0.66%
Read in the press (newspapers, magazines)	0.66%	0.66%	1.99%	0.66%	1.32%
Chief/village leader	-	-	-	-	-

From the above table it can be seen that the surveyed farmers mostly rely on the Department of Agriculture to provide them with all of the information they require in all of the different categories. Generally, this is due to the fact that this is the extension service they are most often exposed to.

After the government extension officers, there seem to be four other information sources that play a substantial role, but to a lesser extent: radio, television, co-op extension and co-farmers. Other sources that provide a substantial amount of information on technical decision-making are co-operative extension officers at 19.21%, followed by television (17.22%) and radio (14.56%).

The second most important source of acquiring the financial information for decision-making, after the government extension, is radio (23.18%), followed by television (21.19%) and then co-op extension services (20.53%). Again, it is interesting that the figures for the input suppliers are so low, especially as they are also the market providers in the case of those farmers who have acquired contracts with SAB. This is mainly due to a lack of knowledge on the farmers' part. Bank managers are less important, as smallholder farmers mostly receive credit from other institutions, like government grants and SAB.

The government extension officers play the biggest role in the marketing segment and they give the most advice as to who the farmers should market their produce to. In some instances the extension officers also try to acquire markets for the smallholder farmers. Radio has the second highest role with respect to information provision regarding marketing decisions (24.5%), followed by co-op extension (19.87%), television (16.56%) and co-farmers, albeit to a lesser extent.

In the case of gathering information on new technologies, television plays the second biggest role, after government extension, with 20.53% of farmers utilising it for this purpose. It is followed by radio, co-op extension and co-farmers. The same four categories feature when training information is needed; after government extension is co-op extension, which is utilised 15.89% of the time, followed by co-farmers, television and radio.

It is clear that the government extension officers play the biggest role in all of the decision-making categories, and other main sources of information include radio, television, co-op extension services and co-farmers or neighbours.

4.6.3 Farmer organisations

Farmers can acquire substantial benefits when they are structured within an organisation. They have more bargaining power when it comes to buying inputs and they can also realise economies of scale and thus acquire inputs at a lower prize. Well-established farmer organisations more easily absorb new information and technologies as they reach everybody quickly and at the same time. Problems that may occur can be handled in groups and everybody is able to learn from each other's experiences.

Each of the five villages that were covered in the survey area had their own farmer organisation, and they are mostly kept in order by the government extension officers. Meetings are held on a monthly basis and various factors are argued at these meetings.

4.7 Marketing management

4.7.1 Marketing outlets

Due to the fact that most smallholder farmers make a living from subsistence farming, poor and unreliable production of agricultural commodities was a constraint that undermines establishing an efficient agricultural marketing system. However, an effective marketing system is vital to ensure economic independence for the smallholder farmers so that their produce can be sold and the farmers can be mainstreamed into the economy. For them to be able to join the mainstream of the economy, it is essential that their produce is competitive in the market and thus it should be of high quality. For many smallholder farmers, access to markets is the biggest constraint that they face.

The main marketing outlets at the Taung irrigation scheme are provided by SAB and the co-operatives. The average distance to the nearest market outlets from the smallholders' farms is 15.5 km. Farmers that have plots nearer to the main roadside use this to their advantage and sell their produce at the roadside; this is mostly in the form of maize. In the informal settlements there are a number of hawkers who will organise transport in order to buy some of the produce on the farm from the farmer and then sell it at their stands. The farmers, however, have a problem when it comes to transporting goods and are unable to transport large amounts of produce into the informal settlement markets.

It was difficult to obtain reliable information regarding the quantities of the produce sold due to the fact that there is no formal manner of recording the produce that was sold. That said, there are reliable figures available for those farmers who have acquired contracts with SAB.

Figure 4.10 indicates who or what factors determine the type of commodity which should be produced. In spite of the big influence that the government extension officers have in most of the decisions the farmers make, SAB has the most influence (50%) on the type of commodity that is produced. This could be due to the fact that all of the farmers are trying to acquire a contract with SAB, therefore they consult with their neighbouring

farmers who already have contracts with SAB to hear what they should produce, hoping that their produce will be purchased.

The government extension officers have the second largest influence, at almost 30%. The government extension officers are widely trusted among the farmers because they are in constant contact with each other.

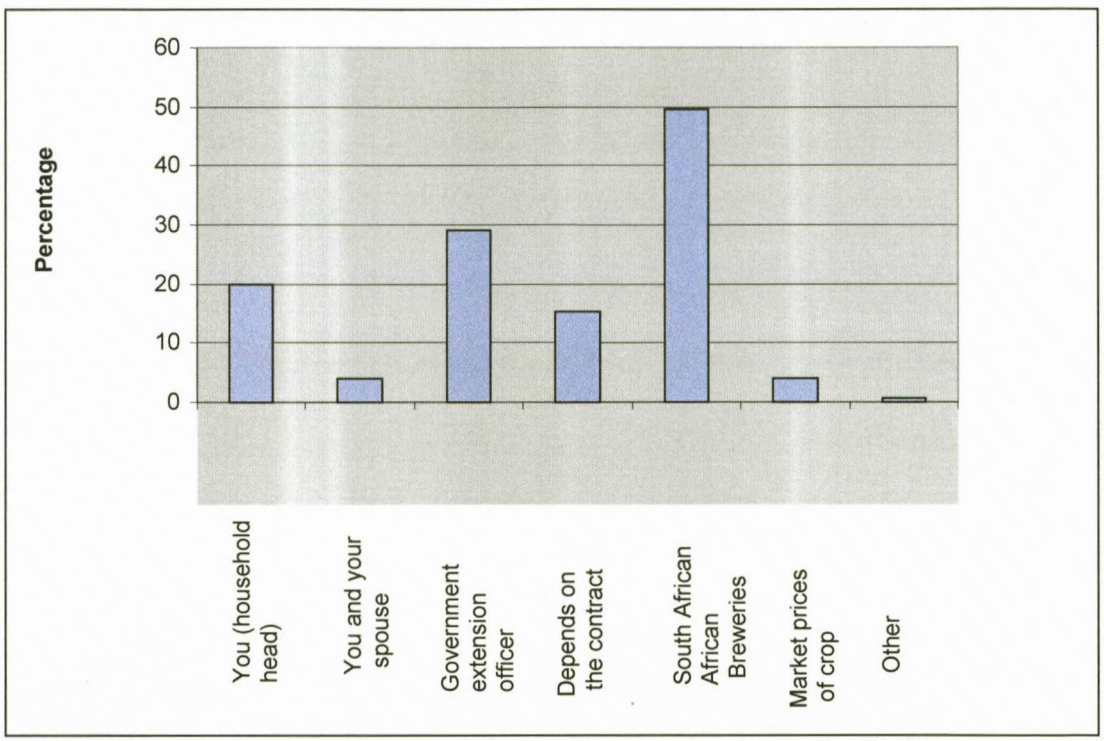

Figure 4.10: Factors that determine the type of crop to be produced

A lesser amount of farmers (20%) make their own decisions on what should be planted. This portion of farmers has no obligation towards any institution regarding the type of crop that they produce.

4.7.2 Input acquisition

Input markets is a very important aspect; however, in the debate about market access, this side of markets is often not researched, as most of the focus is on output markets. The

majority of farmers do not have their own means of transport and have to hire transport in order to acquire their inputs from the nearest town. This leads to farmers not adequately considering where they buy from or the quality of the inputs that they purchase; they rather look at the availability and distance factors.

The farmers in the Taung area were questioned on whether they used high yielding seeds, and 84% of them indicated that they do make use of high yielding seeds. Figure 4.11 indicates how the farmers acquire the high yielding seeds that they use.

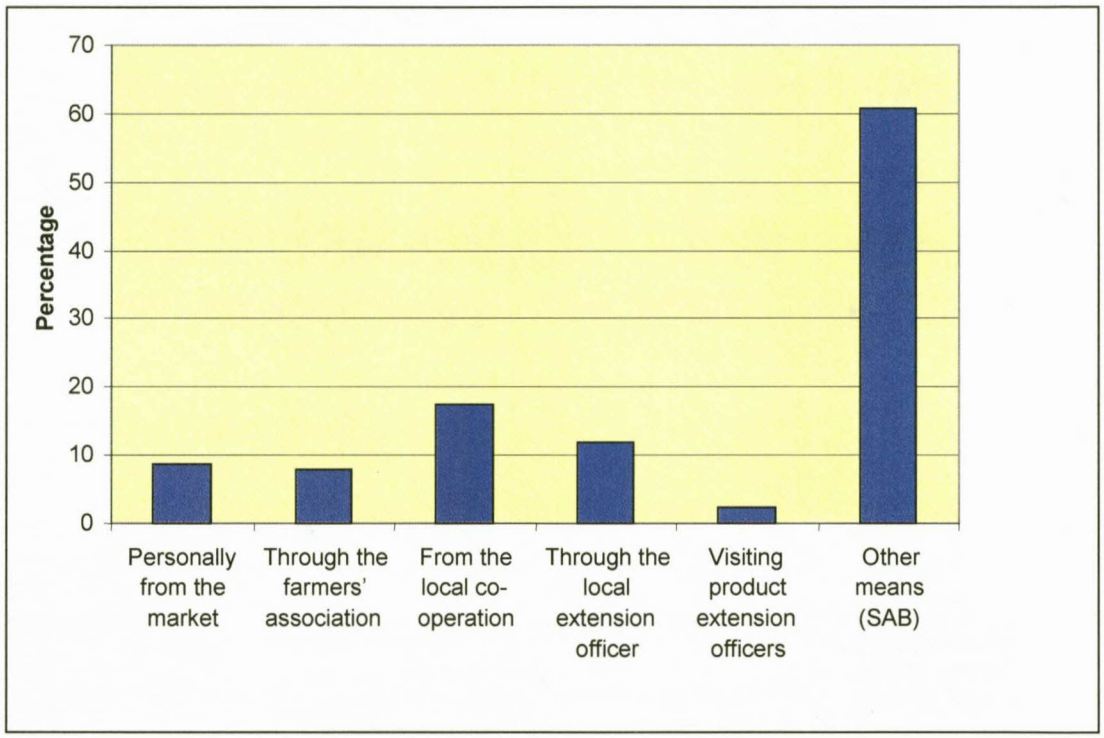

Figure 4.11: Means of acquiring high yielding seeds (n = 151)

More than 60% of the farmers indicated that they acquire their seeds through SAB, and this correlates with the number of farmers that have contracts with SAB. These seeds are delivered to the farmers' plots, thus farmers do not have any problems regarding transporting seeds from the input market to the plot. Another means is to purchase it from the local co-operation (almost 20%), however, this necessitates that the smallholder farmers make use of highly costly rented transport. Generally, when inputs are required

from town, the farmers pool their money together in order to split the transport cost between themselves. The local extension officers sometimes assist by providing government transport for the inputs that the smallholder farmers acquire.

That farmers pool their money together is an important aspect of the organisational structure that exists between the smallholder farmers, and this leads to farmers gaining economies of scale by their placing one order, and thus they have higher bargaining power. The main reasons why the remainder of farmers (16%) indicated that they could not acquire the high yielding seeds are shown in Table 4.6.

Table 4.6: The main reasons why high yielding seeds could not be acquired

Reason	Percentage
High yielding seed too expensive	50
Input markets not easily accessible	-
Cannot get credit to buy seed	4.17
Do not know how to use high yielding seed	8.33
No information on how to acquire seed	16.67
Not interested in using high yielding seeds	4.17
Other reasons (specify)	8.33

The main reason was that the high yielding seeds are too expensive to purchase, and 50% of the farmers supported this notion. This is also due to the fact that farmers have problems acquiring credit to purchase the inputs that they need to farm with. The second largest factor seems to be a lack of information on how to acquire the high yielding seeds. The reason for this is that farmers do not attend the meetings at which information is distributed regarding various production aspects.

4.8 Summary

The majority of the farmers have an obligation to sell their produce to SAB, and the inputs are also acquired from them. This makes it much easier for the farmers as it cancels out the credit and transportation problems, the type of crop that should be produced etc. It seems that the farmers who have a contract with the SAB are better off

than the rest of the farmers, who have to manage on their own and face many constraints and sub-optimal conditions.

Human capital endowments play an important role in creativity and entrepreneurship, mostly in the case of farmers that do not farm on a contract basis. It is up to them to acquire a market for their produce to be sold in.

In the physical farming operations, knowledge and experience are the dominant and most important factors, along with training. In the case of the contract farmers, these aspects are covered by SAB and the farmers basically only provide the labour that is required. It was concluded that the supportive institutions play a mayor role in the production process. The next chapter will conduct analytical tests to determine which of the factors have the greatest influence on the success of smallholder farmers.

CHAPTER 5

CHARACTERISTICS OF POTENTIALLY SUCCESSFUL SMALLHOLDER IRRIGATORS IN THE TAUNG IRRIGATION SCHEME

5.1 Introduction

Regardless of the potential that smallholder irrigated agriculture possesses, small-scale irrigators of South Africa have yet to realise this potential. Smallholders in South Africa are faced with a very large set of constraints, which will be discussed in this chapter. Productivity levels have dropped drastically, especially in the formerly state-managed smallholder irrigation schemes. This relates to the declining government support to smallholders in the so-called Irrigation Management Transfer (IMT) process. In the Limpopo Province, Kamara *et al.* (2002) noted that the level of production had dropped to about 20% in schemes that were previously managed by the Agricultural Rural and Development Corporation (ARDC). This was in contrast to a generally positive growth in the country's agriculture. They also found that some farmers were producing at a loss. Making particular reference to the Eastern Cape, Bembridge (2000) argues that in spite of huge investments, the performance of most small-scale irrigation schemes in the Eastern Cape has been poor and falls short of the expectations of engineers, politicians, development agencies and the participants themselves.

The situation has the potential to become even more complex because South African small-scale agriculture has a history of dependency. Farmers (especially those based in the large former homeland irrigation schemes) had become accustomed to the profound support provided by the parasitical organisations that managed most of the irrigation schemes in the country (Magingxa, 2007).

For a farmer to be considered successful he has to embody the following characteristics: he must be able to assess the future, identify opportunities before

competitors do and be able to create and sustain competitive advantages (Nell and Napier, 2005). In a study conducted by Foreman and Livezey (2003) to determine factors contributing to financial success, they found that the ratio of government payments to total production value, cost control, tenure, crop diversification, yield and debt-to-asset ratio and education was a significant factor influencing financial success. They also concluded that market access is one of the driving forces of agricultural commercialisation. Examining these characteristics will result in a better understanding of these smallholder farmers in the Taung irrigation scheme.

5.2 Methodology

In this chapter, farmers are divided in two groups, namely more successful (MS) and less successful (LS) farmers. Thus, in this chapter the focus is on the characteristics that determine whether farmers will be more successful. The technique used in this chapter provides a categorical variable that can be used in further analysis. Further analysis is based on the results of the cluster analysis, whereby the result from the cluster analysis is used as a proxy. The influence of various factors on success is examined and principle components are formed. A logit model is used to determine which of the principle components have the greatest effect on the success potential of the small-scale farmers in the Taung irrigation scheme. The methodology used is explained in the next section.

The K-means cluster analysis technique was selected to divide farmers based on individual characteristics that influence success potential. The purpose of cluster analysis is to panel a set of objects into two or more clusters so that the objects within a cluster are comparable and objects in different clusters are dissimilar (Magingxa, 2007). The basic data for cluster analysis is a set of N entities (for example, smallholder irrigators) on which p measurements have been recorded. This initial choice of the particular set of measurements used to describe each entity constitutes a frame of reference within which to establish the clusters. The choice seemingly reflects the investigator's judgement regarding significance for the purpose of classification. As a result, it is important to take into account that the initial choice of variables is itself a categorisation of the data, and has no mathematical or statistical guidelines (Everitt, 1983).

Following Kaufman and Rousseuw (1990), there are two types of distance measurements being performed, depending on the type of variable. For N observations to be clustered into K groups:

The Euclidean distance d_{jk} between rows j and k is computed using:

$$d_{jk} = \frac{\sqrt{\sum_{i=1}^{P} \delta_{ijk}^2}}{P} \qquad [1]$$

The Manhattan distance d_{jk} between rows j and k is computed using:

$$d_{jk} = \sum_{i=1}^{P} \left| \delta_{ijk} \right| \qquad [2]$$

Where for interval, ordinal and ratio variables:

$$\delta_{ijk} = z_{ij} - z_{jk}$$

And for asymmetric-binary, symmetric-binary and nominal variables:

$$\delta_{ijk} = \begin{cases} 1 \text{ if } x_{ij} \neq x_{jk} \\ 0 \text{ if } x_{ij} = x_{jk} \end{cases}$$

With the exception that for asymmetric-binary, the variable is completely ignored (P is decreased by one for this row) if both x_{ij} and x_{jk} are equal to zero (the non-rare event).

The objective function D is the total distance between objects within a cluster and it is represented as follows:

$$D = \sum_{k=1}^{K} \sum_{ieC_1} \sum_{jeC_1} d_{ij} \qquad [3]$$

The distance formula used in this study is the Euclidean distance measure, as it is normally used as the default measure in statistical computer programmes.

The variables most likely to influence the success potential and that have been selected for analysis are: thorough planning; financial records; financial decisions; technical decisions: using high yielding seeds and high yielding fertiliser, pesticides and herbicides; training; the need for extension advice; whether the farmer knows the yield value; whether the farmer knows the amount of income he generated; farming experience; education and the size of the area that has been planted.

A correlation matrix – incorporating all the available variables in the questionnaire – has been constructed (Appendix B1). The variables that indicated high correlation values and those that would logically influence the success potential of farmers were selected to be used in the cluster analysis.

Table 5.1 below shows the variables that were selected for analysis and each one's measurement. The hypothesis is that smallholders will be more successful if they thoroughly plan; keep financial records; make financial decisions; apply technical decisions (e.g., making use of high yielding seeds, high yielding fertiliser and using pesticides and herbicides); receive training on the specific farming enterprise; get extension advice on new farming activities; understand and/or know the yield value produced and the income generated; have more farming experience, a higher level of education and have planted a bigger area.

Table 5.1: Variable measurement

Variable	Measurement
Thorough planning	1 = yes : 0 = no
Financial records	"
Financial decisions	"
Tech decisions: Use high yielding seeds	"
Tech decisions: Use high yielding fertiliser	"
Tech decisions: Use pesticides and herbicides	"
Training	"
Need extension	"
Yield known	"
Income known	"
Farming experience	Years
Education	Grades as categorised
Area planted	Hectares

5.3 Results and discussion

After initially running the data through the clustering tool, results of the average profile showed that the appropriate number of clusters that can be obtained is two, namely; more successful (MS) and less successful (LS). Further analysis was therefore carried out with these two clusters.

Table 5.2: Cluster means

Variables	Cluster 1	Cluster 2
Planning	0.11	0.15
Financial records	0.31	0.42
Financial decisions	0.78	0.69
Tech decisions: Use high yielding seeds	0.81	0.89
Tech decisions: Use high yielding fertiliser	0.89	0.93
Tech decisions: Use pesticides and herbicides	0.91	1
Training	0.55	0.42
Need extension	0.88	0.82
Yield known	0.45	0.62
Income known	0.29	0.47
Farming experience	-0.64328	1.12282
Education	0.23479	-0.40982
Area planted	-0.18759	0.32743
Number of cases in each cluster	**96**	**55**

The mean of each cluster represents the average characteristics of farmers in the cluster.

Cluster 1 – Less successful farmers

Cluster 1 is represented by ninety-six observations and can be considered as referring to the less successful (LS) farmers. The variable scores, which are considered to positively influence success potential, do not favour the factors expected to determine success.

Despite the small but positive gap in terms of training and education, this group of farmers exhibits a large and negative gap in farming experience. Thus, these farmers have very poor farming experience in relation to the more successful group of farmers. When combined with extension advice and training, farming experience can increase significantly and, subsequently, so can consistent use of good farming practices.

External training inputs is one of the internal characteristics of successful farmer controlled enterprises, specifically when trying to integrate the farmers into the mainstream economy through the development of links with financial and market intermediaries (Coulter *et al.*, 1999). Coulter *et al.* made use of case studies from Zimbabwe and Kenya. In these case studies, specific training needs were identified in the areas of:

- Improving crop management skills thus enhancing the prospects of obtaining contracts from agri-businesses;
- Developing more effective bargaining strategies thus exercising some choice over the business/es with which they contract; and
- Understanding the cyclical nature of product lifecycles, and the need this generates for savings and backstop strategies.

The farmers in this group scored lower on decisive characteristics such as planning and keeping financial records, which are important for monitoring the financial

position of the farm. This group of farmers scored higher when it came to making financial decisions. These decisions would, however, prove to be poor due to the fact that there is a lack of planning and record keeping. Other important characteristics which this group scored poorly on included not making use of high yielding seeds, fertiliser, pesticides and herbicides.

Although the farmers in this group received more training than the other farmers, there was a lack of knowledge of the yield that had been produced and regarding the total income generated. It seems that this group of farmers have a 'don't care' attitude, which has a negative effect on production. There is also a big negative gap between the areas planted, although this could also be attributed to the fact that farmers did not know how much they had actually planted.

Cluster 2 – More successful farmers

Cluster 2 meets most of the criteria for potential success and can therefore be representative of the more successful farmers. There are four variables where the assumptions do not meet the hypothesis. Lower scores were obtained for financial decisions, training, the need for extension and education. The rest of the assumptions were all met and they correlated with the hypothesis. This cluster is represented by fifty-five observations.

Although the farmers in this group have received less training and education, they have far more farming experience than the less successful farmers. The greater amount of farming experience could also explain why the need for extension in this group of farmers is lower. The lesser score in financial decisions does not necessarily mean that this group of farmers has insufficient financial decision methods. They score higher in planning and financial record keeping, which are essential steps taken prior to making financial decisions, thus this group of farmers make less financial decisions but it seems that the financial decisions they do make are more accurate than those of the less successful farmers.

The farmers in this cluster score positively in other essential farmer characteristics necessary for successful farming. These include making technical decisions

regarding, for instance, use of high yielding seeds, high yielding fertiliser and applying herbicides and pesticides. The farmers in this group appear to be more in control than the less successful farmers as they know the yields that have been obtained as well as the total income they generated. According to the cluster information, the areas that these farmers plant are also bigger than the areas of the less successful farmers.

Table 5.3: Cross-tabulation of having a contract and cluster membership (n = 151)

		Cluster 0	Cluster 1	Total
Contract 0	Actual count	39	18	57
	Expected count	36.2	20.8	57
Contract 1	Actual count	57	37	94
	Expected count	59.8	34.2	94
Total	Actual count	96	55	151
	Expected count	96	55	151

By using the cross-tabulation method (see table 5.3) it was concluded that there is no significant difference between having a contract and being more or less successful.

From the table it is observed that the actual count and the expected count are very close to each over. When the *chi-square* test was conducted, it indicated that there is no relationship between having a contract and one's success potential. The exact significance indicated a value of 0.385, thus it is not significant and the null hypothesis can be rejected.

The conclusion that can be drawn from this is that the contracts acquired with SABM are proportionally spread over the two groups of clusters.

5.4 Factors influencing the success potential of smallholder irrigators in South Africa

Building on the results of the cluster analysis we will examine the influence of assorted factors – that form circumstances within which smallholder irrigators operate – on the potential for success. Van Rooyen (1984) stated that effective agricultural production should start with the farmer and his farming organisation.

5.5 The variables

The proxy for the dependent variable is a result of the cluster analysis conducted, i.e., farmers grouped based on individual characteristics. This separated the farmers into two groups that were referred to as more successful (MS) or less successful (LS) farmers. This yielded a discrete variable with values of either 0 for LS or 1 for MS. The MS group was more positively associated with some of the factors (as mentioned earlier, not with financial decision-making, training, the need for extension and education) considered to lead to more success and vice versa for the LS group. Table 5.4 shows the list of explanatory variables together with their expected signs.

Table 5.4: Explanatory variables and their expected signs

Variable	Measurement	Expected sign
Contract with SABM	1 = Yes; 0 = No	+
Gender	1 = Male; 0 = Female	+
Thorough planning	1 = Yes; 0 = No	+
Market availability	"	+
Access to information	"	+
Transport access	"	+
Training	"	+
Belonging to a farm organisation	"	+
Off-farm income	"	+
Credit availability	"	+
Market distance	Kilometres	-
Extension visits	Times per year	+
Risk attitude	Scale of 1-3	+
Farmer age	Years	+
Road accessibility	1 = Yes; 0 = No	+
Electricity availability	"	+

Based on the factors influencing potential success in this smallholder irrigation project, the variables were selected by using those that would logically influence the success potential. These variables were also run in a correlation matrix and showed significant correlation (Appendix B2). The following variables were included in the analysis: the explanatory variables of having a contract with SABM; the gender of the farmer; whether the farmer planned thoroughly; market availability; access to information; transport access; whether the farmer received any training; whether the farmer belonged to a farmers' organisation; whether the farmer has off-farm income; the availability of credit for production; distance to the nearest market; how many

extension visits per year the farmer has had; the farmer's risk attitude; the age of the farmer; road accessibility and the availability of electricity.

5.6 The Model

In analysing the data, it had been decided to use the logit model because the dependent variable is of a dichotomous nature, as shown in equation 1 below:

$$\ln\left(\frac{P}{1-P}\right)=\alpha_0+\sum_{i=1}^{k}\alpha_i\chi_i \quad or \quad as\left(\frac{P}{1-P}\right)=e^{(\alpha_0+\sum_{i=1}^{k}\alpha_i\chi_i)} \qquad [1]$$

Where P_i represents the probability of the smallholder irrigator i being more successful, and χ_i is the set of explanatory variables determining the smallholder irrigators' potential for success. Denoting $\alpha_0+\sum_{i=1}^{k}\alpha_i x_i$ as Q, equation 1 may be written to give the probability of success of a smallholder irrigator i as:

$$P_i=\frac{1}{1+e^{-Q_i}} \qquad [2]$$

From equation 2, the probability of an irrigator being unsuccessful is given by $(1-P_i)$ as

$$(1-P_i)=\frac{1}{1+e^{Q_i}} \qquad [3]$$

The odds ratio, i.e., $P_i/(1-P_i)$ is given as

$$\left(\frac{P_i}{1-P_i}\right)=\frac{1+e^{Q_i}}{1+e^{-Q_i}}=e^{Q_i} \qquad [4]$$

The natural logarithm of equation 4 gives rise to equation 5.

$$Ln\left(\frac{P_i}{1-P_i}\right)=Q=\alpha_0+\sum_{i=1}^{k}\alpha_i x_i+\varepsilon_i \qquad [5]$$

Rearranging equation 5, with the dependent variable in log odds, the logistic regression can be manipulated to calculate conditional probabilities as

$$P_i = \frac{e^{\left(\alpha_0 + \sum_{i=1}^{k} \alpha_i x_i\right)}}{1 + e^{\left(\alpha_0 + \sum_{i=1}^{k} \alpha_i x_i\right)}} \qquad [6]$$

Attempting to fit equation 5 for the first time using the maximum likelihood procedure failed. This was attributed to multi-colinearity, as can be observed by studying the correlation coefficient matrix.

In solving the multi-colinearity problem, it was necessary to compress the related variables into fewer unrelated principal components. This technique is referred to as *principal component analysis* (PCA). PCA is a technique used to reduce the dimensionality of data while retaining as much information as possible.

The correlation matrix C[1], using standardised variables, was used to calculate eigen values $\lambda_1, \lambda_2, ...\lambda_K$ and corresponding eigenvectors v_i, respectively as

$$|C - \lambda I| = 0, \; |C - \lambda_j I| v_j = 0 \qquad [7]$$

The eigenvectors v_j were then arranged to give matrix V in equation 8.

$$V = \begin{bmatrix} v_{11} & v_{12} & \cdot & \cdot & \cdot & v_{1k} \\ v_{21} & v_{22} & \cdot & \cdot & \cdot & v_{2k} \\ \cdot & \cdot & \cdot & & & \\ \cdot & \cdot & \cdot & & & \\ \cdot & \cdot & \cdot & & & \\ v_{k1} & v_{k2} & \cdot & \cdot & \cdot & v_{kk} \end{bmatrix} \qquad [8]$$

[1] The independent variables were standardised as $(x_i - \bar{x}_i)/s_{x_i}$

The matrix V is orthogonal as its columns satisfy the conditions $v_i'v_i = 1$ and $v_j'v_i = 0$ for $i \neq j$.

The principal components (Z) are calculated as

$$Z = X^S V \qquad [9]$$

Where X^S is an n × k matrix of standardised variables, and V is the eigenvector matrix as defined in equation 9.

There are k principal components as there are k variables[2]. The second Z was chosen to be uncorrelated with the first, and to have as large a variance as possible. Thus, the *X* variables are transformed into new uncorrelated variables, which accounts for as much of the variation as possible in descending order.

Several methods are used when choosing the number of principal components in PCA. Using the scree plot of the eigenvalues is one of the criteria used and it is extracted from the correlation matrix (Appendix B2). In this study, the number was decided by leaving out components with corresponding eigenvalues of less than one. This is the rule of thumb when conducting PCA using a correlation matrix. This is so because an eigenvalue corresponds to the number of variables in a factor and the sum of the eigenvalues corresponds to the total number of variables. A factor that is less than one therefore means that it accounts for variability of less than one variable. The initial variables (Xs) were therefore grouped into 6 *principal components*, altogether accounting for 61.66% of the variability. Table 5.5 shows the results of the exercise described above, with corresponding eigenvalues after *Varimax rotation.* Rotation is a procedure that involves the redeployment of the variation for the different variables between components, such that each variable is more or less clustered in one component rather than spread throughout the components.

[2] This new set of variables (principal components), unlike the original variables, are orthogonal; i.e., they are uncorrelated.

Table 5.5 Principal components and their eigen values

Variable	PC_1	PC_2	PC_3	PC_4	PC_5	PC_6
Contract with SABM	.869	.041	-.049	-.120	-.001	.108
Gender	-.086	.130	.122	.031	-.159	.723
Thorough planning	-.225	.033	.098	.714	.105	-.165
Market availability	.406	.216	.510	.061	.211	.324
Access to information	.162	.768	.045	.133	-.052	-.101
Transport access	.034	.570	-.188	.078	.121	.309
Training	.187	.354	-.543	.172	.127	.210
Belonging to a farm organisation	.083	.239	-.244	.688	-.119	.166
Off-farm income	.016	-.130	-.006	.155	.805	-.131
Credit availability	.673	.170	.024	-.156	-.176	.157
Market distance	-.656	.437	-.083	-.211	-.047	.007
Extension visits	.362	-.185	-.318	-.131	.274	.551
Risk attitude	.135	-.050	.773	-.046	-.047	.047
Farmer age	.138	-.236	.067	.242	-.655	-.082
Road availability	.457	.055	.204	-.410	.220	-.266
Electricity availability	.728	.188	.095	-.023	-.038	-.166
Eigen value	**2.839**	**1.530**	**1.439**	**1.395**	**1.365**	**1.298**
% Variability	**17.75**	**9.56**	**8.99**	**8.72**	**8.53**	**8.11**

The first principal component, PC_1, accounts for 17.75% of variability, while PC_2 through to PC_6 account for 9.56% and 8.11%, respectively, as can be seen in Table 5.5. For clarity purposes, values of factor loadings below 0.45, in either direction, were dropped from the analysis. Analysing the direction (sign of component loading) and strength (value of component loading) of the relationships between the components and the initial variables (as shown in Table 5.5) allows us to interpret the results as follows:

Having a contract with SABM, access to credit and electricity are clearly the biggest contributors influencing the success potential of smallholder irrigators. Access to roads also plays a role, although it is to a lesser extent. All of these factors have a strong and positive relationship with PC_1. This could therefore be interpreted as reflecting ***production capability***. In order to be more successful a farmer should have access to these factors. A negative relationship with market distance indicates that for those farmers who have acquired a contract with SABM, distance to the market has no influence as the yield is collected by contractors from SABM.

PC_2 has a strong relationship with information and transport access. It could be interpreted as referring to ***information accessibility*** – in other words, the more access the farmer has to transport, the more easily he can gain external sources of information. Acquiring external sources of information is crucial to produce successfully in a changing environment.

In PC_3 a positive relationship occurs between risk attitude and market availability. This can be interpreted as referring to the ***ability to identify new opportunities***. The more risk averse the farmer is, the more likely it is that he is not able to identify a new market opportunity. If a farmer takes on the risk of enhancing his infrastructure on the farm, he is more likely to acquire a contract with SABM. Thus, a new market opportunity is opened up for the smallholder farmer. The contrary exists for the risk-averse smallholder farmer who is not willing to improve his infrastructure.

Within the fourth principal component (PC_4) there is a strong relationship between planning and belonging to a farmer organisation. This component can be interpreted as referring to ***planning aptitude*** – whether planning is done individually or within an association. The results of the personal interviews with the farmers showed that a very low percentage of farmers do thorough planning (12.5%) and also that a small percentage of the latter group belong to a farmer organisation (33.1%). The main reason for this is that 62.25% of the farmers interviewed had a contract with SABM, which handles most of the planning and decision-making, thus the farmers do not have to.

PC_5 shows a strong relationship between off-farm income and age. A negative relationship with age exists, indicating that higher ages do not affect the ability to receive off-farm income. This is largely attributed to the pension funds that older farmers acquire through the government.

PC_6 indicates a strong relationship between gender and extension visits. Traditionally, women in black communities do not have the same rights and authority as men do. This leads to women not attending the extension visits due to the fact that they do not have the same influence as the men do. This component can be interpreted as referring to ***gender relations***. For most rural farmers, extension officers

bring the only form of current information on farming issues. In a study done in Nepal on gender aspects of smallholder irrigation technology, Upadhyay (2004) states that extension and adoption of agricultural technology is still predominantly undertaken by males. There are a handful of cases where extension services have reached women farmers. Another study by Upadhyay (2002) revealed that 94% of women in Jamuna (located in the upland area of the Ilam district of eastern Nepal) and 91% in Chhita (Chhita falls under Terai and is a lowland region of the Sunsari district, which has a humid, subtropical climate with rainfall varying from 1000 to 1500 mm a year) did not have any contact with extension agents in 1998-99. Only 5% to 7% of women farmers of Jamuna and Chhita, respectively, had contact with extension agents (only once) in 1998-99. According to Upadhyay (2004), rural women are one of the deprived groups in Nepali communities to benefit from modernisation and the introduction of new technology. However, the extension and adoption system is still largely male dominated and women receive little or no information on technological innovations in agriculture and irrigation.

5.7 The influence of derived components on success potential

After determining the principal components, a regression analysis was conducted to study how the estimated components influence smallholder success potential. For this exercise the discrete variable formed in the cluster analysis was used, and the dependent variable was 0 for less successful and 1 for more successful farmers. The previously described estimated components served as explanatory variables and their values were the component scores (the score of each variable within the component). The component scores are scaled in such a way that they have a variance of one and a mean equal to zero.

A logit model was used to determine the effect of the six components identified earlier regarding smallholders' success potential. The model was chosen because of the dichotomous nature of the dependent variable (i.e., success potential). The following logit model was used to determine the influence of the six principal components on the success potential of smallholder irrigators:

$$Log\left(\frac{P_{(y=1)}}{1-P_{(y=1)}}\right)=\alpha_0+\sum_{i=1}^{n}\alpha_i\chi_i \text{ or as } \left(\frac{P_{(y=1)}}{1-P_{(y=1)}}\right)=e^{(\alpha_0+\sum_{i=1}^{n}\alpha_i\chi_i)} \quad \text{.....(1)}$$

Where P represents the probability of a small irrigator being successful, y represents the more successful farmers and χ_i is the set of explanatory variables determining smallholder irrigators' success potential. According to Kleinbaum (1994), logistic regression is a mathematical modelling approach that can be used to describe the relationship between several Xs and a dichotomous dependent variable. Kleinbaum also states that other modelling approaches are possible but logistic regression is by far the most popular. Logit regression results are reported in Table 5.6.

Table 5.6: Parameter estimates of the logistic regression

Variables	Coefficient	Standard error	T-ratio	Probabilities
Production capability (PC_1)	0.364	0.222	2.686	0.101*
Information accessibility (PC_2)	0.459	0.227	4.086	0.043**
Ability to identify opportunities (PC_3)	0.658	0.218	9.079	0.003***
Planning aptitude (PC_4)	0.329	0.214	2.36	0.124
Off-farm income (PC_5)	-1.566	0.37	17.932	.000***
Gender relations (PC_6)	0.444	0.222	3.998	0.046**
Constant	-0.953	0.235	16.471	.000***

The model has a 39% goodness of fit. The low value for the goodness of fit is due to the cross-sectional analysis. It can be considered a good result when reflecting on the complexity of the research object and the array of factors that influence the success potential of smallholder farmers. As shown in Table 5.6, PC_4 is not significant. PC_3 and PC_5 are the most significant at a 1% (***) level of significance. PC_2 and PC_6 are the second most significant at a 5% (**) level of significance. PC_1 is significant at the cut-off point of 10% (*) significance.

In this type of discussion it is best to contemplate statistical significance because, for the logit model, the estimated coefficients do not have a direct economic interpretation. PC_4 is described as the planning aptitude of the farmers and is based on whether they belong to a farmer organisation and conduct thorough planning. The

result of the regression indicates that it does not have a significant impact on the success potential of farmers. This is also due to the fact that if a farmer acquired a contract with SABM, all of the planning is done by SABM and not by the smallholder farmers.

Now the discussion turns its focus towards the components that have a significant influence on the model. The fifth principal component represents off-farm income. This component proves to be the most significant in determining the success potential of farmers when looking at income alone. Off-farm income has such a big influence because only 7.3% of the farmers have another occupation from which they generate income. The off-farm income they generate can be used to purchase inputs needed for production or to make repairs to the infrastructure, for instance, the pivots. PC_3 denotes the ability to identify opportunities and consists of risk attitude and market availability. It is very significant at a 1% level. More risk-seeking farmers are more likely to discover new markets.

The second component represents the information accessibility and consists of access to information and access to transport. This component is significant at a 5% level of significance. New information is always necessary to keep up with the changes that arise in the production process. Farmers that produce under the contract farming concept of SAB/SABM are obliged to attend Information Days that are held at the local farmer support unions (FSU). SAB facilitates easy access to these Information Days by choosing a central meeting point (most of the time at a building where the FSUs meet regularly). Access to transport in order to attend Information Days in other locations is thus a priority in the bid to acquire external information to help with staying abreast of the latest production issues. The small-scale farmers use public transport in order to meet this need.

PC_6, gender relations, proves to be significant for this model at a 5% level of significance. This is attributed to the fact that most farmers (75.5%) in this study are male. This indicates that if the farmer is male, he is more likely to be successful. As mentioned earlier, this corresponds with the South African and other developing countries' situations, as males in the native community have much more authority than females do and this explains why male farmers generally attend extension visits.

SAB is a BEE compliant company and has to accommodate previously oppressed people. Black women fall under this legislation, thus SAB has to comply and include women farmers in their contract farming arrangements.

The first component represents what can be termed as the production capabilities essential for smallholders to achieve success – for instance, having a contract with SABM, credit availability and access to electricity and roads. The results in the regression show that this component is significant at a 10% level of significance. This could be explained by the fact that if a farmer has acquired a contract with SABM, the farmer has sufficient electricity and road access and SABM provides the credit that is needed for the production. In the personal interviews held with the smallholder farmers it was noted that 62.25% of all farmers had acquired a contract with SABM. This indicates that all of these farmers have sufficient infrastructure and credit provided by SABM.

De Lange (1994) identified several issues that are important for the success potential of smallholder irrigation farmers. They are management and training, appropriate technology usage, organisation and sufficient irrigation. It is clear that production capability strongly relates to sufficient irrigation, particularly considering that the appropriate infrastructure and availability of credit are obtained through having a contract with SABM. Planning aptitude relates strongly to management and organisation. Gender relations and off-farm income do not have a relationship with de Lange's statements but, nevertheless, they are considered very important in determining the success of smallholder irrigators in the Taung irrigation scheme.

5.8 Summary and conclusion

Understanding the success potential of smallholder irrigation projects is critical because it aids in developing proper planning. The general perspective is that smallholder irrigation projects have the potential to present numerous livelihood sources for the rural poor. Beyond serving the function of meeting subsistence needs, surplus production has the potential to improve household incomes. These improvements would feed directly into the government's imperatives of poverty alleviation and economic growth.

This chapter attempted to determine the extent of the influence of these factors and used primary data from the Taung irrigation scheme in the North West Province of South Africa. A principal component analysis was performed due to multi-colinearity among the variables and it yielded six principal components, interpreted as: Production capability (PC_1); Information accessibility (PC_2); Ability to identify opportunities (PC_3); Planning aptitude (PC_4); Off-farm income (PC_5) and Gender relations (PC_6). These accounted for 61.66% of the variability in the success potential variable.

Further regression analysis using the principal components as explanatory variables revealed that the most significant components were off-farm income (mainly received by the older people in the form of pension), the ability to identify opportunities, information accessibility, gender relations and production capability. The model had a 39% goodness of fit. The relatively low goodness of fit is due to the cross-sectional analysis. PC_5 and PC_3 were significant at a 1% level while PC_2 and PC_6 were significant at a 5 % level; PC_1 was significant at a 10% level. These results were in line with the dimensions of success potential described earlier. It should be noted, however, that the total effect of a component is a function of interactions of variables within a component.

The results suggest that these five significant components should receive more attention in order to address the factors that influence the success potential of smallholder irrigators in the Taung irrigation scheme. These findings have implications for both smallholder irrigators and policy-makers. Providing the smallholder irrigators with the necessary infrastructure and including them in a contract-farming organisation can certainly boost their success potential. This will lead to overall wealth increases and the alleviation of poverty.

With respect to the ability to identify new opportunities, it is important that farmers be taught how to identify the risk and whether the risk, if taken, will have a positive or negative effect in the future. In order for the success potential to increase, it is crucial that there be a lot of focus on improving the farmers' ability to identify new market opportunities, as it plays the biggest role in the success potential of farmers.

Other farmers' experiences should be made accessible to smallholder farmers in order to address the problem of lack of information accessibility. Whenever Information Days are held in another location, transport should be made available to the farmers as a group so that they can attend and thus acquire knowledge to apply to their own situations. Extension advice provided by the government, SABM and from farmers is also a very important source of information.

Gender relations indicate that males have the highest potential of being successful. This does not mean that males are actually doing the work. In most instances in South Africa, women are the providers of labour and have no authority. It is therefore important to focus on gender equity as one of the factors behind success potential.

CHAPTER 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The main purpose of this study was to highlight the areas where more attention should be given to helping small-scale irrigators to become more successful in their production methods as well as to mainstreaming them into the economy. Most of the focus fell on the contract-farming concept of SAB/SABM. Contract farming seems to be a solution to the problem of smallholder farmers not being able to participate in the mainstream economy.

A summary, conclusion and recommendations of the study is presented in the following sections.

6.2 Summary

The presence of the rural poor was again highlighted in this study. The fact that most of South Africa's poor live in the rural areas emphasises the importance of agriculture in alleviating poverty and assuring food security. This fits in well with South Africa's development objectives of alleviating poverty and promoting economic growth. Smallholder irrigated agriculture deserves specific attention because of the rainfall situation in the country. About 75% of the country is semi-arid and generally, rainfall is erratic, averaging 464mm/annum. This situation makes the country heavily reliant on irrigation, and about 52% of the current national water use is irrigated (Magingxa, 2007).

Thus, the importance of a thorough investigation into the current functionality of the irrigation schemes is essential, particularly for the rural poor. The investigation is imperative to provide insight to policy-makers.

Literature suggests that a range of factors influence the success potential of smallholder irrigation projects, including access to land, information and markets, infrastructure, family labour, research & development, farmer organisation, training, planning, record-keeping, off-farm income, transport availability, extension and credit.

This study therefore explores the role of different factors in influencing the success potential of small-scale irrigators. Data for this study was collected from the Taung irrigation scheme in the North West Province of South Africa in five villages, namely Bosele, Rethuseng, Tshidiso, Ipelegeng and Areageng (aka Pudimoe). The study has used various analytical tools to address the imperatives raised in the previous discussion. Firstly, a *Cluster Analysis* was performed to separate farmers based on their potential for success, using individual characteristics gathered via a structured questionnaire. Results of this exercise yielded two clusters of farmers – more successful and less successful. What the results also established is that the more successful farmers tend to have more farming experience than the less successful farmers. The results also conclude that the more successful farmers actively plan and keep financial records. They also score positively in other essential farmer characteristics necessary for successful farming, such as making technical decisions of using high-yielding seeds and fertiliser and applying herbicides and pesticides. The more successful group of farmers show that they have more control over their production process than the less successful farmers.

Secondly, building on the above results, the logit model was used to determine factors that influence the success potential of small-scale irrigators. In this exercise, results of the cluster analysis were developed into the dependent variable (success potential). The objective was to assess the role of different variables that would logically influence success potential. Variables that also featured significantly in the results were: having a contract with SAB, availability of credit, markets, roads and electricity, access to

information and transport, risk attitude, thorough planning, belonging to a farmer organisation, off-farm income, gender and finally, extension visits.

The final step employed *Principal Component Analysis* to investigate the factors that influence the success potential of smallholder irrigators. Results grouped six principal components, together accounting for 61.66% of variability. The influence of the derived components on the success potential was determined by again making use of a logit model. However, only five of the six components had a significant influence on success potential. The components were: off-farm income, ability to identify opportunities, information accessibility, gender relations and production capability.

6.3 Conclusions

The conclusions drawn from the results of this study are summarised and presented hereunder and focus on general issues, the principal components influencing success potential and the role of SAB.

6.3.1 General

Of the 151 farmers interviewed in this study, about 62% indicated that they have acquired a contract with SAB to produce barley and maize. Thus, these farmers have a set market for their produce and market access is, in this case, not a significant problem for the small-scale farmers in the Taung irrigation scheme. Farmers who do not have a contract with SAB also make use of the market SAB provides in the area, assuming that the product is in line with the needs and quality specifications of SAB.

Results indicate that more than 89% of the small-scale farmers need credit to produce and more than 72% indicated that they have access to credit. Access to credit is thus not a big constraint in the Taung irrigation scheme. The reason for this is that more than 62% of the small-scale farmers indicated that they have a contract to produce for SAB. SAB acts as a credit provider in the form of inputs. However, there is still a need for access to credit for the remaining farmers in the scheme. The farmers that indicated they do not have access to credit implied that the main reasons for not acquiring credit are:

insufficient security to apply at a commercial bank, lack of knowledge to go about organising credit and finally, high interest and transaction costs. This is a common feature in rural areas where most people do not understand how the system of commercial and agricultural banks works.

The educational levels were determined and they range from having no education to post-matric level. More than 21% of the small-scale farmers have not received any form of education and only about 15% have education up to Grade 12. Even though there is a lack of education among the farmers, it does not seem to have a significant effect on the success potential of the farmers. It was noted that the more successful group of farmers had a lower level of education than those in the less successful group.

More than 50% of the farmers received training on the production methods they use. However, results indicate that it is not significant when determining success as the more successful farmers had received less training. The same results were found for financial decision-making and the need for extension. Although more than 85% of small-scale farmers indicated that they need extension advice, it is not a significant factor in determining success potential.

The factors with the most significant influence on success potential were: farming experience and technical decisions related to making use of pesticides/herbicides, high-yielding seeds and fertiliser.

The overall average of farming experience amongst the small-scale farmers is 15 years. Practical farming experience is a very valuable asset and outweighs any form of training and education. Results in this study support this statement as farming experience was the biggest contributor to success potential. However, education and training are still vital in order to make informed decisions in the farming enterprise. Making technical decisions related to the use of high-yielding seeds, fertilisers and applying pesticides/herbicides are very important factors influencing the success potential. This group of farmers can expect to harvest higher yields and thus improve the income they receive.

6.3.2 Principle components influencing success potential

This study attempted to determine the extent of the influence of factors using primary data from the Taung irrigation scheme in the North West province of South Africa. A principal component analysis was performed due to multi-colinearity among the variables and yielded six principal components, interpreted as: Production capability (PC_1), Information accessibility (PC_2), Ability to identify opportunities (PC_3), Planning aptitude (PC_4), Off-farm income (PC_5) and Gender relations (PC_6). These accounted for 61.66% of the variability in the success potential variable.

Further regression analysis using the principal components as explanatory variables revealed the most significant components to be off-farm income, the ability to identify opportunities, information accessibility, gender relations and production capability. The model had a 39% goodness of fit. The relatively low goodness of fit is due to the cross-sectional analysis. Each of the PCs has a level of significance influencing the success potential. A summary of the five PCs follows below.

Off-farm income proved to be the most significant in determining the success potential of farmers. Off-farm income has such a big influence because only 7.3% of the farmers have another occupation whereby they generate an income. The off-farm income can be used to purchase production inputs, which could be the difference between growing a crop for the following season or not.

Ability to identify opportunities consisted of risk attitude and market availability, and was also very significant at a 1% level. More risk-seeking farmers are more likely to discover new production methods, alternative resources and markets for their products.

Information accessibility consists of information and access to transport. This component was significant at a 5% level of significance. New information is always necessary to keep up with the changes that arise in the production process. Access to

transport is therefore necessary to attend information days in other locations in order to acquire external information to help keep up with the latest production practices.

Gender relations proved to be significant for this model at a 5% level of significance. This is attributed to the fact that most farmers (75.5%) in this study are male. This indicates that if the farmer is a male, he is more likely to be successful. It aligns with the South African situation as males in the black community have much more authority than females do, and this explains why male farmers predominantly attend extension visits.

Production capability consists of having a contract with SAB, credit availability, access to electricity and roads. The results in the regression show that this component is significant at a 10% level of significance. This could be explained by the fact that if a farmer acquired a contract with SAB, the farmer has sufficient electricity and road access, and SAB provides the credit that is needed for production. In the personal interviews held with the smallholder farmers it was noted that 62.25% of all farmers had acquired a contract with SAB. This indicates that all of these farmers have sufficient infrastructure and credit provided by SAB.

The results suggest that these five significant components should receive more attention in order to address the factors that influence the success potential of smallholder irrigators in the Taung irrigation scheme.

6.3.3 The influence of SAB in success potential

According to Magingxa (2007), market access is one of the most critical issues that determine the success of smallholder irrigation projects. It is also acknowledged that access to markets is the critical aspect determining profitability of smallholder irrigation schemes. Smallholder irrigation is envisaged as one of the vehicles for achieving economic growth, thus the role of market access must not be underestimated.

By acquiring a contract to produce for SAB, the small-scale farmer automatically receives access to the market. Thus, the small-scale farmers are assured of an offset for their produce and a definite income. SAB also assists in the pre-production process by acting as financial intermediary and by supplying credit to the small-scale farmers in the form of production inputs.

Production inputs and other expenses can be purchased less expensively due to the economies of scale that the small-scale farmers acquire through SAB. Expert advice and ground-level assistance is supplied by SAB throughout the whole production process. Thus the small-scale farmers are always informed and up-to-date with the newest production methods and market news. SAB is a company that complies with the equity legislation, thus promotes the inclusion of previously oppressed groups. Women small-scale farmers will most certainly benefit from contract farming due to the equity policy.

Working with SAB meets four of the five principle components that influence success potential, namely: the ability to identify opportunities, information accessibility, gender relations and production capability. Thus, contract farming plays an important role in the success potential of small-scale farmers.

6.4 Recommendations

Important recommendations are made following the preceding set of conclusions presented in this section. Recommendations are presented under two headings: policy, and recommendations for further research.

6.4.1 Policy

The conclusions made above have crucial implications for possible steps that can be taken to deal with the problem of smallholder irrigation management.

- Results in this study have shown that the majority of farmers are old. Literature tells us that old age hinders the ability to react to opportunities and also impacts negatively on the process of adopting new technologies. Making smallholder farming interesting to the younger generation could be a way to improve the performance of the small-scale sub-sector. It is vital that the older farmers' existing knowledge be transferred to younger farmers. This will lead to the development of a new generation of entrepreneurs and will reduce the over-reliance on often non-existent employment opportunities.

- Directly related to the above is the issue of capacity-building in the small-scale farming sector. Avenues that can be explored in this regard include continual specialised training and the encouragement of constant interaction with more experienced market participants. In this case, government can partner with general society and the private sector to facilitate such interaction.

- One way of dealing with the problem of high-cost transportation may be to extend the public transport subsidies enjoyed by bus operators to providers of transport for the produce of smallholder irrigation schemes. That will make the exercise attractive to service providers and will also encourage small-scale farmers to use common transport rather than the more expensive alternative of small pick-up vans. However, that will also mean attention has to be paid to the road infrastructure. It is important for rural farmers to trade with outside buyers because the local market is often not big enough nor is it widely dispersed.

- The issue of farmers who hold on to land for non-productive purposes can be approached in two ways. Firstly, more power can be given to community organisations. Community organisations should be in a position to give productive land to those interested in farming. Secondly, a land market system can be created that will improve the economic value of the landholdings and facilitate exchange. In addition, rural non-farm enterprises may have to be

developed to provide more incentives for committed farmers to remain in the irrigation schemes.

- A platform wherein government, the private sector, civil society and farmers are partners is important. The goal should be to overcome exclusion from policy-making and to design programmes that facilitate small-scale farmer market access and private sector service provision. In this regard, the government will have to play a facilitative role by designing, together with the other partners, a framework that will facilitate an ongoing and protected investment by the private sector in rural farming enterprises.

- A lot of research work on smallholder irrigation management is done by research professionals. However, the link between the results of this research and the policy-making process is unclear. What is needed here is ongoing interaction between policy-makers and scientists who work with the farmers, in order to facilitate a two-way movement of information.

- Farmer organisations and associations should be encouraged. There may even be a reward system to encourage them. These could even serve as surety where credit is needed and could see the small-scale irrigation sub-sector improving. A popular example is that of the Asian Grameen Bank, which works well with farmer groupings.

- Rebuilding important farmer support services and institutions is crucial. Within these, extension services show signs of not being efficient in terms of the quality and quantity of interactions. It may be necessary to strengthen this service and also to encourage specialisation and ongoing training of extension officers.

- Information is cited as one of the major sources of transaction costs. It is critical to facilitate better information access regarding quality requirements and prevailing prices in the formal and more lucrative markets. Access to this type of

information will assist smallholders to gear up for the opportunities provided. Examples tried elsewhere include riding on the current wave of less costly information technology, for instance using cell phones in addition to traditional media.

6.4.2 Further research

Further research on the following aspects is recommended:

- It is possible to conclude that the marketing system for smallholder farmers is generally quite poor. Smallholder irrigators largely do not pre-select a market outlet and also do not sell to the buyer of choice. The choice of outlet has implications in terms of costs and prices obtained by the producer at the market. It would be interesting to research methods of designing agricultural marketing systems that can influence productivity and growth for smallholder irrigators. Such knowledge would benefit both the government, private sector and the farmers themselves.

- The pricing of produce in smallholder irrigation farming is usually fluctuating and *ad hoc* in nature. It would be helpful to determine more stable pricing measures that will establish farmer expectations. Such knowledge would result in repeat business from potential buyers and improve the competitiveness of the sub-sector.

- One of the factors that discourages formal business from dealing with the informal small-scale farmer is the uncertainty in upholding agreements. It would be very valuable to determine a framework that would facilitate the involvement of the private sector in creating smallholder agreements within a protected environment.

- Whilst there is general consensus that smallholder farmers should be encouraged to form associations in order to better access markets, increase their volumes and

improve their bargaining power, it is not clear as to how such formations should be conceived. Specific research on the role of market association to clarify the extent to which such formations will help, as well as guidelines as to how they should be conceived, would be valuable.

- Comparative studies on the efficacy of various information sources is important to guide policy-makers on how to convey critical information to smallholder irrigators about existing prices and quality requirements in the more profitable markets.

- Studies on how to develop the vital links between policy-makers, donors, researchers and the private sector would most likely contribute to improving the chances of smallholder irrigated agriculture being more successful and sustainable.

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APPENDIX A

QUESTIONAIRE

UNIVERSITY OF THE FREE STATE
FACULTY OF NATURAL AND AGRICULTURAL SCIENCES
DEPARTMENT OF AGRICULTURAL ECONOMICS

Farmer Questionnaire on constraints of small scale farmers in Taung, North West Province

Date:	DD	MM	YYYY
Questionnaire no:			

J.P. Klopper
Mobile: 0825473673

Email: klopperjp.sci@ufs.ac.za
Office: 051-4013570

INSTRUCTION: Ask to speak to the farmer i.e. the person responsible for the day-to-day activities

GENERAL INFORMATION

Name of the interviewee _____

Name of the village	Bosele		1
	Rethuseng		2
	Tshidiso		3
	Ipelegeng		4
	Areageng		5
Do you have a contract to produce for South African Breweries?		Yes	No

A. DEMOGRAPHIC INFORMATION OF HOUSEHOLD

A.1 Gender of household head?	Male	1
	Female	2
A.2 Age of household head?		years
A.3 How many people are currently resident in your household?		
A.4 Household composition (include absentees)		
1. Children 0 – 4 yr		
2. Children 5 – 9 yr		
3. Children 10 – 18 yr		
4. Males 19 – 44 yr		
5. Males 45 – 64 yr		
6. Males > 65 yr		
7. Females 19 – 44 yr		
8. Females 45 – 64 yr		
9. Females > 65 yr		

B. HUMAN CAPITAL ENDOWMENTS

B.1 What is the highest level of education for:

	Farmer	Spouse	Child with highest qualification still living at home
1. None	1	1	1
2. ≤ Grade 5	2	2	2
3. Grade 6-7	3	3	3
4. Grade 8-9	4	4	4
5. Grade 10	5	5	5
6. Grade 11-12	6	6	6
7. Post-matric	7	7	7

B.2 Indicate whether you have the following language abilities:

	Language	Talk	Read	Write
1. English		1	2	3
2. Afrikaans		1	2	3
3. Your home language	(specify)	1	2	3
4. Other language	(specify)	1	2	3

		Always	Sometimes	Never
B.3	Do you take risks in trying new farming techniques	1	2	3
B.4	If you have a problem on your farm, do you wait for an extension officer to help you?	1	2	3
B.5	Do other farmers ask you for help?	1	2	3
B.6	Do you ask other farmers for help?	1	2	3
B.7	Do you consult other farmers before making a decision?	1	2	3

C. LAND AND AGRICULTURE

C.1	How long have you been farming		years
C.2	Type of farming	1. Crop - Irrigation	1
		2. Crop – Dry land	1
		3. Vegetables	1
		4. Livestock	1
		5. Other - specify	1
C.3	Soil type of the land	1. Sandy	1
		2. Clayey	2
		3. Loamy	3
		4. Other (specify)	4
		Do not know	5

C.4	What is the size of your land	ha

C.5	Are you satisfied with the size of your land?	Yes	1
		No	2

C.6	If "**NO**" to C.5, what is the reason?	1. Too small	1

(mark more than one, if necessary)	2. Do not have ownership	1
	3. Shallow soils	1
	4. Income not sufficient	1
	5. Other (specify)	1

D. PLANNING AND MANAGEMENT

D.1 To what extend do you plan for the future		
	1. Through plans and objectives stated	1
	2. Some plans (rough + incomplete)	1
	3. Only some idea about planning	1
	4. No plans (not considered)	1

D.2 Do you keep any financial records?	Yes	1
	No	2

D.3 If "**YES**" to D.2, fill in the following table for the type of records you keep

	Yes	No
1. Cost records	1	2
2. Income records	1	2
3. Crop production records	1	2
4. Animal production records	1	2
5. Labour records	1	2
6. Inventory records	1	2
7. Other records (specify)	1	2

D.4 Do you think that keeping financial records are important?	Yes	1
	No	2

D.5 If "**YES**" in D.4, how important is keeping records to you?

	Not important	Important	Very important
1. Determining financial position	1	2	3
2. Decision making and planning	1	2	3
3. To keep the bank or co-op manager happy	1	2	3
4. Other (specify)	1	2	3

E. MARKETING

E.1 Do you sometimes produce more produce than you can sell?	Yes	1
	No	2
E.2 Do you store part of your produce?	Yes	1
	No	2

E.3 Are there output markets available within an accessible distance from your farm?	Yes	1
	No	2

E.4 Through which marketing system do you market your crops?
(fill in the names for the different crops)

Crop	Crop 1	Crop 2	Crop 3	Crops 4
1. At the field or on the roadside (%)	%	%	%	%
2. Open market in town (%)	%	%	%	%
3. Local trader or Co-operation (%)	%	%	%	%
4. Own consumption (%)	%	%	%	%
5. Value adding direct marketing (%)	%	%	%	%
6. Other (specify)	%	%	%	%

E.5 Do you process (some of) your produce on the farm?	Yes	1
	No	2

E.6 Is there any produce that you could **not** sell in 2006/2007	Yes	1
	No	2

E.7 What is the distance from your farm to where you sell your produce?	km

E.8 Who or what determines the crop which should be produced for the season?	
1. You (household head)	1
2. You and your spouse	2
3. Government extension officer	3
4. Depends on what contract you get in the beginning of the season	4
5. South African Breweries	5
6. Market prices of the intended crop at time of planting	6
7. Other (specify) 1	7
2	8
3	9

F. INPUTS

F.1 Do you use any high yielding seeds on your farm?	Yes	1
	No	2

F.2 If "**YES**" to F.1, how do you acquire these?	1. Personally from the market	1
	2. Through the farmers' association	1
	3. From the local co-operation	1
	4. Through the local extension officer	1
	5. Visiting product extension officers	1
	6. Other means (specify)	1

F.3 If "NO" to F.1, what is the reason?	1. High yielding seed to expensive	1
	2. Input markets not easily accessible	1
	3. Can not get credit to buy seed	1
	4. Do not know how to use high yielding seed	1
	5. No information on how to acquire seed	1
	6. Not interested in using high yielding seeds	1
	7. Other reasons (specify)	1

F.4 Do you use any high yielding fertilizers on your farm?	Yes	1
	No	2

F.5 If "YES" to F.4, how do you acquire these?	1. Personally from the market	1
	2. Through the farmers' association	1
	3. From the local co-operation	1
	4. Through the local extension officer	1
	5. Visiting product extension officers	1
	6. Other means (specify)	1

F.6 If "NO" to F.4, what is the reason?	1. Fertiliser to expensive	1
	2. Fertiliser markets not easily accessible	1
	3. Can not get credit to buy fertiliser	1
	4. Do not know how to use fertiliser	1
	5. No information on how to acquire fertiliser	1
	6. Not interested in using fertiliser	1
	7. Other reasons (specify)	1

F.7 Do you use remedies like pesticides and herbicides? Yes 1
No 2

G. INSTITUTIONS

G.1 If you sell in the formal market, do you know in advance the prices prevailing in the market?	Yes	1
	No	2

G.2 Do you know in advance the quality requirements for specific markets?	Yes	1
	No	2

G.3 Do you make use of public or rented transport to acquire inputs?	Yes	1
	No	2

G.4 Do you have access to transport?	Yes	1
	No	2

G.5 What source(s) of information do you use or approach when you have to make the following decisions, acquire information or need training? (Mark as many as applicable)

	Technical decision	Financial decision	Marketing decision	Information on new technologies	Training
1. Radio	1	1	1	1	1
2. Television	1	1	1	1	1
3. Extension publications (leaflets etc.)	1	1	1	1	1
4. Co-farmers / neighbours	1	1	1	1	1
5. Department of Agriculture Extension officer	1	1	1	1	1
6. Co-operative – extension officers	1	1	1	1	1
7. No one –use own physical or technical records	1	1	1	1	1
8. No one –use own financial records	1	1	1	1	1
9. Bank manager	1	1	1	1	1
10. Supplier of inputs	1	1	1	1	1
11. Sell to the buyer who is the closest to my farm	1	1	1	1	1
12. Market agents	1	1	1	1	1
13. Read in the press (news papers, magazines)	1	1	1	1	1
14. Chief	1	1	1	1	1
15. Other specify	1	1	1	1	1

G.6 Did you receive any training on the technologies you use?	Yes	1
	No	2

G.7 Indicate which of the following institutions' services are freely and easily accessible to you, the farmer

1. Government extension system	1
2. Cooperative extension system	1
3. Agricultural research council (ARC)	1
4. Input suppliers (seed, fertilizer, herbicide, fuel, etc. companies)	1
5. Output markets (institutions like co-ops, etc.)	1
6. Credit institutions	1
7. Other (specify)	1

G.8 Do you need any extension advice?	Yes	1
	No	2

G.9 If "**YES**" to G.8 is any of the next extension officers available when you need them?

	Yes	No
1. Government extension officers	1	2
2. Cooperative extension officers	1	2
3. Input supplier extension officers	1	2

G.10 How many times have you been visited by an extension officer this year?

1. Government extension officers		Times
2. Cooperative extension officers		Times
3. Input supplier extension officers		Times
4. Total		Times

G.11 Do you think the extension officer has enough knowledge to supply you with the necessary information you need on your technical and financial management needs?

	Technical		Financial	
	Yes	No	Yes	No
1. Government extension officers	1	2	1	2
2. Cooperative extension officers	1	2	1	2
3. Input supplier extension officers	1	2	1	2

G.12 Are there any farmers' organisations in the scheme (whether formal or informal)?	Yes	1
	No	2

G.13 Do you belong to any farmers' organisation (whether formal or informal)?	Yes	1
	No	2

G.14 Do you have any rules regarding the management of the irrigation scheme?	Yes	1
	No	2

G.15 Are you aware of any government legislation(s) relating to your farm operation and/or marketing?	Yes	1
	No	2

G.16 Are you familiar with the new National Water management Act (NWA)?	Yes	1
	No	2

G.17 Are you familiar with the Marketing of Agricultural Products Act (MAP)?	Yes	1
	No	2

H. INFRASTRUCTURE AND CAPITAL

H.1 Indicate which of the following infrastructure are freely available and easily accessible to you the farmer?

1. Roads	1
2. Transport	1
3. Telephones	1
4. Electricity	1
5. Local markets	1
6. National markets	1
7. International markets	1
8. Other (specify)	1

I. RESOURCES

I.1 Land-use

	Share cropping	Rented land	Open access	Communal land	Partnership	Total area
1.Crops under centre pivot irrigation	ha	ha	ha	ha	ha	ha
2.Crops sprinkler irrigation	ha	ha	ha	ha	ha	ha
3.Vegetables under centre pivot irrigation	ha	ha	ha	ha	ha	ha
4.Vegetables under sprinkler irrigation	ha	ha	ha	ha	ha	ha
5.Other (specify)	ha	ha	ha	ha	ha	ha
6.Total (ha)	ha	ha	ha	ha	ha	ha

I.2 Please provide the following information regarding last seasons' produce

Crop	Crop 1	Crop 2	Crop 3	Crop +
1. Area planted	Ha	Ha	Ha	Ha
2. Total yield	Ton	Ton	Ton	Ton
3. Total income	R	R	R	R
4. Cost per Hectare	R	R	R	R
5. Price received for produce	R/ton	R/ton	R/ton	R/ton

I.3 Do you render services to other farmers	Yes	1
	No	2
I.4 If "**Yes**", are you paid for these services	Yes	1
	No	2
I.5 If "**Yes**", to I.3 what type of services?		
I.6 If "**Yes**" to I.3, then state the income you receive from this	R	
I.7 Do you have another occupation (job)	Yes	1
	No	2
I.8 If "**Yes**" to I.7, the state the income you receive from this	R	

J. CREDIT

J.1 Do you make use of external sources of capital	Yes	1
	No	2

J.2 If "**YES**" name the source and amount outstanding on 31/12/2007

Source	Amount (R)
Formal sources	
1. Commercial bank	R
2. Land Bank	R
3. Agricultural Cooperative	R
4. Department of Agriculture	R
5. South African Breweries	R
6. Other	R
Informal sources	
7. Credit unions	R
8. Farmers' association	R
9. Family and friends	R
10. Stokvels	R
11. Other (specify)	R

J.3 Do you need credit for farming activities (inputs, food, etc)	Yes	1
	No	2
J.4 Is credit available to you the smallholder farmer	Yes	1
	No	2

J.5 If "**NO**" to J.4, what is the reason

1. Do not need extra money – have enough to buy inputs	1
2. The cost (interest) of money is to high	1
3. Bank does not want to lend me money due to insufficient security (land)	1
4. Poor repayment ability of farm	1
5. Do not know how to go about organizing credit	1
6. Other (specify)	1

J.6 How do you buy the inputs (seed, fertilizer, pesticides, fuel etc.) for crops? (mark only 1)

Use only own funds	1
Buy only on credit	2
Combination of own funds and credit	3

Thank you

Appendix B 1: Correlation matrix cluster variables

Variables	Planning	Financial records	Financial decisions	Tech 1	Tech 2	Tech 3	Training	Need extension	Yield known	Income known	Farm experience	Education	Area planted
Planning	1.000	.139	.082	-.054	-.008	.011	-.022	.157	-.107	.092	.114	-.030	-.332**
Financial records	.139	1.000	.426**	.016	.012	-.049	.009	-.011	.138	.204*	.153	.092	-.053
Financial decisions	.082	.426**	1.000	-.002	-.091	-.146	-.057	-.066	.073	.082	-.011	.122	-.125
Tech 1	-.054	.016	-.002	1.000	.643**	.503**	.148	.129	.154	.173*	.083	-.107	.416**
Tech 2	-.008	.012	-.091	.643**	1.000	.478**	.201*	.051	.117	.109	.028	-.141	.471**
Tech 3	.011	-.049	-.146	.503**	.478**	1.000	.030	.134	.033	.071	.198*	-.080	.241**
Training	-.022	.009	-.057	.148	.201*	.030	1.000	-.110	-.073	-.143	-.146	.065	.279**
Need extension	.157	-.011	-.066	.129	.051	.134	-.110	1.000	.008	.034	-.031	.155	.020
Yield known	-.107	.138	.073	.154	.117	.033	-.073	.008	1.000	.483**	.133	-.081	.103
Income known	.092	.204*	.082	.173*	.109	.071	-.143	.034	.483**	1.000	.156	-.145	.082
Farm experience	.114	.153	-.011	.083	.028	.198*	-.146	-.031	.133	.156	1.000	-.215**	.139
Education	-.030	.092	.122	-.107	-.141	-.080	.065	.155	-.081	-.145	-.215**	1.000	-.054
Area planted	-.332**	-.053	-.125	.416**	.471**	.241**	.279**	.020	.103	.082	.139	-.054	1.000

** Correlation significant at 0.01 level

* Correlation significant at the 0.05 level

Appendix B 2: Correlation matrix PCA and Logit variables

Variables	Contract	Gender	Planning	Market availability	Information	Transport access	Trainig	Belong to farm org	Off-farm income	Credit	Market distance	Extension visit	Risk attitude	Age
Contract	1.000	.033	-.281**	.332**	.132	.073	.183*	-.004	.008	.614**	-.480**	.304**	.088	.026
Gender	.033	1.000	-.016	.081	.109	.098	.050	.106	-.137	.059	.044	.109	-.039	-.051
Planning	-.281**	-.016	1.000	-.048	.024	.007	-.022	.242**	.047	-.166*	.073	-.189*	-.112	-.003
Market availability	.332**	.081	-.048	1.000	.131	.160	.068	-.014	.021	.293**	-.206*	.134	.266**	-.030
Information	.132	.109	.024	.131	1.000	.240**	.208*	.203*	-.045	.122	.057	-.066	.002	-.065
Transport access	.073	.098	.007	.160	.240**	1.000	.273**	.247**	-.023	.012	.160*	.200*	-.119	-.049
Trainig	.183*	.050	-.022	.068	.208*	.273**	1.000	.249**	.075	.152	.045	.189*	-.239**	-.083
Belong to farm org	-.004	.106	.242**	-.014	.203*	.247**	.249**	1.000	-.035	.060	-.009	.038	-.138	.086
Off-farm income	.008	-.137	.047	.021	-.045	-.023	.075	-.035	1.000	-.167*	-.049	.099	.009	.246**
Credit	.614**	.059	-.166*	.293**	.122	.012	.152	.060	-.167*	1.000	-.186*	.229**	.144	.001
Market distance	-.480**	.044	.073	-.206*	.057	.160*	.045	-.009	-.049	-.186*	1.000	-.194*	-.114	-.116
Extension visit	.304**	.109	-.189*	.134	-.066	.200*	.189*	.038	.099	.229**	-.194*	1.000	-.088	-.089
Risk attitude	.088	-.039	-.112	.266**	.002	-.119	-.239**	-.138	.009	.144	-.114	-.088	1.000	.131
Age	.026	-.051	-.003	-.030	-.065	-.049	-.083	.086	-.246**	.001	-.116	-.089	.131	1.000

** Correlation significant at 0.01 level

* Correlation significant at the 0.05 level