SMALLHOLDER IRRIGATORS AND THE ROLE OF MARKETS: A NEW INSTITUTIONAL APPROACH

by

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ABSTRACT

There is growing evidence that many smallholder farmers can benefit from market-oriented agriculture. However, high transaction costs are a barrier to accessing the markets. Poor households are also often ill-equipped to respond to rapidly changing market conditions. In some cases they have seen old production strategies undermined by new competition, without being able to take advantage of the new opportunities provided by liberalisation policies such as the deregulation of agricultural markets in South Africa. According to literature market access in developing countries cannot be explained by conventional neo-classical economics and requires an institutional analysis.

Using primary data collected from six smallholder irrigation schemes, this study tackles the smallholder performance problem from several angles. Firstly, the role of market access in influencing the success potential is explored. Secondly the role and nature of factors that influence market access are investigated. The investigation focuses on the role that institutions can play in improving both performance in general and market access in particular. The study uses cluster analysis, principal component analysis and principal component regression techniques to perform the analysis.

As expected, market access was found to be one of the significant factors influencing the success potential of smallholder irrigation projects. Other significant variables included access to information, training, transport, extension and planning. The most significant components influencing market access were found to be physical access to markets, farmer skills and the nature of access to markets.

The issues of importance when it comes to market access raised in this study are institutional in nature. The study provides a reference framework for assessing potential success in smallholder farm management. The study also reveals the embedded institutional 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

Daar is groeiende bewyse dat kleinboere voordeel kan trek uit markgerigte landbou. Hoë transaksiekoste kortwiek egter toegang tot markte. Arm huishoudings is dikwels ook nie so goed toegerus om vinnig op veranderende marktoestande te reageer nie. In sommige gevalle ervaar kleinboere dat ou produksiestrategieë deur nuwe mededinging ondermyn word, sonder dat hulle die vermoë het om voordeel te trek uit nuwe geleenthede wat daargestel word deur liberaliserende beleidsrigtings soos die deregulasie van landboumarkte in Suid-Afrika. Die literatuur dui duidelik daarop dat marktoegang in ontwikkelende lande nie met behulp van konvensionele neo-klassieke maatstawwe verduidelik kan word nie, dit vereis 'n institusionele analise.

Deur gebruik te maak van primêre data wat by ses kleinboer-besproeiingskemas ingesamel is, benader hierdie studie die prestasie-probleem ten opsigte van kleinboere uit verskillende oogpunte. Eerstens word gekyk na die rol wat marktoegang speel om die suksespotensiaal te bepaal. Tweedens word die rol en aard van faktore wat marktoegang beïnvloed, ondersoek. In die ondersoek word veral klem gelê op die rol wat instellings kan speel om prestasie in die algemeen en marktoegang in besonder, te verbeter. Die analise is voltooi deur gebruik te maak van

klusteranalise, analise van die hoofkomponente en hoofkomponent regrasietegnieke.

Soos verwag, is bevind dat marktoegang een van die beduidende faktore is wat die potensiaal tot sukses in kleinboer-besproeiingsprojekte beïnvloed. Ander belangrike veranderlikes sluit in toegang tot inliging, opleiding, vervoer, voorligting en beplanning. Die belangrikste komponente wat marktoegang beïnvloed is fisiese toegang tot die mark, die boer se kundigheid en die aard van die marktoegang.

Die aspekte van belang, wanneer dit kom by marktoegang, wat in hierdie studie uitgelig word, is institusioneel van aard. 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 verhoging 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

Being the major source of food supply and household income in rural areas, agriculture is central in most of Africa's rural population. Hence, most concerned with rural livelihoods or poverty alleviation in Africa are necessarily concerned with agriculture. Even though South Africa is relatively more industrialised, the challenge is to make sure that agriculture in South Africa contributes to the country's policy objectives of economic growth, reducing income inequalities and eliminating poverty. According to the National Department of Agriculture (NDoA) (2000), agriculture can contribute through:

- an increase in agricultural productivity and output which will enhance the sector's contribution to national economic growth;
- an increase in the incomes of the poorest groups in society, through the creation of opportunities for small and medium-scale farmers to raise their production for own consumption and the market;
- the creation of additional employment opportunities in agriculture; and
- an improvement in household food security through expanded production and a more equitable distribution of resources.

Currently, agriculture's contribution to the national Gross Domestic Product (GDP) is estimated at about 4%. This figure is misleading because agriculture's total contribution to the overall economy is much greater than this figure suggests. A closer examination of agriculture's role, especially during droughts or periods of exceptionally favourable rainfall, suggests that its contribution is more complex. Droughts and low yields negatively affect the national GDP by as much as 0.5 to 2% (NDoA, 2000). This is a very high figure for a sector, which is apparently playing a relatively small role in the economy. Agriculture's strong indirect role in the economy is a function of its backward and forward linkages to other sectors. Agriculture's purchase of

inputs such as fertilizers, chemicals and implements forms backward linkages with the manufacturing sector while forward linkages are formed through the supply of raw materials to industry. About 66% of agricultural output is used as intermediate products in the sector (NDoA, 2000). These linkages augment the sector's contribution to the GDP.

The small-scale agriculture sub-sector shows a relatively low contribution. In addition to other reasons that will be discussed for the poor performance of small-scale producers such as scale economies, lack of proper infrastructure and the nature of their organisation, this has been partly due to inappropriate policies that have promoted mainly large-scale commercial producers over the small-scale sub-sector. There is thus the possibility that agricultural output could be increased if this resource could be fully harnessed. Therefore the promotion of productive small and medium-scale producers, by creating an enabling environment is viewed as one way for improving the viability of this sub-sector, while contributing to the Government's policy objectives stated earlier.

To determine policy priorities to address poverty and food insecurity, and to assess the role that agriculture can play in South Africa's efforts, it is necessary to understand how people in rural areas create livelihoods. Livelihood is defined as adequate stocks and flows of food and cash to meet basic needs. For the majority of rural households, these stocks are met through agricultural production, although non-agricultural incomes may also be important at particular times (Elliot, 1999). A livelihood does not only end with ways of getting food and/or income, it refers to other aspects such as social aspects in the community and its institutions. A livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the standard of living gained by the individual or household (Ellis, 2000). Poor rural households combine their resources in a variety of ways to enable them to maintain a minimum living standard. These livelihood strategies include agricultural production, off-farm wage labour,

small and micro-enterprise activities, claims against the state (e.g. pensions) and reliance on social networks.

It is common knowledge that in the African small-holder context, farmers who work small plots often pursue what Chambers (1983) calls the "fox's strategy" of depending on a variety of sources of earning a livelihood. In this mix of strategies, small-scale production has a critical role by reducing spending on food and providing income for other household needs. Small-farm production is indirectly labour-creating as well, because it results in income flows to low-income rural dwellers who tend to purchase services, building materials and consumer goods from local small scale rural services and industries.

Despite the potential for multiple livelihood strategies that can be derived from agriculture, these strategies remain unreliable. This is partly due to the poor rainfall situation in the country. About two thirds of the country is arid or semi-arid. Rainfall, which averages around 464 mm/annum, remains unreliable, often with long drought periods as well as devastating floods. Only 30 per cent of the country records rainfall of more than 600 mm per annum. In total, 65 per cent of the country has an annual rainfall of less than 500 mm, which is usually regarded as the absolute minimum for successful rain-fed agriculture. As a result of the rainfall conditions prevalent in South Africa, the country is left with a heavy reliance on irrigation, currently using up to about 50 per cent of the national waters. Permanent irrigation is applied to almost 80 percent of all land under irrigation. Supplementary and occasional irrigation are relatively insignificant in comparison. Major crops in the country such as maize and wheat, as well as many products such as wine, citrus fruits and vegetables, are grown under irrigation. The most important technologies of irrigation are sprinkler, flood and micro irrigation (Backeberg *et al.*, 1996).

The rainfall situation in the country therefore also warrants that irrigators in small-scale agriculture – the focus of this study, should receive specific attention even though issues may be similar to rain-fed agriculture. This is so because, given the landholding size prevalent in small-scale producers, it is difficult to produce beyond subsistence under rain-fed conditions. Irrigation

can increase crop yields, reduce crop production risk, providing greater incentives to increase input use, intensify crop production, and encourage diversification into higher valued crops. The resulting increase in marketable surplus and commercial activities has the potential to generate increased income for farmers (Freeman and Silim, 2001). In the same breath, Huang *et al.*, (2002), relate three factors to be responsible for the higher crop revenues of a plot when irrigation is introduced: higher yields (of same crop), increasing intensity (producing more than one crop per season), and shifts to higher valued crops that are possible after irrigation. These gains can, however, only be realised if the market situation is reliable with guaranteed access for smallholder irrigators.

Small-scale agriculture is extremely important in achieving the government's development objectives because it directly contributes to household food security through meeting subsistence requirements. According to Van Koppen (2000), ample evidence suggests a synergy between promoting smallholder irrigated production and agricultural growth. Hazell (2005) argues that agricultural growth needs to be broad based (or equitable) so that it puts increased purchasing power into the hands of the rural masses, and not just a privileged few. Smallhoder agriculture has a potential to drive economic growth because medium sized farms are typically more efficient producers than large farms in low income countries (Heltberg, 1998), and have better consumption and investment patterns for stimulating growth in the non-farm economy (Hazell and Roell, 1983 and Mellor, 1973). Studies that have assessed the influence of holding size on land productivity in the green revolution areas such as India, Pakistan, the Philippines, Sri Lanka and Bangladesh, show that smallholdings, compared to large holdings that have access to irrigation, tend to have higher net sown proportions of their land irrigated; have higher cropping intensities; apply more fertilizer per unit of cultivated land; cultivate more diversified, higher-value, and more labour-intensive crops; and obtain higher yields per crop per unit of land (Van Koppen, 2000).

While this may not necessarily apply in all parts of South Africa, small scale farming generally means that labour is substituted for machines. Therefore production outlays that would have been allocated to paying interest, loan repayment and depreciation costs on machinery, are instead paid as wages to labour, or earned as self-employment incomes by family farmers. In general, 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 transaction costs (Lyne, 1996). On the other hand, the importance of improving smallholder productivity is increasingly being realized. When this is achieved and if surplus is produced, it can be sold to cover other household needs. De Lange (1994) and Du Plessis et *al.* (2002) further disaggregate South Africa's smallholder irrigators into:

- farmers on irrigation schemes (which will be the emphasis of this study);
- vegetable gardeners (served by communal water supply infrastructures);
- independent smallholder farmers, each with private water supply; and
- independent food plot farmers operating on individual residential sites

In spite of the potential that small-scale irrigated agriculture possesses, there has been a reverse process in relation to smallholder irrigators of South Africa. Compared to other countries, smallholders in South Africa are faced with a very large set of constraints at the same time. Productivity levels have dropped drastically especially in the formerly state-managed smallholder irrigation schemes. This is in relation 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 is against a general 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 widening productivity gap between subsistence and commercial agriculture in South Africa was pointed out a while ago by Van Zyl *et al.* (1992). Today the major dilemma for a government faced with budget constraints and social pressures, is to reconcile a social, rights-based, gap-filling and developmental approach with an approach based on productivity and economic efficiency. Such an issue is reflected in the difficult circumstances currently facing smallholder irrigation schemes of South Africa (Perret, 2002). The critical issues that concern smallholder irrigators have been noted in recent studies as mentioned by the farmers and from policy documents as generally having to do with water availability, infrastructure, access to input and output markets, credit availability, organizational structures, suitability of technology and managerial capacity of the farmers. (e.g. De Lange, 1994 and Magingxa, 2001). Furthermore, the type of economy, which we live in, is aptly referred to as the market economy and culminates from the recent policies that have been promulgated in the country and the rest of the world. This suggests that the market is the final determinant in the commercial processes of the country. This situation puts smallholder irrigators in direct competition with well-established counterparts.

In response to global trends in economic reforms, South Africa has embarked on a process of review of its policies regarding food production and marketing. The past years of economic reforms in South Africa have increasingly acknowledged a need for improving the access of resource-poor farmers to land, water and institutional support systems as a means of combating rural poverty. Policies of the old system created a scope for the agricultural sector to be dominated by large commercial farms that are owned by a relatively small number of individuals. This situation marginalized some eight million rural dwellers (mainly black farmers) into subsistence production on only 14% of the nation's agricultural land (the rest being in the hands of the commercial farmers) (Kamara *et al.*, 2002). While reforms in the land and water laws are currently high on the agenda as a means of redressing imbalances of the

past, there is a growing concern about access of resource-poor farmers to institutional support services such as credit, extension, and especially the entrance of these small farmers to agricultural markets (input and output markets) from which they have been eliminated for too long.

Currently, the main emphasis is on a redefinition of the role of the previously disadvantaged smallholder agriculture (which is largely dominated by black small scale irrigators), and promoting participation of this sub-sector in the agricultural market economy through increased production and market orientation. The potential for market orientation by small-scale irrigators on a sustainable basis cannot be ruled out. It remains reliant on a number of issues, of which the creation of marketing opportunities and institutional support systems that facilitate integration of small farmers into national economic system are important.

Institutions have to be improved so as to remove current distortions in access to agricultural markets, facilitate the flow of information and functional markets mechanisms that allow competition and market entrance by emerging farmers, so as to enable them to get a share of market generated efficiency gains. High transaction costs become particularly problematic where individual transactions require significant transfers of information about the source or any credence attributes of commodities being transacted (Poulton *et al.*, 2005).

The situation has a potential for more complexity 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 parastatal organizations which managed most of the irrigation schemes in the country. For example, the Agricultural and Rural Development Corporation (ARDC) which was responsible for the management of schemes in the former Northern Province (now known as Limpopo Province), used to finance all the activities of the farmers and would in the end do the calculations to determine what was due

to the farmer or the ARDC itself. The ARDC had been responsible for cultivating some 120 000 ha of government farms and providing a range of services to the farmers. Its salary bill alone was R22 million (Shah *et al.*, 2001). The unsystematic discontinuation of such an elaborate support system with no alternative support was crippling to the farmers in government schemes. This means that also the costs of inputs are to be taken care of by the farmers themselves. They also have to organise the whole production process and find the markets for inputs as well as outputs themselves instead of the government doing it for them.

1.2 PROBLEM STATEMENT

There is growing evidence that many smallholder farmers can benefit from market-oriented agriculture. However, high transaction costs (a concept that will be discussed further in the section on literature review) are a barrier to accessing the markets. Poor households are often ill-equipped to respond to rapidly changing market conditions and, in some cases, have seen old production strategies undermined by new competition without being able to take advantage of the new opportunities provided by liberalisation policies e.g. the deregulation of agricultural markets in South Africa. The response of smallholder agricultural production to marketing liberalisation has thus so far been mixed.

Much of the current policy advice focuses on the effects of policy distortions and inadequate attention is given to the serious, embedded institutional deficiencies that limit many smallholder areas from taking advantage of market opportunities e.g. lack of information, adequate contract systems, farmer organisations, credit system and property rights system. These institutional deficiencies require intensive and long term attention, if globalisation is to offer opportunities for smallholder development (Kydd, 2002). The challenge of economic development therefore is to identify sources and reduce transaction costs of increasingly complex forms of trade. This is achieved through the development of institutions that support trade, by making available information (on markets and technologies), protecting

property rights and providing effective mechanisms for enforcing agreements. However if the institutions that are put in place discourage trade, the poor remain poor or get poorer (Poulton *et al.*, 1998).

Smallholder farmers in South Africa experience the same situation especially in the wake of the withdrawal of state organisations that carried out most of the marketing functions for smallholder irrigators. Directly related to the withdrawal of state support for marketing and other related functions, most of the irrigation schemes have either reduced to a fraction of original levels of production and some have gone completely defunct. As already mentioned in the background, recent studies in the Eastern Cape by Bembridge (2000) and in the Limpopo Province by Kamara *et al.* (2002) shows evidence of this deteriorating situation. There is reasonable evidence that suggest that market access issues may have a significant role in this downward trend.

1.3 RESEARCH OBJECTIVES

A substantial number of studies in the recent history have put market access as one of the main ingredients to successful irrigation management. The core argument in recent studies such as Gabre-Madhin and Haggblade (2001), Hau and von Oppen (2002), Foremen and Livezey (2003) and Muhammad, *et al.* (2004) is that market access needs to receive more attention in studies dealing with smallholder farmers. However, as Kherallah and Kirsten (2002) argue, the frequent occurrence of market failure in developing countries requires an institutional analysis.

Within the above context, the study is designed with the primary objective of generating information on the role of market supporting institutions in successful smallholder irrigation management. Specifically, the study will focus on the extent to which market access influences the potential for success.

Secondly, the study seeks to identify and measure key determinants of market access for smallholder irrigators. A better understanding of whether

the constraints relate more to lack of physical access or institutional would be useful in informing policy decisions aimed at improving smallholder agricultural performance.

The study aims to achieve the above stated objectives by following the approach outlined below:

1. The background to smallholder irrigation management in South Africa is outlined.

2. A literature survey is conducted involving factors affecting the success potential of farmers in smallholder irrigation and determinants of market access for smallholder farmers both internationally and locally.

3. Empirical farm-level data is collected in irrigation schemes focusing on household characteristics and resources and institutions related to the access to markets of smallholder irrigators.

4. A statistical technique is applied to determine the characteristics of potentially successful farmers.

5. Results from step 4 are used to assess the influence of access to market and other related variables to the observed success potential using an econometric model.

6. A model is developed to assess the influence various variables obtained from literature on the potential of smallholder irrigators to access output markets.

Improved smallholder productivity will contribute to the overall economic growth of the country (through sectoral linkages) as well as tackle the problem of food insecurity and poverty. It is therefore important to identify institutional options to facilitate linking smallholder irrigators to the markets.

1.4 DATA AND METHODOLOGY

Data for the study was collected in six smallholder irrigation schemes in the Eastern Cape, Limpopo and Mpumalanga provinces of South Africa. The irrigation schemes under study are Melani, Qamdobowa, Roxeni and Somgxada in the Eastern Cape; Sepitsi in Limpopo and Hereford Irrigation scheme in Mpumalanga. The data set focuses mainly on socio-economic factors and market access issues.

Several considerations were during the selection of the irrigation schemes including spatial considerations and availability of background information on the irrigation schemes to ensure representivity. The research interests of funding institutions also influenced the final selection of irrigation schemes. A detailed account of scheme information is provided in Chapter 3.

Following Leedy and Ormrod (2001), samples of farmers were selected within each irrigation scheme and a total of 121 farmers were interviewed for the study using a structured questionnaire that is attached as Appendix A. The lack of proper records by the farmers presented a problem and some of the information depended on the accuracy of the farmer's recall.

The analysis conducted employs several methods at each of the steps highlighted in section 1.3 above. The study uses mainly econometric analytical methods to achieve the afore-mentioned objectives. The cluster analysis method was used to analyse the characteristics of the potentially successful farmers. To determine factors influencing the success potential in smallholder irrigation schemes, a Principal Component Regression (PCR) technique was employed. Finally, the Principal Component Analysis (PCA) technique was applied to determine the influence of various factors on market access. A detailed description of each of the techniques is provided at each of the steps in the subsequent chapters.

1.5 OUTLINE OF THE STUDY

The study is primarily concerned with the role of market supporting institutions in successful smallholder irrigation management. To sufficiently address this objective, the next chapter provides a review of relevant literature on smallholder market access highlighting some of the processes and policy changes that have led to the prevailing situation. It also presents factors that are understood to have an influence in the success potential of smallholder farmers and their projects, as well as those (physical and institutional) that are understood to influence their market access.

Chapter 3 gives a description of the study areas in terms of the history of irrigation schemes, their location, irrigation systems, number of farmers involved, main crops produced and the institutional set-up. 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. This chapter also discusses resources available to the various households, institutions and marketing management. Primary data used in this study was collected in six irrigation schemes in three provinces (Eastern Cape, Limpopo and Mpumalanga).

In Chapter 5 the cluster analysis tool is employed to assess the success potential amongst the surveyed farmers. The analysis produces two groups of farmers namely the more successful and the less successful. Subsequently, the role of market access in influencing the potential for success of irrigation projects is dealt with in Chapter 6 using the results from the previous chapter. Here a principal component regression tool is used. Subsequently, a principal component analysis is engaged in Chapter 7 to examine the factors that in turn influence market access. The analysis tools employed in Chapter 6 and Chapter 7 are used to deal with the problem of multi-collinearity in the data. For these three previous chapters, a detailed account of the methodology is provided in each chapter.

Chapter 8 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

This chapter provides a review of relevant literature on smallholder market access. Firstly, the importance of institutions for the rural poor is addressed and the institutional approach to understanding problems of small farmers is discussed in detail. The chapter also presents factors that are understood to have an influence in the success potential of smallholder farmers and their projects, as well as those (physical and institutional) that are understood to influence their market access.

2.1.1 Markets and institutions for the rural poor

It is difficult to look at poverty without looking at agriculture and the rural sector as a whole. Even for the urban poor the success of agriculture is vital to them. Confirming what is increasingly being classified as common knowledge, a study conducted by the International Fund for Agricultural Development (IFAD) in 2003 concludes that, rural households have diverse livelihood strategies, encompassing a range of activities. For most, agriculture is a key element of their strategy; however, many are also engaged in non-agricultural activities, including micro enterprises (agro-processing, trading and other off-farm occupations). Through these various activities, households seek both to ensure their food requirements and to generate the income they require to satisfy their immediate consumption needs, social purposes and investments. This also agrees with the 'fox' strategy by poor rural people (Chambers, 1983) of combining a number of activities to achieve a livelihood as discussed in Chapter 1.

Drawing from a number of studies, Killick, Kydd and Poulton (2000) articulate the fact that in Africa, Asia and Latin America, poor rural households regularly

obtain up to half of their income from off-farm sources. Moreover, it appears that this proportion is rising. There is considerable debate as to how far this can be seen as a positive phenomenon, implying diversification into new opportunities, and how far it is a desperate response to a crisis in agricultural production, with informal rural activities acting as a (very low paying) welfare net for people who are less and less able to make ends meet from the land. Upon closer inspection, however, both views are compatible with an analysis that still places agricultural development at the heart of rural growth and poverty reduction. The authors further explain that implicit in the explanation of agriculture's role in promoting economic growth and poverty reduction is an understanding that smallholder agriculture needs to undergo a process of commercialisation.

The relations between agricultural productivity and poverty reduction are largely rather straightforward. Productivity improvements in agriculture lead to increases in food production, which leads to cheaper food. Cheap food carries enormous benefits for poor consumers, which includes both the farmer and the urban poor. The reduced cost of food is not the only benefit. To reduce the cost of food we have to produce more food. As more food is produced and moves from the farms to the urban areas, economic activities, small and big, are generated all along the way in production, collection, grading, storing, transporting, consolidation, processing and resale. These activities create employment and income opportunities for both the rural and urban poor (Hartmann, 2003). Mellor (1999) argues that agricultural development is the reason so much of the world is finding its way out of poverty (all of Asia for example) and that the reason poverty reduction is slowing in those same areas is that agricultural growth has received much less attention in the last decade in favour of industrialisation.

In most of sub-Saharan Africa, there appears little immediate prospects for rural industrialization or other non-farm engines of growth, so smallholder agriculture is likely to remain the major source of rural growth and livelihood improvement for some time (Dorward, Kydd and Poulton, 1998). Within this situation, cash crops have a key role to play. The starting point for promoting

economic growth in rural areas in almost all African countries is to alleviate supply constraints for agricultural exportables, principally through technological change that permits total factor productivity gains (Delgado, Hopkins, Kelly, Hazell, Alfano, Hoijati, Gruhn, and Sil, 1994). Development of smallholder cash crop production has the potential to bring direct benefits to a large number of farm households within a given district or region. Even households that do not benefit directly may reap indirect benefits through increased demand for hired labour (often a valuable source of income for the poorest). The predominantly poor in Africa are mainly smallholder farmers. Dorward *et al.* (1998) highlight some of the properties of cash crops, which need to be taken into account in this line of thinking as high value commodities; handled through reasonably concentrated marketing systems; require purchased inputs and are linked to international prices. This displays that for smallholder irrigators to fully harness the benefits of cash cropping, they need to invest higher than for subsistence farming purposes and require access to adequate and relevant information.

Inherent in the movement of food from the farms to urban areas is the issue of market access. Virtually all households in rural areas are, by preference, both producers and consumers, buyers and sellers; and many sell agricultural produce and buy their food at different times of the year (IFAD, 2003). Interacting with agricultural markets is thus an important aspect of the livelihood strategies of many rural households, rich and poor alike. Markets are where, as producers, they buy their agricultural inputs and sell their products; and where, as consumers, they use their income from the sale of crops, or from their non-agricultural activities, to buy their food requirements and consumption goods. Access to markets is critical in allowing new farmers into the main stream because it is considered as one of the most important determinants for their success (NDoA, 2000). However, rural households that, for one reason or another, are unable to interact with these markets are prevented from adopting these diverse livelihood strategies; and indeed, in many parts of the world, rural poor people often say that one reason they cannot improve their living standards is that they face difficulties in accessing markets (Heinemann, 2002). A major reason why even those farmers who

can produce a surplus remain trapped in the poverty cycle is lack of access to profitable markets (International Institute of Tropical Agriculture (IITA), 2001). For these reasons, improved market access is not an issue of consequence only to better-off producers, and it is not relevant only to cash crop production, rather than food crop production. It is of importance to all rural households, and assisting rural poor people in improving their access to markets must be a critical element of any strategy to enable them to enhance their food security and increase their incomes (IFAD, 2003).

From this perspective, the integration process of the emerging farmers should not be viewed in a narrow context of only allocating land and water, but in a broader perspective that embeds the access to these resources in an overall economic framework that include access to markets, credit, extension, etc. These aspects of viability should be viewed in line with other important factors such as managerial abilities of the farmers. This requires applied research and monitoring so as to generate information on the conditions for achieving sustainable livelihood strategies for the smallholder farmers, and eventually integrate them in the national economic system. The realization of the above situation forms a good basis for revisiting existing policies and institutional framework, and enriching them with accurately researched information on the factors that affect productivity within this institutional framework. While the problems of smallholders are discussed in most of the literature on smallholder irrigators, the debate could benefit from further documenting of the extent or significance of these problems. This discussion shows that market access issues are extremely important and that ways of reducing transaction costs for smallholder irrigators should be investigated.

Literature related to smallholder agricultural production shows that increasing production is one approach to improving farm incomes and food availability, but an additional strategy with considerable promise is that of making better use of what is already produced. Improving post-harvest handling, marketing, and storage has not received the attention warranted (IFAD, 2003) . Some losses are inevitable, but reducing loss will translate to an increase in farmer incomes and total food availability without using additional natural resources.

Supportive policies to lower the transaction costs implicit in smallholder crop production will require significant institutional innovation. In Africa's changing political and fiscal environment, many of these institutions will involve decentralization and privatization of functions once thought to be more appropriate to parastatal activity. In part, they will involve grass-roots producer organization, in part trader associations. Such institutions will need to be able to function within market principles, yet also to deal with the public-goods-nature of some of the issues. They will need to facilitate the integration of the production, marketing, and retailing functions of the marketing chains (Ndulu and van de Walle, 1997). South Africa is no exception to this reality and therefore market access for the rural poor remains a critical factor in improving household food security and living standards for the rural poor.

It is increasingly being recognised that the important step in market access for producers in developing countries may be to any non-traditional markets, not necessarily to foreign markets. Similarly, the analysis of how trade influences development has moved from focusing on manufactures to all non-traditional exports. Increased integration into national markets, particularly new types (for example urban, where imports compete) may require similar efforts and have similar effects to increased exports. There is increased globalisation of standards and information, not simply increased flows of goods - the growing share of supermarkets in food sales in developing countries (Reardon and Berdegué, 2002), a trend which is just starting in Africa, means that even for small farmers the national market is becoming more like the international. Once they sell beyond local markets, they face the same high standards and concentration of buyers (Page, 2003).

2.1.2 Studies related to smallholder market access

Research and development initiatives on smallholder market access have been conducted by various institutions and scholars in Africa and other parts of the world and has gained considerable momentum in the 21st century. Research and development organizations have recognized that enhancing the ability of resource-poor farmers to produce beyond subsistence and improving

market access for their produce is critical for agricultural development in developing countries.

IFAD's experience over the last 25 years unequivocally shows that rural poor people are fully capable both of integrating themselves into the mainstream of social and economic development, and of actively contributing to improved economic performance at the national level – provided that the causes of their poverty are understood and conditions are created that are conducive to their efforts (IFAD, 2003).

Killick *et al.* (2000) define market access as a term which refers to the processes by which people access markets and the nature, efficiency and costs of these processes. According to them, market access is determined by the following: Firstly, information about product availability, attributes and prices, including the frequency, quality and cost of this information. Secondly, information about counter-parties to transactions, as trustworthiness is critical if payment is not instantaneous or checking of quality is costly. Thirdly, the extent of confidence in market conduct, e.g. how well are markets regulated (voluntarily or by government). Fourthly, the physical costs of accessing the market, a function of the quality of infrastructure and the organisation of the transport sector; and finally, actual prices found in the markets in which people transact. The above definition is not far from the IFAD (2003) definition, where market access is considered according to three dimensions *viz.*, physical access to markets (distances, costs etc.); structure of the markets (asymmetry of relations between farmers, market intermediaries and consumers); and producers' lack of skills, information and organisation (understanding of the market, prices, bargaining etc.).

However, to develop markets and institutions that support them takes time. At times, reforms to build markets fail entirely. When they succeed, they frequently impose costs on specific groups in society. When the losers from reforms include poor people, who are particularly vulnerable to shocks, countries have a special obligation to ease the burden of reform. And even when markets work, societies have to help poor people overcome the

obstacles that prevent them from freely and fairly participating in markets (World Bank, 2000).

Continuing work by IFAD also demonstrates that there are impediments that have to be dealt with concerning smallholder farmers in particular. In one of their recent outputs they acknowledge that a full process of market liberalisation will not necessarily increase the participation of small producers to a significant extent unless specific support measures are taken and they move to higher value added products. There are a number of "invisible", yet critical, barriers to trade that must be overcome such as the lack of awareness of market opportunities and of familiarity with standards, limited scale of operations and specific skills, among others (IFAD, 2004).

In their assessment, Shah, van Koppen, Merrey, de Lange, and Samad (2001), argue that besides getting the process right, South Africa—and the rest of Africa—also need to focus on evolving the right Irrigation Management Transfer strategy that addresses the entire complex of constraints that smallholder irrigation schemes are facing, replacing the so-called downward ratchets by strong upward ones. In order to do this the tenor of discourse in the whole of African smallholder irrigation context needs to shift from institutional reform of smallholder irrigation management to institutional intervention designed to significantly enhance smallholder productivity and incomes.

Based on their research, the IITA has developed a macro-information service which collects and processes market information for the use of government and development agencies to assist their work in providing food security, monitoring the economy and improving agricultural performance. The maize component of the project utilises the services of local radio stations to broadcast information in the local language to actors in an important maize-producing area of Eastern Uganda. These broadcasts take the form of a two-minute announcement, on three days a week, of relevant prices collected from local and wholesale markets.

The paper by Matungul, Ortmann, and Lyne (2002) provides empirical evidence of the impact of transaction costs on crop income earned by communal farmers in two regions of KwaZulu-Natal. The hypothesis that the variety and quality of marketing channels is determined by transaction costs, which in turn influence the level of crop income, was tested using a block-recursive model. Transaction costs are seen as a primary determinant of crop income level. Greater depth in marketing methods which indirectly reflects low transaction costs has a positive influence on crop income. Three key determinants with statistically significant coefficients - the depth in marketing methods, the size of allocated arable land and off-farm income - had a positive impact on crop income. The significant impact of the regional dummy on crop income implies that the fertility of the study area also affects crop sales. The context of this study is very relevant because according to Killick *et al.* (2000), the most important market for the poor is access to their own local market.

The Re-governing markets programme is also worth mentioning in this discussion. This programme of collaborative research and policy support aims to deepen understanding of the keys to inclusion into agri-food systems for countries and regions experiencing different degrees of restructuring. The focus is on the dynamic restructured national and regional markets that are displacing existing chains, and their interface with small-scale farmers and local rural economies. The objective is to inform public sector policy and private sector strategies by providing practical approaches to engage with policy processes. It uses comparisons across countries and regions examining the different levels of market restructuring as well as the differing policy environments. Through empirical and action research on social and economic implications, it will assess the opportunities for small-scale producers and small and medium scale enterprises (SMEs). The programme aims to identify good and /or innovative practices for connecting small-scale producers with these dynamic markets. It will bring the findings into the wider policy arena through support to learning platforms and strategic activities at international, regional and national levels. Lessons learnt are shared with a view to contribute to policy dialogue, with the ultimate aim of influencing

policy. This programme is supported by Department for International Development (DFID), Canadian International Development Agency (CIDA), International Development Research Council (IDRC), Interchurch Organisation for Development Co-operation (ICCO) and Catholic Organisation for Relief and Development AID (Cordaid).

In the South African context, Vink and Kirsten (2000), found ample empirical evidence that deregulation of agricultural marketing in South Africa, brought net welfare gains for commercial agriculture and therefore for the entire nation. Food prices declined, investment in agriculture increased, higher production per hectare was achieved, and farmers began producing higher value crops, with spectacular increases in the hectares planted to deciduous fruit such as plums and grapes. South African farmers are now considerably more efficient and are making their presence felt on world markets. However, this does not necessarily mean that smallholders have enjoyed these gains because of a number of constraints that inhibit smallholder access to agricultural markets in South Africa. Hypothesized problems usually include infrastructure, market access, credit, organizational structures, suitability of technology and managerial capacity of the farmers. The importance of paying particular attention to smallholder market access is discussed further in the following section.

Even though some of the issues that determine and limit access to markets by small-scale farmers to commodity markets in South Africa are related to policy, most are location-, farmer-, and/or commodity specific, and some are more pertinent to other provinces than others (Makhura and Mokoena, 2003). In addition to the problems listed earlier, they include farmer discrimination and lack of institutional responsibility to the list of small-scale farming problems in South Africa. They argue that some farmers experience discrimination through their products being traded last and affecting their prices. They also argue that there is lack of responsibility regarding ensuring market access for small farmers with various government departments and organisations bouncing the responsibility between themselves.

2.1.3 Study focus

This review focuses on produce marketing in selected smallholder irrigation schemes of South Africa. To sufficiently address the issues around this debate, this discussion will now move to examine changes in international agricultural markets and their effects on poor smallholder farmers in South Africa and internationally. Specific attention will also be given to market reforms in South Africa as these directly have an effect on the access to produce markets for smallholder farmers. The role of markets in the potential for success in smallholder farming is discussed further. In addition, factors that influence market access will be examined. Specific attention will be given to institutional reforms and relevant theoretical issues regarding smallholder agricultural marketing.

2.2 INTERNATIONAL AGRICULTURAL MARKETS

2.2.1 Introduction

The last few decades have seen huge and rapid economic transformations in the developing world. At the top of these reforms have been the concepts of globalization and the concomitant economic integration. There have been advances and specific developments in world markets for agriculture and changes in government policies, notably market liberalisation. It should be recognized that poor rural households may be affected by these trends in a variety of ways - as consumers, agricultural producers, suppliers of labour and producers of non-tradable goods and services (including some agricultural products) demanded by surplus-producing agricultural households. However, the importance of expanding smallholder agricultural production to facilitate rural growth and poverty reduction cannot be over-emphasised.

The last 50 years of development economics have seen hopes for global development raised high and dashed time and again. While there has been positive, sometimes even impressive, growth in many countries, in most of the world experience has not matched expectations. The accumulations of

physical capital and human capital, liberalization and privatisation have all been proposed as elixirs of growth. While all these arguments have some merit, by themselves, they are incomplete solutions to the problem of development. The essential ingredient that might catalyse the ingredients mentioned above into a thriving economy is good governance (Azfar, 2002).

Two decades ago, major markets in many developing countries were controlled by governments. Monopolistic parastatal marketing agencies were typically responsible for both the delivery of agri-inputs and the marketing of agricultural produce, through a network of distribution outlets and marketing depots, and at prices (usually pan-territorial) that were determined in advance. Marketing of agricultural products in South Africa was also done through the so-called Marketing Boards e.g. Maize Board, Wheat Board etc.

The so-called Berg report published by the World Bank in 1981, which called for a move away from state intervention in economic activity and a freeing of markets, had a major role in influencing the path for economic development (Dorward *et al.*, 1998). This is supported by a number of other studies such as IFAD (2003), Jayne, Govereh, Mwanaumo, Nyoro, and Chąpoto. (2002), Kherallah and Kirsten (2002) and Killick *et al.* (2000). Its aim was to unleash the creative forces of private entrepreneurship, in particular within smallholder agriculture and indigenous trading systems. With respect to agricultural marketing systems, the Berg report argued that state marketing organizations should be reformed, so as to operate on a sounder commercial basis, and that the private sector should be permitted to enter marketing systems to provide competition and encourage efficiency (Dorward *et al.*, 1998).

2.2.2 Market reforms and small scale producers

Although most of the changes in agricultural and food markets are taking place in the developed countries, they have far-reaching implications for agricultural development efforts in developing countries (Kirsten and Sartorius, 2002). It should also be noted that the majority of the rural poor are smallholder farmers. According to Kherralah, Delgado, Gabre-Madhin, Minot,

and Johnson (2002), the evidence on the impact of agricultural market reforms on poverty is mixed.

There is evidence that such liberalization, privatisation and tax reforms in fact created serious instability, inequity and inefficiency, because they were carried out without the regulatory and legal frameworks, and government rules and structures, that make banking systems, corporate governance, and tax collection work effectively in advanced industrial countries (Azfar, 2002). The combined effects of liberalization of agricultural markets and globalization have generally increased economic differentiation among communities and households. By virtue of their location, asset base and levels of organization, some communities – and some households within communities – have succeeded in responding to new market opportunities, and have been able to increase their incomes, in some cases substantially (IFAD, 2003). With the withdrawal of the state from agricultural marketing, a new – and highly uncertain environment has been created, in which prices, whether for selling produce or purchasing inputs, are now largely negotiated. New commercial relations must be struck with a myriad of suppliers and buyers. For some farmers, this has created major new opportunities; for others, it has created major problems. Smallholder farmers are ill equipped to benefit from the new market environment. They face enormous constraints in physically accessing markets. They also lack information about markets, business and negotiating experience, and a collective organisation to give them the power they need to interact on equal terms with other – generally larger, stronger market intermediaries. The result is poor terms of exchange and little influence over what they are offered (Heinemann, 2002).

Peasant producers have veered away from production of traditional export crops and commercial staple foods in rural areas remote from roads and urban markets. Non-agricultural income diversification has been substituted in the search for much-needed cash earnings (Bryceson, 2002). Poor households are often ill-equipped to respond to rapidly changing market conditions and, in some cases, have seen old production strategies undermined by new competition without being able to take advantage of the

new opportunities provided by liberalization policies (Killick *et al.,* 2000). In other words, as IFAD (2003) put it, smallholder producers find themselves in a world entirely unlike the one they faced two decades ago. Perhaps ironically, market reform has been most severely criticised in countries where direct government involvement in marketing has remained entrenched, such as the former settler maize economies of eastern and southern Africa (Jayne *et al.*, 2002).

According to Kherallah *et al.* (2002), if agricultural reforms in Africa are to fulfil the high expectations of their proponents, improvement will have to be made in four areas. First, the task of liberalizing agricultural markets must be completed. This task implies the withdrawal of state enterprises from direct agricultural production, marketing, and processing, as well as convincing signals from political authorities that the reforms will not be reversed or undermined. Second, complementary policies in other sectors are needed to enhance the benefits of the reforms and alleviate the negative effects. A stable macro-economic environment, progress in taming corruption, and stronger legal infrastructure are prerequisites for stimulating domestic and international investment, including that in the agricultural sector. Similarly, programmes to provide a credible safety net for households adversely affected by the reforms are justifiable on their own terms as well as for the political sustainability of the reforms. Third, the withdrawal of the state from commercial activities should not be interpreted as withdrawal from its essential role in providing public goods. Governments and international organizations need to reverse declining investments in agricultural research and extension, improve transport infrastructure, promote the sustainable use of natural resources, and develop public services such as market information, plant protection, and disease control. Fourth, the government can play a role in promoting non-governmental institutions in the agricultural sector. Farmer associations facilitate dialogue between the government, on the one hand, and farmers and traders on the other. This dialogue should guide the design of public institutions such as grades and standards, plant protection regulations, and market information services.

2.2.3 Market failures

Early arguments for greater involvement of the private sector in agricultural marketing centred largely on the inefficiencies of past state provision and the difficulties of improving the quality of services provided by the state sector. In the agricultural sector these programmes were designed to eliminate price controls on agricultural commodities, disband or privatise state farms and state-owned enterprises, reduce the heavy taxation of agricultural exports, phase out subsidies on fertiliser and other inputs, and allow greater competition in agricultural markets (Kherallah *et al.*, 2002). Kherallah goes further to say that the pace and extent of reforms has varied widely across countries, and the reforms have often not been implemented fully. Food markets have been dramatically transformed in some countries like Ethiopia, Madagascar and Tanzania whilst in others they have been partially transformed e.g. Malawi, Zambia and Zimbabwe. According to IFAD (2003), the process is most advanced in countries that were the first to introduce market reforms as well as those countries that have relatively sophisticated and diverse economies, a well established private sector and an entrepreneurial culture, and a relatively developed rural infrastructure. Within countries, markets have grown more rapidly in areas close to urban centres, with relatively dense populations, and in higher-potential areas where levels of agricultural production and surpluses are greater. By contrast, in areas that are remote, have weak infrastructure, are scarcely populated and have low agricultural potential, the process of market development has been far slower.

Dorward *et al.* (1998), argue that one explanation for the apparently disappointing response to market liberalisation was that enthusiasts such as Berg had held an unduly optimistic view of the potential of the African private sector to provide the services previously provided by state organs. They argue that in practice, and in retrospect not surprisingly, the emergence of private-sector market intermediaries (ranging from small-scale informal traders to large, often foreign owned, agro-processors) to fill the vacuum left by the withdrawal of the state has generally been less smooth and less rapid than expected. In this rapidly evolving context, the policy and institutional

frameworks established by governments of developing countries have not been consistently supportive of private-sector-led market development. Market failures occur when costs and benefits that guide individuals/private sector differ from those that are economically optimal for society as a whole. This can result, for instance, from private investors being unable to obtain benefit from certain investment because they cannot stop `free-riders'; individuals/companies having incentive to impose costs of pollution to others; and information not being equally available to buyers and sellers of particular goods or an over-concentrated market.

Kherallah and Kirsten (2002) argue that the frequent occurrence of market failure and incomplete markets (because of higher transaction costs and information asymmetries) in developing countries cannot be explained by conventional neo-classical economics and requires an institutional analysis. They argue that in addition to the many applications of the New Institutional Economics (NIE) framework to input market failure it can also now be argued that the rapid changes in the food and agricultural sector in developing countries in the aftermath of market liberalization and government devolution provides an additional and probably much more fertile terrain for the application of the NIE framework.

NIE is concerned fundamentally with problems of market coordination, and the incentives for economic agents to devise institutional responses to problems of market imperfections (Dorward *et al.*, 1998). NIE encompasses a number of disciplines like law, sociology and history which is increasingly recognized as a formidable tool for analysing different issues of development interest. NIE analysis begins from a distinction between the physical *transformation* activities by which people use assets (or asset combinations) to produce goods or services, and the human *transaction* activities by which people hold and exchange assets, goods and services and combine them to allow desired physical transformations (Morrison, Dorward, Kydd, Poulton and Smith, 2000). Key concepts are uncertainty, the transaction costs of contracting through market exchange, the role of institutions in reducing costs, and their influence on the organisation and development of economic activity.

The effects of market failures may include, among others:

- The private sector under-investing in some goods and services which are needed for sustained growth, such as basic research and infrastructure.
- Buyers of seed or agro-chemicals running the risk of buying sub-standard items.
- Environmental damage, especially in the situation of a lack of clear property rights.

In such cases of market failure, Government may intervene in several ways including:

- Investing in rural infrastructure;
- Regulating to counter pollution of water-courses or other environmentally damaging practices;
- Assisting with funding research into untraded or non-hybrid crops or into farming systems or resource conservation where private sector organisations find it difficult to realise a return;
- Reducing anti-competitive behaviour;
- Regulating to reduce risk in food safety; and
- Funding services and regulation to minimise threats of epidemics among animals.

The Government will also seek to strengthen the efficiency of service provision by targeting those most in need of support, principally the resource-poor and emerging farmers. NIE therefore focuses on the choices people make, while at the same time it allows for factors such as pervasiveness of information and human limitations on the processing of information, evolution of norms, and willingness of people to form bonds of trust (Clague, 1997). As such this paradigm seems ideally suited to explain the commercialization behaviour of smallholders. Sometimes development practitioners are faced with a difficult question of whether imperfect governments should be used to correct imperfect markets, or contrariwise whether imperfect markets should be brought into play to improve the resource misallocations of imperfect

governments. What the NIE tells us is that neither answer is invariably correct. Rather, the task is to estimate the respective net changes in transaction costs in comparison with the anticipated allocative improvement, to find out whether policy should be favouring additional government intervention or further privatization (Toye, 1995).

2.3 REFORMING THE SOUTH AFRICAN AGRICULTURAL MARKETS

The process of deregulation in South Africa began some time before the first democratic election in the country in 1994. Agricultural marketing in South Africa virtually went through a full circle in the twentieth century – from *laissez-faire* system to one of very rigid controls and back to a system with fewer controls and less government intervention than in most countries in the world (van Schalkwyk, Groenewald and Jooste, 2003).

While the changes were not as dramatic as those in other parts of the world, they were felt by the entire population. Agriculture is integrally tied to everyone because changes in agriculture can result in quantity and price fluctuations in the food supply. The change back to fewer controls could be seen as a major paradigm shift whereby the responsibility for marketing of agricultural products shifted from marketing control boards to producers. The control boards used to control the marketing of a particular commodity in a prescribed manner. A total of 23 Control Boards were established, a framework which was then systematically dissolved. Much of the process is now managed through the National Agricultural Marketing Council (NAMC), which was created under the Marketing of Agricultural Products Act of 1996. The 1996 Act states its objectives explicitly in Section 2, where it spells out the conditions under which any statutory measures are to be allowed. These include:

- increased market access for all market participants;
- the promotion of efficiency in the marketing of agricultural products;
- optimisation of export earnings from agricultural products; and
- enhancing the viability of the agricultural sector.

The main objective of the NAMC was to investigate market access for disadvantaged market participants and to make recommendations to integrate them into commercial agriculture. It lists participants in the disadvantaged groups into four categories *viz.*, subsistence farmers, newly emergent participants, those in transition / semi-commercial and commercial farmers. While the NAMC states its main focus as being set on groups 2 and 3, to lead them into a commercial efficient agricultural system, it stresses that particular attention will be given to subsistence farmers because of the possible impact envisaged on their food security (Groenewald, 1999).

The study by Vink and Kirsten (2000), mentioned in 2.1.2 found ample empirical evidence that deregulation of agricultural marketing in South Africa, brought net welfare gains for commercial agriculture and therefore for the entire nation. Food prices declined, investment in agriculture increased, higher production per hectare was achieved, and farmers began producing higher value crops, with spectacular increases in the hectares planted to deciduous fruit such as plums and grapes. South African farmers are now considerably more efficient and are making their presence felt on world markets. Later the report prepared for the NAMC by ECI in 2002 substantiated their findings by concluding that for the general population, there is an increase in absolute food security. However, this does not necessarily mean that smallholders have enjoyed these gains because of a number of constraints that inhibit smallholder access to agricultural markets in South Africa. Hypothesized problems usually include infrastructure, market access, credit, organizational structures, suitability of technology and managerial capacity of the farmers. The importance of paying particular attention to smallholder market access is discussed further in the following section.

2.4 AGRICULTURAL MARKETING AND PERFORMANCE

2.4.1 Introduction

The performance of smallholder irrigation farmers in South Africa is continually underscoring the expectations of those involved in their development. This is in spite of substantial reforms to improve the performance of this sub-sector. Currently, the government is involved in land reform processes to redress past imbalances and meet its objectives of poverty alleviation and economic growth. The process mainly involves restitution, redistribution and tenure reforms. Recipients are expected to engage in entrepreneurial activities and improve their living standard. It is clear therefore that the government attaches a lot of weight to land based strategies in helping it to achieve its objectives.

These concerns are not only limited to new entrants in farming but also existing irrigation schemes. This continued under-performance provides a good basis for exploring characteristics that could possibly affect potential success of smallholder irrigators in general and look at how South African smallholders compare. The latter part of the exercise is performed using an analysis tool in Chapter 5. This section is limited to exploring these specific individual characteristics. Understanding these characteristics will contribute to a better understanding of the farmers involved in small-scale irrigation farming. In addition, it is necessary to understand the factors that influence the potential for success of irrigation projects. This knowledge would benefit farmers themselves and those working with them like providers of extension services, capital providers and trade partners. This line of thinking is supported by van Rooyen (1984) when he says that effective agricultural production should start with the farmer and his farming system.

2.4.2 Success in smallholder irrigation management

Recent thinking trends largely support the notion that the process of economic growth depends largely on entrepreneurship. Marshall and Peake (2005)

comment that within entrepreneurship literature, three main factors of capital have been recognised as essential elements of the entrepreneurial process - human, financial and social capital. In entrepreneurial context, 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 in business establishment (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. Clearly these components of human capital form part of necessary characteristics that influence the potential success in smallholder irrigators. This argument is supported by Rauch and Frese (2000) when they say that human capital of small business owners constitutes an important factor of small business success. They emphasise on the aspects of knowledge and skills of the business owners as those that help in the tasks to run a business and learn more about it.

Backeberg and Groenewald (1995) echo the above arguments advancing that for the purpose of policy formulation in the present mature phase of the water economy, it must be accepted that the driving force in the market process is productive activity of the individual entrepreneurs. According to them, entrepreneurial initiative in the market process must be supported and facilitated by government.

Blackman, Hurd, and Timo (2000) contribute to this discussion by emphasising on three characteristics that are mainly found in entrepreneurial individuals. These characteristics are innovation, creativity and the need to achieve. In their study, respondents who scored higher in these characteristics were more entrepreneurial than their counterparts.

Nel, Botha and Groenewald (1998) sum this discussion up when they advance that, the relationship between managerial ability and farming success has been recognised ever since the emergence of Agricultural

Economics and Farm Management as academic disciplines (citing Taylor and Taylor, 1952). They suggest that this relationship should be borne in mind when efforts are made to settle new farmers on land as is the case with the efforts described earlier. They argue that it is important that farmers settled on land farm successfully and become financially independent. Again, this argument is as much relevant to new farmer settlement as it is to existing irrigation schemes. Within the debate on managerial ability, farmer age also becomes very relevant.

Long ago in studies related to farming, the age of the farmer has always been considered an important aspect in farm management. This factor holds because it can affect ability to respond to opportunities. Age can, to a large extent, also affect the response to modern innovations in farming practices. For example, using a logit model to evaluate the factors that influence farmers' willingness to participate in a weed eradication programme, Collins, Larson, Roberts and Burton, (1999) found age to be significant in determining producer willingness to vote for the programme.

2.4.3 Market access as a success factor

Even though various scholars focus on different issues that have a potential influence on success of smallholder irrigation projects, there are those that seem to be consistently being acknowledged commonly. A complex combination of factors has a role in influencing the potential success of these activities. Lipton (1996) identified what he referred to as the 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. Thus 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, insufficient irrigation, organization, management and training.

Foremen and Livezey (2003) conducted a study to determine factors contributing to financial success and found that the ratio of government payments to total production value, tenure, crop diversification, cost control, education, yield and debt-to-asset ratio as significant factors influencing at least one financial success measure. According to them market access is one of the driving forces of agricultural commercialisation. In their study, Muhammad, Tegegne, and Ekanem (2004) included the following factors as having potential to influence level of success - 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, extension and education needs. In addition, they also examined the plans for the future 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 their study (Hau and von Oppen, 2002) present an analysis of the impact of market access on agricultural productivity. Results provided evidence for the importance of investments in physical and institutional infrastructure of agricultural markets. They assert that an improvement 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 view therefore that market access is one of the critical factors that determine success of smallholder farming projects. This is an acceptable view even among professional 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 favourable policy environment as the most prominent determinates of success.

2.4.4 Market institutions

Kherallah and Kirsten (2002) note the commonly agreed upon definition for institutions as a set of formal (laws, contracts, political systems, organizations, markets, etc) and informal (norms, traditions, customs value systems, religions, sociological trends, etc.) rules of conduct that facilitate co-ordination or govern relationships between individuals or groups. In other words institution can be viewed as the structural framework for social interaction, focusing on conventions and rules as co-ordinators of social behaviour and economic interaction. On the other hand a market is often defined as a medium where change of ownership for goods and services takes place. In other words, markets exist to facilitate the transfer of ownership of goods from one owner to another within a particular set of rules. Therefore a market can be viewed as an institution.

This exchange can be through bartering or money can be used. If the series of changes of ownership and economic processes by which products are transferred from the primary producer (the farmer) to the final consumer are thought of as marketing chains then it is apparent that there are many alternative marketing chains (Colman and Young, 1989). A very general institutional description of a food marketing chain might be that it involves five groups of economic agents and that a 'shape' to their activities may be assumed which is based upon the number of agents in each class as shown in Figure 2.1 below.

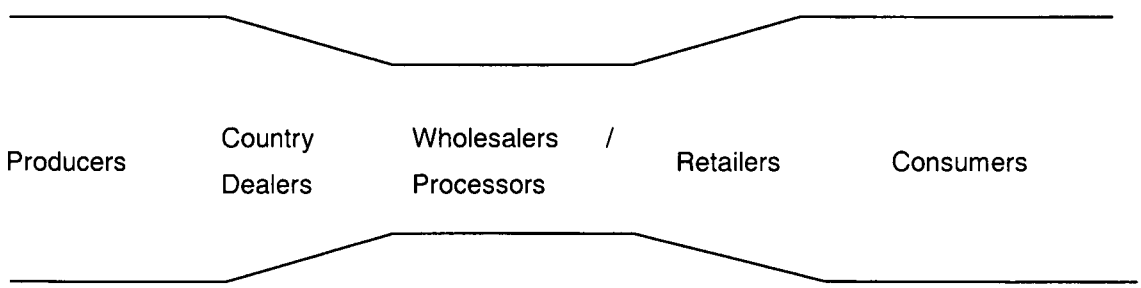

Figure 2.1: Basic structure of an agricultural marketing chain
Source: Colman and Young (1989)

Five alternative marketing chains, which may simultaneously operate in agricultural output markets are identified by Timmer *et al.* (1983). In Figure 2.2 the symbols T, S and P are used to denote the various marketing services which may be provided by one of the two parties at any exchange in ownership. In Figure 2.2 which shows the five alternative marketing chains, P represents the processing function; T represents the transport function and S represents the storage function.

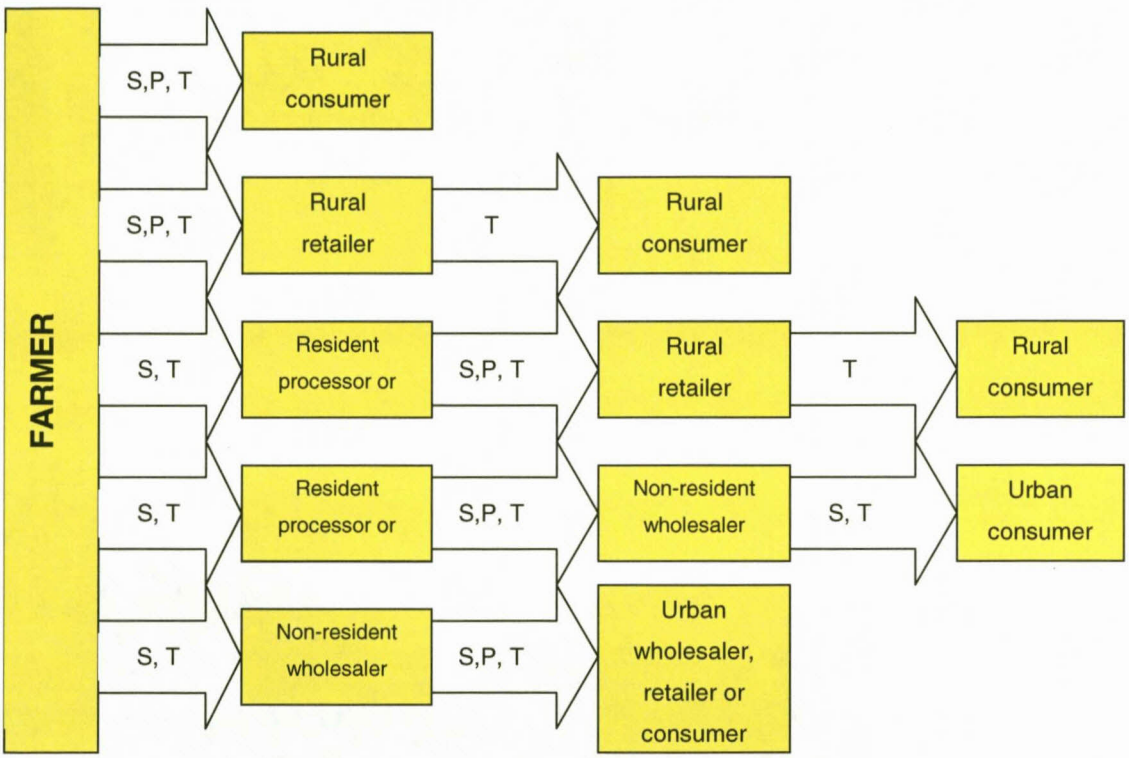

Figure 2.2: Alternative marketing chains in agricultural output markets

Source: Timmer (1983)

A number of marketing functions may be performed at any of these points in the chain. They can be assembly, storage, processing, financing, distribution and grading. These functions share two prime characteristics (1) they add value to the product and (2) they require a variety of inputs to perform, and so incur costs. Provided that each function is positive, firms and individual entrepreneurs (including farmers themselves) will find it profitable to compete to supply the service entailed. For instance, for a pre-pack of vegetables, the

consumer pays a price slightly higher than the farm-gate price as the retailer charges for the processing function. The difference between these prices is what is usually known as the marketing margin. A marketing margin therefore is the difference between the retail price of a product and the price received by farmers for its agricultural product content; this is known as the retail-farmgate margin. Marketing margins can be observed at any level where prices are determined, e.g. retail-wholesale margin or wholesale farm-gate margin.

Agricultural economists group market institutions into two broad categories: (1) those that facilitate exchange (auctions, grading, and standards, etc.) and (2) those that alter the economic structure and economic performance of the market (Christy, 2001). Christy later identifies three market institutions in the latter group *viz.*:

- U-pick operations where small farmers are organized into independent grower-owned production units to serve a select group of consumers. It can also be viewed as an attempt to reverse the traditional food market flow by letting consumers engage in the harvest directly.
- Farmers' markets (urban food markets) probably the most widespread, with individuals, groups, producers and middlemen involved. Can be any form or size and the length of the chain depends on area and circumstances. They are highly competitive because there is no control or timing therefore produce is subject to perishability.
- Producer cooperatives and associations where the same group of people own, control, and use the services, as members of the organization.

Colman and Young (1989) argue that, a perfectly competitive market for a good or commodity is one defined to have the following set of properties:

1. Firms are independent profit maximisers, and consumers are utility maximisers with independent tastes.

2. There are many sellers (firms) and buyers (consumers), none of whom has a large enough market share for their decisions to affect market prices. Sellers and buyers are price takers.
3. All firms have identical technology, production functions and management ability.
4. The product is homogeneous so that consumers are indifferent between the produce of alternative suppliers.
5. Factors of production are freely mobile in the economy, so that there are no barriers to firms wishing to enter or leave the market.
6. Seller and buyers have perfect knowledge and foresight about market conditions, and adjust their decisions accordingly.

However, they go on to state that for many analytical purposes these are an unnecessarily restrictive set of conditions and it is sufficient for markets to be efficient that pure competition should exist in which properties 3 and 6 above are relaxed.

2.5 SMALLHOLDER AGRICULTURAL MARKETING

2.5.1 Smallholder agricultural marketing in South Africa

The marketing situation in South Africa's small-scale irrigation sub-sector, exhibits a number of diverging issues. For most of the smallholders in South Africa, access to a good roads network might not be the only problem. Other barriers related to institutional factors may be responsible for the apparent lack of access to markets. Understanding these issues requires a methodology that will facilitate inclusion of all the different situations or types of situations, to ensure a well representative sample. These can be observed in the categories formulated according to common trends below.

Type 1: Little or no marketing

The level of active marketing of the produce differentiates this category from others. The majority of small-scale irrigators belong to this producer category.

The main characteristic of this type is that there is little or no marketing on the scheme; regardless of the amount of produce they obtain at any given season. Factors such as lack of transport, long distance from markets, amongst others, are hypothesized to be the reasons for this situation. A typical example is the Arabie Irrigation Scheme, where the ARDC was mainly involved for decades. During the ARDC period of management, marketing was done on behalf of the farmers, who over the years did not develop any farm management or marketing skills (Van Zyl, 1996; Kamara, van Koppen and Magingxa, 2002).

Type2: Farm gate sales

This type is characterised mainly by the attraction of buyers to the farming area. The buyers include small and medium entrepreneurs aiming to resell the produce and may come from the village and surrounding areas, as well as individuals buying for household consumption. Buyers organize their own transport and produce is sometimes sold directly from the field. A typical example of such a situation can be observed in Boschkloof Irrigation Scheme (Magingxa, 2001; Stimie, Richters. Thompson, Perret, Matete, Abdallah, Kau and Mulibana, 2001). In this scheme, all the farmers belong to a Farmers Association and it is relatively easy to reach the scheme by road.

Type 3: Organised transportation and active sales

The dominant characteristic of this type is the fact that the farmers are actively involved in the marketing of their produce, not only in selling but also transporting the produce to the potential buyers. This typology is also characterized by a relatively high level of organization. This is so partly due to the necessity of such organization in terms of identifying the potential markets for instance and bringing down the costs incurred through transportation. It also requires more capital to organize own trucks for example. A typical example of this typology is the Rural Women's Association (RWAA) of Apel (Pardeller, de Lange, Magadlela, Smal, Sugrue, Stimie and van Koppen, 1999). One reason for the relative success of this association is hypothesized

to be the strong organizational factor. This association also enjoyed the support of the National Agricultural Marketing Council with further (NAMC funded) improvements in the marketing infrastructure like centralized market and storage facilities which are in the pipeline.

Type 4: Contracted growers

This type exhibits the highest level of organization for marketing. Usually producers have pre-arranged markets and prices before the produce is harvested. Two clear examples of this typology can be noticed in the Komati/Lomati basin where sugar cane is grown as well as for the citrus producing smallholders in Kat River basin.

2.5.2 Marketing Constraints for smallholders

In their dealings with the market, smallholder farmers find themselves at a major disadvantage. Several authors argue that many do not understand the market very well, how it works and why prices fluctuate; they have little or no information on market conditions and prices; they are not organized collectively; and they have no experience of market negotiation e.g. IITA (2001), Freeman and Silim (2001) and Heinemann (2002). Smallholder farmers in Sub-Saharan Africa face a range of marketing and exchange problems, among which informational constraints are much cited but little researched. Producers experience a weak bargaining position vis-à-vis traders because often they do not have timely access to salient and accurate information on prices, locations of effective demand, preferred quality characteristics of horticultural produce, nor on alternative marketing channels. In addition, most of the literature related to smallholder agricultural marketing e.g. Dorward *et al.* (1998), Freeman and Silim (2001), IFAD (2003), Jayne *et al.* (2002), Kherallah and Kirsten (2002) and Killick *et al.* (2000), reiterates that the problem of market access is linked to the following constraints *viz.*; price risk and uncertainty, difficulties of contract enforcement, insufficient numbers of middlemen, cost of putting small dispersed quantities of produce together, and inability to meet standards. Other problems relate to physical market

access like physical infrastructure – roads, market facilities, power and electricity. In rural areas, smallholders are often geographically dispersed, roads and communication poor and the volumes of business insufficient to encourage private sector service provision.

The issue of market access also needs particular attention when dealing with rural households because:

- The trend within both domestic and international policy making is towards greater reliance on market mechanisms in all spheres of economic activity, including agriculture.
- Expansion of smallholder production is closely related to processes of commercialisation, which imply greater reliance on markets for both inputs and output, as well as possibly for food.
- The crucial role of market linkages for rural poverty reduction has only recently received the attention it deserves in the development arena.
- Markets are of fundamental importance in the livelihood strategy of most rural households, rich and poor alike (IFAD, 2003).

Barriers to market access and information flows may be structural and behavioural. Structural barriers of a horizontal nature may be gender, family, educational levels, ethnicity and other social factors. Information that is available to rural communities may not be equally distributed, and smaller scale producers and those distanced further from the market are more disadvantaged. Vertical characteristics include personalized repeat dealing (clientisation), exclusivity, trust and reputation effects. The current significance of personalised relations in developing economies is receiving new research interest. Analysis of imperfect market coordination in developing economies, and the solutions proposed to the problems and imperfections identified, must take account of these fundamental structural features of markets and behavioural characteristics of individuals and firms (Wye, 2003).

2.5.3 Marketing problems experienced by smallholder farmers in SA

The dual nature of the agricultural sector in South Africa consisting of a well established commercial sub-sector and a small-scale sub-sector provides a contrasting picture. According to van Schalkwyk *et al.* (2003), the established commercial sector and the areas in which commercial agriculture preponderates, are served by a sophisticated agricultural marketing system with infrastructure supporting agricultural production and marketing.

The problems for in South Africa have further been complicated to a large extent by the reform processes discussed earlier in this thesis. The history of dependency on parastatal organisations to support smallholder farmers has presented the farmers with an unfamiliar situation that has very little support for marketing functions. The government has reduced the degree to which domestic producers of agricultural products are protected from competition from imports. The policy of the government is such that producers are responsible for managing the many risks they face (price and yield), while processors are also expected to manage their price risks. Government has limited the degree to which it will intervene to the facilitation of the market (Groenewald, 1999).

A proper institutional framework that supports smallholder marketing of their produce is absent. Currently the bulk of smallholder producers relies on unreliable informal markets as outlets for their produce and has no access to the more lucrative markets. The report on the investigation into market access by the NAMC (1999) provides pertinent information on what the marketing problems are for smallholder producers. It is based on an investigation into market access for disadvantaged market participants with the ultimate goal of a commercialised, efficient agricultural system. In this report the marketing problems of South African smallholders are summarised as follows:

- As most of the farmers do not have their own means of transport, they rely on contractors, taxis or neighbours and some expensive hired transport because of relatively small quantities of produce. These

means are sometimes inaccessible themselves because of the poor roads network in most rural areas.

- Lack or unsuitability of assembly and storage points for the farmers' produce.
- Long distances over which produce has to be transported to reach the National Fresh Produce markets network.
- Lack of or poor roads infrastructure especially in provinces like KwaZulu-Natal and Eastern Cape.
- Lack of market information and means to disseminate such information which is critical for the survival of small farmers in the increasingly competitive marketing environment.

As it can be seen from this preceding account, the problems range from physical impediments to institutional issues. These problems all contribute to making it difficult for smallholder farmers to access markets for their produce. In other words, they contribute to the increased effort that the farmers have to make to sell their produce. These problems are viewed as sources of transaction costs for the smallholder farmers.

2.5.4 Transaction costs

In general, 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 transaction costs (Lyne, 1996). Transaction costs generally refer to the costs that have to be incurred before a sale is made. More specifically, transaction costs are resource costs that have to be incurred to achieve market or political exchange. According to Morrison *et al.* (2000), transaction refers to the activities that allow or constrain transformation activities and that transaction costs are the costs associated with the transactions that are necessary for transformation to take place. The concept belongs to a host of studies related to it which economists call Transaction Cost Economics (TCE). TCE belongs to the relatively new school of thought that is referred to as New Institutional Economics (NIE)

which will be discussed further later. The overall perspective is that *transactions* activities (doing business) should be given equal prominence in economic analysis as *transformation* activities (making or growing things), because without transactions, only very basic transformation can occur (inputs cannot be obtained, and output cannot be traded) (Kydd, 2002). Williamson (1985), cited in Poulton, Dorward, Kydd, Poole and Smith (1998) argues that the risk level, frequency of transaction and degree of investment into specific assets are the three main characteristics of a transaction that determine its cost.

Kherallah and Kirsten (2002) debate that, the most important source for transaction costs is lack of information or imperfect information and the opportunistic behaviour of other economic agents. In other words, transaction costs emanate from differential access to assets and information, and tend to be household specific. They go further to say that transaction costs include the cost of reaching decisions, negotiating contracts and of policing and enforcing those contracts. In empirical studies, a direct measurement of transaction costs is simply the economic value of resources used in locating trading partners and executing transactions (Wang, 2003). Some empirical studies have found that specific household characteristics contribute to the existence of transaction costs. As the transaction costs faced by a given individual depend on his or her location, knowledge, social status and even wealth endowment, the opportunity cost of a given resource or good thus differs from individual to individual and it no longer makes sense to talk of a single set of prices whereby price and opportunity cost are equalised and welfare maximised (Poulton *et al.*, 1998). Transaction cost economics (TCE) is part of the NIE as it also recognizes that commercial activity does not occur in a friction-free economic environment, and that the existence of transaction costs encourages the use of non-market arrangements to co-ordinate firm and industry activity (Ortmann, 2001). According to Frank and Henderson (1992) and Ortmann (2001), the most influential transaction cost factors (transactional inefficiencies) are related to uncertainty, asset specificity, input supplier concentration and scale economies.

North (1995) argues that in a close traditional village community, transaction costs between villagers are low - people know about each others' activities and reliability while social relations and structures both encourage people to keep agreements and also provide mechanisms for enforcing agreements and resolving disputes. For development to proceed, however, people need to trade between communities and with the wider national and international economies. This requires institutional environments and institutional arrangements that are effective in reducing the transaction costs and risks of increasingly complex and distant forms of trade and property rights (Morrison *et al.*, 2000). That is because traders will have to rely on informal trading networks to provide information and to defend each other if cheated or threatened by non-members. The transaction cost economics is especially relevant for agricultural market analysis in developing countries and the changes in the agricultural sector in general. As the agricultural sector becomes a more globalised and deregulated industry, the transaction becomes the unit of analysis. This implies that transaction cost economics can potentially offer useful insights to agricultural policy research in developing countries (Kherallah and Kirsten, 2002).

2.5.5 Possible solutions proposed for marketing constraints

To overcome these problems, farming communities have formed cooperatives, collective marketing associations, and other mutual alliances to increase their buying and selling power in the market place. Larger commercial players have also been active, forming mutually beneficial alliances with farmers supplying marketable products at agreed prices. Clearly, it is only by such means that most developing country farmers can move from a poverty cycle to an income cycle, and begin to make a real contribution to overall economic development (IITA, 2001).

Other options explored in literature include warehouse receipt systems e.g. Coulter and Onumah (2002), contract farming e.g. Kirsten and Sartorius (2002), and a rural assembling point system Freeman and Silim (2001). Other firms embark on a process specifically termed vertical integration,

where they would be involved at all stages of a product processing. To some extent, lack of access to markets can influence the choice of crops to be grown. This is because, even though growing horticultural crops may seem profitable as compared to staple food crops like maize, the enterprise budgets do not cover transaction costs that are not explicitly measured (Freeman and Silim, 2001). The South African situation is much the same because the parastatal organisations left a void in the operation of smallholder farmers. Smallholder farmers have to compete with the larger and better organised counterparts in the same markets.

2.6 APPROACHES TO ANALYSE MARKETS

2.6.1 Overview of study approaches

Generally, the first area of contention when conducting a study usually concerns the choice between qualitative and quantitative methodologies. The choice depends on the purpose of the study and the desired form of outcome. Magrath (1992) shares a comment made by a research assistant in an agro-economic survey in Indonesia where he says, "If I use qualitative data, I believe it but no-one else does; if I use quantitative data, everyone believes it but I don't." In this study, largely quantitative techniques are used to analyse the issue of market access for smallholder irrigators and economic theory is employed to evaluate the results of the various analyses.

As Magrath (1992) puts it, methodology includes a conceptual framework and data collection techniques since these aspects are often interrelated. The options available usually include a formal sample survey, informal survey and interview techniques or the use of secondary data. These options can either be used individually or in a complementary fashion to each other. The appropriate data collection techniques depend on the type of information required. In this study a structured questionnaire was used to interview smallholder irrigators in irrigation schemes. This approach presents a number of challenges when applied to developing country situations. Often the question of the validity of the sample and the compatibility of the

questionnaire with the situation on the ground come into play. Mostly the latter can be rectified by pre-testing the questionnaire thereby making sure it is flexible to handle complexity and variability within the local categories. Leedy and Ormrod (2001) provide some guidelines regarding sample size and those informed sample selection in this study. The other challenge is usually the sensitive nature of the information. Magrath (1992) suggests in-depth interviews with respondents already familiar with the researcher as a more appropriate form of dealing with the challenge. Unfortunately, in most cases, studies are carried out within limited resources especially regarding time and finance and these issues are not adequately addressed.

Magrath (1992) provides a review of several models used in studying markets. One is the *structure, conduct and performance* approach. Another method used in analyzing markets is referred to as structure, conduct performance analysis. Such analyses were first developed for the behaviour of markets for industrial goods in the U.S. They are an attempt to compromise between formal structures of perfectly competitive markets in economic theory and empirical observations of organizational experience in the imperfect markets of the real world. The method is a standard tool for market analysis in the U.S. and the U.K. Its purpose is to draw up a checklist or analytical framework for a number of variables such that their approximation to conditions of effective or workable or acceptable competition may be evaluated. If a marketing system is judged effectively competitive, then it follows that the efficiency with which resources are allocated within the system is maximized. The implication is that social efficiency and equity goals are simultaneously maximised (Harriss, 1982).

Market structure consists of characteristics of the organization of a market which seem to influence strategically the nature of competition and pricing within the market. In particular these are the numbers of traders, the degree of seller and buyer concentration, entry conditions, the extent of agent and product differentiation and distribution of market information, and its adequacy in sharpening price quality and comparisons in reducing risk. Market conduct

is the pattern of behaviour which enterprises follow in adapting or adjusting to the markets in which they sell (or buy). In particular this refers to methods employed to determine price, sales promotion and co-ordination policies and the extent of predatory or exclusionary tactics directed against established rivals or potential entrants. Market performance represents the economic results of structure and conduct, in particular the relationships between distributive margins and the costs of production of marketing services. Most commonly time series price data are used to throw light on the degree of competition in marketing systems through:

- Intermarket price correlation to indicate the degree of market integration, widely interpreted as an indicator of competition.
- Static analyses of the relationship between components of distributive margin, meaning the shares of the producers and those of the various intermediaries generally carried out for a limited geographical area.
- Dynamic analyses of the distributive margin comprising the relationship between transport costs and intermarket price differences (using graphical plots, regression analyses and the analysis of average margins) to indicate the competitiveness of interregional trade; the relationships between processing costs and differences in the prices for different product forms in order to indicate the efficiency of product transformation; the relationships between seasonal price fluctuations and storage costs to indicate market competitiveness through time.
- Through calculations of annual and longer term moving averages to investigate longer period cyclical changes in the price level.

Even though it was developed by the Industrial Organisation school for application to markets, it has been used in developing countries by various scholars (Magrath, 1992). One of the problems faced by this approach is that it does not specify the causal links between performance criteria and the factors that are supposed to affect them. Magrath then refers to the *commodity system* approach developed by Shaffer in 1980 and later adapted Riley and Staatz in 1981 and others. This approach builds on the structure, conduct and performance approach and explores all activities in a commodity

from input supply through transport and processing to retailing. Both horizontal and vertical linkages are explored. It provides a good framework but judgement is required in specifying the boundaries of the system to be studied. This method would be inappropriate for the purpose of this study because it is commodity based. Another method covered in this review is the so-called spatial and inter-temporal models. These are more appropriate where spatial market integration or seasonal markets are studied.

The new institutional economics approach attempts to address the shortcomings of the above-mentioned approaches. The applicability of the previously discussed approaches has been questioned in developing country context especially because the institutional context (including legal and political structures) may be very different, and standard performance criteria may be inappropriate (e.g. Seers, 1963; Gregory, 1982). As previously discussed, smallholder farmers in general, use a number of other methods to address the absence of formal markets or legal structures to address exchange issues. These can lead wide variations in transaction costs for different traders. This approach therefore suggests looking beyond traditional economic variables usually associated with market access to include institutional aspects like access to information, credit, etc. In this approach, market information and its distribution have been cited as key factors in determining market performance.

Kydd (2002) attempted to depict the environment within which smallholder farmers attempt to access markets and he summarise the relationships that exist between various elements in this environment. This summary is depicted in Figure 2.3 below.

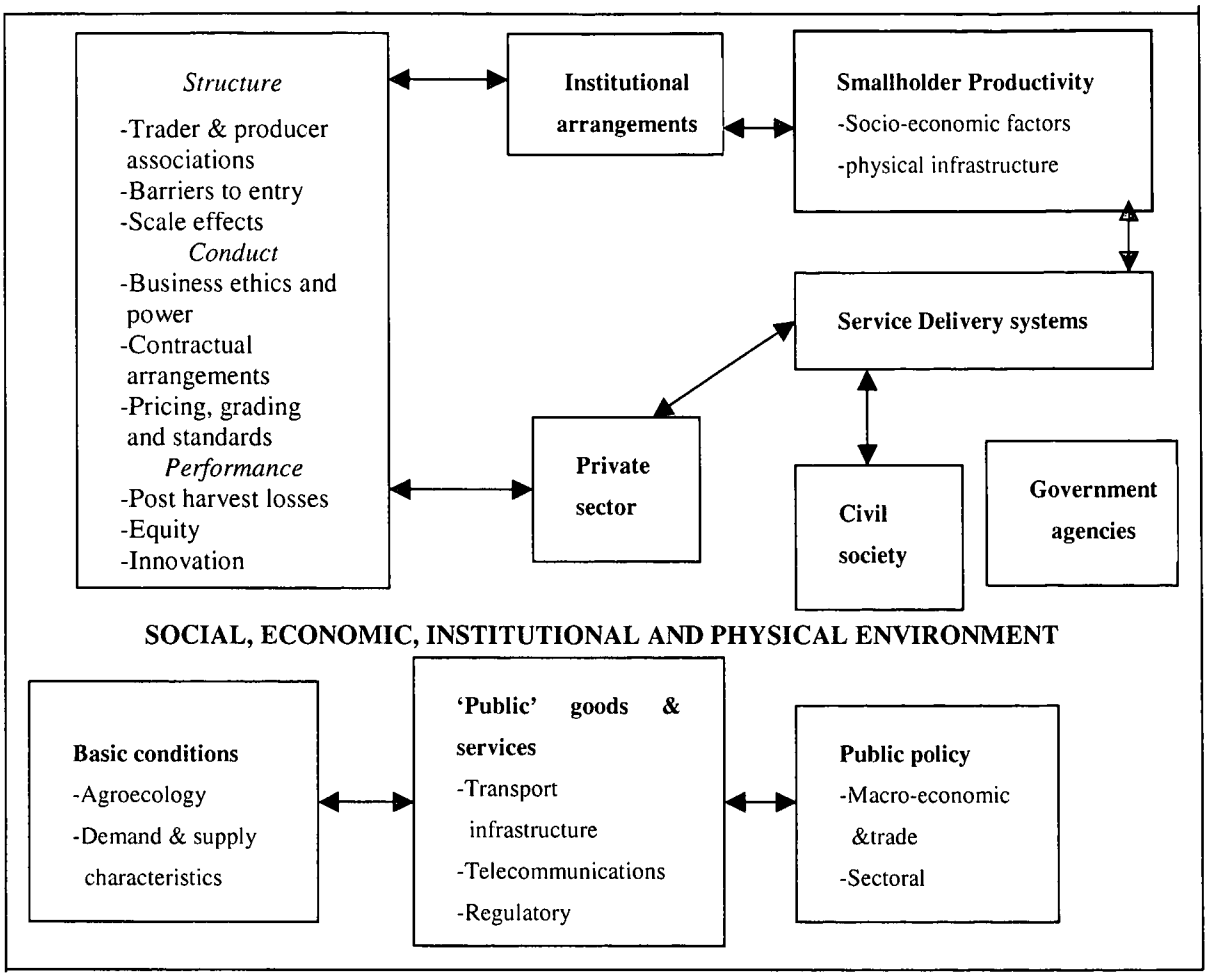

Figure 2.3: Smallholder marketing environment

Source: Kydd (2002)

In this depiction, the environment within which smallholders operate comprises the social, economic, institutional and physical environment. These conditions are further categorized into basic conditions, public goods and services as well as public policy. The government together with the private sector and the civil society provide the services for smallholder production and the level of provision depends on the existing structure and the way the service delivery system functions.

The quality of the service from private sector, civil society and government agencies affects productivity in the same way that factors that determine productivity (socio-economic and infrastructural factors) affect service delivery.

As it can be seen in the depiction, market access can be facilitated by institutional arrangements in place. What is also displayed here is that productivity levels determine the nature of arrangements that in turn affect market access. For instance, produce volumes from smallholder production may limit private companies from entering into contracts with smallholder producers which open market linkages like supermarkets. The other way holds because, these arrangements are governed by markets and affect productivity.

The relationship between the private sector and the markets is also two-way because in the same way that market forces govern private sector participation, the private sector influences the markets.

2.6.2 The market access variable and analysis methods

Smallholder market access can be examined in a number of ways. As already shown in preceding discussions, smallholder farmers are often forced to sell to the buyer of convenience, not of choice at that buyer's price. In other words, smallholder market access can be evaluated as whether smallholder irrigators sold the produce to the market of choice. This is important because there is evidence that smallholders do not necessarily sell to the most profitable market because of the constraints discussed earlier. To be able to present market access in these dimensions would necessitate data on volumes for specific market outlets and prices at the various markets for the period under study. Data to address these aspects was unavailable because of inadequate record-keeping by the farmers. The study depended largely on the recall of farmers on specific aspects of the study.

The two aspects discussed above are very important but the minimum requirement is for surplus produce to be sold. In this study, farmers were grouped into whether the produce meant for the market was sold or not, yielding a categorical variable with 1=yes and 0=no. In such case, the choice of analysis model is either logit or probit model. According to Gujarati (1988) these two formulations are quite similar and the choice is a matter of

mathematical convenience and availability of computer programmes. But he qualifies this by saying that logit is usually preferred above probit. These two models types are appropriate for analysing a dichotomous variable.

Other tests can also be done to confirm the relationship between the categorical variable and the explanatory variables. In his early work, Ferber (1949) pointed out that on market research, one may seek to determine which factors or combination of factors, have the greatest influence on purchases of a certain product. He argues that although solutions might be arrived at in some of the cases through repeated use of significance tests for the difference between two statistics, these problems are best solved by applying two methods - chi-square and analysis of variance. Chi-square analysis makes it possible to assess the significance of entire sample distributions instead of only two statistics at a time. In case where the interaction includes continuous variables, Mukherjee *et al.*, (1998) suggest the use of a slope dummy. They argue that it measures the interaction effect and its t-statistic shows whether it is significant or not.

2.7 CONCLUSION

This review has displayed the strong link that exists between poverty elimination and agricultural development. Embedded in this line of thinking is the acknowledgement that increased food production also leads to better income generation opportunities. Therefore, smallholder producers need proper management of their farming enterprises so as to ensure the desired outcomes. Market access for smallholder irrigators is central in this debate.
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. Literature suggests an institutional approach to address problems of smallholder market access.

If it is true that markets, and improved market access, are of critical and immediate importance to rural poor households, it is also evident that they are a prerequisite for enhancing agriculture-based economic growth and increasing rural incomes in the medium term. 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). But before embarking on analysing this task, it is important to put the study in context by describing the study areas which were covered in this exercise.

CHAPTER 3

DESCRIPTION OF THE STUDY AREAS

3.1 INTRODUCTION

In South Africa smallholder irrigation schemes cover approximately 46,000 to 47,500 ha as former Bantustan schemes, and about 50,000 ha as garden schemes and food plots. Almost half of them are located in the Limpopo Province (171 schemes covering 20,000 to 220,000ha). It is estimated that two thirds of South Africa's smallholder irrigation schemes are dedicated to food plots, the purpose of which is subsistence, and that 200,000 to 230,000 rural black people are dependant at least partially for a livelihood on such schemes (Perret, 2002).

This prevents a formidable task to those who are interested in studying such a large population. Strydom and Venter (2003) argue that a complete coverage of the total population is seldom possible, and all the members of interest cannot possibly be reached. They argue that the use of samples may therefore result in more accurate information than might have been obtained if one had studied the entire population. According to Leedy and Ormrod (2001) the important consideration to make in such situations is to ensure that the sample selected is truly representative of the population. This ensures external validity of the research study.

This study was conducted in six smallholder irrigation schemes in the Eastern Cape, Limpopo and Mpumalanga provinces of South Africa (see Figure 3.1). The irrigation schemes under study are Melani, Qamdobowa, Roxeni and Somgxada in the Eastern Cape; Sepitsi in Limpopo and Hereford Irrigation scheme in Mpumalanga.

Figure 3.1: The provinces housing the six irrigation schemes

Most of the smallholder irrigation schemes are found in the former homeland areas within the current provincial structure. As Woolard (2002) also advances, in South Africa, the poorest people live in former homeland areas. The former homelands or Bantustans are areas that were set aside by the former South African government for various African ethnicities and were later re-incorporated into the Republic of South Africa under the new dispensation.

The decision to select the schemes under study was informed by several sampling considerations as highlighted earlier. In addition, the schemes selected cover different agro-ecological zones of South Africa. Limpopo Province and Eastern Cape are also classified as the poorest provinces in the country (SSA, 2000). The impact of the study findings will therefore have a greater impact in those provinces. Limpopo province also houses about half of the total number of smallholder irrigation schemes in the country as explained earlier.

The former Ciskei area (see Figure 3.4) generally has a mainly dry or semiarid climate with small areas of high rainfall in the central mountain region. It appears that most of the land area is not suited to rainfed cropping. Average rainfall is generally low, and varies from year to year, and the predominant soil types and general topography are not suited to this method of agriculture. Nevertheless, rainfed cropping is practised in most areas by smallholder farmers. Grain sorghum was the most important cereal crop at the beginning of this century but this has largely been superseded by maize. Vegetables, in particular cabbage, carrots, pumpkin, beetroot, spinach, potatoes, watermelons and onions, are also widely grown.

Additional considerations made include the availability of background information on the schemes under study. Sepitsi and Hereford irrigation schemes form part of a group of irrigation schemes where IWMI (the funding organisation) has conducted research before, and therefore provide an opportunity to revisit the areas and follow up on new developments. Both irrigation schemes are within IWMI's benchmark basin in South Africa (Olifants River basin), an area where focused and continuing research is conducted. Benchmark basins are IWMI's field laboratories. Each benchmark site serves the dual role of research and capacity building with local partners. Each basin is a partnership between IWMI and a range of local authorities, including ministries of water and agriculture, national research and university communities, environmental groups, NGOs, and - as relevant - local communities. Partners come together to study the benchmark basin's hydrology, its institutional arrangements for managing water and land, socio-economic conditions, and health and environmental factors. This data is collected and analyzed to present a dynamic portrait of the basin's natural resources management profile, as it evolves.

The Eastern Cape schemes were selected in consultation with the Agricultural and Rural Development Research Institute (ARDRI) that have conducted research and development work in the area over an extended period of time, together with the extension officers in Alice and Middledrift. They were considered as representative of the area. There was also the opportunity to

access background information through these institutions. Because of the relatively small number of participants within the Eastern Cape irrigation schemes (as can be seen in Table 3.1), it was necessary to combine a number of them to accommodate a larger number of households for the study. Leedy and Ormrod (2001) provide a set of guidelines for sampling in a sub-population and these were applied to sample farmers for the study within smallholder irrigation schemes.

The rest of this chapter gives a brief description of the surveyed schemes according to history and current operations as well as orientating the reader about the location of the schemes.

3.2 HEREFORD IRRIGATION SCHEME

3.2.1 History

Hereford Irrigation Scheme is found in the Groblersdal district in the south of Mpumalanga province (Figure 3.2). It is located about 3 km to the east of Groblersdal town centre lodged between Olifants River and the Hereford canal (also shown in Figure 3.2).

The irrigation scheme of the Loskop Dam (see Figure 3.2), 32km south of Groblersdal, is the reason for the existence of this town. The Loskop Dam wall was built in the 1930s across a nearby gorge. In the 1970s the dam wall was raised, flooding more of the valley. The dam is approximately 30km long and supplies water to a vast irrigation scheme in the areas of Loskop, Groblersdal and Marble Hall. The presence of the dam makes up for the unreliable rainfall supply of the area Groblersdal, where Hereford Irrigation scheme is located, and an important irrigation area which yields a wide variety of products such as citrus fruit, cotton, tobacco, wheat and vegetables.

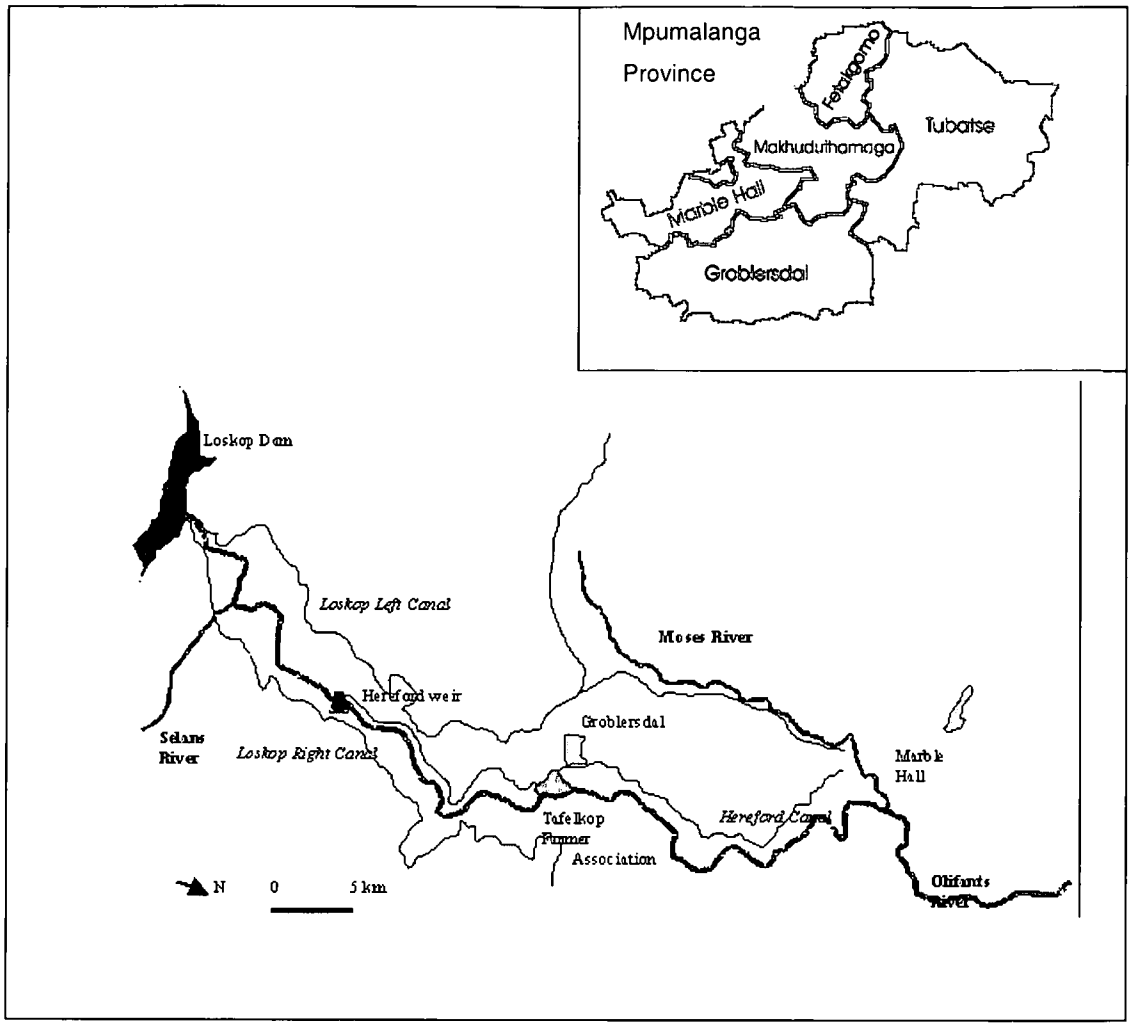

Figure 3.2: Hereford Irrigation Scheme

The area now known as Hereford Irrigation Scheme was land allocated to returning soldiers after the 2nd World War by the former South African government. After a while, producing various crops and practicing dairy farming to a limited extent, the farmers started moving out and the land became idle with opportunistic bushes taking over. A group of black farmers from Tafelkop moved in on the 160 ha land in what Tapela (2005) refers to as non-violent occupation. The farmers settled with no capital / government support. They cleared the bushes but did not change the original land allocations for the various farms.

Early 1994 the Tafelkop Farmers' Association (TFA) was established and the farmers at Hereford are part of that group. Initially they got water from leakages in the system, as the occupation was deemed illegal. Later

negotiations led to access to the water from Hereford dam in principle. Because the farm is at the end of the Hereford canal, there were always problems with water shortages. The farmers claimed that during this period, they received less than half of what they were entitled to. This was due to the inefficiency of the canal due to age as well as improper management of the weeds growing on the water path. In addition to the inefficiency, there are complaints that the bigger water users, who are mainly at the head-end of the canal took more water than it is sufficient for downstream flow. They also had to deal with a bill for water left by the previous farmers. This matter was since resolved when the farmers joined the Hereford Water Users Association with the large-scale commercial farmers.

3.2.2 Current operations

The project is operating on a 160 ha piece of land, with 33 farmers who all belong to the Tafelkop Farmers Association, farming the land. An elected executive committee serves as the representative body for the farmers.

The objectives of the project are to generate profit, create jobs for the people in the neighbouring communities and to contribute towards the social and economic growth in the region. They are growing high value crops such as baby marrows, baby gems, yellow patty pans and other vegetables. They have also secured a contract to grow tobacco for a local tobacco company (MKTV) where each farmer allocates 1ha of the land to this crop.

The lease contracts given to the farmers include an option to purchase even though the modalities have still not been clarified by the government. At the time of data collection, the lease contracts had not been serviced for a period of 2 years.

Problems cited by farmers include high cost of credit, limited market access for their fresh produce, lack of storage facilities and water shortages. However at the time of data collection, a lot of work had gotten underway to rehabilitate the canal.

3.3 SEPITSI IRRIGATION SCHEME

3.3.1 History

Sepitsi Irrigation Scheme is located some 30 km south of Lebowakgomo which is under the municipality of Lepelle-Nkumpi in the Capricorn district of Limpopo province (see Figure 3.3). The Municipality of Lepelle-Nkumpi was established in 2000 with the merger of three former Transitional Local Councils which were Greater Lebowakgomo, Greater Zebediela and part of Fetakgomo/Nokotlou (Mafefe and Mathabathe).

Sepitsi Irrigation Scheme is one of the schemes formerly managed by the parastatal organization Agricultural and Rural Development Corporation (ARDC) before 1994. People from the surrounding villages of Tooseng, Marulaneng, Lenting and Mamatonya served as labourers on the scheme.

Figure 3.3: Sepitsi Irrigation Scheme in Limpopo Province

As the ARDC folded up its operations, in 1995 the land was handed over to the local authorities. A story verified in a farmers' meeting is that early in 1996, a few opportunistic members of the local communities tried to lay claim

on the scheme and attempted to exclude the rest of the locals. However this was averted by the intervention of the local traditional authorities and the land was subsequently sub-divided into small plots (600 m^2) and given to the locals on a first come first served basis.

In May 1996 farmers started operating on the scheme, taking over the irrigation infrastructure set up by the ARDC. The ARDC continued to support the farmers with inputs for a short while, a role that was later briefly assumed by the then Northern Province Department of Agriculture which is now Limpopo Provincial Department of Agriculture and Environment (LPDAE).

3.3.2 Current operations

The area where Sepitsi Irrigation Scheme is located is semi-arid like most of the country. Rainfall is mainly in summer with long dry spells. There is very little potential for rainfed agriculture and therefore almost all production is carried out under irrigation. The scheme uses flood irrigation. The water is pumped out of the Olifants River, which is located approximately 1 km from the project site. The project has a management which is responsible for coordinating meetings, and a water committee which manages water affairs.

In the Lepelle-Nkumpi IDP Review for 2005/2006 and subsequently, for 2006-2011, Sepitsi Irrigation scheme is listed as one of the LED projects operating considerably below potential. Members were interested to start the project to generate income and produce food for home consumption. Main crops grown are tomato, onion, cabbage, beetroot, spinach, and butternut squash.

Currently, the farmers are responsible for operation and maintenance in the scheme but the LPDAE provides limited assistance, for example when they need transport for heavy equipment etc. The water use in the scheme is registered but there is no payment for water. Besides the payment for operation and maintenance of irrigation infrastructure they pay for electricity.

Since October 1998, the project faced water problems as a result of continuous breakdowns of the pumps. This affected crop production significantly. The high cost of electricity and that of maintaining the pump is cited by the farmers as one of their biggest problems. Other problems cited by farmers on the scheme include limited market access and lack of storage facilities that result in the produce being spoiled on the plot.

3.3 MELANI IRRIGATION SCHEME

3.3.1 History

Melani Irrigation Scheme is located in Alice under the Nkonkobe Municipality which forms part of the Amathole District Municipality. The irrigation scheme is located some 15 km from the town centre.

The former Ciskei area (see Figure 3.4) is part of what is currently known as the Eastern Cape Province. Smallholder agriculture has a significant role to play in this area as it is classified as one of the poorest in the country. Schemes surveyed in this area are located approximately 60 km from Bhisho, the provincial capital.

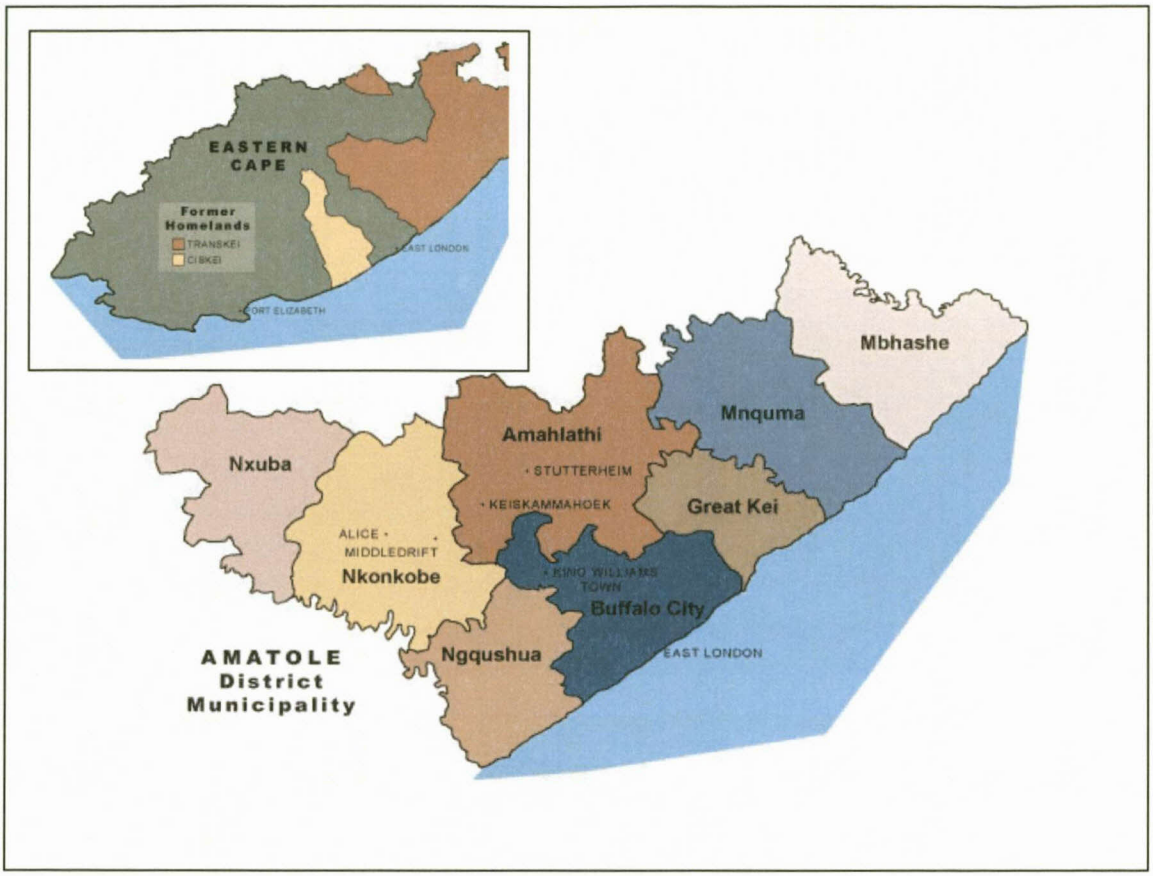

Figure 3.4: Alice and Middledrift in the Eastern Cape Province

Before the Ciskei government received its sovereign powers in 1981, the 14,5 ha piece of land known as Melani Irrigation Scheme was a citrus farm belonging to one commercial farmer. The land was then handed over to the Ciskei government. The current scheme was created by Ciskei authority the in 1974 for community members who did not have access to field plots allocated previously for dry land farming. The land was divided into 16 equal sized plots for an equal number of families even though currently there are only 8 farmers who are actively producing on the land.

3.3.2 Current operations

The incoming farmers changed crops to vegetables for commercial purposes and maize for home consumption. This was done mainly because vegetables had a shorter growth period and therefore would provide income more often

and also because they require less complex management. Water is pumped from nearby Beanfield Dam that was built by the Ciskei government to also supply other villages. Farmers use mainly sprinkler irrigation on this scheme.

There is no management structure in place on the scheme and all operations are individualized. Major problems cited by farmers in this scheme include deterioration of fencing which is too expensive for the farmers to finance themselves. The high cost of maintaining the tractor that belongs to the scheme members has led to advice from the extension officers that its use be discontinued. Similar to other smallholder irrigation schemes, the issue of access to markets is mentioned as a serious problem.

3.4 QAMDOBOWA IRRIGATION SCHEME

3.4.1 History

Qamdobowa Irrigation Scheme is located in Middledrift (Figure 3.4) which is also under the Nkonkobe Municipality which forms part of the Amathole District Municipality. The irrigation scheme stands some 25 km from the town centre with very poor roads. This is one of the schemes that were previously managed by Ulimo Corporation (ULIMOCOR), a parastatal of the former Ciskei government. After 1994 Ciskei was to be re-incorporated into South Africa and ULIMOCOR was to dissolve, the land was handed over to the local authority for community management. Like many of the smallholder irrigation schemes in the former homeland areas, the scheme was created to provide employment and food for the local people (Bembridge, 2000).

Most of the irrigation infrastructure, even though it was already aging, was still in place. Farmers had to deal with a lot of costly repairs to the system that had deteriorated during the lengthy period that lapsed before they could finally take over. Initially, a group of about 23 farmers signed up to occupy and farm the land but currently there are only six farmers actively farming the land. With the assistance of the provincial department of agriculture and various

sponsors for inputs, they moved from farming parts of the land to cultivating the whole area with various vegetables, maize and lucerne.

3.4.2 Current operations

At the time of data collection, six of the farmers on the irrigation scheme were cultivating the whole scheme in a joint operation. Qamdobowa irrigation scheme has recently been re-vitalised and is one of four irrigation schemes recently (May 2006) re-launched by the Eastern Cape Department of Agriculture. About R500 000 was spent on these projects during January 2006.

The rehabilitation of these projects is to ensure that there is maximum food security thereby alleviating poverty. Benefits from this revitalised irrigation scheme are expected to accrue to the rest of the community in terms of readily available and affordable fresh produce.

3.5 ROXENI IRRIGATION SCHEME

3.5.1 History

Roxeni Irrigation Scheme is located in Alice under the Nkonkobe Municipality which forms part of the Amathole District Municipality. The irrigation scheme stands about 15 km to the west of the town centre.

Roxeni Irrigation Scheme started when a 3 ha piece of land was made available by the local authority in 1992 for community gardening. Initially 11 people signed up for equally divided plots, paying a R20 joining fee. In 1995, 4ha of land was added to the project making it 7 ha and the number of farmers who signed up grew to 31 and land was re-allocated. The current total size of the land is 12 ha and was allocated in 1999 to 51 farmers.

3.5.2 Current operations

The scheme pumps water from a nearby small dam that was built by the then Ciskei government for livestock drinking. With dwindling livestock numbers, currently it is used for both irrigation and livestock. When electricity was installed in the 1990s, they switched from diesel pumping to an electricity driven pump to haul water to the plots. Framers use mainly sprinkler irrigation on this scheme.

There is a scheme management committee led by a former extension officer that deals with general issues concerning project members. A set of rules are etched in the constitution and fines are imposed on transgressors by the committee. This scheme is seen as a symbol of success in the Eastern Cape and this is attributed to the harmonious co-operation and accountability amongst community members. Main problems cited are similar to other irrigation schemes and include market access, high cost of mechanisation, high cost of transport for the produce to the town centre and nearby villages.

3.6 SOMGXADA IRRIGATION SCHEME

3.6.1 History

Somgxada Irrigation Scheme is located just outside the Alice town centre about 3 km to the north. The land on which Somgxada farmers are farming belongs to the Lovedale College, a local further education institution. Through negotiations with the local authorities and the management of the college, an agreement was reached wherein members of the community were granted permission to use the land which was largely lying idle.

3.6.2 Current operations

When the project started in 1997, there were about 23 farmers who signed up to be involved. A number of farmers got discouraged because of difficulties in getting the necessary inputs for farming. Currently, there are only 8 farmers

who are farming the land, growing various vegetable crops – mainly potatoes for commercial purposes.

The scheme management committee is active and represents the farmers in all scheme related matters. The common problems experienced by most smallholder irrigation schemes in South Africa also prevail on this scheme. Market access is cited as one of the most prominent problems with periodic water shortages an additional concern. The University of Fort Hare manages some experimental plots next to this scheme and the farmers are in a position to benefit from the immediate findings and knowledge generated in the process.

3.7 SUMMARY

A large number of irrigation schemes in South Africa were created during the homeland era for employment purposes and food provision for the rural poor. Most of these have become defunct with a few that are still performing well. The sample of irrigation schemes covered in this study are representative of the smallholder irrigation environment in the country and exhibit most of the problems experienced by smallholder irrigators in general. Amongst these problems, the issue of market access is cited frequently by members of the different projects. Table 3.1 below provides a visual summary of the information about each of the selected schemes.

Table 3.1: Summary of scheme information

Scheme	Scheme size (ha)	No. of farmers involved	Water source	Type of irrigation
1. Hereford	160	33	Loskop Dam	Sprinkler
2. Sepitsi	13	90	Olifants River	Flood
3. Melani	14.5	16	Beanfield Dam	Sprinkler
4. Somgxada	12	14	Tyume River	Sprinkler
5. Roxeni	46	51	Roxeni Dam	Sprinkler
6. Qamdobowa	48	6	Tyume River	Sprinkler

From table 3.1, it is evident that the surveyed schemes range from 12 ha to 160 ha in total size and the plot sizes also vary a lot. The schemes were created to fulfil different objectives form employment to food production for the rural poor. The irrigation schemes also exhibit divergent historical aspects. Some of the schemes surveyed were created with an initiative from the government authorities while others were community driven. The next chapter describes the data collected form these irrigation schemes under various topics to give a picture of farmers involved in smallholder irrigation in South Africa as well as the schemes.

CHAPTER 4

FARMING HOUSEHOLDS AND MARKETING MANAGEMENT

4.1 INTRODUCTION

The review of literature on Chapter 2 has shown that access to markets is an essential ingredient to a well performing farm enterprise. However, it has also been shown that, market access 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 market access can be influenced by both physical 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 therefore, is to give an overview of data regarding the farmers, farming household characteristics and household composition. Further, human capital endowments and resources are described. Later, existing institutions and their relation to market access are examined. Finally the observations are synthesized in a summary at the end of the chapter.

4.2 AGE AND HOUSEHOLD COMPOSITION

4.2.1 Age of farmers

Table 4.1 presents the average age for all farmers. As shown in the table, age ranges from 27 years to 82 years with an average of about 58 years. For some, this is considered as a bleak picture for smallholder farming in general because age is considered as one source of transaction costs for smallholder market access (e.g. Matungul *et al.*, 2002). It should however be remembered that smallholder farming still has an important role to play in rural

livelihoods because it supplements household income and reduces money spent on food (which forms a very large proportion of poor people's spending). Smallholder farming also becomes very important in that, most of the older people, including those who have worked before were involved in less formal employment with none of the retirement proceeds that their counterparts in formal employment usually enjoy.

Table 4.1: Age of Farmers

Scheme name	Mean	Std. Dev.	Range
Hereford	57.2	10.017	43.73
Melani	60	9.522	52-82
Qamdobowa	61	9.633	48-71
Roxeni	53.9	12.648	32-80
Sepitsi	60.4	10.815	35-79
Somgxada	45.4	13.721	27-62
All farmers	57.6	11.272	27-82

4.2.2 Household composition

When households are put together, the age distribution displays normal tendencies as would be expected. The age-group 15-34 is the largest throughout the schemes. The age distribution within families in households is shown Table 4.2.

Even though farmer age is quite high, there seems to be availability of able-bodied hands in families, who can assist in the farming activities. Average household sizes range from lowest of about 4 to a maximum of about 8. The figures suggest a rather high value in terms of the person per ha ratio. The section on the size of land holdings will take this issue further.

Table 4.2: Household composition

		Age group					
Scheme name		**≥ 55 years**	**35-54**	**15-34**	**7-14**	**≤ 6 years**	**Av. H/hold size**
Hereford	No.	28	17	68	32	3	5.9
	%	18.9	11.5	45.9	21.6	2.1	
Melani	No.	7	12	16	10	5	6.3
	%	14	24	32	20	10	
Qamdobowa	No.	9	4	11	7	2	5.5
	%	27.3	12.1	33.3	21.2	6.1	
Roxeni	No.	30	28	29	21	5	3.6
	%	28	26.2	27.1	19.6	4.7	
Sepitsi	No.	46	59	75	72	50	6.9
	%	15.2	19.5	24.8	23.8	16.6	
Somgxada	No.	17	15	34	7	1	8
	%	26.6	23.4	53.1	10.9	1.6	
All schemes	No.	137	135	233	149	66	6
	%	19	18.8	32.4	20.7	9.2	

4.3 HUMAN CAPITAL ENDOWMENTS

4.3.1 Education and training

The educational levels were determined and they range from none to post matric level. The educational qualifications of farmers are shown in Figure 4.1. More than 25% of the interviewed farmers had never received any formal education. In some schemes the figure for illiterate people was even higher. Overall, only 9% of the farmers had gone beyond matric level and again in some schemes, this figure is zero. For farmer spouses, there is not much difference.

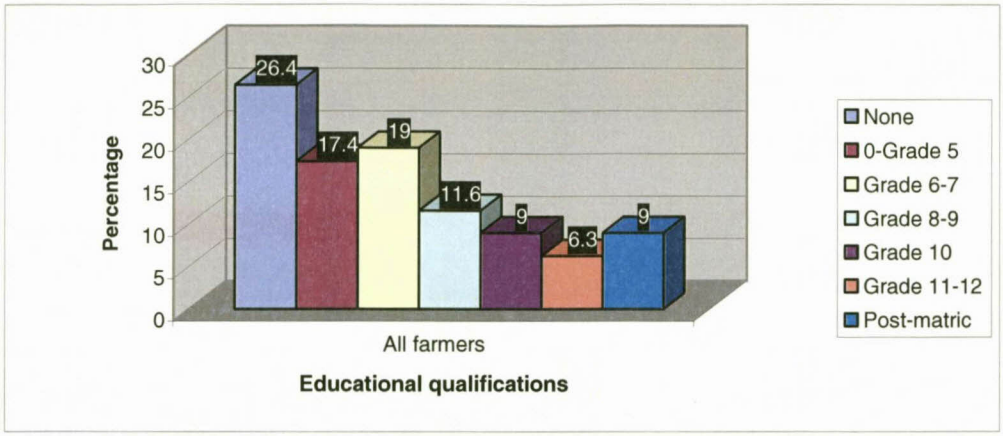

Figure 4.1: Educational qualifications of respondents in percentage per level.

More than 80% of the farmers had at some stage, received some form of training in their cropping practices. The percentage of farmers trained in each of the surveyed schemes is shown in Figure 4.2. Largely, training was received either from government extension officers or some from sources commissioned by the government. To a lesser extent, specialized input suppliers had contributed some training. On the other hand, in at least two of the schemes, there are local university crop trials through which farmers also receive training.

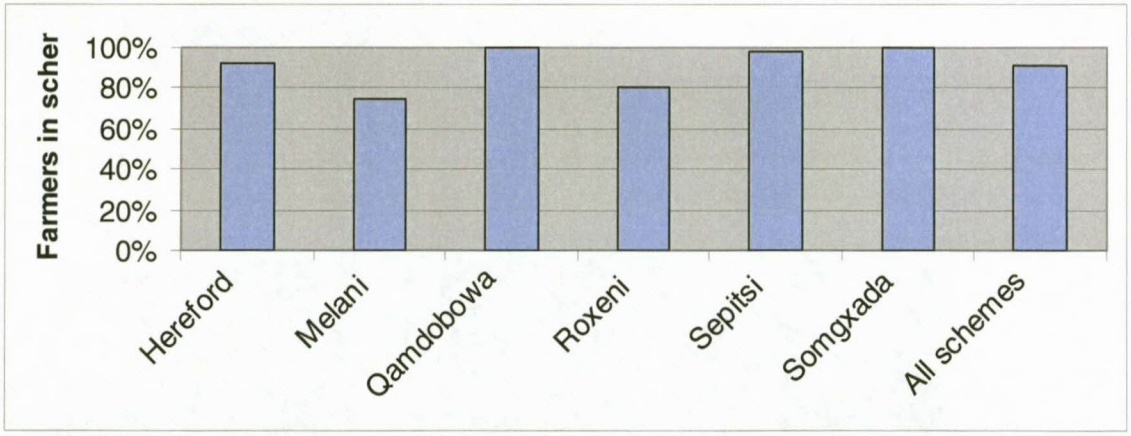

Figure 4.2: Farmers that have received training in cropping practices

The importance of education and training as it also improves the ability to be more creative in their farming operations. This aspect of human capital

endowments will be discussed later under the section on entrepreneurship and creativity.

4.3.2 Language abilities

The results in Table 4.3 show that for all schemes, less than 30% of farmers could read and write English with this figure much less in other schemes. Similarly, Afrikaans literacy has an even lower figure of about 17%. Generally, higher figures are obtained for vernacular languages (74%) with only a few who cannot read or write (about 26%). This figure agrees almost perfectly with the percentage of farmers who had never gone through formal schooling as depicted in Figure 4.1 above.

Table 4.3: Language abilities of farmers in surveyed schemes (%)

Language	Hereford	Melani	Qamdobowa	Roxeni	Sepitsi	Somgxada	All schemes (n=121)
English							
Talk	32	50	33.3	60	13.6	12.5	32.2
Read	28	50	16.7	50	18.2	12.5	29.8
Write	28	37.5	16.7	40	15..9	12.5	25.6
Afrikaans							
Talk	76	50	50	26.7	20.5	12.5	36.4
Read	20	37.5	0	23.3	13.6	0	17.4
Write	20	12.5	0	20	13.6	0	14.9
Vernacular							
Talk	100	100	100	100	100	100	100
Read	80	62.5	83.3	100	52.3	75	73.6
Write	76	62.5	83.3	100	52.3	75	72.7

4.3.3 Arithmetic skills

Figure 4.3 shows that good arithmetic skills are generally low in all schemes. The highest percentage of farmers with good arithmetic skills can be found in Roxeni at 40%. There are schemes where good arithmetic skills could not be found at all.

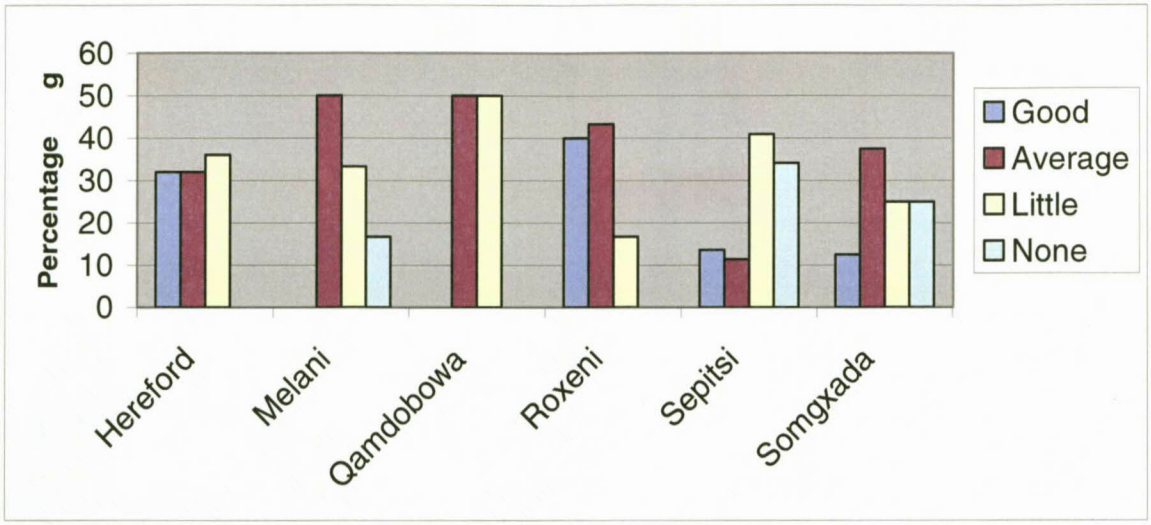

Figure 4.3: Arithmetic abilities within schemes

Unsurprisingly, these are also schemes where education levels are extremely low to none. Figure 4.4 shows the arithmetic abilities in all schemes.

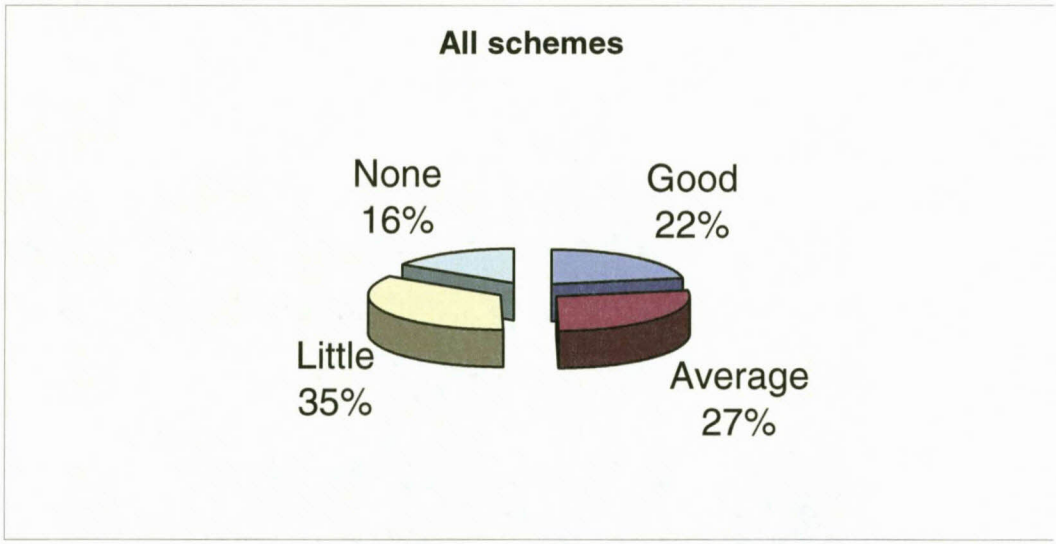

Figure 4.4: Arithmetic abilities in all schemes

For the purposes of this study, "little arithmetic abilities" refers to the ability to do simple operations like addition and subtraction. Multiplication and division are added as one progresses from average to good arithmetic skills respectively.

4.3.4 Knowledge/Farming experience

Across the various schemes, farming experience ranges from about 5 years to over 40 years. The mean values for each scheme on overall farming experience range between 7 years and 18 years across schemes, while experience on current enterprises, values range between 6 years and 12 years as shown in Figure 4.5.

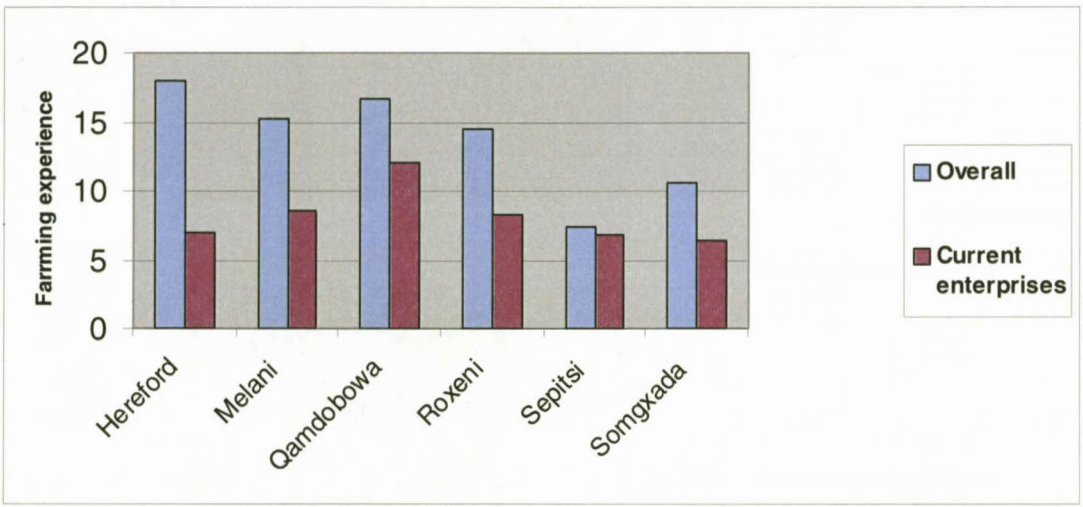

Figure 4.5: Knowledge/Farming Experience

The sources of this experience range from farming on dryland as well as livestock before getting involved in irrigated agriculture. Other farmers were employed as labourers in large-scale commercial farms before managing their own enterprises. The mean values in the overall are higher than values on current enterprises as a result.

4.3.5 Entrepreneurship and creativity

To determine the entrepreneurship and creativity of the farmers, an assemblage of positive statements was put together. The idea was to get the farmers to respond to these statements with responses ranging from strongly disagree on one end, to strongly agree on the other without knowing what the response means to the study. These statements related to important aspects of entrepreneurship and creativity *viz.*:

- Leadership;
- Desire to achieve goals;
- Creative skills;
- Motivation to progress; and
- Need for autonomy.

The answers were then ranked from 1 to 4 with 1 being strongly disagree and 4 being strongly agree. For the purpose of summarizing this information, answers 1and 2 (strongly disagree and disagree) were put together as lower level and then answers 3 and 4 (agree and strongly agree) were put together as higher level for each category of statements. Figure 4.6 shows results only relating to the upper level.

The results show that largely there are more farmers across schemes in the upper level for all categories of statements. This suggests a good potential for entrepreneurship of the farmers. There are however exceptions, especially regarding creativity in certain schemes. The answer could be found in a closer examination of what this aspect entails. Creativity, as addressed here would benefit a lot from formal education to be also able to make sense of the figures as well as understand new concepts better.

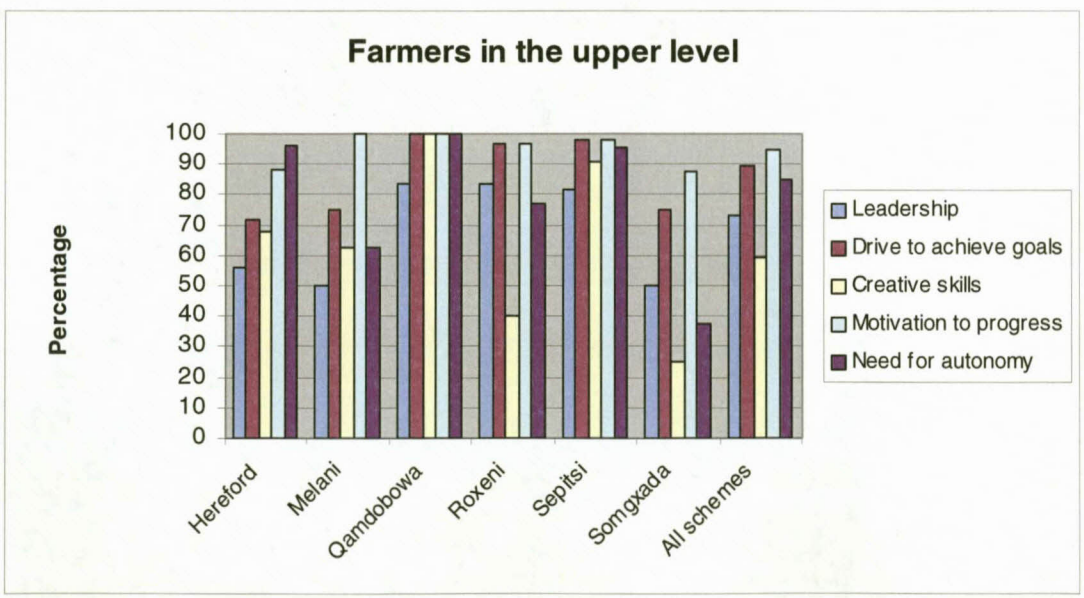

Figure 4.6: Entrepreneurship and creativity

4.3.6 Planning skills

To determine planning skills, farmers had to choose between four categories of responses ranging from no plans on one end to thorough plans on the other. The results are shown in Figure 4.7. Results show that, whilst there is a sizeable proportion of farmers who make thorough plans for their farming operations (about 32%), a majority of farmers only make rough plans (about 55%).

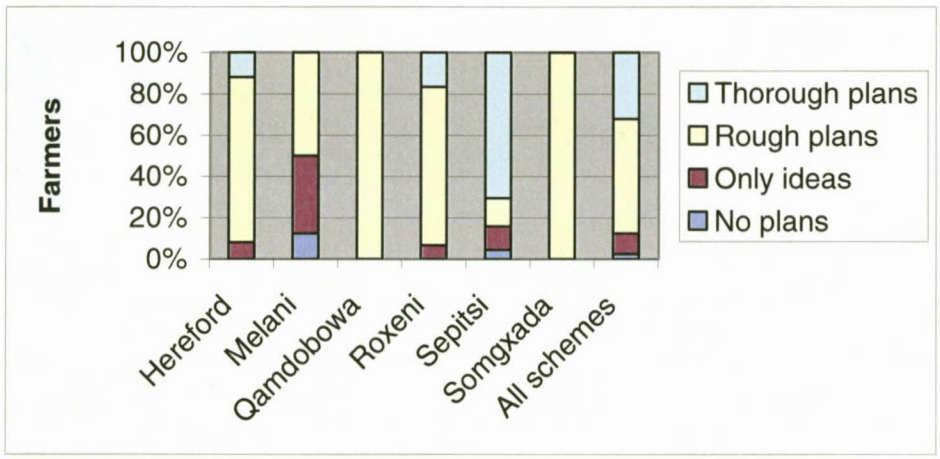

Figure 4.7: Planning skills

In some schemes, there are farmers who admit to not making any plans at all. This group of farmers forms about 2.5% of all the farmers interviewed and the rest is farmers who "only have ideas". This situation is usually attributed to the highly uncertain environment under which smallholders operate. These uncertainties relate to variability in the availability of resources for farming operations like capital and inputs.

4.3.7 Financial management and record keeping

Record keeping is widely accepted as the first major step to sound financial management. But this is usually a problem because of literacy levels of most smallholder farmers. There are already initiatives to explore record keeping formats that do not require any literacy skills.

Figure 4.8 shows that across schemes, more than 70% of farmers keep farming records. The proportion of farmers keeping farming records ranges from 48% to 100% within the various schemes.

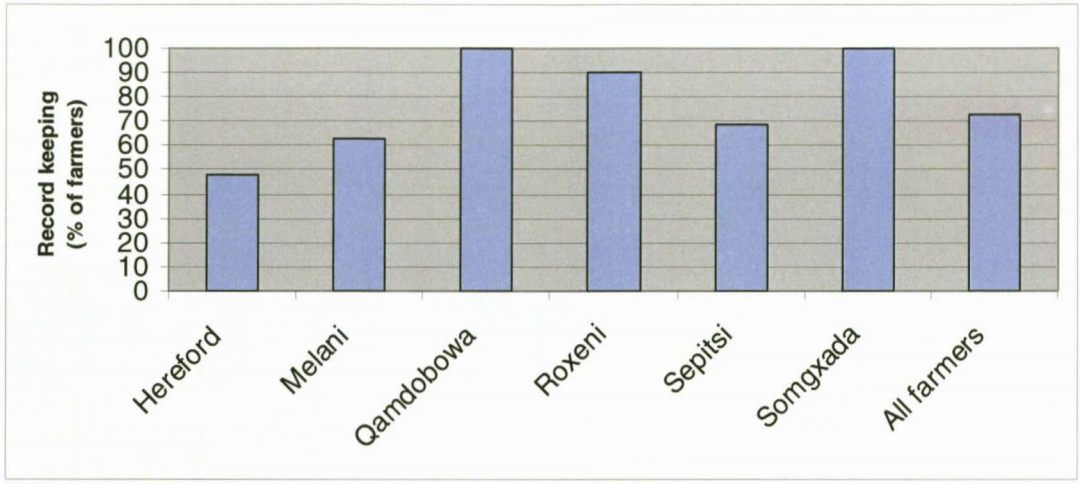

Figure 4.8: Record keeping

Whilst variations occur mostly in schemes where individuals are responsible for different plots, the figures of 100% mainly occur in schemes where records are kept centrally. In such cases, all farmers respond positively to the question regarding keeping of records. Results of the survey show that even those farmers who do not keep records agree that keeping records is important (96.7%) as shown in Table 4.4. That is partly due to the fact that some farmers are unable to keep records because of being illiterate as already mentioned.

A large number of farmers that consider keeping records as important, assert keeping records as important for determining financial position 94.2% and helping in decision-making (94.2%). For most of the farmers (78.5%), keeping records to keep the bank/co-op manager happy was not important at all. This reason comes out as important mainly in those schemes where farmers have access to foreign capital.

Table: 4.4 Importance of keeping farm records

RESPONSE	Number	%	
Important*	117	96.7	
Not important*	4	3.3	
Reasons for importance	%		
	Very important	**Important**	**Not important**
Determining financial position*	94.2	0	5.8
Decision making and planning*	94.2	4	1.8
To keep the bank or co-op manager happy*	21.5	0	78.5

*n=121

4.3.8 Risk management

To determine the attitude of farmers towards risk, a set of statements as shown in Table 4.5 were assembled. The study shows that 76.9% of the farmers are risk averse, and only a small percentage are risk-takers (7.4%) as shown in Table 4.5. Again, a relatively small percentage (15.7%) of the farmers are risk-neutral.

Table 4.5: Attitude towards risk

Statements	**Number**	**%**
Variety A will give you a profit of R10 000 in two out of ten years and in the other eight years R0 (High profit, high risk)	9	7.4
Variety B will give you a profit of R3 000 in six out of ten years and in the other four years R0 (Medium profit, medium risk)	19	15.7
Variety C will give you a profit of R2 000 in eight out of ten years and in the other two years R0 (Low profit, low risk)	93	76.9

It could be argued that use of pesticides and other crop protection measures could be a strategy to reduce risk associated with crops. The level of use of crop protection measures is close to 100% when all schemes are combined as shown in Figure 4.9.

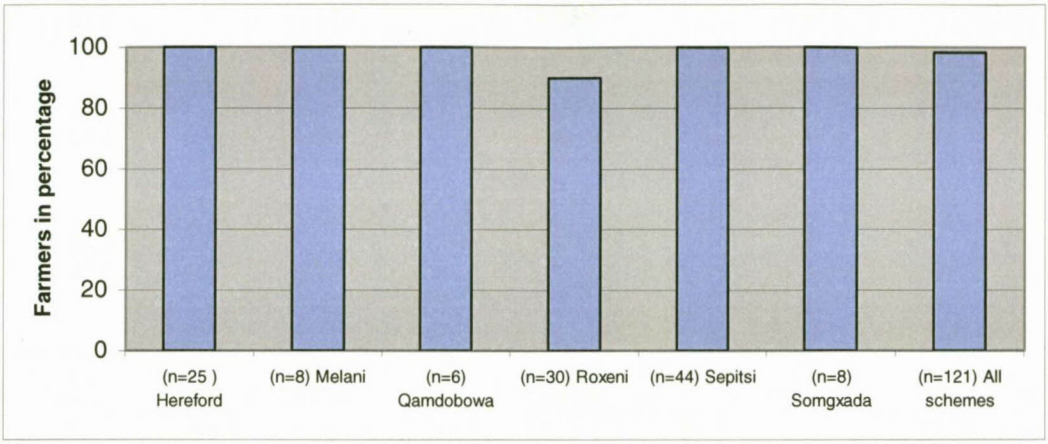

Figure 4.9: Use of crop protection measures

Whilst this may be seen as a confirmation of an inclination towards reduction of risk, some farmers have little choice in the situation. This is so because, in some schemes, a joint decision is taken that everybody controls particular pests as they may spread to neighbouring plots. However, the main reason that came up for all people who did not use any crop protection measures was lack of funds.

4.4 RESOURCES

4.4.1 Farm sizes and land use

Except for Hereford, farmers on these irrigation schemes mainly have a tenure system that gives the permission to occupy the land – the so-called P.T.O. system. Here the farmers have a lease contract with an option to purchase. As discussed previously in Chapter 3, most of the schemes were run by the parastatal agencies attached to the homelands' departments of agriculture. Plot sizes range from 0.06ha to about 9ha. The averages plot sizes are shown in Figure 4.10.

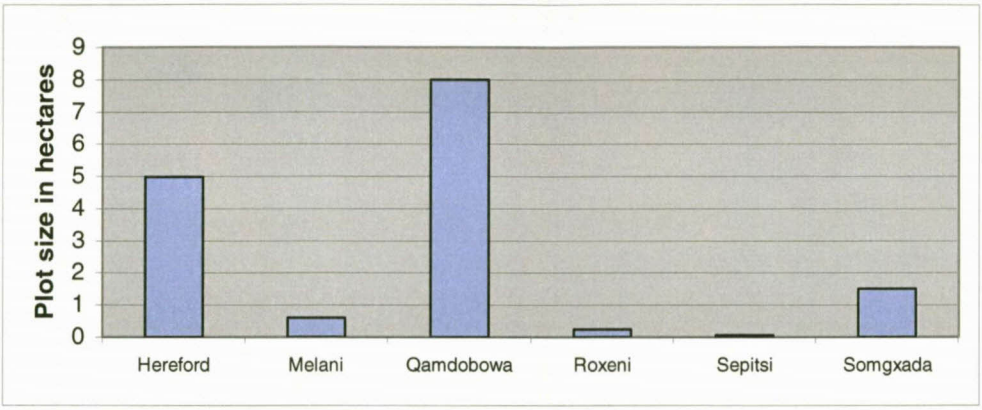

Figure 4.10: Average plot sizes

In some instances, even where plots are supposed to be equal in size, some farmers have more than one plot. The biggest average plot/farmer sizes are found in Qamdobowa at 8ha.

For almost all the schemes, plot sizes are usually agreed upon within the farmers and the allocating authority (traditional or government). However in Hereford, as it has already been explained in the history of the scheme in Chapter 3, these were originally private small farms and as farmers moved in, they did not change the arrangement regarding farm size.

As shown in Table 4.6, the main crops grown are maize (mainly for home consumption) and various vegetables (most of which are sold for income). Until recently, Hereford farmers were also producing tobacco as one of their main crops.

Table 4.6: Main crops grown

	Scheme name					
	Hereford	**Melani**	**Qamdobowa**	**Roxeni**	**Sepitsi**	**Somgxada**
Major crops	Tobacco, vegetables	Vegetables	Vegetables, maize, lucerne	Vegetables	Tomato, beetroot and butternut	Mainly potatoes and cabbage & various vegetables

4.4.2 Infrastructure and capital

It could be argued that physical infrastructure between major centres of South Africa is largely well developed. However, a big part of rural areas is still left out of this network. Mostly, access roads to rural areas – where most of the smallholder farmers are found, are poor and ill maintained. This poses a major problem for the produce in these areas to reach the main centres.

Similarly, transport services leave a lot to be desired. This leaves farmers with a heavy reliance on private contractors for transport of their produce. Timely moving of the produce is extremely important because of a lack of storage facilities. Some of the produce cannot be sold because it gets spoiled, as it will be shown in the section on unsold produce. It only becomes easier for farmers with own transport in terms of vehicles and tractors (as they are also used to transport produce). Table 4.7 shows ownership of vehicles, tractors and implements. As it can be seen in Table 4.7 for all smallholder schemes surveyed, only about 20% of the farmers own private vehicles and/or tractors.

Table 4.7: Ownership of vehicles tractors and implements

Scheme name	Private owners of vehicle/tractor/farm implements		Jointly owned movable assets
	Number	Percentage	
Hereford	14	56	No
Melani	0	0	Tractor, trailer and implements.
Qamdobowa	0	0	Tractor, trailer and implements.
Roxeni	5	16.7	Tractor, trailer and implements.
Sepitsi	5	11.4	No
Somgxada	0	0	No
All schemes	24	19.8	

A lot of progress has been made to link up rural areas to the telephone and electricity networks since 1994. Telephones are important for sharing information, which is a very important aspect in accessing input and output

markets. The cellphone technology which covers even rural areas can also serve as an important communication tool.

4.5 INSTITUTIONS

4.5.1 Services

Agricultural extension is one of the most important support services. More than 98% of the farmers surveyed indicated a need for extension services as shown in Figure 4.11.

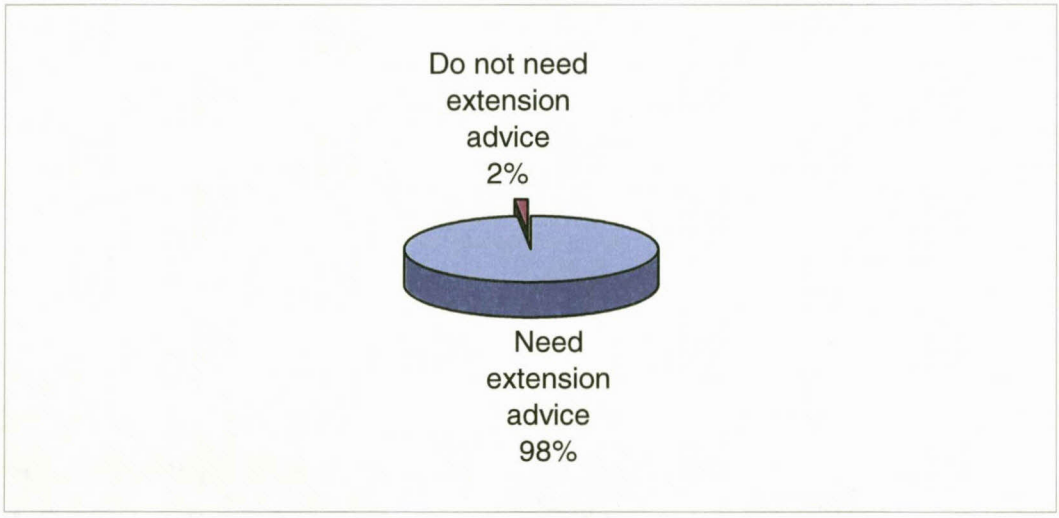

Figure 4.11: Need for extension services

In the light of the current withdrawal of government support, extension is supposed to be the critical area where government plays a major role. In this study, agricultural extension is divided into three categories: government extension, co-op extension services as well as advice from input suppliers. Table 4.8 shows the supply and demand for extension services under the various categories.

The first part of the table shows the percentage of farmers to whom extension services are available, while the second part shows how many times farmers have been visited by various extension officers.

Table 4.8: Supply and demand for extension services and farmers perceptions

Availability and accessibility of extension services	Percentage
Government extension service	88.4
Co-op extension service	9.1
Input supplier extension service	15.7
Times visited by extension officers	**Mean**
Government extension officers	22
Co-op extension officers	1
Input supplier officers	2
Total visits per year	25

The figures vary widely between schemes and what is presented in the table is a summary of the results for all farmers. The figures were taken from 2003/2004 based on what the farmers could recall. In other schemes, a government extension officer visits almost every week whilst others rarely see a government extension worker. In Roxeni, for instance, one of the farmers is a retired extension officer and fellow farmers rely on him for most of the advice that they could otherwise get from government employed extension workers.

It is clear therefore that farmers have to rely on a number of sources for information and advice as will be shown in the section on sources of information. Table 4.9 shows the perception of the farmers on whether the various extension officers have the necessary knowledge to help them make informed technical and financial decisions.

Results show that 62% of the farmers believe that government extension officers have the necessary technical knowledge while 45% believe that they have the necessary financial knowledge. When it comes to co-op extension, 12% of farmers believe that co-op extension officers have the necessary technical knowledge while 9% believe that they have the necessary financial knowledge. There have been a number of non-responses regarding co-op extension because farmers have never received any co-op services or input supplier support. This could explain the very low figures when it comes to perceptions on co-op extension.

Other important services include agricultural research, input supplier markets, output markets as well as credit services. Agricultural research is perceived to play a very limited role in the operations of these small farmers. Furthermore, as they have very little regard for it, the work of a researcher becomes very difficult in most of these schemes. Perhaps the link between the advice they get from extension officers and agricultural research is not very clear to them.

Table 4.9: Perception of farmers on the knowledge of extension officers

PERCEPTIONS	Number	Percentage
Technical		
Government extension service	75	62
Co-op extension service	14	12
Input supplier extension service	27	22
Financial		
Government extension service	54	45
Co-op extension service	11	9
Input supplier extension service	23	19

Agricultural research receives high regard in those schemes that have seen the benefit through contact with researchers that conduct field trials on their schemes. For instance, the University of Fort Hare conducts field trials in Somgxada and sometimes provides inputs for the scheme. Input supplier markets and output markets will be discussed later under the topic marketing management. The need for credit services is displayed as very high in Table 4.10.

Table 4.10: Need for credit

Irrigation scheme	Need for credit (%)	
	Need for credit (%)Need	Not available
Hereford	21	10
Melani	8	8
Qamdobowa	6	0
Roxeni	19	24
Sepitsi	31	44
Somgxada	8	8
All farmers	93	94

More than 76% of all the farmers express a need for credit. However a response as to whether credit is available to them yields a similar figure saying it is not available as shown in Table 4.10. For the purposes of discussion, the limit is specifically to formal sources of credit. In all surveyed scheme, except one (Hereford), farmers did not have access to formal credit. However even in Hereford there are also farmers who did not have access to credit for reasons that will be explained later in this section. Farmers in Hereford still have outstanding loans from the Land Bank with amounts ranging from as little as R300 up to R20 000. Some of the farmers have access to revolving credit from the local co-op as they are also members of a co-op that includes large-scale commercial farmers.

A number of reasons given by farmers as to why credit is not available are also shown in Figure 4.12. The most common reason is that the farmers do not know how to go about organizing credit (48%). This is a common feature in rural areas where most people do not understand how the whole system of commercial and agricultural banks works. This is closely followed by 35% of farmers who have insufficient security to secure finance. This is usually due to the tenure system in most smallholder schemes.

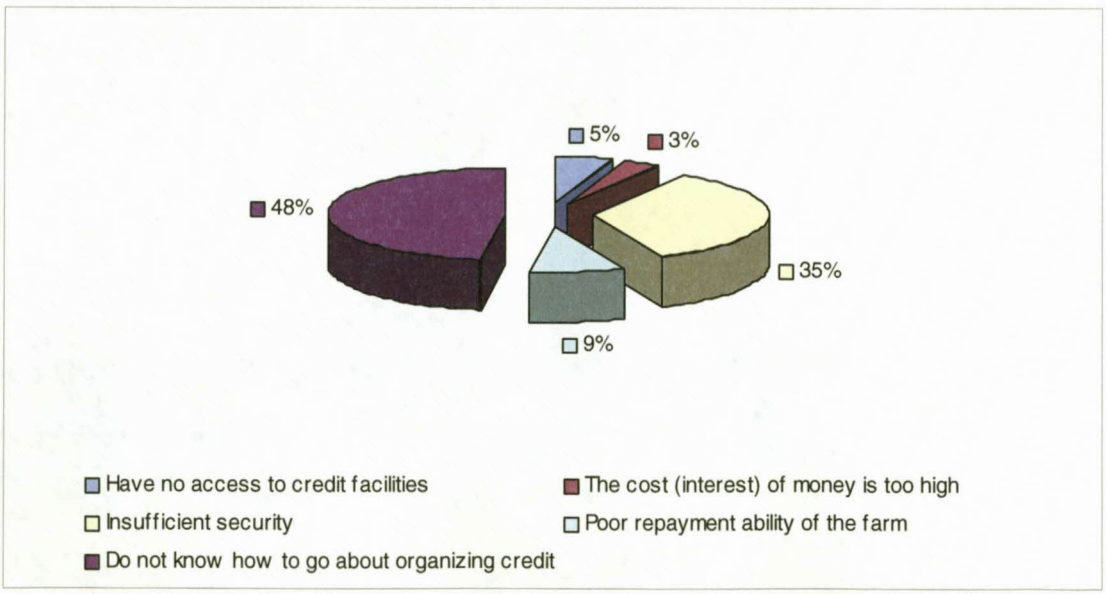

Figure 4.12: Reasons credit is not available to farmers

Other reasons are poor repayment ability of the farm. Most of the farmers who responded this way are from Hereford. The reason is that the past couple of years they encountered some problems with the water system in the scheme and could not earn sufficient income to service their loans. This was compounded by a delay in the payment for a harvest of tobacco that was produced just before this situation.

4.5.2 Information sources

As mentioned briefly before in this chapter, smallholders use a number of information sources to make specific decisions regarding management of their farming operations. As shown in Table 4.11, decisions to be made have been categorized into technical, financial, marketing decisions as well as information on new technologies.

Table 4.11: Information sources

Sources used for decision making and information	Technical decisions* (%)	Financial decisions* (%)	Marketing decisions* (%)	Information on new technologies* (%)
Mass media (radio, TV press) and extension publications (leaflets and periodicals)	10.7	17.4	-	14.9
Co-farmers and neighbours	52.9	64.5	78.5	64.5
Department of agriculture – extension officers	78.5	57.9	74.4	70.2
Co-op extension officers	9.1	12.4	12.4	18.2
Own records	24.8	72.2	0.1	0.1
Bank manager	-	2.5	-	-
Input supplier such as co-op manager	21.5	14.9	5	35.5
Sell to the buyer closest to my farm	-	-	78.5	-
Market agents	-	-	-	-
Chief or other traditional authority	-	-	-	-

*n=121

Mainly, farmers in the surveyed schemes rely on the Department of Agriculture extension officers for technical knowledge (78.5%). This is mainly due to the fact that this is largely the main extension service that they are exposed to. Other major sources of information for technical decisions are co-farmers and neighbours (52.9%), followed by own records at 24.8% whilst

21.5% get technical information from input suppliers. The presence of input suppliers is not a surprise because, in a bid to sell their products, they may supply technical information to the farmers on how to get the best results from the use of their products. A relatively small number of farmers (10.7%) claim to also get technical information from the media.

Financial decisions are made by consulting mainly own records (72.2%). The second most important source of information for financial decisions is co-farmers and neighbours (64.5%) followed by Department of Agriculture extension officers. When data is summarized, bank manager is less important because most of the farmers do not use foreign capital. The small number that is displayed for bank manager is mainly from some farmers in the Hereford scheme. To a limited extent, input suppliers also seem to influence financial decisions.

Results show that when it comes to marketing decisions, farmers mainly sell to the buyer closest to them or equally consult co-farmers and neighbours (78.5%). Another important source of information for marketing decisions is government extension officers (74.4%). The role played by co-op extension officers and input suppliers seems to be much less (12.4% and 5% respectively). Other sources of information are insignificant for marketing decisions.

Information on new technologies is mainly obtained from government extension officers (70.2%). This is followed by co-farmers and neighbours at 64.5%. Input suppliers also play a significant role in providing information on new technologies. This is also expected as they may be suppliers of equipments for instance relating to that new technology.

Clearly the main sources of information for the farmers in making technical and financial decisions as well as getting information on new technologies are the Department of Agriculture extension officers, co-farmers and neighbours, own records as well as input suppliers. When it comes to marketing, farmers

sell to the buyer closest to them and often get marketing information from co-farmers and neighbours.

4.5.3 Farmer organisations

The way farmers are organized plays a major role in the management of the scheme and can therefore have serious implications for its performance. When farmer organisations are well established, it is easier to work with them. New technologies and information reaches everybody quickly and problem solving through consensus is enhanced. When organized, farmers can negotiate better marketing terms with input suppliers as well as buyers of their produce.

In all the schemes surveyed, there is an existing farmer organisation and all the farmers interviewed belong to the respective organisations. Rules of farmer organisations range from those that regulate water sharing, land management and to a lesser extent, marketing management. Rules regarding water sharing often relate irrigation scheduling of plots as often the water supply is shared. Land management is mainly about weed and pest control.

Marketing management, except in a few schemes where land is jointly managed and not divided into individual plots, is an individual venture. Joint marketing decisions are however sometimes taken in some schemes regarding pricing of the produce. In Sepitsi, for example, if a farmer charges more than the agreed price for a product, a penalty is imposed. This is because of a perception that charging higher prices may drive potential buyers away affecting everybody. Similarly, in other rules mentioned above, depending on the seriousness of the offence, penalties or fines may be imposed.

4.5.4 Legal and regulatory framework

Whilst the government of South Africa is engaged in a process of revamping the legal and regulatory framework regarding natural resource management (NRM), a lot of people – mainly rural people, have been left confused. Laws regarding NRM and agriculture have undergone an almost complete overhaul since the new government came into power. The most important pieces of legislation are the National Water Act (NWA), (Act 36 of 1998); Water Services Act (WSA), (Act 108 of 1997); and the Marketing of Agricultural Products Act (MAPA), (Act 47 of 1996).

The NWA provides for the creation of new WRM institutions called Catchment Management Agencies (CMAs) and Water Users Associations (WUAs). Whilst the government will remain the custodian of the country's water resources, a lot of regulatory functions have been transferred to these institutions. One of the main stipulations of the NWA is compulsory registration and licensing of water rights. The dissolution of Irrigation Boards and concomitant formation of WUAs means that small farmers have to participate in the same institutions with large-scale commercial farmers.

The liberalization of markets and dissolution of product control boards together with the government withdrawal of support to small farmers leaves smallholders in direct competition with their well-established large-scale commercial counterparts in marketing of their produce. However, the National Agricultural marketing Council (NAMC), that was formed as part of the provisions of the MAPA puts smallholder market access as one of its priority areas. What is important to note here, is the fact that 98% of the farmers interviewed are not familiar with these new institutional changes.

4.6 MARKETING MANAGEMENT

4.6.1 Marketing outlets

There is growing evidence that many smallholder farmers can benefit from market - oriented agriculture. However, smallholders often face a number of barriers to accessing the markets. Rural people in Africa, especially the poor, often say that one reason they cannot improve their living standards is that they face difficulties of accessing markets where they can obtain agricultural inputs and consumer goods and sell the produce that they grow (Heinemann, 2002). A major reason why even those farmers who can produce a surplus remain trapped in the poverty cycle is lack of access to profitable markets. All too often farmers are forced to sell to the buyer of convenience at whatever price that buyer dictates (IITA, 2001). Mainly farmers across schemes sell their produce in the outlets shown in Table 4.12.

Table 4.12: Main output outlets

Scheme name	Main outlets				
	On-site at the field plot	Roadside marketing	Hawkers and traders	Open market in town	Sell to surrounding villages
Hereford	18	20	42	20	0
Melani	20	0	50	20	10
Qamdobowa	30	0	50	0	20
Roxeni	30	0	30	10	30
Sepitsi	18	37	35	0	10
Somgxada	48	0	30	22	0
All schemes (Mean)	27.3	9.5	39.5	12	11.7

For most of the smallholder farmers, deciding on a market outlet leaves very little room for choice because of the location of these schemes. Schemes closer to the main roads may exploit the roadside marketing channel more as seen in Hereford and Sepitsi. In most cases hawkers organize transport to fetch the produce from the farm, but farmers still need transport to take their produce to town centres and neighbouring villages to sell directly to consumers. Again here as mentioned earlier, farmers with own vehicles can

access these market outlets easier. Other means of transport are animal drawn carts and for shorter distances, even wheelbarrows are used. The volumes for hawkers are generally higher because they buy in bulk for purposes of resale. Besides hawkers who come to buy directly from the plot, farmers also sell to local villagers directly from the plot. At the time the survey was conducted, there was an initiative to create a central market in the Alice area.

The amount of produce sold through each outlet in each scheme was a challenge to quantify because this information was not very clearly recorded and mostly could be recalled with great difficulty. An attempt was made to try and make sense out of the estimated values. The most voluminous smallholder produce goes through hawkers and traders, followed by produce sold directly from the field plot. A relatively small proportion is sold directly in open markets in towns and surrounding villages. Since these modes require moving of the produce, they have a relatively low proportion closely Lastly, produce sold on the roadside is also a low proportion because this is mainly enjoyed only by schemes close to paved roads and many are far.

4.6.2 Unsold produce

As the previous discussion shows, farmers face a lot of challenges in getting their produce to the buyers. This sometimes results in unsold produce as shown in Table 4.13.

Table 4.13: Farmers with unsold produce

Irrigation scheme	Percentage
Hereford (n=25)	92%
Melani (n=8)	62.5%
Qamdobowa (n=6)	100%
Roxeni (n=30)	53.3%
Sepitsi (n=44)	4.5%
Somgxada (n=8)	0%
All schemes (n=121)	41.3%

The figures in Table 4.13 reflect the number of farmers who had produce they wanted to sell but could not for any given reason(s) in the past year. Unsold produce results in losses in income forgone as a result of that situation.

Farmers gave various reasons for being unable to sell their produce. These reasons are displayed in Figure 4.13. The most common reason was "not enough buyers". Closer probing in this response reveals that part of the cause is that farmers may concentrate on the same crop for a limited market which results in oversupply of that product. This is a reflection of less creative skills as shown in the previous section on entrepreneurship and creativity.

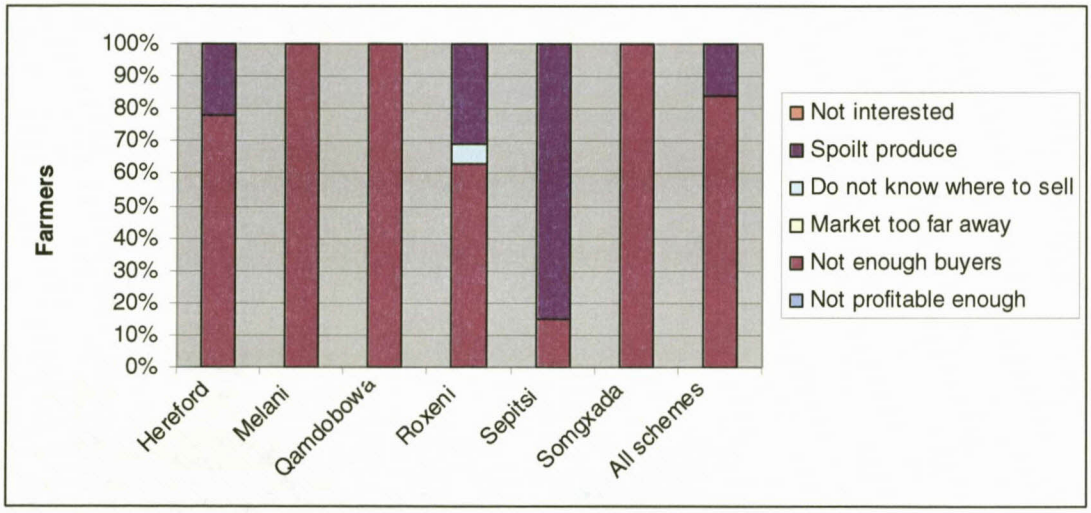

Figure 4.13: Reasons for unsold produce

In other instances, as most of the produce is sold fresh, it can get spoiled before buyers can come. This ties in with the lack of storage facilities discussed in the section on infrastructure and capital. Less specified but not less important, is the reason that farmers did not know where to sell their produce. Even though none of the farmers indicated that the market was too far, the reason of not enough buyers very much relates to this because if other means were available to access far off markets, the problem of "not enough buyers" would be partly solved.

4.6.3 Pricing and Processing

Pricing is generally arbitrary. There are no formal methods of determining the price of the produce. A common trend especially in the Alice area, is to source the going prices in the local supermarkets and arrive at a price based on that.

Currently, mainly all the produce in the surveyed schemes is sold fresh. However, in Hereford, there are tobacco curing facilities. The processing of tobacco improves the price almost ten fold. Grades and standards do not play any significant role in the production practices and marketing. Mainly farmers have no information about quality requirements for specific markets.

4.6.4 Acquisition of inputs

In the discussion about market access, the side of input markets is usually lost in the mist as much of the discussion focuses on output markets. However this side of the market is also extremely important. As depicted in Table 4.14, more than 80% of the farmers rely on rented or public transport to acquire their inputs. Again here, the decision to buy where and at how much does not really depend on the farmers' preferences but by what is available within a reasonable distance and affordability.

The main modes of acquisition of inputs are shown in Table 4.15. The figures in the table are rankings of the significance of particular modes of acquisition in the various schemes. Mainly farmers get inputs as individuals from the markets in town centres. In some few instances, farmers would pool their money together and organize a common transport from local contractors to purchase the required inputs from town.

Table 4.14: Use of rented or public transport for input acquisition

Scheme name	Farmers	
	Number	Percentage
Hereford	11	44
Melani	8	100
Qamdobowa	6	100
Roxeni	25	83.3
Sepitsi	39	88.6
Somgxada	8	100
All schemes	97	80.2

Schemes that are closer to town also enjoy the possibility of having inputs delivered to the field site. In some schemes, the local offices of agriculture also play a role by providing government transport to access inputs from keenly priced and well-stocked markets in cities as is the case for example in Qamdobowa.

Table 4.15: Main modes of acquisition of inputs

Scheme name	Personally from the market	Farmers association	Local co-op	Local extension officer	Input suppliers
Hereford	2	0	1	0	2
Melani	2	0	0	2	0
Qamdobowa	1	2	0	2	2
Roxeni	2	1	1	1	0
Sepitsi	2	0	0	2	0
Somgxada	0	2	0	2	0

What should be noted here is the importance of organisation of farmers in purchasing their inputs, because this service is mainly a feature in those schemes that operate as a unit and have the ability to place a single order for the whole scheme at any given time. It is the same schemes type of arrangement that facilitates delivering of inputs by input suppliers and better price negotiation as discussed under the section on farmer organisations.

4.7 SUMMARY

A majority of the farmers sell their produce through the easiest accessible outlet, not the most profitable. This trend is similar for accessing input markets. This to a large extent relates to the farmers' resource base as well as human capital endowments. Human capital endowments inevitably affect the level of entrepreneurship and creativity.

Whilst knowledge and experience play a major role in the farming operations, the role of training is also extremely important. Access to supportive institutions remains very critical. The next chapter will provide analytical tests to determine whether these supportive institutions and other variables discussed here indeed explain access to markets for smallholder irrigators.

CHAPTER 5

CHARACTERISTICS OF POTENTIALLY SUCCESSFUL SMALLHOLDER IRRIGATORS

5.1 INTRODUCTION

Continued underperformance of small-scale irrigation in South Africa warrants for this sub-sector to be put under scrutiny. The potential for success may be influenced from mainly two dimensions. The first one regards the individual characteristics of the farmer and the second one is concerned with the conditions within which he operates. This chapter deals with the former. As discussed in the section on literature review, entrepreneurship is increasingly being viewed as key in economic growth of a country. Within this kind of understanding, individual farmer characteristics play a major role in determining the entrepreneurial potential of a small farmer.

Successful farmers must be able to assess the future, be able to create and sustain competitive advantages and identify opportunities before competitors do (Nell and Napier, 2005). As discussed in Chapter 2, various researchers such as Nel *et al.*, (1998), Collins *et al.*, (1999), Blackman *et al.*, (2000), Rauch and Frese (2000) and Marshall and Peake (2005) advance various characteristics of farmers that positively influence the success potential. These attributes include aspects such as leadership, motivation, entrepreneurship, etc., (see Table 5.1). Examining these characteristics will lead to a better understanding of the farmers involved in smallholder irrigation farming. Such knowledge will be invaluable in planning of irrigation projects and formulation of policies that affect smallholder irrigators. It can also be possible to build on this information to assess the influence of the environment within which the farmers operate in determining this potential.

In this chapter therefore, farmers are separated into two groups based on these attributes. This chapter therefore assesses the influence that farmer

characteristics have on the potential to be more successful. The technique used in this exercise provides a new categorical variable that can be used in further analyses. The methodology followed is outlined in the next section.

5.2 METHODOLOGY

The cluster analysis technique was used to separate farmers based on individual characteristics that influence success potential as discussed earlier. The objective of cluster analysis is to partition a set of objects into two or more clusters such that the objects within a cluster are similar and objects in different clusters are dissimilar (Hintze, 1998). 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, and the choice presumably reflects the investigator's judgement of relevance for the purpose of classification. Consequently, it is important to bear in mind that the initial choice of variables is itself a categorisation of the data which has no mathematical or statistical guidelines (Everitt, 1983).

Various forms of cluster analysis technique are used for different objectives and the choice also depends on the nature of the data. These include fuzzy clustering, hierarchical clustering and dendrograms, k-means, medoid clustering and regression clustering. In this exercise a medoid partitioning clustering technique was used to categorise farmers based on the above attributes. The medoid partitioning technique finds representative objects around which a cluster will be formed. The medoid of a cluster is defined as that object for which the average dissimilarity to all other objects in the cluster is minimal. The medoid report helps in interpreting and recognizing the clusters.

Following Kaufman and Rousseuw (1990), two types of distance measures are 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:

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

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

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

where for interval, ordinal and ratio variables:

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

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

$\delta_{ijk} =$ 1 if $x_{ij} \neq x_{jk}$

0 if $x_{ij} = x_{jk}$

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:

$$D = \sum_{k=1}^{K} \sum_{ieC_l} \sum_{jeC_l} d_{ij} \quad \text{.....[3]}$$

To constitute a frame of reference within which to establish the clusters, a set of variable was selected. The variables selected for analysis are as follows: age, farming experience, leadership, drive to achieve goals, motivation to progress, creativity, entrepreneurship, need for autonomy, education, risk attitude, planning, nature of decision making, gender, training, record keeping

and need for extension. Table 5.1 below shows the variables that were selected for analysis and the measurement of each.

Table 5.1: Variable measurement

Variable	Measurement
Age	Years
Farming experience	Years
Leadership 1	Scale of 1-4
Leadership 2	"
Leadership 3	"
Drive to achieve goals 1	"
Drive to achieve goals 2	"
Motivation to progress 1	"
Motivation to progress 2	"
Creativity	"
Entrepreneurship	"
Need for autonomy 1	"
Need for autonomy 2	"
Education	Grades as categorised
Risk attitude	Scale of 1-3
Planning	"
Technical decisions	Person(s) involved
Financial decisions	"
Gender	1=male; 2=female
Training	1=yes; 0=no
Record keeping	"
Need for Extension	"

The variables leadership, drive to achieve goals, motivation to progress and need for autonomy are further disaggregated based on the number of questions within each variable measurement as it can be seen on Table 5.1. Leadership 1, 2 and 3 refer to capacity to try new techniques before fellow farmers without seeking help; decision making power and setting an example for other farmers respectively. Drive to achieve goals 1 refer to drive to deal with challenges while drive to achieve goals 2 deals with the ability to set goals and organise production factors. Motivation to progress 1 and 2 refer to sense of independence and supporting fellow farmers respectively. Need for autonomy 1 refers to reliance on own knowledge while the second category refers to ability to adopt new technologies before others have tried them.

5.3 RESULTS AND DISCUSSION

After initially running the data through the clustering tool, results of the average silhouette showed that the appropriate number of clusters that can be obtained is two. Further analysis was therefore carried out with this predetermined number of clusters. Table 5.2 below shows the cluster medoids and the last row shows the location of the particular medoid in the data set.

Table 5.2: Cluster medoids

Variable	Cluster 1	Cluster 2
Age	52	59
Farming experience	20	6
Leadership 1	3	4
Leadership 2	3	4
Leadership 3	3	4
Drive to achieve goals 1	3	4
Drive to achieve goals 2	2	4
Motivation to progress 1	3	4
Motivation to progress 2	3	4
Creativity	2	4
Entrepreneurship	2	4
Need for autonomy 1	3	4
Need for autonomy 2	3	4
Education	2	4
Risk attitude	2	3
Planning	3	3
Technical decisions	4	1
Financial decisions	4	2
Gender	1	2
Training	0	1
Record keeping	0	1
Need for Extension	1	1
Row #	27	109

As already mentioned, the medoid report from the analysis helps in interpreting and recognizing the clusters. The medoid in each cluster represents the average characteristics of farmers in the cluster.

5.3.1 Cluster 1 - Less Successful Farmers

Cluster 1 is represented by fifty-five observations and can be considered as representative of the less successful (LS) farmers. In this cluster, most of the variable scores which are considered to positively influence success potential, do not favour success as discussed in literature review.

Despite showing a big positive gap in terms of experience, this group of farmers have largely not been trained in their operations. It may be argued that unless experience is constantly being fed with updated training in new methods, it may become obsolete. When combined with training, experience can significantly increase competence and long-term capacity-building. One of the internal features of successful farmer controlled enterprises includes external training inputs, particularly when aimed at integrating the group into the wider economy through the development of links with financial and market intermediaries (Coulter *et al.*, 1999). Coulter *et al.* used case studies from Kenya and Zimbabwe, specific areas are mentioned where farmers should receive training. These are:

- to bargain more effectively and exercise some choice over the business with whom they contract
- about the cyclical nature of product lifecycles, and the need this generates for savings and back-stop strategies
- to improve crop management skills, enhance the prospects of obtaining contracts from agri-business

The group of farmers in this cluster also score less in terms of critical characteristics like leadership, drive to achieve goals, motivation to progress, creativity, entrepreneurship and need for autonomy. This group of farmers is also less educated than their counterparts. Farmers in this group also do not

keep farming records often considered critical in successfully carrying out the monitoring function. This could also be linked to the level of education of the farmers in this group. Farmers in the less successful group also tend to be relatively risk averse compared to the more successful group.

The medoid of this cluster shows that this group is made up of mainly males. In rural areas of South Africa smallholder food production is mainly carried out by females even though most of the food plots are registered in the names of the male members of the family.

As it can be seen in the last row of Table 5.2, the medoid of this cluster is in row number 27 of the data set. Working back through the data reveals that this medoid represents a farmer in the Melani Irrigation Scheme. As described in Chapter 3, in this scheme there is no management structure. Half of the farmers allocated plots on the scheme have since abandoned their plots. Farmers are faced with the high cost of maintaining the scheme tractor and fencing costs they cannot manage. The irrigation scheme is linked to the town centre by 15 km of bad roads. As a result, market access is also cited as a serious problem.

5.3.2 Cluster 2 - More Successful Farmers

Cluster 2 meets most of the criteria for potential success as discussed in Chapter 2. Cluster 2 can therefore be considered as representative of the more successful (MS) farmers. This cluster is represented by sixty-six observations.

Even though in the representative medoid, experience is lower than the less successful farmers (LS), the medoid for the more successful farmers (MS) shows that most of them have received some form of training. As discussed earlier, training increases competence and builds capacity over a long term.

According to the cluster medoid, the farmers in this group score positively in other critical farmer characteristics necessary for successful farming. These

include leadership, drive to achieve goals, motivation to progress, creativity, entrepreneurship and need for autonomy. These attributes can be considered as *sine qua non* for farmer success.

This medoid also represents a group of farmers who are more risk inclined. This agrees very well with the studies done on the behaviour of successful farmers. Unsurprisingly, this group of farmers is also slightly more educated than the LS farmers. This gives them the advantage of finding it less difficult to organize factors of production and may find it easier to understand complex phenomena in their midst. This group is also keen on keeping farm records. This is very helpful in monitoring the performance of the farm and aids in decision making.

The cluster medoid shows that farmers in this cluster are mainly female farmers. As already explained, most of the smallholder farmers in rural areas are female because of primarily the fact that able-bodied males are commonly migrant labourers in cities and nearby towns.

The medoid represents a farmer in Sepitsi Irrigation Scheme. Even though market access is cited as one of the problems in this scheme, the scheme is located a very short distance (about 3km) from the tarred road. Lebowakgomo, which is the main business centre of the Lepelle-Nkumpi municipality is just 30 km away. There is also a proper management structure in this irrigation scheme where all farmers belong to a farmers' association.

5.4 CONCLUSION

Economic growth, to a large extent, depends on entrepreneurship. Within this kind of understanding, factors that influence entrepreneurship become of interest. Mainly, these are individual characteristics of the farmer and these affect the way a farmer conducts his business.

In this chapter, several factors were examined and the influence in grouping of the farmers into more successful or less successful farmers was assessed.

This exercise reveals more or less similar characteristics in a group. With this kind of information, it is possible classify and describe farmers in terms of their success potential focusing on the factors highlighted by relevant literature. The result was two groups of farmers, the more successful and the less successful. Compared to their counterparts, the more successful group of farmers tend to be better in the critical aspects of entrepreneurship like leadership, drive to achieve goals, motivation to progress, creativity, entrepreneurship and need for autonomy. Results also show that they are mainly female farmers. What can be drawn from this exercise is a suggestion on the areas that need to be developed amongst smallholder irrigators. By developing these areas, it would be possible to move more farmers into the more successful category. This can be done through building the capacity of the farmers using appropriate methods of education and training and providing the necessary support to boost their confidence.

Besides being used to understand the performance factors in existing smallholder irrigation schemes, this approach could also be used for farmer selection in new smallholder irrigation projects. It is also relevant for evaluating potential success for the beneficiaries of the land reform programmes. This approach can be applied in wider studies with larger samples to assist policy making efforts and make intervention projects more targeted to the intended beneficiaries. The results of this exercise are extended to the next chapter in assessing the role of market access in influencing the potential for a farmer to belong to the more successful group of farmers.

CHAPTER 6

FACTORS INFLUENCING THE SUCCESS POTENTIAL IN SMALLHOLDER IRRIGATION PROJECTS OF SOUTH AFRICA

6.1 INTRODUCTION

In the quest to improve the success rate in smallholder irrigation projects, one aspect that has to be examined concerns the conditions within which smallholder irrigation projects are carried out. According to the review of literature as discussed in Chapter 2, several factors can have an influence in this regard. Within these factors, the role of market access – the subject of this study is emphasised. Lack of market access is said to be the reason even those farmers who can produce surplus remain trapped in poverty. It also is the main ingredient for successful commercialisation of smallholder production. Access to markets is seen therefore as a stepping stone in achieving the imperatives of government that aims to improve smallholder performance in order to contribute to economic growth and alleviate poverty.

This chapter builds on the results of the previous exercise that addressed individual characteristics of potentially successful smallholder irrigators. It examines the influence of various factors that form conditions within which smallholder irrigators operate, on the potential for success. This line of thinking is supported by van Rooyen (1984) when he says that effective agricultural production should start with the farmer and his farming system. Mainly, the objective is to demonstrate the importance of market access as one of the factors that are important for the success potential of smallholder irrigation projects.

6.2 DATA AND METHODOLOGY

The preceding discussion makes it very clear that market access is just one of the factors that influence the success potential of smallholder irrigators. To

get a better understanding of the role of market access in the success potential therefore, it is necessary to analyse many possibilities.

6.2.1 The variables

The proxy for the dependent variable is a result of the cluster analysis conducted in Chapter 5, that grouped farmers based on individual characteristics. This separated the farmers into two groups that were referred to as more successful (MS) or less successful (LS). This yielded a discrete variable with values either 0 for LS or 1 for MS.

Based on the review of literature on factors influencing potential success in smallholder irrigation projects as presented in Chapter 2, the following variables were included in the analysis: The continuous explanatory variables include use of family labour, planning level, off-farm income and number of extension visits. Discrete explanatory variables include tenure system (private = 1 or P.T.O. = 0) infrastructure availability, access to information, access to training, access to research and development, belonging to a farmer organization, market access, transport availability and access to credit.

It is understood that the problem of market access for small-scale farmers takes many forms. It may be the fact that the produce is not sold to the buyer of choice and most of the time not at the price of choice. However, because of lack of relevant data to address these concerns due to insufficient record-keeping, this exercise is limited to whether the produce meant for the market was sold or not. The proxy for the market access variable therefore was developed around a response to a question regarding whether all of the produce that was meant to be sold the previous season was sold or not. This yielded a discrete variable with values either 0 for no or 1 for yes as shown in Table 6.1. Table 6.1 shows the list of explanatory variables together with their expected signs.

Table 6.1: Explanatory variables and their expected signs

Variable	Measurement	Expected sign
Tenure system	Private=1; PTO=0	+
Infrastructure	1=yes; 0=no	+
Information	"	+
Market access	"	+
Family labour	Number of members providing assistance	+
Research & development	1=yes; 0=no	+
Farmer organization	"	+
Training	"	+
Planning	1-4 (from no plans to thorough plans)	+
Off-farm income	ZAR	+
Transport availability	1=yes; 0=no	+
Extension	Estimated number of visits per year	+
Credit	1=yes; 0=no	+

6.2.2 The Model

A decision was taken to fit the logit model because of the dichotomous nature of the dependent variable:

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

Where, P_i represents the probability of small irrigator *i* being more successful, χ_i are the set of explanatory variables determining 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 potential of irrigator i as:

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

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

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

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

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

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

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

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

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

The first attempt to fit equation 5 using maximum likelihood procedure failed. This was attributed to the perfect multicollinearity problem after studying the correlation coefficient matrix and eigen values of the correlation matrix of explanatory variables (see Appendix B1 for the full correlation matrix). The smallest eigen value calculated was 0.002833. The sum of the reciprocals of the eigen values is 395 which is 28 times the number of variables.

The problem was solved by resorting to the principal component regression (PCR) procedure. The methodology outlined next is different from other

studies in the way PCR is applied. Here PCR is applied within maximum likelihood estimation framework.

The correlation matrix C using both standardized and unstandardised variables was used to calculate eigen values $\lambda_1, \lambda_2, ...\lambda_K$ and corresponding eigenvectors v_i respectively as:

$$|C - \lambda I| = 0, \ |C - \lambda_j I| v_j = 0 \quad \text{.....[7]}$$

The independent variables were standardised as $(x_i - \bar{x_i})/s_{x_i}$. The eigenvectors v_j were then arranged to give matrix V in equation 8.

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

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:

$$Z = X^S V \quad \text{.....[9]}$$

Where X^s is n × k matrix of standardized variables; V is eigenvector matrix as defined in equation 9. There are k principal components as there are k variables. The new set of variables (principal components) unlike the original variables are orthogonal i.e. they are uncorrelated.

After the principal components (PC) are calculated and PCs with the smallest eigen values are eliminated (see Table 6.2 for the remaining eigen values),

equation 10 was fitted to determine PCs having significant impact on the probability of success:

$$Ln\left(\frac{P}{1-P}\right) = \alpha_o^s + X^s VV'\varphi^s + \varepsilon \quad \text{.....[10]}$$

Table 6.2: Remaining principal components and eigen values

Principal component	Eigen value	%variability
PC_1	3.674	28.26
PC_2	2.562	19.71
PC_3	1.654	12.72
PC_4	1.170	9
PC_5	1.018	7.83
Sum	**10.078**	**77.53**

After insignificant PC from equation 11 are identified and eliminated (see Table 6.3 for significant PCs), equation 12 is obtained in terms of the retained principal components.

$$Ln\left(\frac{P}{1-P}\right) = \beta_o^s + Z\gamma + \varepsilon^{oo} \quad \text{.....[11]}$$

Where, $Z = X^S V$ and $\gamma = V'\varphi^s$. Z is an $n \times \ell$ matrix of retained principal components, V is a $k \times \ell$ matrix of the eigenvectors corresponding to the ℓ retained components, γ is ℓ x ℓ vector of coefficients associated with the ℓ components. Standard errors of the estimated coefficients γ are represented by an ℓ x 1 vector

$$Var(\hat{\gamma}) = \hat{\delta}^2 (Z'Z)^{-1} = \hat{\delta}^2 diag(\lambda_1^{-1}, \lambda_2^{-1}, ...\lambda_l^{-1}) \quad \text{.....[12]}$$

Where $\hat{\delta}^2$ is variance of residuals from equation 10. Therefore standard error of γ may be given by:

$$k^s = \left(s.e._{\hat{\gamma}_1}\ s.e._{\hat{\gamma}_2} \ldots s.e._{\hat{\gamma}_\ell}\right)' \quad \ldots\ldots [13]$$

Table 6.3: Parameter estimates of logistic regression

Variables	Coefficient (α)	Standard error	T-ratio	Probabilities
Constant	0.15585	0.31864	0.48912	0.626
PC_1	2.7941	0.52039	5.3692	0.000***
PC_2	0.55672	0.35689	1.5599	0.122
PC_3	1.5314	0.45160	3.3911	0.001***
PC_4	-0.53615	0.30608	-1.7517	0.083*
PC_5	0.79102	0.31474	2.5133	0.013**

***, **& * = 1% , 5% and 10% respectively

Results obtained using equation 11 may be transformed back to the principal component estimators of standardized variables as follows:

$$\begin{bmatrix} \alpha^s_{1,pc} \\ \alpha^s_{2,pc} \\ . \\ . \\ . \\ \alpha^s_{k,pc} \end{bmatrix} = \begin{bmatrix} v_{11} & v_{12} & . & . & . & v_{1l} \\ v_{21} & v_{22} & . & . & . & v_{2l} \\ . & . & & & & . \\ . & . & & & & . \\ . & . & & & & . \\ v_{k1} & v_{k2} & . & . & . & v_{kl} \end{bmatrix} \times \begin{bmatrix} \hat{\gamma}_1 \\ \hat{\gamma}_2 \\ . \\ . \\ . \\ \hat{\gamma}_\ell \end{bmatrix}, \quad \ldots\ldots [15]$$

Where $\hat{\gamma}_i$ is estimator of γ_i in equation 12. The constant $\alpha^s_{0,pc} = ln\frac{P_i}{1-P_i} - \sum a_i^s p_c \bar{x}$. The standardized coefficients evaluate the relative importance of the explanatory variables in determining the success potential of irrigators.

Following Fekedulegn, Colbert, Hicks & Schuckers (2002), variance of the principal component estimators in standardized variables is given by:

$$Var(\alpha_{pc}^{s}) = \Psi_{\ell}^{s} K^{S} \quad \text{.....[16]}$$

Where Ψ_{l}^{s} contains the squares of the elements of V_{l}^{s} in equation 8, and K^{s} contains the squares of the elements of the matrix of standard errors of the coefficient matrix of γ in equation 11. The corresponding standard errors for the estimators of principal components of standardized variables are given by:

$$s.e.(\alpha_{pc}^{s}) = [Var(\alpha_{pc}^{s})]^{\frac{1}{2}} \quad \text{.....[17]}$$

Following Fekedulegn, *et al*, (2002), standardized coefficients $\alpha_{j,pc}^{s}$ of standardized variables X_{j}^{x} were transformed back to unstandardised coefficients $\alpha_{j,pc}$ of X_{j}

$$\alpha_{j,pc} = \frac{\alpha_{j,pc}^{s}}{S_{xj}},\ j = 1, 2, \ldots, k \quad \text{.....[18]}$$

and

$$\alpha_{o,pc} = \alpha_{o,pc}^{s} - \frac{\alpha_{1,pc}^{s}\bar{x}_1}{S_{x1}} - \frac{\alpha_{2,pc}^{s}\bar{x}_2}{S_{x2}} - \ldots - \frac{\alpha_{k,pc}^{s}\bar{x}_k}{S_{xk}} \quad \text{.....[19]}$$

Where S_{xj} is the standard deviation of the j^{th} original variable X_j & $\alpha_{o,pc}^{s}$, $\alpha_{1,pc}^{s}$ pc, $\alpha_{2,pc}^{s}$, $\alpha_{k,pc}^{s}$ are coefficients of the standardized variables.

Partial effects of the continuous individual variables on potential success of irrigators may be computed by the expression:

$$\frac{\partial P_i}{\partial x_{ij}} = P_i(1 - P_i)\alpha_{j,pc} \quad \text{.....[20]}$$

The" partial" effects of the discrete variables are calculated by taking the difference of the probabilities estimated when the value of the variable is set to 1 and 0 $(x_i = 0, x_i = 1)$, respectively.

6.3 RESULTS AND DISCUSSION

Table 6.4 shows the results of the regression.

Table 6.4: Summary of results

Variables	Standardised Coefficient	Unstandardised Coefficient
Tenure system	-1.04574 (0.213846)***	2.57217 (0.525991)*
Infrastructure	0.00661 (0.294122)	0.030324 (1.349232
Information	1.617806 (0.23913)***	3.318946 (0.490578)*
Training	1.108553 (0.22161)***	3.349972 (0.669691)*
Family labour	0.356419 (0.219566)	0.333503 (0.205449)
Access to Research & Development	0.096961 (0.08292)	0.200728 (0.171661)
Membership to farm organization	-1.06852 (0.211361)***	-2.2768 (0.45037)*
Market access	0.782917 (0.233998)***	1.583379 (0.47324)*
Planning	1.498991 (0.239327)***	2.119601 (0.338412)*
Off farm income	0.047676 (0.204184)	2.67E-06 (1.14E-05)
Transport	1.077983 (0.241693)***	3.089256 (0.692638)*
Extension	0.835903 (0.238204)***	0.032404 (0.9234)*
Credit	-0.35272 (0.245609)	-0.84365 (0.587466)
Constant	--	-15.4064*
Number of Observations		121
Goodness of fit		87.6%
Pesaran-Timmermann test		7.4459[.000]

***, ** and *= 1%, 5% and 10% respectively; Numbers in brackets are standard errors

As it can be seen in Table 6.4, out of the thirteen variables, eight were highly significant at the 1% level. Six of the significant variables have the expected direction of relationships with the dependent variable. The two variables that are significant in a direction opposite the expected one are: nature of access to land and membership to a farm organization. The goodness of fit of the model is 87.6%.

It is difficult to explain why these two variables have an inverse relationship with success potential because as discussed earlier, they are both supposed to improve the success potential. Their signs do not make economic sense in this case. In the case of farm organization, perhaps the understanding of the fact that the existing organizational structure does not translate to any real returns can explain the situation. It does not necessarily translate to any benefits in terms of, e.g. marketing association and also the fact that only a small number (about 30%) of the surveyed farmers belong to a farm organization. The nature of access to land is the difference between the more prevalent permission to occupy (PTO) and private ownership or lease contract. Results of this study show that success favours farmers who have PTO. This can be attributed to the fact that PTO is the more prevalent tenure system with only 20% of the surveyed farmers having private lease contracts. Therefore a large number of the more successful farmers have permission to occupy, this can influence the results.

According to the standardized coefficients of the remaining six other variables, information has the biggest impact. Salient and timely information is key to improving success potential. This is usually the biggest source of transaction costs for smallholder farmers in general. Smallholder farmers are seldom in a position to understand what to produce, when and in what quantities or quality requirements. They usually also lag behind in terms of technology as a result of this. This makes it difficult to enter the more lucrative markets for their produce. Following information is the level of planning which is very important in farming enterprises. This is because of the volatile nature of agricultural production and the time lag between investment and harvesting.

Therefore farmers who have more detailed plans have a higher potential for success.

The above variables are closely followed by training, transport, market access and extension. Transport availability is key in accessing both input and output markets. It is therefore not surprising that together with market access they are significant and have a positive relationship with success potential. Market access is important because farmers can generate income to use for household needs and re-invest in the farming enterprise.

Extension has also been shown in numerous studies as a very important aspect in improved smallholder irrigation management. This is mainly how the results of the R&D exercise reach the farmers. For some farmers, extension officers are the only contact farmers have with the government department of agriculture. In other areas, extension officers play a role larger than just dissemination of information but assisting farmers in acquiring the factors of production including assistance in credit acquisition.

Partial effects of the significant variables were calculated and they are shown in Table 6.5.

Table 6.5 Partial effects of the significant variables

Variable	Partial effect
Information	0.0607
Market access	0.0025
Training	0.6002
Transport	0.5828
Planning	0.5267
Extension	0.0081

For the continuous variables, the factor for calculating marginal effects obtained from the regression output (0.24849) was used. For discrete variables, the following formula was used:

$$PE=\phi(1-\phi)X \quad \text{.....[21]}$$

Where ø is the base probability for variable X and X is the coefficient of the variable.

The estimated partial effects shown in Table 6.5 could be interpreted as meaning that a unit improvement in each variable will increase the probability to be more successful by the corresponding coefficient. For example, if information were to be available to the farmers, the probability to be more successful would be increased by 6%. Similarly, if the farmers received targeted training, the probability to be more successful would increase by 60%.

6.4 SUMMARY AND CONCLUSION

Understanding success potential of smallholder irrigation projects is critical because it aids in proper planning. The common understanding is that smallholder irrigation projects have a potential to provide multiple livelihood sources for the rural poor. Beyond serving the purpose of fulfilling subsistence needs, surplus production has a potential to improve household incomes. These improvements would feed right into the government's imperatives of poverty alleviation and economic growth.

In this chapter the method of Principal Component Regression (PCR) is used to understand the myriad of factors hypothesized to influence success potential in smallholder irrigation projects. This technique combats co-linearity by transforming the original variables into a new set of orthogonal or uncorrelated variables called principal components. At the end of the procedure principal component estimators were obtained. These are coefficients of the transformed variables.

Results of this PCR show that of the eight significant explanatory variables, six have the expected signs and are statistically significant. Access to

information, training, market access, planning, transport and extension are all significant at the 1% level.

This elucidates the complexity of the task that faces those that deal with smallholder irrigation management. In addition to the farmers themselves, these include extension service providers, capital providers and trade partners. This study has tried to provide guidelines on which areas should receive attention when dealing with smallholder irrigation management. Some implications of these results are discussed below.

Access to information has been shown to be a critical area in improving the success potential of the farmers and needs to be improved. One way of doing that is to ensure that farm specific information is available through media that are accessible to the smallholder farmers. The other complementary approach is to focus on improving the extension services. Extension is shown to be highly significant as one of the factors that influence success in smallholder irrigation projects. This suggests that more focus should be directed at improving the effectiveness and efficiency of the extension services. It might be necessary to improve the training levels of the extension officers so as to be able to deliver a better service to the farmers. Also, the capacity of the farmers themselves should receive attention through targeted training as training has shown to be a significant factor in improving the success potential.

A majority of farmers only make rough plans (about 55%). In some schemes, there are farmers who admit to not making any plans at all. This situation is usually attributed to the highly uncertain environment under which smallholders operate. These uncertainties relate to variability in the availability of resources for farming operations like capital and inputs. A combination of improved access to information regarding potential demand for various markets and quality requirements together with capacity building through specific training may solve part of the problem.

The implication of the results regarding market access is that in designing irrigation projects, market access should be included in the planning process and not as an additional aspect, late in planning. In other words, it should not come after assessments regarding physical suitability have been conducted but should be an integral part of the initial planning stages.

The main objective of this exercise was to determine the role of market access in influencing success potential of smallholder irrigation projects. Throughout this exercise, market access has been shown to be highly significant. In other words, the role of market access in influencing potential success has been confirmed.

The market qualifies as an institution because it needs rules and regulations to function properly. Recalling earlier discussions in Chapter 2, it is evident that an institutional approach is necessary to analyse the problems of smallholder irrigators. Indeed, revisiting existing policies and institutional framework, and enriching them with accurately researched information on the factors that affect performance is where to start. Issues raised in this chapter such as information access, market access, extension, etc. are institutional in nature. According to Morrison *et al.* (2000) institutions can reduce costs, and can have an influence on the organisation and development of economic activity. Institutions that will provide all the services necessary for an enabling environment therefore are absolutely necessary. The following chapter assesses the factors influencing market access - one of the significant institutions necessary for improved performance in smallholder irrigation management.

CHAPTER 7

FACTORS INFLUENCING MARKET ACCESS FOR SMALLHOLDER IRRIGATORS IN SOUTH AFRICA

7.1 INTRODUCTION

The importance of market access in smallholder irrigation farming has been the subject of the previous discussion. Market access is central in the debate on improving rural livelihoods. In addition, within the South African context, market access is also seen as feeding directly into the government's development objectives that include poverty alleviation and economic growth. In this regard, it becomes important, therefore to understand the factors that influence market access in smallholder irrigation production. Knowledge of the factors will improve the knowledge of those involved in rural development in general and smallholder irrigation management in particular, about which factors to pay attention to when designing successful smallholder irrigation projects.

Against this background, the purpose of this chapter is to investigate factors that influence market access for smallholder irrigators in South Africa. This chapter represents Step 6 of the approach outlined in Chapter 1. The intention is to contribute to the body of knowledge on smallholder irrigation management and aid policy making efforts. To achieve this objective, an analysis tool is used to determine the influence these various factors have on market access. Results provide a basis for making recommendations on how to think about solving the problem of smallholder market access.

Because of the development nature of the problem, it is necessary to analyse a complex number of factors to understand their influence on market access. As previously discussed, factors influencing market access can be in mainly three areas: physical access to markets, structure of the markets and producers' lack of skills, information and organisation. The variables that are

analysed therefore should cover these areas. In this regard, variables selected for analysis include extension (number of visits in the past year), creativity, entrepreneurship, distance (to the nearest central market), farmer age and off-farm income, infrastructure (availability), information, credit, farmer organisation, local market availability, transport and training.

7.2 COMPONENTS OF FACTORS INFLUENCING MARKET ACCESS

From the discussion in Chapter 2, it is obvious that there is a complex set of factors that influence access to markets by smallholder irrigators. To clearly understand the issue of smallholder irrigator market access therefore, it is necessary to take into account many possibilities. This task is often complicated by the problem of multicollinearity. As discussed in the preceding chapter, this is a situation where the explanatory variables become highly correlated, and this can lead to biased parameter estimates.

The understanding of the complexity of the problem of market access as explained in Chapter 6 influenced the manner in which the dependent variable was developed. The proxy for the dependent variable (market access) was developed in the manner described in Chapter 6, yielding a discrete variable with values either 0 for no or 1 for yes. This separated the farmers into two groups, those that sold all their produce and those that did not. It should be noted that this grouping is different from the one made in Chapter 5 using cluster analysis. The analysis in this chapter assesses the factors influencing market access which was shown to be a significant factor in the analysis done in Chapter 6.

Based on the review of literature conducted in Chapter 2 of this thesis on factors influencing market access in smallholder irrigation projects, the following variables were included in the analysis: The continuous explanatory variables include extension (number of visits in the past year), creativity, entrepreneurship, distance (to the nearest central market), farmer age and off-farm income. Discrete explanatory variables include infrastructure (availability), information, credit, membership to a farmer organisation, local

market availability, transport and training. Table 7.1 shows the list of explanatory variables together with their expected signs.

Table 7.1: Explanatory variables and their expected signs

Variable	Measurement	Expected sign
Infrastructure	1=yes; 0=no	+
Information	1=yes; 0=no	+
Local market availability	1=yes; 0=no	+
Creativity	Scale of 1-4 depending on response to carefully chosen statements (see Appendix A)	+
Entrepreneurship	Same as above	+
Farmer organisation	1=yes; 0=no	+
Training	1=yes; 0=no	+
Distance	km	
Off-farm income	ZAR	+
Transport availability	1=yes; 0=no	+
Extension	Estimated number of visits per year	+
Farmer age	years	-
Credit	1=yes; 0=no	+

To analyse the data, decision was taken to run a logit model because the dependent variable is of a dichotomous nature as shown in equation 1 below:

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

Where, P_i represents the probability of smallholder irrigator i accessing the market, χ_i are the set of explanatory variables determining smallholder irrigators' potential for market access.

Following similar steps as displayed in Chapter 6 yields equation 2 below.

$$P_i = \frac{e^{\left(\alpha_0 + \sum_{i=1}^{k} \alpha_i x_i\right)}}{1 + e^{\left(\alpha_0 + \sum_{i=1}^{k} \alpha_i x_i\right)}} \quad \text{.....[2]}$$

Attempting to fit equation 2 using maximum likelihood procedure failed. This was attributed to perfect multicollinearity problem again after studying the correlation coefficient matrix and eigen values of the correlation matrix of explanatory variables (see Appendix B2 for the full correlation matrix). This is not surprising because most of the variables in this exercise are similar to the variables used in Chapter 6. These variables had displayed perfect collinearity in the previous exercise. Based on this outcome, it was therefore decided to condense the related variables into fewer unrelated clusters or principal components. This technique is referred to as *principal component analysis* (PCA). PCA is a technique used to reduce dimensionality of data while retaining as much information as possible.

Further tests had to be carried out on the data to ensure that PCA is the right way to proceed. When the data was first run on a PCA tool, the Gleason-Staelin redundancy measure (phi) indicated was 0.327. This is an indication of how interrelated the variables are. A zero value means that there is no correlation among the variables, while a value of one indicates perfect correlation among the variables. However, this coefficient may have a value less than 0.5 even when there is obvious structure in the data, so care should be taken when using it. Further, the Bartlett's sphericity test had a probability value close to zero. This test is used to test the null hypothesis that all correlations are zero. It is advised that if a probability value greater than 0.05 is obtained, then PCA should not be performed on the data. Therefore there was sufficient confirmation to carry out PCA.

The correlation matrix C using both standardized and unstandardised variables was used to calculate eigen values $\lambda_1, \lambda_2, \ldots \lambda_K$ and corresponding

eigenvectors v_i respectively as:

$$|C-\lambda I|=0,\ |C-\lambda_j I|v_j=0 \quad \text{.....[3]}$$

The independent variables were standardized as $(x_i-\bar{x_i})/s_{x_i}$. The eigenvectors v_j were then arranged to give matrix V in equation 8.

$$V=\begin{bmatrix} v_{11} & v_{12} & \cdot & \cdot & \cdot & v_{1k} \\ v_{21} & v_{22} & \cdot & \cdot & \cdot & v_{2k} \\ \cdot & \cdot & \cdot & & & \\ \cdot & \cdot & \cdot & & & \\ \cdot & \cdot & \cdot & & & \\ v_{k1} & v_{k2} & \cdot & \cdot & \cdot & v_{kk} \end{bmatrix} \quad \text{.....[4]}$$

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:

$$Z=X^SV \quad \text{.....[5]}$$

Where X^s is n × k matrix of standardized variables; V is eigenvector matrix as defined in equation 9.

There are k principal components as there are k variables. This new set of variables (principal components) unlike the original variables are orthogonal i.e. they are uncorrelated. The second Z is chosen to be uncorrelated with the first, and to have as large a variance as possible. The *X* variables are thus transformed into new uncorrelated variables, which account for as much of the variation as possible in descending order.

There are several methods used in choosing the number of principal components in PCA. One criterion is to use the scree plot of the eigen values.

The scree plot is likened to a cliff with rubble at the bottom. Different researchers apply different methods here, some leave out the factors represented by the "rubble" and some propose taking all factors up to the cliff plus one factor at the beginning of the rubble. This method is highly subjective and can cause different researchers to analyse the same data with different results.

Secondly, a certain percentage of variability to be accounted for can be set. The idea is therefore to keep enough factors so that this variation is achieved. Usually, this cut-off percentage is used as a lower limit. In other words, if the number of factors do not account for at least 50% of variance, then the whole analysis is aborted.

The third method involves using a cut-off value of 0.7 when PCA is conducted with correlation matrices. In other words, all factors with corresponding eigen values less than 0.7 are dropped from further analysis. However, this should be done with caution and taking into account the largest eigen value. If the largest eigen value is close to one, this method can cause useful factors to be dropped.

In this study, the number was decided by leaving out components with corresponding eigen values of less than one. This is the rule of thumb when conducting PCA using a correlation matrix. This is so because an eigen value corresponds to the number of variables in a factor and the sum of the eigen values corresponds to the total number of variables. Therefore, if a factor is less than one that means that it accounts for variability of less than one variable. The initial variables (X) were therefore grouped into 6 *principal components* altogether accounting for 86.25% of variability. Table 7.2 shows the results of the exercise described above with corresponding eigen values after *Varimax rotation.*

Table 7.2: Principal components and eigen values after Varimax rotation

Variable	PC_1	PC_2	PC_3	PC_4	PC_5	PC_6
Infrastructure	-0.895					
Information			-0.845			
Credit	0.576		0.592			
Extension		0.631				
Farmer organisation			0.896			
Local market availability					0.544	
Transport availability	-0.672			0.601		
Training				0.903		
Creativity		0.950				
Entrepreneurship		0.931				
Distance	0.850					
Age					-0.887	
Transport cost	0.924					
Off-farm income						0.972
Eigen value	3.633	2.745	2.044	1.445	1.18	1.027
% variability	25.95	19.61	14.60	10.32	8.43	7.33

Rotation is a process that involves the redistribution of the variation for the different variables between components such that each variable is more or less clustered in one component than being spread throughout the components.

The first principal component, PC_1, accounts for 25.95% of variability, while PC_2 through to PC_6 account for 19.61% through to 7.33% as can be seen in Table 7.2. For purposes of clarity, values of factor loadings below 0.5 on either direction were dropped from the analysis. Analyzing 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 7.2) allows us to interpret the results as follows:

Distances to the nearest central market and the concomitant cost of transportation for the produce are arguably the biggest contributors to the difficulty with which smallholders access markets. Both these have a positive relationship with PC_1. This could therefore be interpreted as ***physical access***

to the market. It is no surprise therefore that this has a strong negative relationship with infrastructure and transport availability because both these are elements of transport infrastructure – unavailability of these makes physical access difficult. In addition, there is a weak but positive relationship with credit availability. Causality cannot be confirmed in this case but it can be argued that there is a positive relationship with the high cost of physical access to the market and the need for credit.

PC_2 has a strong positive relationship with the creativity and entrepreneurship variables. It could be interpreted as an index for ***farmer skills***. It concerns the ability to realize, create and seize market opportunities. There is also a positive relationship with extension visits. This is so because for most rural farmers, extension officers are their only source of updated information on all aspects of farming. The number of visits therefore indeed improves the levels of entrepreneurship.

The third principal component (PC_3) has a positive relationship with farmer organisation and credit availability variables. It could be interpreted as the ***nature of access to the market*** - in other words, whether markets are accessed as an individual or as part of an association. The positive relationship with credit availability could be expected, because the South African government encourages those soliciting government funding to be organized in contractual groups. This arrangement makes up for the collateral that is always missing when dealing with smallholder farmers. If funding is solicited by a group, then the group serves as the collateral. Most agricultural lending institutions have also adopted this approach in meeting the needs of the small farmer in a win-win situation. To a large extent, information about grades, standards and quality requirements for various markets is not available to the smallholder. However, because mostly smallholders sell to the informal market, these become largely irrelevant. That could explain the negative sign regarding information in this component.

In PC_4 a strong positive relationship with transport availability and training is noticed. Both these aspects form part of the framework of services that should

be available to smallholder farmers if they are to be able to compete successfully at the market level. This component could therefore be interpreted as indicating an ***inventory of available support services.*** Within PC_5 an interaction between availability of the local market and farmer age is witnessed. This component has a strong negative relationship with farmer age. As farmer age increases, it becomes more difficult to respond to opportunities, including accessing the local market. Age can, to a large extent, also affect the response to modern innovations in farming practices. Therefore this component could be interpreted as representing ***the ability to respond to opportunities***. Finally, PC_6 displays a strong positive relationship only with off-farm income. Therefore it can be interpreted as representing ***off-farm income***.

7.3 THE INFLUENCE OF THE DERIVED COMPONENTS ON MARKET ACCESS

After the principal components were estimated, a regression analysis was performed to study how the estimated components influence smallholder access to market. For this exercise, the market access variable was again chosen as the dependent variable. The previously described estimated components served as explanatory variables with their values being the component scores (the score of each variable within the component). The component scores are scaled such that they have a variance of one and mean equals to zero.

As in the previous chapter, a logit model was used in this study to determine the effect of the six components identified earlier on smallholders' access to market. The model was chosen because of the dichotomous nature of the dependent variable (i.e. market access). The following logit model was used in this study to determine the influence of the six principal components on the market access 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 having access to the market, y is market access, χ_i are the set of explanatory variables determining smallholder irrigators' access to market. Kleinbaum (1994) states that, logistic regression is a mathematical modelling approach that can be used to describe the relationship of several Xs to a dichotomous dependent variable. According to him, other modelling approaches are possible also but logistic regression is by far the most popular. The logit regression results are reported in Table 7.3.

Table 7.3: Parameter estimates of logistic regression

Variables	Coefficient	Standard error	T-ratio	Probabilities
Constant	0.528	0.34889	1.5132	0.133
Physical access to market (PC_1)	-2.478	0.71307	-3.4749	0.001***
Farmer skills (PC_2)	0.695	0.29674	2.3417	0.021**
Nature of access to market (PC_3)	-1.45	0.34556	-4.2031	0.000***
Inventory of available support services (PC_4)	-0.272	0.21050	-0.12902	0.898
Ability to respond to opportunities (PC_5)	-0.258	0.27400	-0.094009	0.925
Off-farm income (PC_6)	-0.384	0.27702	-1.3852	0.169

The model has an 82.7% goodness of fit. This can be considered a good result considering the complexity of the research object and the multiplicity of factors that influence market access. As shown in Table 7.2, PC_4 to PC_6 and the constant term are less significant. PC_2 is significant at the 5% (**) level while PC_1 and PC_3 are significant at the 1% (***) level.

In this kind of discussion, it is best to concentrate on statistical significance because for the logit model, the estimated coefficients do not have a direct economic interpretation. The fourth component represents what can be termed as part of the services that are essential to facilitate easier access to the market by smallholders – training and transport. The influence of this component is not shown to be significant in the resultant regression. This could be explained by the fact that the dominant variable in this component is almost uniform throughout the farmers. A very high percentage of farmers have received some training in one way or another. PC_5 is described as representing the ability to respond to opportunities based on the interactions between farmer age and perception of the availability of the local market. Results of this study show that this is not a very important factor in accessing the market. This situation can be explained by the fact that there is no significant difference between the average age of farmers with or without market access. The result agrees with the South African situation where most smallholder farmers are older people. This situation has prevailed over the years when younger able-bodied people prefer to move to the cities for more lucrative employment than practicing farming in rural areas. Therefore this aspect may not play a highly significant role.

The sixth component represents off-farm income and is also shown to be less significant in this study. The explanation for that may be because a large number (about 65%) of the interviewed farmers have access to off-farm income in the form of government grants and the effect on market access may therefore be unclear.

The discussion will now focus on the components with a significant influence in the model. The first principal component represents physical access to the market and is highly significant. As described earlier, physical access to markets is a function of the quality of infrastructure and the organisation of the transport sector. Transport cost has always been shown as the single biggest source for the cost of accessing the market for smallholders. Omamo (1998) argues that the cost of transport even influences crop choices in smallholder

farmers and this leads to cash crops being forgone for less profitable crops. The outcome of this research therefore confirms that.

The second component represents farmer skills. It is a result of positive interactions between creativity and entrepreneurship. The fact that it has come out as significant could be tied to the prevailing agricultural marketing situation in South Africa. Until recently, marketing of smallholder produce was done mainly by parastatal organizations through agricultural product control boards. The dissolution of these boards in the wake of liberalization of agricultural markets calls for creativity and an entrepreneurial spirit on the part of smallholders to continue marketing their produce.

Finally, component 3 deals with the nature in which markets are accessed. This involves whether markets are accessed as an individual or as part of an organised grouping. Again, the nature of organisation is becoming an increasingly important aspect for smallholder farmers in developing countries in general. It is not only limited to accessing credit but also improves the bargaining power of the small farmer at the market. Therefore, the significance of this component is to be expected.

As it can be seen, these components fall directly within the three broad dimensions of market access mentioned earlier. The first component relates strongly to the first dimension on physical access to the market. The second component relates to the dimension regarding the role of the farmer while the third relates to the structure of the markets. It should be mentioned that the total effect of the various components on market access depends on the extent of the variable interactions within components and also on the significance of these components in influencing market access.

The next step was to estimate the partial effects of the principal components on market access. This exercise was limited only to the significant components. The estimates of the partial effects are calculated by re-scaling the estimated coefficients using a scaling factor (0.23336) produced in the regression analysis. The estimated partial effects are interpreted as follows:

For *physical access to market*, it is -0.578; for *farmer skill* it is 0.162 and for the *nature of access to market* it is -0.339. Interpretation of the partial effects is a somewhat complex exercise. This is so because the interpretation has to make economic sense. In the first component, the partial effect could be interpreted as that a R1 reduction in the cost of physical access to the market can lead to a 0.578 increase in the probability of accessing the market. One example can be to use single larger trucks as a group than individual hiring of smaller trucks to transport produce. Similarly, the partial effect in PC_2 can be interpreted as that an improvement in skills of the farmer can lead to a 0.162 increase in the probability of accessing the market. The skill of the farmer can be improved by getting more knowledge about the way markets operate through education and training and interaction with successful counterparts. Finally, the partial effect in PC_3 could be interpreted as meaning that a R1 decrease in the cost of transaction due to nature of access to the market will lead to a 0.339 increase in the probability of accessing the market.

Further simulations were carried out to determine the effect of each of the significant principal components on market access while holding the effect of the others constant. The results of the simulations are shown in Appendix C and summarised in Table 7.4 below.

Table 7.4: Summary of simulation results

Component	Probability	Improvement	% of Change in Market access
Base	0.0922	--	
Physical access to market	0.1166	20 % decrease	26.5
Farmer skills	0.1022	50% increase	11
Nature of access to market	0.1055	20% decrease	14.4

The base represents farmers with no market access. It was calculated taking into account averages of the components. The conditional probability of market access for the base group is 0.09 (Table 7.3). This means that of 100

smallholder irrigators, 9 have access to markets. The simulations reveal that a mere 20% reduction in the physical cost of accessing the market will lead to a 26.5% increase in the probability of accessing the market. A 50% increase in farmer's skill and knowledge through e.g. increase in number of years spent in school or relevant training programmes attended will lead to an 11% increase in the probability of accessing the market. Similarly, a 20% reduction in transaction costs associated with the nature of access to the market will lead to a 14.4% increase in the probability of accessing the market.

7.4 CONCLUSION

Market access is one of the most important aspects for viability of small scale agriculture. A major reason why even those farmers who can produce surplus remain trapped in poverty is lack of access to profitable markets. Factors influencing smallholder access to markets are widely discussed in literature and often form a part of the complex web of factors that affect smallholders in general. This chapter attempted to contribute to the debate about this situation. Market access can be viewed in 3 dimensions that include physical access to markets, the structure of the market and the role of the producer.

This chapter attempted to determine the extent of the influence of these factors using primary data from six irrigation schemes in three provinces of South Africa. Principal component analysis was performed due to multicollinearity among the variables and yielded six principal components interpreted as: physical access to market (PC_1), farmer skills (PC_2), nature of access to market (PC_3), inventory of support services (PC_4), ability to respond to opportunities (PC_5) as well as off-farm income (PC_6). These accounted for 86.25% of in the market access variable.

Further regression analysis using the principal components as explanatory variables revealed the most significant components as physical access to market, farmer skills and nature of access to market. The model had 82% goodness of fit. PC_1 and PC_3 were significant at 1% level while PC_2 was significant at 5% level. These results were in line with the dimensions of

market access described in this thesis earlier. It should be noted however that the total effect of a component is a function of interactions of variables within a component. The next step was to conduct simulations that revealed that 20% reduction in the physical cost of accessing the market and 20% reduction in transaction costs associated with the nature of access to the market will lead to a 26.5% and 14.4% increase in the probability of accessing the market respectively. In the same vein, a 50% increase in farmer's skill and knowledge will lead to an 11% increase in the probability of accessing the market.

The most significant components are found to be physical access to market, farmer skills and the nature of access to market; this suggests these areas should receive better focus in dealing with the problem of smallholder market access. These findings have implications for both smallholder irrigators and policy makers. Making reliable transport available is one way of dealing with the problem of physical access to the market, but the cost component can also be alleviated. Transportation costs usually form the largest component of costs of physical access to the market. Therefore, to address this problem it may be necessary to explore a way of supporting the transportation costs of small farmers. The government is already subsidising transport operators in rural areas, keeping the costs of accessing the major centres affordable. A similar scheme could be worked out for providers of transport services to the small farmers. On the other hand, the farmers should explore the use of larger shared transport instead of individual smaller transportation means to reduce costs. It may also be necessary to explore the development of local markets that are linked to outside buyers, where farmers can send their produce directly without having to take it to the major centres.

It may also be necessary to deal with the skills problem with further education and targeted training. This will improve the farmers' ability to respond to opportunities in the market and better understand the workings in it. In this regard, it might be necessary to revisit the concept of farmer schools that would facilitate the above suggestions. Farmers will also be in a position to

learn more on other aspects of management including record keeping which is usually considered key to successful management.

Accessing the market as an organised group of farmers results in farmers being better placed to bargain with large buyers. As individuals, small farmers usually have very little impact in the produce markets because of the small volumes that they produce. Usually, this is important in accessing the more lucrative and more organised big retailers like supermarkets. This ensures better and more regular profits for the farmers. It should be noted however, that these aspects of market access make better sense as part of a larger support framework.

Skewed participation in agriculture is also acknowledged in the NDoA's Strategic Plan (2001). This situation is attributed to the past policies of the country that promoted exclusion and discrimination. Amongst the strategies identified to move towards equitable access is to deal efficiently with land reform to ensure rural stability and market certainty and create adequate farmer support programmes. Within support services, improved market access and removal of entry barriers to new entrants are regarded as one of the key initiatives.

The role of institutions in addressing the issues raised above is crucial. Dorward *et al.* (1998) tried to explain the apparent disappointing response to market liberalisation as the failure of the private sector to provide the services previously provided by governments. They argue that the private sector in developing countries has not developed fully to address the problems which are developmental in nature and that the government policies and institutions have not been consistently supportive of private-sector-led market development.

In this situation, NIE tells us that the task is to estimate the respective net changes in transaction costs in comparison with the anticipated allocative improvement, to find out whether policy should be favouring additional government intervention or further privatization (Toye, 1995). This suggests a

co-operative effort between government institutions and private sector-led institutions. This is especially critical when considering the duality of the agricultural sector in South Africa where blanket policies may not necessarily be effective. Evidently, what is necessary is an innovative policy making process that supports the development of smallholder agriculture whilst also taking into account the needs of the large-scale commercial farmers.

CHAPTER 8

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1 INTRODUCTION

The study focused mainly on the role of market supporting institutions in improving smallholder irrigation performance in South Africa. Certain factors responsible for improving the success potential in smallholder irrigation projects were highlighted, with an emphasis on the role of markets. The institutional approach proposed in the study was discussed with a view to understanding the problems of smallholder market access.

A summary and conclusion of the study is presented in the following two sections. The last section proposes some recommendations for policy and an outline of possible areas for further research is provided.

8.2 SUMMARY

This study moves from the premise that, generally agriculture is central in most of Africa's economies. Within this premise, smallholder agriculture occupies a particularly important position as a major source of food supply and source of household incomes. This fits in well with South Africa's development objectives of alleviating poverty and economic growth. Building on this argument, smallholder irrigated agriculture deserves specific attention because of the rainfall situation in the country. About two-thirds of the country is semi arid and generally rainfall is erratic averaging 464mm/annum. This situation leaves the country with a heavy reliance on irrigation, currently accounting for about 52% of national water use.

This necessitates a topical investigation into the functioning of the smallholder irrigation sub-sector and being able to draw poignant conclusions from such

an exercise. Besides providing better understanding of the sub-sector, such experiments would be effectual in informing the policy-making process.

Review of relevant literature takes us to the fundamentals of the success potential by zeroing in on entrepreneurship as a cornerstone for economic growth. The importance of entrepreneurship in economic growth is supported in several studies (e.g. Blackman *et al.*, 2000 and IFAD, 2003). Within this assertion arise the concomitant issue of farmers' individual characteristics as highly relevant in determining the potential success of smallholder irrigators. Such characteristics include leadership qualities, the drive and motivation to succeed as well as ability to respond to relevant opportunities. The individual characteristics of farmers can determine whether a farmer will be more successful or not but the conditions within which they conduct their operations also influences whether a farmer will be more successful or not. Within this assertion, a number of factors come into play. Literature suggests a range of factors to have an influence in the success potential of smallholder irrigation projects including nature of access to land, infrastructure, information, market access, family labour, research & development, farmer organization, training, planning, record keeping, off-farm income, transport availability, extension and credit.

What is most important in this debate is that market access – the subject of this study, is expected to be one of the critical factors that influence this potential for success. In addition to lack of market access is considered to be the reason even those farmers who produce surplus remain trapped in the poverty cycle. Smallholder access to markets is also considered central in the commercialisation debate of small-scale agriculture in general because it is implicit in the view that development of smallholder agriculture can influence economic growth. Market access is defined as the processes by which people access markets and the nature, efficiency and costs of these processes. The issue of smallholder market access has drawn particular attention because of the recent global developments that include liberalisation of markets. These processes have created a more competitive environment which most smallholders have no experience of. In most cases, smallholders

are unable to respond to opportunities because they do not understand the workings of such an environment. The process of accessing more lucrative markets is hindered by various factors that increase the transaction costs of smallholder irrigators. Literature highlights factors such as inaccessibility of relevant information and other support institutions like credit and extension services (e.g. Lyne, 1996 and Poulton *et al.*, 2005) . In the South African context, the situation has potential for more complexity because of a history of dependency. Farmers had become accustomed to the profound support provided by the parastatal organizations which managed most of the irrigation schemes in the country from production to marketing functions.

This study therefore explores the role of market access in influencing success of irrigation projects and examines the factors that influence smallholder market access. Data for this study was collected in six smallholder irrigation scheme in three provinces namely: Eastern Cape, Limpopo and Mpumalanga. The study has used various analytical tools to the imperatives raised in the previous discussion. Firstly, a *Cluster Analysis* was performed to separate farmers based on the potential for success using their individual characteristics mentioned in literature aş influencing the potential to be more successful as entrepreneurs. Results of this exercise yielded two clusters of farmers – the more successful and the less successful. What the results also demonstrated is that the more successful farmers tend to possess better qualities in terms of leadership, drive to achieve and are highly motivated. They are also slightly more educated and are able to keep farming records.

Secondly, building on the above results, a *Principal Component Regression* was performed to determine factors that influence success potential in irrigation projects. In this exercise, results of the cluster analysis were developed into the dependent variable (success potential). The objective was to assess the role of market access in influencing this success potential. Variables that also featured significantly in the results were infrastructure, market access, R&D, off-farm income, extension, planning and transport. Market access was proved to be a critical aspect in determining the success potential in smallholder irrigation projects. The final step employed *Principal*

Component Analysis to investigate the factors that influence market access for smallholder irrigators. Results showed that physical access to markets, farmer skills and the nature of access to markets are significant factors.

8.3 CONCLUSIONS

The conclusions drawn form the results of this study are summarised and presented under three headings; general conclusions, the role of market access and institutional issues.

8.3.1 General

Even though the average for all farmers is generally high at 57.6 years, it does not seem to have a highly significant role in determining the potential for success. The more successful farmers however still tend to be slightly younger than the less successful ones as it can be seen in Chapter 5. The age of the farmer may not be highly significant in separating between the more successful and the less successful because most smallholder farmers are older people as youth seems to be more interested in jobs potential in urban areas. This means therefore that smallholder agriculture has a particular role to play as the rural poor lean on it when no longer able to seek employment. It supplements the government pension scheme upon which most depend in their old age.

Lack of education for most of the farmers seems to affect other management aspects that could improve performance like record keeping and autonomy. There is an unsurprising positive relationship between better educated farmers and the potential to be more successful. Education is critical in that even basic education allows farmers to be able to keep records and therefore are able to monitor progress of the enterprise. In addition, better educated farmers are better placed to understand prices and be able to strategise to respond to opportunities that surface in the market. Besides basic education, lack of specific training also compromised the farmers and removes the competitive edge in the rapidly changing market conditions.

Mainly farming takes place in fairly small irrigated plots. Examining this phenomenon against average family sizes, it is evident that in most cases, the produce may be inadequate to satisfy even the household food needs. There seems to be a positive relationship between size of land holdings and access to markets. These farmers are in a better position to produce the volumes needed and attract better attention from potential buyers in the private sector. Also these farmers are in a better position to raise enough income to buy own vehicles and overcome one of the serious problems in smallholder market access – transport. Directly related to that is the issue of infrastructure which seems to be largely poor in these areas. Very few of those schemes are easily accessible to potential buyers.

Whilst more than 90% of the farmers have indicated the need for extension services, extension visits are very few. This suggests a serious efficiency problem in this area. Except a few, most farmers receive about three visits from government extension officers in a year. Extension is shown to be highly significant as one of the factors that influence success in smallholder irrigation projects. Results also show that more than 76% of the farmers are in need of credit but with a similar figure saying they cannot access credit. Reasons for the unavailability of credit range from lack of knowledge on how to organise it to insufficient security. In addition, to the issues listed above, there seems to be a serious problem accessing the most critical information, which regards prices and quality requirements for the bigger and more lucrative markets.

In most smallholder irrigation schemes, land tenure system is based on a permission to occupy (P.T.O.). It is not surprising therefore that the nature of access to land was not highly significant in separating the more successful and less successful farmers. That is probably due to the fact that the case of Hereford Irrigation Scheme, where farmers have a private lease agreement is the only one in the sample. Use of family labour was also not highly significant in separating the more successful to the less successful probably because this is largely a standard phenomenon in small-scale agriculture in general.

Even though the aspect of off-farm income was not significant in influencing the market access, it was highly significant in explaining the difference between more successful and less successful. Results show a negative relationship between off-farm income and potential to be more successful in smallholder irrigation farming. This is in line with findings elsewhere as highlighted in the summary in Chapter 6. A possible explanation would be that the higher the percentage of household income derived from agricultural activities, the higher the commitment to prosper in that regard. Studies done by e.g. Perret (2003) show that in South Africa's rural areas, government grants and remittances from family members employed in cities are a greater source of rural incomes than irrigation farming. Reliance on these alternative income sources could therefore shift the focus away from irrigation farming. Generally smallholder farmers display what Chambers (1983) calls hedgehog behaviour. This is where various strategies are employed to eke out a livelihood and attention is given depending on how much that strategy provides for the household income at a particular moment.

8.3.2 The role of market access

Relevant literature tells us that market access is one of the most critical issues that determine the success of smallholder irrigation projects (e.g. Gabre-Madhin and Haggblade, 2001 and Hau and von Oppen, 2002). It is also agreed that access to markets is the critical link to profitability of smallholder irrigation schemes. In the envisaged role of smallholder irrigation as one of the vehicles for economic growth, the role of market access is implicit in the message. In this exercise, market access was used as one of the explanatory variables to study the factors influencing the potential success. Further simulations confirm positive improvements in the potential to be more successful as market access is made available. The results of this study have therefore confirmed the importance of market access in improving the potential for success in smallholder irrigation projects.

The implication of such findings is that in designing irrigation projects, market access should be included in the planning process and not as an additional

aspect, late in planning. In other words, it should not come after assessments regarding physical suitability have been conducted but should be an integral part of the initial planning stages. For existing irrigation schemes, an assessment could be made and market access ruled out first when the project is encountering problems.

8.3.3 Institutional issues

Results of the analysis of factors influencing market access have shown that the most significant factors fall under physical access to market, farmer skills and nature of access to the market. A 20% change in the conditions that affect physical access to market improves the probability of accessing the market by 26.5%. Under the transformed physical access to market variable the main interaction is between distances and cost of transportation. These two variables are of course very much related and both are a result of the lack of profitable markets within reasonable proximity to the smallholder irrigation scheme. In other words, when smallholder irrigators are unable to access local profitable markets, this impacts negatively on the potential to be more successful. The issues raised here raise the cost of transaction – the cost of effecting a sale by the farmer. As the study has shown, an institutional intervention is necessary to solve these problems.

The question of farmer skills relates mainly to issues of creativity and entrepreneurship. It has already been seen earlier in this thesis that these aspects are mainly aligned to individual farmer characteristics. What the results of the simulation show us is that an improvement in these individual characteristics makes a positive change in the probability to access markets.

In addition to the two aspects addressed above, the nature of access to the market has shown to be critical. Nature of access in this context mainly refers to the nature of organisation of farmers for market access. Farmers can either access markets as individuals or as part of an organised grouping, e.g. market association. What literature tells us (e.g. Heinemann, 2002), is that for smallholders, organised farmers stand a better chance of accessing the

market than individuals. This is partly because of the small volumes produced in smallholder operations and partly because as organised members of a grouping, farmers can bargain better with formal business who rely on assured quantities at agreed times for retailing. What can be concluded from these observations is that there is a clear need for a new approach in addressing the problem of market access.

The problem of physical access to market cannot be viewed as divorced from embedded institutional problems in smallholder irrigation management. The lack of proper local markets that are linked to outside buyers where smallholder irrigators can sell their produce is clearly an institutional issue. What literature tells us is that a market is an institution and therefore needs to be viewed as such. It is basically where exchange takes place between buyer and seller and to function well, it needs rules and regulations that have to be followed by parties involved in the transaction. This lack of profitable local markets is a source of transaction costs for most smallholders in general and this can be appropriately understood within the context of new institutional economics.

The argument advanced above can easily be extended to the issue of farmer skills. This issue can also be understood in relation to institutions that facilitate farmer creativity and entrepreneurship. Absence of proper institutions to address these, leads to the *status quo*. Farmer organisations are well within the amplitude of institutions and therefore warrant an institutional treatment. As literature has shown us, new institutional economics is concerned fundamentally with problems of market co-ordination and amongst the key concepts encompassed is the role of institution in reducing transaction costs and their influence on the organisation and development of economic activity. It can therefore be concluded that indeed, the problem of market access in smallholder irrigated agriculture, due to rapid changes in the food and agricultural sector in developing countries in the aftermath of market liberalisation and government withdrawal, provides a fertile ground for the application of the New Institutional Economics framework.

8.4 RECOMMENDATIONS

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

8.4.1 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 more successful farmers tend to be younger than the less successful. Literature tells us that old age hinders the ability to respond to opportunities and also impacts negatively in the process of adopting new technologies. One of the ways to improve the performance of the small-scale sub-sector would therefore be to direct the thinking process into making smallholder farming interesting to the younger generation. This will breed a new cadre of entrepreneurs and reduce the over-reliance on currently non-existent employment opportunities. What this also suggests is that a thorough selection process is absolutely necessary to improve potential of success even amongst beneficiaries in the land reform programmes.

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

- One way of dealing with the problem of cost of transportation may be to introduce incentives for transport contractors involved in smallholder agriculture. That will make the exercise attractive to service providers

and also encourage small farmers to use common transport that the more expensive alternative of the small pick-up vans. But 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 and widely dispersed.

- The issue of farmers who hold on to land for non-productive purposes can be dealt with in two ways. Firstly, by giving more power 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 land holdings and facilitate exchange. In addition, rural non-farm enterprises may have to be developed that will provide more incentives for committed farmers to remain in the irrigation schemes.

- A platform where government, private sector, civil society and farmers are partners is necessary. The goal should be to overcome exclusion from policy making and design programmes that facilitate smallhoder 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 continued 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 continuing interaction between policy-makers and scientists who work with the farmers 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 can even serve as surety where credit is needed and could see small-scale

irrigation sub-sector improving. A popular example is the Asian Grameen Bank that works well with farmer groupings.

- Rebuilding of important farmer support services and institutions is crucial. Within these, extension service show signs of being less efficient in terms of the quality and quantity of interactions. It may be necessary to strengthen this service and also encourage specialisation and continued training of extension officers.

- Information is cited as one of the major sources of transaction costs. Facilitation of information regarding quality requirements and prevailing prices in the formal and more lucrative markets is critical. 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 like use of cell phones, in addition to traditional media.

- The collective aim of the Land Reform Programme is to ensure the transfer of agricultural land to previously disadvantaged individuals while maintaining productivity of the land. This initiative is expected to address political, social and economic objectives of the government. However, the lack of proper institutions to positively influence the success potential may continually produce negative results. The embedded institutional deficiencies need to be addressed to achieve a well functioning agricultural sector. An enabling environment that reduces the transaction costs experienced by small farmers through problems such as lack of information and unenforceable contracts is paramount.

8.4.2 Further research

Further research on the following aspects is recommended:

- It is possible to conclude that the marketing system for smallholder farmers in general is 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 for 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 will 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 be able to determine ways of more stable pricing measures that will establish a level of certainty. Such knowledge would result in repeat clientisation amongst the potential buyers and improve the competitiveness of the sub-sector.

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

- Whilst there is general agreement that smallholder farmers should be encouraged to form associations when accessing markets to increase their volumes and improve their bargaining position, 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 efficiency of various information sources would be important in helping policy makers decide how best to convey

critical information to smallholder irrigators about prevailing prices and quality requirements in the more lucrative markets.

- Studies on how to develop the critical links between policymakers, donors, researchers, and the private sector would contribute to improving the probability of realizing more successful smallholder irrigated agriculture in a sustainable manner.

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APPENDIX A

QUESTIONNAIRE

All information provided will be treated as STRICTLY CONFIDENTIAL

SMALLHOLDER IRRIGATORS AND THE ROLE OF MARKETS: A NEW INSTITUTIONAL APPROACH

FARMER QUESTIONNAIRE

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Sources: Nell, W.T.
Van Schalkwyk, H. D.

Questionnaire no: ☐☐☐ Date: DD - MM - YYYY

INSTRUCTION: Ask to speak to the farmer i.e. the person responsible for the day-to-day activities of the field plot(s).

General information

			For office use only
Name of interviewee			[1]
Location: Scheme / Village			
District			1-3
Province			[ ][ ][ ]
Telephone number			
Are you the plot / title holder?	Yes	1	
	No	2	[ ]4
Type of farming (Name one)	Crops - Irrigation	1	
	Crops – Dryland	2	
	Fruit – Irrigation	3	
	Mixed	4	
	Livestock	5	[ ]5
Irrigated plot(s) size (ha) [For multiple plots – the combined size]		☐ ha	[ ]6
Kind of farm (tenure status) (Name one)	Private owner	1	
	Communal	2	
	Permission to occupy (PTO)	3	
	Rent and share cropping	4	
	Open access	5	[ ]7
How was the land acquired?	Inherited	1	
	Bought	2	
	Allocated by local authority	3	
	Other (specify)	4	[ ]8

A. Biographical characteristics

A.1 Gender	Male	1	[ ]9
	Female	2	

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A.2 Age in years		years	[ ] 10
A.3 Gender of household head	Male Female	1 2	[ ] 11
A.4 Age of household head in years		years	[ ] 12
A.5 Household size			[ ] 13

B. *Human capital endowments*

Education

B.1 What is your highest educational qualifications?

	Farmer	Spouse(s)	Child with highest qualification	Specify sex of child	Other h'hold member - highest qualification	Specify rel'ship
None						
≤ Grade 5						
Grade 6-7						
Grade 8-9						
Grade 10						
Grade 11-12						
Post-matric						

14-19
[ ][ ][ ]
[ ][ ][ ]

Knowledge – farming experience

B.2	How long have you been farming?	years	[ ] 20
B.3	How long have you been farming on your current farm?	years	[ ] 21
B.4	How long have you been farming with the current enterprises?		
	Crops – Dryland	years	[ ] 22
	- Irrigated	years	[ ] 23
	Livestock	years	[ ]24

B.5 Indicate whether you have the following language abilities:

	Talk	Read	Write
English			
Afrikaas			
Your vernacular			

25-33
[ ][ ][ ]
[ ][ ][ ]
[ ][ ][ ]

B.6	Indicate your arithmetic abilities.	None Little Average Good	1 2 3 4

[ ] 34

B.7	Are you or your spouse, family of the chief	Yes No	1 2

[ ]35

Level of entreprencurship and creativity

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B.8 Rate the farmer (description of the farmer's characteristics) according to the following statements between 4 (strongly agree with the statement) and 1 (strongly disagree with the statement. **(Do not mention the headings to the farmer while completing the questions!!!)**

	Strongly disagree	Disagree	Agree	Strongly agree	
8.1 Leadership					
You are not afraid to try a new technique (pesticide) before your fellow farmers and you will try to do it on your own before seeking help. (Self-starter)	1	2	3	4	[ ] 36
If you decide to do something on your farm, you will do it and nothing will stop you from doing it.	1	2	3	4	[ ] 37
Even though people tell you "it can't be done", you have to find it out for yourself.	1	2	3	4	[ ] 38
8.2 Drive to achieve goals					
If you have a problem (challenge) on your farm you will keep on trying to solve the problem (challenge) and you will not quit.	1	2	3	4	[ ] 39
You have the ability to organise the four production factors (land, labour, capital and management) in such a way that the goals set for the farm are achieved.	1	2	3	4	[ ] 40
8.3 Creativity					
You have the ability to adapt to changes in the farming environment. If the price of one crop declines and the price of a different crop increases are you able to change your farming practices in such a way that you can start producing the crop with a higher price for the higher demand?	1	2	3	4	[ ] 41
8.4 Entrepreneurship					
You are always looking for opportunities to increase the profit of your farm (The creation and identifying of new markets for products. Have the ability to start growing a new crop, in some cases add value and create a new market for the new product.)	1	2	3	4	[ ] 42
8.5 Motivation to progress					
You are not dependent on subsidies or other incentives to adopt new technologies.	1	2	3	4	[ ] 43
You like supporting and helping your fellow farmers when you see they are struggling or when they come to you with problems.	1	2	3	4	[ ] 44

	Strongly disagree	Disagree	Agree	Strongly agree	For office use only
8.6 Need for autonomy					
You do not often need to ask other people's opinions before you decide on important things - you can rely on your own knowlege or family to make good decisions.	1	2	3	4	[ ] 45
You are not afraid to be different when it comes to the adoption of new technologies on your farm.	1	2	3	4	[ ] 46
8.7 Attitude towards risk (See B.41)					

Planning skills

B.11 To what extent do you plan for the future?

Thorough plans and objectives stated	4
Some plans (rough, incomplete)	3
Only some idea about planning	2
No plans (not considered)	1

[ ] 47

B.12 How long in advance do you think it is necessary to plan?

| | | days | [ ] 48

B.13 What are your future plans for your plot(s)?

Indicate in sequence of importance what future plans you have	Specify in terms of crops or hectares	How do you plan to achieve these objectives?	
1			[ ][ ][ ]49-51
2			[ ][ ][ ] 52-54
3			[ ][ ][ ] 55-57
4			[ ][ ][ ] 58-60

B.14 What do you think is the most important financial strategies you must follow (planning that you must do in future) to make a long term success of your farm? Place it in sequence of importance from 1 to 5.

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	Not important		Important		Very important	
To have sole land rights	1	2	3	4	5	[ ]61
Keep production costs low	1	2	3	4	5	[ ]62
Must get financial management training.	1	2	3	4	5	[ ]63
My farm must earn a substantial profit for growth	1	2	3	4	5	[ ]64
I must be able to honour my instalments each year	1	2	3	4	5	[ ]65
Other (specify)	1	2	3	4	5	[ ]66

Decision making

B.15 Who makes the following agricultural decisions? (Mark only the most important one in each column)

	Technical	Financial	
Self	1	1	
Husband	2	2	
Wife	3	3	
Husband and wife	4	4	
Husband, wife and children	5	5	
Father	6	6	
Husband and father	7	7	
Mother	8	8	
Husband and mother	9	9	
Other (specify)	10	10	[ ][ ]67-68

Financial management

B.16 Do you keep any farming records? Yes 1 / No 2 [ ]69

If "yes", fill in the following table for the type of records you keep.

	Thorough neat	Rough incomplete	Only ideas	None	
Cost records	4	3	2	1	[ ]70
Income records	4	3	2	1	[ ]71
Crop production records	4	3	2	1	[ ]72
Labour records	4	3	2	1	[ ]73
Inventory records	4	3	2	1	[ ]74
Other (Specify): 1.	4	3	2	1	[ ]75
2.	4	3	2	1	[ ]76
3.	4	3	2	1	[ ]77
4.	4	3	2	1	[ ]78

B.17 Do you think that keeping records is important? Yes 1 / No 2 [ ]79

B.18 If "yes", how important is the records to you?

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	Not important	Important	Very important	
Determining financial position	1	2	3	[ ] 80
Decision-making and planning	1	2	3	[ ] 81
To keep the bank or co-op manager happy	1	2	3	[ ] 82
Other (Specify)	1	2	3	[ ] 83
				[ ] 84

Marketing management

B.19 Do you (sometimes) produce surplus?

Yes	1	[ ] 85
No	2	

B.20 Do you store (part of) your produce?

Yes	1	[ ] 86
No	2	

B.21 Why do you store produce?

For future consumption	1	
For seed	2	
To sell later at a higher price	3	
Lack of access to market	4	[ ] 87
Other (specify)	5	

B.22 How much of your produce did you store during the 2002/2003 period?

Crop	Amount (kg)	
		[ ][ ] 88-89
		[ ][ ] 90-91
		[ ][ ] 92-93
		[ ][ ] 94-95
		[ ][ ] 96-97
		[ ][ ] 98-99

B.23 Are there output markets available within an accessible distance from your farm?

Yes	1	[ ] 100
No	2	

B.24 Through which marketing system do you market your crops?
(Fill in the names for the different crops)

Crop					
On-site at the field plot %	1	2	3	4	[ ][ ][ ][ ][ ] [ ][ ] 101-107
Roadside marketing %	1	2	3	4	
Open market in town %	1	2	3	4	[ ][ ][ ][ ][ ] [ ][ ] 108-114
Local trader or cooperative %	1	2	3	4	
Own consumption %	1	2	3	4	[ ][ ][ ][ ][ ] [ ][ ] 115-121
Value adding direct marketing %	1	2	3	4	
Other (Specify) %	1	2	3	4	[ ][ ][ ][ ][ ] [ ][ ] 122-128

B.25 What are the prices /kg you received during the last season?

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Crop				
On-site at the field plot				
R/kg				
Roadside marketing				
R/kg				
Open market in town				
R/kg				
Local trader or cooperative				
R/kg				
Value adding direct marketing				
R/kg				
Other (Specify)				
R/kg				

[ ][ ][ ][ ][ ]
[ ][ ] 129-135

[ ][ ][ ][ ][ ]
[ ][ ] 136-142

[ ][ ][ ][ ][ ]
[ ][ ] 143-149

[ ][ ][ ][ ][ ]
[ ][ ] 150-156

B.26 How many times (seasons) per year do you sell your crops?

Crop	Number of times/yr

[ ][ ] 157-158
[ ][ ] 159-160
[ ][ ] 161-162
[ ][ ] 163-164
[ ][ ] 165-166
[ ][ ] 167-168

B.27 Do you process (some of) your produce on the farm?

Yes	1
No	2

[ ] 169

B.28 If yes, what is the additional amount of money that you make by processing?

Crop	Amount (R/kg)

[ ][ ] 170-171
[ ][ ] 172-173
[ ][ ] 174-175
[ ][ ] 176-177
[ ][ ] 178-179
[ ][ ] 180-181

B.29 Is there any produce that you could not sell in 2002/2003?

Yes	1
No	2

[ ] 182

B.30 If yes, what was the reason?

Not profitable enough	1
Not enough buyers	2
Market too far away	3
Did not know where to sell	4
Not interested	5
Other reasons (specify)	6

[ ] 183

B.31 Do you also buy any of the commodities you produce from the market?

Yes	1
No	2

[ ] 184

B.32 Do you use any inputs like high yielding seeds and fertilisers on your farm?

Yes	1
No	2

[ ] 185

B.33 If yes, how do you acquire these?

		For office use only
Personally form the market	1	
Through the farmers' association	2	
From the local co-op	3	
Through the local extension officer	4	
Visiting product extension officers	5	
Other reasons (specify)	6	[ ] 186

B.34 If no, what is the reason?

Inputs too expensive	1	
Input markets not easily accessible	2	
Cannot get credit to buy inputs	3	
Do not know how to use them	4	
No information on how to acquire these	5	
Not interested	6	
Other reasons (specify)	7	[ ] 187

Risk management

B.35 Do you use remedies like pesticides and herbicides on your crops?

Yes	1	
No	2	[ ] 188

If "no", complete B.36 and B.37 and go to question B.40. If "yes", go to question B.38.

B.36 Do you think that the use of pesticides and herbicides will increase your risk?

Yes	1	
No	2	[ ] 189

B.37 If "yes" at question B.36, why do you say so? Specify, e.g. if there is drought I will not be able to repay my debt.

	1	[ ] 190
	2	[ ] 191
	3	[ ] 192
	4	[ ] 193
	5	[ ] 194
	6	[ ] 195

B.38 If "yes" at B.35, did the adoption of the use of pesticides and herbicides change your attitude towards risk?

Yes	1	
No	2	[ ] 196

B.39 If "yes" at B.38, in which way?

	1	
	2	[ ] 197
	3	[ ] 198
	4	[ ] 199
	5	[ ] 200
	6	[ ] 201
	7	[ ] 202

B.40 If more definite information were available on the results of higher production with the usage of pesticides and other remedies for parasites, and/or diseases, would it have an influence on your attitude towards the risk involved in the usage of these remedies?

Yes	1	
No	2	[ ] 203

B.41 **Attitude towards risk**: Which <u>one</u> of the following situations will you choose in your farming operation?

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Variety A will give you a profit of R10 000 in two out of ten years and in the other eight years R0 (High profit, high risk)	1
Variety B will give you a profit of R3 000 in six out of ten years and in the other four years R0 (Medium profit, medium risk)	2
Variety C will give you a profit of R2 000 in eight out of ten years and in the other two years R0 (Low profit, low risk)	3

[ ] 204

C. *Institutions*

If an extension officer accompanies you, he must leave you and the farmer alone at this stage. (Arrange with the extension officer before the visit to leave you and the farmer in advance.)

Information and training

C.1 If you sell to the formal market, do you know in advance the prices prevailing in the market?

Yes	1
No	2

[ ] 205

C.2 Do you know in advance the quality requirements for specific markets?

Yes	1
No	2

[ ] 206

C.3 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 are applicable)

	Technical decisions	Financial decisions	Marketing decisions	Information on new technologies	Training	
Radio						207-211 [ ][ ][ ][ ][ ]
Television						
Extension publications (all leaflets, periodicals)						212-216 [ ][ ][ ][ ][ ]
Co-farmers - neighbours						217-221 [ ][ ][ ][ ][ ]
Department of Agriculture - Extension officers						222-226 [ ][ ][ ][ ][ ]
Cooperative - Extension officers						227-231 [ ][ ][ ][ ][ ]
No one - use own physical or technical records						232-236 [ ][ ][ ][ ][ ]
No one – use own financial records						237-241 [ ][ ][ ][ ][ ]
Bank manager						242-246 [ ][ ][ ][ ][ ]
Supplier of inputs like the cooperative manager						247-251 [ ][ ][ ][ ][ ]
Sell to the buyer who is the closest to my farm						252-256 [ ][ ][ ][ ][ ]

C.3 Continued

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[2]

[ ][ ][ ]
1-3
4-8
[ ][ ][ ][ ][ ]
9-13
[ ][ ][ ][ ][ ]
14-18
[ ][ ][ ][ ][ ]
19-23
[ ][ ][ ][ ][ ]

	Technical decisions	Financial decisions	Marketing decisions	Information on new technologies	Training
Market agents					
Read in the press (newspapers, magazines, etc.)					
Chief					
Other (specify)					

C.4 Did you receive any training on the technologies you use on your farm? Yes 1 / No 2 [ ] 24

C.5 Indicate which of the following institutions' services are freely and easily accessible to you, the farmer.

Government extension system	1	[ ] 25
Cooperative extension system	2	[ ] 26
Agricultural research	3	[ ] 27
Input suppliers (businesses where farmer can buy seed, fertiliser, fuel, etc.)	4	[ ] 28
Output markets (institutions like the co-op where you can market your outputs)	5	[ ] 29
Credit institutions	6	[ ] 30
Other (specify)	7	[ ] 31

C.6 Do you need any extension advice? Yes 1 / No 2 [ ] 32

C.7 If "yes", is one of the following extension officers available when you need them?

	Yes	No	
Government extension officers	1	0	[ ] 33
Cooperative extension officers	1	0	[ ] 34
Input supplier extension officer (seed, fertiliser, chemicals, etc.)	1	0	[ ] 35

C.8 How many times have you been visited by an extension officer last year?

Government extension officers		Times	[ ] 36
Cooperative extension officers		Times	[ ] 37
Input suppliers extension officers		Times	[ ] 38
TOTAL		Times	[ ] 39

C.9 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	
Government extension officers	1	0	1	0	[ ][ ] 40-41
Cooperative extension officers	1	0	1	0	[ ][ ] 42-43
Input suppliers extension officers (seed, fertilizer, chemicals, etc.)	1	0	1	0	[ ][ ] 44-45

C.10 Do you make use of mechanization services (tractors, implements, etc.) on your farm? Yes 1 / No 2 [ ] 46

			For office use only
C.12 Do you make use of rented or public transport for either acquiring inputs or selling your produce?	Yes No	1 2	[ ] 47
C.13 Do you have access to transportation services?	Yes No	1 2	[ ] 48

Management of the scheme

C.14 Is there any farmer organisation on the scheme (whether formal or informal)?	Yes No	1 2	[ ] 49
C.15 Do you belong to this organisation?	Yes No	1 2	[ ] 50
C.16 Do you belong to any other farmer organisation (whether formal or informal)?	Yes No	1 2	[ ] 51
C.17 Do you have any rules regarding the management of the scheme?	Yes No	1 2	[ ] 52

C.18 If yes, please explain under the following headings:

Type of rule (e.g. water management, marketing etc.)	Enforcement (fines, penalties etc.)	No. of violations in the past 3 years	Main violators	
1.				[ ][ ][ ][ ] 53-56
2.				[ ][ ][ ][ ] 57-60
3.				[ ][ ][ ][ ] 61-64
4.				[ ][ ][ ][ ] 65-68

Legal (regulatory) framework

C.19 Are you aware of any government legislation(s) relating to your farm operation and/or marketing?	Yes No	1 2	[ ] 69

C.20 If yes, how do(es) they affect your farm operation and/or marketing?

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Legislation	Effect	
1.		[ ][ ] 70-71
2.		[ ][ ] 72-73
3.		[ ][ ] 74-75
4.		[ ][ ] 76-77

C.21 Are you familiar with the new National Water Act (NWA)? | Yes 1 / No 2 | [ ] 78

C.22 Are you aware of any stipulations of the NWA that affect your Operations? | Yes 1 / No 2 | [ ] 79

C.23 If yes, how do(es) they affect your farming operations?

Stipulation	Effect	
1.		[ ][ ] 80-81
2.		[ ][ ] 82-83
3.		[ ][ ] 84-85
4.		[ ][ ] 86-87

C.24 Are you familiar with the new National Agricultural Marketing Act (NAMA)? | Yes 1 / No 2 | [ ] 88

C.25 Are you aware of any stipulations of the NAMA that affect your marketing activities? | Yes 1 / No 2 | [ ] 89

C.26 If yes, how do(es) they affect your marketing activities?

Stipulation	Effect	
1.		[ ][ ] 90-91
2.		[ ][ ] 92-93
3.		[ ][ ] 94-95
4.		[ ][ ] 96-97

D. Infrastructure and Capital

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D.1 Indicate which of the following infrastructures are freely and easily accessible or available to you, the farmer.

Roads	1	[ ] 98
Transport	2	[ ] 99
Telephone	3	[ ] 100
Electricity	4	[ ] 101
Local markets	5	[ ] 102
National markets	6	[ ] 103
International markets	7	[ ] 104
Other (specify)	8	[ ] 105

D.6 Please fill in the following table on mechanized assets at your disposal (including vehicles).

Type of asset	Condition (e.g. poor, good etc.)	Quantity	Age (years)	Estimated value (R)	
					[ ][ ][ ][ ][ ]
					[ ][ ][ ][ ][ ]
					[ ][ ][ ][ ][ ]
					[ ][ ][ ][ ][ ]
					[ ][ ][ ][ ][ ]
					[ ][ ][ ][ ][ ]

106-135

E. Resources

Farm size and land-use

E.1 Land-use

	Private ownership (ha)	Share cropping (ha)	Rented land (ha)	Open access (ha)	Communal land (ha)	Partnership (ha)	Total area (ha)	
Croplands								[ ][ ][ ] 136-138
Irrigation								[ ][ ][ ] 139-141
Dryland								[ ][ ][ ] 142-143
Orchards & vineyards								[ ][ ][ ] 144-146
Total area (ha)								

Farm size, land use and gross farm income

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E.2 Please provide the following information regarding last season's crops as well as what is planned for the coming season.

Crop		Crop1	2	3	4	5	6	Total	
Dryland									
Area planted	2003/2004								[ ][ ][ ][ ][ ]
	2004/2005								[ ][ ] 147-153
Total yield	2003/2004								[ ][ ][ ][ ][ ]
	2004/2005								[ ][ ] 154-160
Total income	2003/2004							R	
	2004/2005							R	
Irrigation									
Crop								Total	
Area planted	2003/2004								[ ][ ][ ][ ][ ]
	2004/2005								[ ][ ] 161-167
Total yield	2003/2004								[ ][ ][ ][ ][ ]
	2004/2005								[ ][ ] 168-174
Total income	2003/2004							R	
	2004/2005							R	

Income from livestock

E.3 Please provide the following information regarding income from livestock in the past year as well as what is planned for the coming year

Animal		Animal1	2	3	4	Total	
Product sales	2003/2004					R	
	2004/2005					R	
Animal sales	2003/2004					R	
	2004/2005					R	175-179
Other (specify)	2003/2004					R	[ ][ ][ ][ ][ ]
	2004/2005					R	
TOTAL	2003/2004					R	180 -184
	2004/2005					R	[ ][ ][ ][ ][ ]

Other farm income

E.4 Do you render services to other farmers?

Yes	1
No	2

[ ] 185

E. 5 If "yes", are you paid for the services rendered?

Yes	1
No	2

[ ] 186

E.6 If 'yes", please state the source and amount received.

Source	Amount	
		[ ][ ] 187-188
		[ ][ ] 189-190
		[ ][ ] 191-192
		[ ][ ] 193-194
		[ ][ ] 195-196
Total per year	R	[ ][ ] 197-198

Non-farm income

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E.7 Apart from income derived from farming, does any one of the household have any other form of income which is also used in farming operations? | Yes | 1 | / | No | 2 | [ ] 199

E.8 If "yes", please use the following scale to complete the table:

Scale (per year)	Code
R0 - R500	1
R5 001 - R10 000	2
R10 001 - R15 000	3
R15 000 - R20 000	4
R20 001 - R25 000	5
R25 000>	6

Member of household	Source of income (e.g. café, taxi, pension, rental income from house, land or natural veld, etc.)	Code	Amount (R)	
1.				[ ][ ][ ][ ]
2.				[ ][ ][ ][ ]
3.				[ ][ ][ ][ ]
4.				[ ][ ][ ][ ]
Total income			R	[ ][ ][ ][ ] 204-219

E.9 If "yes" at E.7, where did you start? | Farm | 1 / Business | 2 / Job | 3 | [ ] 220

Labour

E.10 Family size at time of interview

Adults	Number	
Elders 55 years and older		
Middle-aged 35-54 years		[ ][ ] 221-222
Young adults 15-34 years		[ ][ ] 223-224
Children (own) and relatives who stay permanently in your home		[ ][ ] 225-226
Older children (7-14 years)		
Younger children (6 and under)		[ ][ ] 227-228
Total family size		[ ][ ] 229-230
		[ ][ ] 231-232

E.11 How many of your children and relatives work on your farm? | | Number | [ ] 233

E.12 Do you employ permanent labour on your farm? | Yes | 1 / No | 2 | [ ] 234

E.13 If "yes", how many? | | Labourers | [ ] 235

E.14 Do you employ seasonal or casual labour? | Yes | 1 / No | 2 | [ ] 236

E.15 If "yes", how many per year? | | Labourers | [ ] 237

E.16 If "yes", how many days per year? | | Days | [ ] 238

Credit

For office use only [3]
[ ][ ][ ] 1-3

E.17 Do you make use of any foreign capital?

Yes	1
No	2

[ ] 4

E.18 If "yes", name the source, type, interest rate and amount outstanding on 1/1/2004.

Source (Commercial Bank/Co-op)	Type (Hire purchase/bond/ overdraft/production loan)	Interest rate (%)	Amount (R)	
Formal sources				
Commercial Bank				
Agricultural Bank of South Africa (Land Bank)				[ ][ ][ ][ ]
Agricultural cooperative				[ ][ ][ ][ ]
Other (specify)				[ ][ ][ ][ ]
Informal sources				[ ][ ][ ][ ] 5-20
Credit unions				[ ][ ][ ][ ]
Farmers' Association				[ ][ ][ ][ ]
Family and friends				[ ][ ][ ][ ]
Stokvels				[ ][ ][ ][ ]
Other (specify				[ ][ ][ ][ ] 21-40

E.19 Do you need credit?

Yes	1
No	2

[ ] 41

E.20 Is credit available to you the smallholder farmer?

Yes	1
No	2

[ ] 42

E.21 If "no", please state why not.

Do not need extra money - have enough money of your own to buy inputs	1
Have no access to credit	2
The cost (interest) of money is too high	3
Bank does not want to lend me money due to insufficient security	4
Poor repayment ability of farm	5
Do not know how to go about organizing credit	6
Other (Specify):	7

[ ] 43

E.22 How do you buy the inputs for crops? (fertiliser, pesticides etc.) (Mark only one)

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

[ ] 44

Transportation

For office use only

E.23 What is the cost of transporation for acquiring inputs?

Input	Distance from the plot (km)	Means	Cost per trip (R)

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45-78

E.24 What is the cost of transporation for marketing your output?

Crop	Distance from the plot (km)	Means	Cost per trip (R)

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79-102

APPENDIX B

CORRELATION MATRICES

B1: Correlation matrix A
B2: Correlation matrix B

Appendix B1: Correlation matrix A

Variable	TENURE	INFRA	INFO	M.ACC.	FAM.LAB.	RESDEV	F.ORG.	TRAIN	PLAN	OFF-INC	TRANS	EXT.	CREDIT
TENURE	1	0.12	-0.61**	-0.53**	-0.05	0.39**	0.74**	0.07	-0.08	-0.11	-0.09	-0.36**	0.46**
INFRA		1	-0.18**	0.27**	-0.02	0.30**	-0.33**	-0.09	0.05	0.00	0.56**	0.16	-0.43**
INFO			1	0.24**	-0.01	-0.31**	-0.59**	0.12	0.25**	0.15	0.22**	0.13	-0.19**
M.ACC.				1	0.03	0.24**	-0.46**	0.04	0.21**	-0.10	0.29**	0.62**	-0.44**
FAM.LAB.					1	0.04	-0.02	0.17	0.01	0.00	0.08	0.08**	0.05
RESDEV						1	0.30**	0.34**	0.24**	-0.23**	0.29**	0.71	-0.09
F.ORG							1	0.15	-0.13	-0.12	-0.28**	-0.22**	0.52**
TRAIN								1	0.37**	0.03	0.21**	0.29**	0.14
PLAN									1	-0.01	0.26**	0.29**	0.02
OFF-INC										1	0.04	-0.13	0.18**
TRANS											1	0.31**	-0.30**
EXT.												1	-0.41**
CREDIT													1

** = significant at 5% level

APPENDIX B2: Correlation matrix B

Variable	INFRA	INFO	CREDIT	EXT	F_ORG	L.MKT	TRANS	TRAIN	CREAT	ENT	DIST	AGE	T.COST	OFF-INC
INFRA	1													
INFO	-0.18**	1												
CREDIT	-0.43**	-0.19**	1											
EXT	0.16	0.13	-0.41**	1										
F_ORG	-0.33**	-0.59**	0.52**	-0.22**	1									
L.MKT	0.21**	0.02	-0.04	0.40**	0.02	1								
TRANS	0.56**	0.22**	-0.30**	0.31**	-0.28**	0.22**	1							
TRAIN	-0.09	0.12	0.14	0.29**	0.15	0.24**	0.21**	1						
CREAT	-0.04	0.21**	0.01	0.47**	-0.27**	0.28**	0.18**	0.19**	1					
ENT	-0.03	0.15	0.04	0.47**	-0.19**	0.27**	0.14	0.27**	0.90**	1				
DIST	-0.62**	0.35**	0.23**	-0.64**	-0.11	-0.35**	-0.40**	-0.21**	-0.26**	-0.31**	1			
AGE	-0.08	-0.01	-0.04	0.04	-0.08	-0.17	-0.07	0.02	0.12	0.12	-0.03	1		
T.COST	-0.74**	0.40**	0.38**	-0.60**	0.04	-0.33**	-0.36**	-0.05	-0.21**	-0.25**	0.94**	-0.01	1	
OFF-INC	0.00	0.15	0.18**	-0.13	-0.12	0.01	0.04	0.03	0.13	0.12	0.20**	0.06	0.18	1

** = significant at 5% level

APPENDIX C

SIMULATION RESULTS

APPENDIX C: Results of simulations

VARIABLE	AV/BASE	COEFF	AVG*Coeff
Physical access to market	0.529	-2.4778	-1.31076
Farmer skills	-0.329	0.69488	-0.22862
Nature of access to market	0.515	-1.4524	-0.74799
Sum			-2.28736
Probability			**0.092175**
1. PC1 REDUCED BY 20%			
VARIABLE	**AV/BASE**	**COEFF**	**AVG*Coeff**
Physical access to market	0.423	-2.4778	-1.04811
Farmer skills	-0.329	0.69488	-0.22862
Nature of access to market	0.515	-1.4524	-0.74799
Sum			-2.02471
Probability			**0.116633**
2. PC2 INCREASED BY 50%			
VARIABLE	**AV/BASE**	**COEFF**	**AVG*Coeff**
Physical access to market	0.529	-2.4778	-1.31076
Farmer skills	-0.1645	0.69488	-0.11431
Nature of access to market	0.515	-1.4524	-0.74799
Sum			-2.17305
Probability			**0.102197**

3. PC3 REDUCED BY 20%			
VARIABLE	**AV/BASE**	**COEFF**	**AVG*Coeff**
Physical access to market	0.529	-2.4778	-1.31076
Farmer skills	-0.329	0.69488	-0.22862
Nature of access to market	0.412	-1.4524	-0.59839
Sum			-2.13776
Probability			**0.105481**