FACTORS AFFECTING PARTICIPATION IN MAINSTREAM CATTLE MARKETS BY SMALL-SCALE CATTLE FARMERS IN SOUTH AFRICA

by

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Submitted in partial fulfillment of the
requirements for the degree of

MSc (Agric)

in the

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May 2006

ACKNOWLEDGEMENTS

B.D.Montshwe

May 2006

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ABSTRACT

Even though livestock farming has been identified in the Integrated Sustainable Rural Development Strategy as the agricultural sub-sector with the most likely chance of improving household food security and addressing poverty alleviation in the small-scale farming areas of South Africa, the reality is that the small-scale cattle sector has not achieved its full potential despite many efforts through research and development programmes. Previous studies have mainly identified factors impeding participation of small-scale farmers in both informal and mainstream markets and the extent or degree at which participation is affected.

The purpose of this study was to investigate the probability of small-scale cattle farmers participating in mainstream markets and measure the impact of change of selected variable on the probability to participate. This is a departure from previous research in that the study attempts to identify those factors that have

the greatest probability to increase participation in mainstream markets by small-scale farmers.

The study was conducted in three different areas, namely Hammanskraal, Ganyesa and Sterkspruit. The sampling technique used in Hammanskraal is the stratified random sampling technique. In Ganyesa all the identified farmers were interviewed. Since the number of small-scale farmers was unknown in the Sterkspruit area the snowball sampling technique was used. The total sample size is 150 small-scale cattle farmers.

A logit model is used in this study. Since multicollinearity in the data was identified principle component (PC) analysis was used to deal with this problem. After PC's were calculated and PCs with the smallest eigenvalues were eliminated, principle component regressions (PCR) were fitted using the standardized variables to improve the estimation power of the logistic regression model.

Partial effects of the significant continuous variables (i.e. herd size, desired market distance, household size, lobola, dependents, theft, household assistance and mortality) on the probability to use mainstream markets are relatively small. However, partial effects for the significant discrete variables (i.e. market information, remittances, training and farming systems) are more significant. The increase in the probability to participate in mainstream markets if the initial conditions are addressed range between 0.3 and 0.6.

Simulations with regard to a base group of households revealed training and access to information will have the largest positive impact on the probability of small-scale cattle farmers to market their cattle through mainstream cattle markets if initial conditions improve. Although desired distance to markets, herd

size and household size have the potential to increase off-take to mainstream markets, its potential impact is less that training and access to information.

The impact of remittances and lobola on the small-scale cattle sub-sector, risk behaviour and the informal market are areas that need further research.

Keywords: Small-scale Cattle Producers, Cattle Marketing, Principle Component Analysis, Principle Component Regressions, Development

FAKTORE WAT DEELNAME DEUR KLEINSKAALSE BEESPRODUSENTE AAN HOOFSTROOM BEESMARKTE IN SUID-AFRIKA AFFEKTEER

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UITTREKSEL

Alhoewel lewendehawe deur die Geintegreerde Volhoubare Landelike Ontwikkelingstrategie as die landbou sub-sektor geindentifiseer word wat die grootste kans het om huishoudelike voedselsekuriteit te verbeter en ook armoede te verlig in die kleinskaalse boerdery gebiede in Suid-Afrika is die realiteit dat die kleinskaalse bees sub-sektor nie sy volle potensiaal bereik het nie. Dit is nieteenstaande die feit dat verskeie navorsings- en ontwikkelingsprojekte reeds gepoog het om probleme in hierdie sub-sektor aan te spreek. Verskeie studies het hoofsaaklik faktore geidentifiseer wat deelname deur kleinskaalse boere aan informele en hoofstroom markte belemmer, asook die aard van hoe deelname belemmer word.

Die doel van hierdie studie was om die waarskynlikheid te ondersoek dat kleinskaalse boere sal deelneem aan hoofstroom markte, asook die faktore wat dit sal beinvloed. Wat hierdie studie onderskei van vorige studies is dat dit poog

om die faktore te identifiseer wat die grootste waarskynlikheid het om verhoogde deelname aan hoofstroom markte in die hand te werk.

Die studie is uitgevoer in drie areas, naamlik Hammanskraal, Ganyesa en Sterkspruit. Die gestratifiseerde toevallige opname tegniek is gebruik in Hammanskraal. In Ganyesa is met al die produsente onderhoude gevoer. Aangesien die getal kleinskaalse produsente onbekend was in Sterkspruit is die sneeubal opname tegniek gebruik. In totaal is daar 150 kleinskaalse produsente ingesluit in die studie.

'n Logit model word gebruik in die studie. As gevolg van multi-kollineariteit in die data is prinsipaal komponent (PK) analise gebruik om die probleem op te los. Nadat die PK's bereken is en die PK's met die kleinste eigenwaarde ge-elimineer is, is prinsipaal komponent regressies (PKR) gepas deur die gestandardiseerde veranderlikes te gebruik om sodoende die skattingsvermoë van die logistiese regressie te verbeter.

Die gedeeltelike effekte van die betekenisvolle kontinue veranderlikes (d.i. kudde grootte, verlangde markafstand, grootte van die huishouding, lobola, afhanklikes, diefstal, huishoudelike hulp en mortaliteit) op die waarskynlikheid om deel te neem aan hoofstroom markte is relatief klein. Die gedeeltelike effekte van die betekenisvolle diskrete veranderlikes (d.i. markinligting, toelae, opleiding en boerderysisteem) is egter meer betekenisvol. Die verhoging in die waarskynlikheid om deel te neem aan hoofstroom markte indien die inisiële kondisies aangespreek word is tussen 0.3 en 0.6.

Simulasies met betrekking tot 'n basisgroep van huishoudings toon dat opleiding en toegang tot inligting die grootste positiewe impak sal hê op die waarskynlikheid vir kleinskaalse beesprodusente om hulle diere te bemark deur

hoofstroom markte indien die inisiële kondisies verbeter word. Alhoewel verlangde afstand na die mark, kudde grootte en grootte van die huishouding ook 'n positiewe impak sal hê op die waarskynliheid om beeste deur hoofstroom markte te bemark sal die impak kleiner wees.

Verdere navorsing is nodig op die impak van toelae en lobola op die kleinskaalse beesprodusent, risiko gedrag en die informele mark.

Sleutelwoorde: Kleinskaalse beesprodusente, Beesbemarking, Prinsipaal Komponentanalise, Prinsipaal Komponent Regressie, Ontwikkeling

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LIST OF ABBREVIATIONS

ASGISA - Accelerated Shared Growth Initiative in South Africa

DoA   - National Department of Agriculture

EC   - Eastern Cape

GDP   - Gross Domestic Product

ISRDP   - Integrated Sustainable Rural Development Plan

KM   - Kilometer

LSU   - Large Stock Unit

NERPO - National Emerging Redmeat Producers Organisation

OLS   - Ordinary Least Square

PCA   - Principal Component Analysis

PCR   - Principal Component Regression

RPO   - Red Meat Producers Organisation

SAMIC - South African Meat Industry Company

SAFA   - South African Feedlot Association

SA   - South Africa

USA   - United States of America

CHAPTER ONE

INTRODUCTION

"The day will come when nations will be judged not by military or economic strength, nor by the splendour of their capital cities and public buildings, but by the well-being of their people: by, among other things, their opportunities to earn a fair reward for their labour, their ability to participate in the decisions that affect their lives; by the respect that is shown for their civil and political liberties; by the provision that is made for those who are vulnerable and disadvantaged" .   .   -UNICEF (1998)

1.1   Introduction

According to Nkosi and Kirsten (1993) and Montshwe, Jooste and Alemu (2005), livestock farming holds a position of great significance in the developing areas of South Africa (SA) and has been considered as a major agricultural activity in the past ten years. The potential significance of livestock in the development of rural livelihoods is undisputedly substantiated by the enormous contribution of the livestock sector at a macroeconomic level.   The livestock sub-sectors' contribution to the total agricultural gross domestic product (GDP) is the largest of all the agricultural sub-sectors in South African agriculture.

Livestock farming, and more specifically cattle farming in South Africa, has multiple dimensions and objectives. The cattle sub-sector is the most important red meat sub-sector in South Africa. It contributed an estimated 8 per cent to the total agricultural GDP in South Africa over the last 5 years (DoA, 2005). Moreover, Coetzee, Montshwe and Jooste (2004) mentioned that cattle farming in rural areas are enshrined within the traditional practices and that a large proportion (approximately 35%) of the national livestock herd is owned by the non-commercial sector.

The importance of cattle to the rural poor can therefore not be over emphasized. Cattle farming play a vitally important role in rural systems, economic growth and

also have a strong human dimension (Birner, 1999; Kumar, Chander and Harbola, 2000). Cattle kept by small-scale farmers are often the main source of income, which is primarily intended for their children's education and emergencies (Adessou, 1999).

In addition, cattle are often the main way in which small-scale farmers can acquire real assets. According to Fidzani (1993); Schwalbach, Groenewald and Marfo (2001); Rocha, Starkey and Dionisio (1991) and King (1985), cattle are a source and store of wealth, it constitutes a hedge against inflation, it is easily converted into cash (Nell, 1998; Moorosi, 1999; Coertze, 1986), and it is often the preferred currency for the rural people. Cattle also provide manure to maintain soil fertility and lastly, Birner (1999), added that, animal draught power increases the productivity of labour.

Despite the aforementioned, Mathebula and Kirsten (2000) states that the contribution of the small-scale cattle sub-sector in South Africa has been underestimated and largely neglected. This state of affairs was inherited from distorted policy frameworks and as a result, little has been done to improve the livelihoods of the small-scale cattle producers and their livestock, thus far. This is despite the fact that small-scale cattle farmers in South Africa have a central role to play in building a strong rural economy and in the process, pushing back the frontiers of poverty through more efficient use of natural resources, employment creation and concomitantly increasing their economic returns.

Prior to complete deregulation of the red meat industry almost a decade ago, the red meat industry was heavily regulated. These regulations included restrictions on the movement of animals, a surplus removal scheme, quotas, etc.

The deregulation of the red meat industry, which commenced in the early 1990's and finally implemented in 1997 was intended at achieving a number of objectives, and these include, increased efficiency, productivity, flexibility and increased access to markets by all farmers (Van Schalkwyk, Groenewald and Jooste, 2003).

Despite the transformation of the national legal and political framework, a vast majority of the small-scale farmers in rural areas are still trapped in a vicious circle characterized by low economic returns due to lack of access to markets, low levels of tacit knowledge pertaining to marketing, slow technology adoption, and inferior infrastructure in rural areas. The focus of this study is on market access and participation of small-scale cattle farmers in mainstream cattle markets.

1.2   Motivation and problem statement

Apart from a policy environment that still does not adequately address the needs of small-scale cattle farmers; other factors also contribute to their current state of well-being. In rural areas, animals are marketed in small numbers by a large number of producers in a non-organized manner that usually involves moving animals over large distances – these farmers are mostly located far away from the conventional mainstream markets.

Various studies have over the past years investigated marketing of cattle by and characteristics of small-scale cattle farmers in South Africa. These studies provide the background against which this study is conducted. In this section a short summary of the finding by these studies is made. A more comprehensive review of literature by various studies is provided in Chapter 2.

Factors considered as restraining small-scale farmers ability to market their cattle include lack of market information (Nkosi and Kirsten; 1993), large distances to the market place (Mahanjana, Esterhuizen and Van Rooyen; 2001), marketing infrastructure (Fraser, 1991), lack of diversity of the market outlets (Lyster; 1990), cultural and subsistence type of farming (Ainslie, Kepe, Ntsebeza, Ntshona and Turner, 2002), and Makhura (2001) mentions that small-scale farmers contribute inadequately to the mainstream market because of low production and poor access to other options for obtaining a livelihood. Other factors include, farmer training, herd size, household characteristics and support services, (Lapar, Holloway and Ehui, 2003; Coetzee *et al.*, 2004; Bellemare and Barrett, 2004; Nkhori, 2004).

Nkosi and Kirsten (1993) analysed and described different channels for the marketing of livestock by farmers in the developing areas of South Africa. The key finding which relates to the background of the current study was that the lack of market information affects the farmers' hope of profiting through any venture. Although the study recommended training as one of the remedies, it did not for example, show how farmer training will affect the ability of farmers to use the other channels which were for non-private sales.

In a study conducted in Kwazulu-Natal on agricultural marketing, Lyster (1990) gives a perspective on marketing at farm household level and concluded that market outlets are not diversified in rural areas and this affects the choice and decision making by small-scale farmers. Therefore, according to Lyster (1990), this provides scope for the private sector to be further involved in the marketing functions. The study only identified the constraints but did not analyse factors affecting the ability of the small-scale farmers to participate in the mainstream cattle markets. The study furthermore did not provide insight into what is the impact of the identified factors on the likelihood of farmers participating in the mainstream markets.

Fraser (1991) investigated the marketing of agricultural produce by small-scale farmers in the former Ciskei which is now part of the Eastern Cape Province. One of the key findings which relates to this study was that livestock owners who claimed to sell animals on a regular basis all sold to local people in very small quantities. The study further indicated that the reasons why farmers preferred private sales included lack of knowledge of the other marketing channels, infrequency of the sales and sufficient local demand. The study recommended solutions but it did not measure the potential impact of the suggested solutions on the ability of the small-scale farmers to participate in mainstream cattle markets.

Makhura (2001) analysed the decision to sell and the level of sales for various agricultural commodities, including livestock. The focus of the study in terms of livestock as a commodity was on cattle, sheep, goats, pigs and poultry. The key findings of the study were that proximity to the nearest town, ownership of livestock and being a female affected the decision of households to sell livestock and also that there are some variable transaction costs associated with livestock sales (for example, access to good roads). The study applied a probit model in establishing the probability of participation in the output market. The study did not measure the impact of different variables on the probability of participating in the output markets, nor did it analyse the probability to sell should the initial conditions change in which non-sellers to mainstream markets find themselves.

Having considered the factors impeding on the marketing of livestock it is apparent that marketing in the broad sense (including timing of marketing, marketing channels used and type of product sold) could play a central role in facilitating change in the small-scale cattle sub-sector. This would entail that various interlinked and complex issues will have to be addressed.

Similarly, in other African countries, the cattle sub sector is faced with serious but common challenges. Fafchamps and Gavian (1995) provides evidence pertaining to the persistent disparity across ethnic groups in the motives for selling livestock and further link price differentials between regions to differences in ethnic settlement. For example, in South Africa cattle that are being used for lobola in the culture of Xhosa will vary in prices whereas other tribes like Pedi and Tswana will have a fixed price for the cattle that are being used in the case of lobola.

Presumably, producers who sell animals only in times of hardship tend to get a lower price than those who can afford to wait (e.g. animals that were accumulated in good times are massively sold or lost during drought). Due to a lack of formal training in both technical and economic efficiency, farmers tend to receive prices below their expectations. According to Fidzani (1993), marketing of cattle when they are beyond the optimal beef producing age constitutes inefficiency in utilization of scarce forage resources.

It is therefore apprehended in this study that, the limits of scarce resources impose a certain range within which a farmer must operate. It is equally true that the producer must improve efficiency to the extent allowed by his most limiting resources.

Having considered the aforementioned coupled with the importance attached to the livestock sector in the Integrated Sustainable Rural Development Plan (ISRDP) it is troublesome that the small-scale cattle sector has not developed to the extent expected. In fact, De Lange (2004) argues very little has changed over the last decade in terms of positioning the small-scale livestock sector to act as a tool for alleviating poverty, improving household food security and contributing to economic growth in South Africa. Given the information generated by the studies cited on factors impeding on the marketing of cattle by

small-scale farmer, it is still not clear what interventions will have the highest probability to act as catalysts for change.

1.3 Objective of the study

In his study, Makhura (2001) revealed that access to assets and market information in combination with particular household characteristics are important determinants of market participation. In terms of market access, Jooste and Van Rooyen (1996) concluded that the transition of the small-scale livestock sector towards commercial production will ultimately be determined by its access to markets. Generally, it is clear that commercialization of the small-scale cattle sector implies increased participation in the output markets by small-scale cattle producers.

The primary objective of this study is not about the amount of cattle sold by small-scale cattle farmers. This study is concerned about the probability of small-scale cattle farmers to participate in the mainstream markets (i.e. the probability of farmers to sell or not to sell cattle into mainstream markets). Once the probabilities have been calculated, the study further measures the impact of change in selected variables on the probability of participating in the mainstream cattle markets against a base group of households. Given the multi-facetted nature of the research problem, various secondary objectives will have to be met.

1.3.1 Secondary objectives

- Identify factors that affect small-scale cattle farmers ability and willingness to participate in mainstream cattle markets;

- Quantify the contribution of individual factors on participation of small-scale cattle farmers in mainstream cattle markets;

- Quantify the impact of different factors on the probability of small-scale cattle farmers to market cattle through conventional mainstream cattle markets; and

1.4 Outline of the study

This study consists of six chapters. Chapter 2 draws from of a wide range of studies and experiences in South Africa and internationally with the aim of reviewing literature on cattle marketing by small-scale farmers. Chapter 3 presents methodological issues pertaining to survey design, data collection and an empirical model for analysis of the survey data. Chapter 4 presents the descriptive characteristics of the households surveyed in the selected study areas. Chapter 5 presents the results of the models used. Chapter 6 deals with the conclusions and recommendations of this study.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

Since the advent of a deregulated and liberalized market economic system within the agricultural industry in South Africa, integration of the small-scale sector into the commercial sector has been of topical interest; the livestock sector is no exception.   Mathebula and Kirsten (2000) stresses that commercialization of small-scale cattle farmers depends on both the natural and human resources, and central to these is the demographic and enthnographic change, new technology, infrastructural development as well as macro-economic and trade policies as stated by Jooste and Van Rooyen (1996), and Kydd and Poulton (2000).   It is therefore clear that an increase in participation by the small-scale sector in mainstream markets is affected by a complex and inter-related set of issues.   In this chapter specific attention will be given to issues that affect participation of small-scale cattle farmers in the market, with special attention to mainstream markets.

Access and participation of small-scale cattle producers in mainstream markets remains a challenge in South Africa.   According to Makhura (2001), very few small-scale cattle farmers participate actively in mainstream cattle markets.   This state of affairs, according to Nell (1998), dates back to the early nineteenth century.   According to Doran, Low and Kemp (1979), Vink (1986), Tapson (1990) and Jooste (1996) this contributes to the fact that the cattle herd in the hands of small-scale cattle farmers is under-utilized.

Various authors, among which Van Rooyen *et al.*, (1987) and Kirsten (1994) have called for the need for reforms if participation by small-scale cattle farmers

in the commercial agricultural markets is to be enhanced. This is especially important in the light of the fact that cattle farming play a vitally important role in rural systems, economic growth and also have a strong human dimension (Birner, 1999; Nkosi and Kirsten 1993; Kumar *et al.*, 2000; Fidzani, 1993; Tapson, 1990). It is therefore, not a coincidence that the ISRDP identifies livestock farming as the agricultural enterprise with the most likely chance of improving household food security and addressing poverty alleviation in the rural areas of South Africa.

2.2   The reasons for keeping cattle in rural areas

According to Ouma, Obare and Staal (2003) and Rendani (2003), the role of cattle in traditional systems is still underrated. They stress that the reasons for keeping cattle vary from community to community and largely determine the strategies, interventions, demand and supply as well as the development of opportunities.

Cattle are a form of retained capital, and according to Bailey, Barrett, Little, and Chabari (1999) they provide a stream of desired goods and services, including milk, transport, and traction. For example, the findings of the study conducted in Limpopo Province by Randela (2003) was that, the average consumption of milk per farming family is about 2-4 liters daily.

In developing areas, cattle are also seen as a hedge against households risks and wealth. According to Ouma *et al.,* (2003) they hedge against risk because the capital invested in the herd forms a guarantee for meeting future unexpected requirements. Bailey *et al.,* (1999) also agree with the aforementioned reasons for keeping cattle and further mentioned that sometimes this capital is consumed directly through slaughtering and meat consumption, but more often cattle are

sold and the proceeds used for expenditure needs such as school fees payment and funerals (Nkosi and Kirsten, 1993). Ouma *et al.,* (2003) also highlights the importance of cattle as a potential means of a living "savings". The role of livestock as a store of wealth is also reflected in social institutions such as lobola and inheritance.

Having stated the aforementioned it is important to take cognizance of the notion by Schmidt (1992) and Doran *et al.,* (1979) that the prestige linked to cattle ownership is diminishing because of the adoption of Western cultural norms, especially among younger people. Nkosi and Kirsten (1993) also suggested that, the farming system in the developing areas is gradually shifting to commercialization and further referred to "commercial" as households keeping livestock with the idea of selling a number of animals in the future when cash is needed.

2.3 Marketing system and channels in developing areas

According to Bekure and Tilahun (1983), marketing provides the mechanism whereby producers exchange their livestock for cash. However, it is widely perceived that cattle markets in developing areas suffer significant inefficiencies due to high transaction costs, difficulties in contract enforcement, limited throughput capacity and selling animals that does not comply with market requirements. For example, in terms of the latter, a study in the Eastern Cape conducted by NERPO and IDT (2005) found that the general perception of livestock buyers were that farmers sell animals when they are too old and too lean but demand unreasonable prices for them.

Fraser (1991) highlights that participation in the marketing system has relatively little to do with the provision of marketing facilities but rather with the role and

number of cattle held by an individual. On the other hand, Groenewald (1981) stated that, marketing should be recognized as a pre-requisite and not as a result of production, despite the quantity and quality of surplus available for sales.

Although small-scale farmers have limited outlets, they still use channels of their own choice, and this implies that no one system fits every producers needs. The choice of the marketing channel depends on a number of aspects. These include availability of markets, prices offered in the market, distance to the market and the potential of the market to absorb the stock on sale. Paterson (1997) stated that, for the farmers to be successful, the situation of a perfect market should prevail implying that there has to be many buyers, many sellers, defined products, a market place, and market organization. In many traditional settings this is not the case as is discussed in subsequent sections, but it is first necessary to look at different marketing channels.

According to Nkosi and Kirsten (1993), private sales are the most preferred channel in developing areas; this finding is also supported by a study conducted by NERPO (2005) for the Department of Agriculture. Speculators occupy a very important role in this regard. Often they function in the remotest and least accessible areas where institutional services frequently do not reach, thus providing marketing channel for rural surpluses, and often also fulfilling the consumption needs of the rural communities by selling consumer goods. According to Bailey *et al.* (1999), a cohort of competitive arbitrageurs is essential to efficient marketing arrangements. Speculators are, however, often labeled by small-scale producers as exploitative. Where the context of institutions and infrastructure is not concrete, speculators may force emerging cattle farmers to confront a single, monopsonistic buyer, consequently resulting in exploitation. According to Bellamy and Greenshields (1979), the anti-speculator attitude in Sub-Saharan Africa has led to distrust, wide product output and price fluctuations, misallocation of farm resources as well as the deterioration of product quality.

Another marketing channel used by small-scale producers is auctions, which plays a very important role in price setting (Nkosi and Kirsten, 1993). According to Nkosi and Kirsten (1993), auctioneers in developing areas experience a number of problems of which lack of reasonable saleable number of cattle is the main problem. Generally, the majority of the small-scale farmers in developing areas do not understand the *modus operandi* of auctions. Nongoma District municipality is a typical example where an auction system could not function primarily because farmers wanted the auction to operate the opposite way (i.e. they could not accept price per kilogram and wanted to determine prices in a similar way as during the private sales). Other areas where auctions are not functioning well or are completely absent include Libode, and Port St Johns (Eastern Cape), Ganyesa (North West Province), and Sekhukhune and Bohlabela District municipalities (Limpopo Province).

2.4 Marketing constraints in developing areas

In this section several marketing constraints experienced in developing areas are discussed to provide further insight into the factors that affect marketing of cattle by small-scale farmers. The constraints discussed are not exhaustive but links to issues already mentioned and provides the necessary foundations for the rest of the study.

2.4.1 Inadequate infrastructure

According to Nkosi and Kirsten (1993), inadequate infrastructure merely takes away from the farmer the limited incentives that are available to them. The shortcomings of infrastructure, according to Bailey *et al.*, (1999), seriously impede the physical flow of animals ultimately creating *de facto* barriers to domestic trade. The inadequacy of infrastructure is widespread particularly in the

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former homeland areas, and even more so in deep rural areas (Kgantsi and Mokoene, 1997). The lack of infrastructure can seriously impede on development initiatives in rural areas. Ruijs, Schweigman and Lutz (2004) argue that investment in infrastructure have important positive effects on development.

According to Bailey *et al.,* (1999), the most important physical infrastructural weaknesses for the livestock marketing system relates to transport and holding facilities. An efficient transport system is critically important to efficient agricultural marketing. It is in this context that Thormeyer (1989) argues that, if transport services are infrequent, of poor quality or expensive, farmers won't be timeous and will be exposed to price risk. Thormeyer (1989) also points out that the level of sophistication of a transport system can improve the mobility of the user and the accessibility of market opportunities. The reality of the aforementioned in South Africa is demonstrated by Bailey *et al.,* (1999) who argues that many communities complain of insufficient access to traders mainly due to traders that are reluctant to make trips because of high transaction costs they incur due to poor physical infrastructure such as roads and loading facilities, as well as distance to reach farmers.

2.4.2 Marketable livestock numbers

According to Stevens and Jabara (1988), livestock numbers in less developed areas are generally found to be low per producer and that the average weight of animals are generally lower compared to areas characterised by commercial farming. Several constraints that impede on increased productivity (e.g. increased animal numbers and weight, and off-take rates) have been identified by the World Bank (1998). These include animal disease, poor quality and inadequate supply of feed, no or slow adoption of technology and diminishing plant and animal bio-diversity.

In South Africa off-take rates in the small-scale cattle sector is much lower than in the commercial sector, i.e. an off-take rate of between 5 -10 per cent compared to 25 per cent in the commercial sector.   This emphasises the challenges that lay ahead in further developing this sub-sector.

2.4.3 Market information

The bulk of the literature on market information in developing areas is founded on the assumption that there is a role for public market information services because market information is a 'public good'. According to Fenyes and Groenewald (1985) insufficient market information is common due to the large number of small producers, inefficient communication systems and low levels of literacy as well as information administration. The provision of information to small-scale farmers is one way of maintaining transparency and inclusiveness. According to Schubert (1993) this will make markets to be more accessible. Bailey *et al.,* (1999) agrees that there is evidence that market information reduces risk.

In their study, Frick and Groenewald (1999) identified several roles of market information:

- Creating stimuli by indicating market opportunities;

- Stimulating competition among suppliers and traders;

- Promoting the adoption of suppliers to the development of demand; and

- Preconditioning for the planning and control of market interventions

According to Frick and Groenewald (1999), the small-scale farmers will undoubtedly benefit from information about prevailing market conditions, type of product demanded, quality, quantity, price and market opportunities.

Within a South African context, the lack of timeous and reliable market information is particularly acute if one, for example, considers that information on the number of cattle slaughtered (supply) can not be officially verified. This represents a major problem since demand and supply forces determine prices.

2.4.4 Poor condition of livestock

Although a lack of buyers is frequently given as a reason why small-scale farmers are unable to access the market, the fact is that when such buyers do wish to buy from small-scale farmers, the poor condition of livestock results in lower farm gate prices, especially during dry spells. Livestock auctioneers and speculators often raise concerns that they cannot pay competitive prices for animals that are in poor condition or not ready for the market (Luppnow, 2003). De Waal (2004) mentions that the poor condition of livestock is important, but the age of animals (too old) when farmers do sell, is equally contributing to poor prices. Poor condition of livestock is also attributable to inadequate grazing and the extreme degradation of the natural resource. Lack of suppliers of important agricultural inputs for livestock farmers, such as vaccines and feed supplements, and common problems of genetic inferiority of animals further reduces the desirability of animals. The low levels of technology adoption further compounds the problem (Nell, 1998)

2.5   Conclusions

Small-scale cattle farmers in South Africa face many challenges that need to be addressed if this sub-sector is to play its rightful role in economic development in South Africa. Many of the challenges fall beyond the scope of direct intervention by small-scale cattle farmers themselves and require interventions by government and the private sector. Important is that small-scale cattle farmers must identify those areas where they could have a direct impact and engage in serious efforts to address such challenges. The problem however is that many of the challenges that can be addressed directly are dependant on those challenges that must first be addressed by government and the private sector. Hence, organized agriculture, government and private sector should take a holistic and integrated view of the development challenges faced by small-scale cattle producers if any development programmes are to achieve any significant successes. The rest of the study provides guidelines on those issues that will have the most significant impact and that should be addressed urgently.

CHAPTER 3

RESEARCH METHODOLOGY

3.1   Introduction

This chapter focuses on reviewing the research methods used. The discussion is intended to show how this study is conducted using the specific research tools which include, the survey design and the analytical framework. Attention is afforded to the choice of study area, sampling techniques and determination of sample size. The discussion is then followed by the designation of the survey instrument, outlining procedure for data collection, descriptive statistics as well as the empirical model employed for data processing. The chapter concludes with the justification of the selected variables and it also shows the independent variables used.

3.2   Survey design

3.2.1 The study area

Interviews were conducted by means of a questionnaire in three different areas, namely Hammanskraal, Ganyesa and Sterkspruit (see Appendix 1 for the questionnaire). The areas are described below (See Appendix 4 for maps).

3.2.1.1   Sterkspruit

Sterkspruit is in the Eastern Cape Province. This area is classified as highveld with summer rainfall which according to Brown (1969) can be described as being

erratic. There are various grass species found in this area which can be categorized as sourveld, sweetveld and mixed veld. The natural grazing is good enough for extensive production of cattle; however, with inadequate grazing management practice, which includes no rest-periods, availability of grazing is not sufficient for a well balanced animal production system.

Sterkspruit provides evidence of small-scale farmers who have endeavored to improve their livelihoods through livestock farming despite the existing production and marketing constraints. Sterkspruit is mainly characterized by small-scale farmers in both livestock and crop farming with low risk-bearing capacity, poor transport means, infrastructure and poor communication.

Despite the low offtake and/or participation in the mainstream cattle markets documented by Ainslie *et al.*, (2002) in the Eastern Cape, Sterkspruit is considered among the most popular cattle-producing areas in the province. The production areas targeted included Witterbergen, Phelandaba, Makhumsha, Ndofela, Blikana, Tugela and Rietcliff.

3.2.1.2 Hammanskraal

Hammanskraal is located in the North-West Province, near to the livestock markets in Gauteng Province. Having considered the underlying circumstances under which small-scale farmers in Sterkspruit operate, it is a different case with Hammanskraal. To start with, ethnicity is not regarded as dictating participation in the mainstream markets by small-scale farmers in Hammanskraal. There are constraints to livestock production and marketing, and the understanding is that the extent differs in both areas. Small-scale farmers in Hammanskraal have a more conducive institutional environment, better business opportunities as well as a more culturally flexible environment.

3.2.1.3   Ganyesa

Ganyesa is located in the North West province. It is on the boundaries of Segonyane to the South West, Naledi to the South and Molopo district to the West. The target villages constitute multiracial populations and include Ganyesa village and Morokweng. There are few business opportunities in the area. There are both commercial and small-scale farmers in the area. Ganyesa has well built marketing infrastructure. The small-scale cattle farmers in this area sell through the traditional outlets found in rural areas, but auctions normally take place in Vryburg.

3.2.2 Sampling technique and size

Sampling involves the determination of the sample size giving due cognizance to the fact that it should be representative enough to conduct reliable statistical analysis. Sample size depends largely on the degree to which the sample population approximates the characteristics and qualities resident in the general population. Scheaffer, Mendenhall and Ott (1990) define a sample as a collection of sampling units drawn from the sampling frame. In other words, a sample is a finite part of a statistical population whose properties are studied to gain information about the whole.

The manner in which the sample units are selected is very important. This means representativeness and adequacy should be taken into consideration when generalizing from the sample to the larger population (i.e. the sample is used to make inferences to a universe). A statistically adequate sample is one that is of such size that the inferences drawn from the sample are accurate to a given level of confidence (Frick, 1999). Representativeness means that the sample selected should have approximately the same characteristics as the

population relevant to the research in question (De Vos, Strydom, Fouché and Delport, 2002).

A sample becomes inaccurate mainly due to human factor/bias and distortion due to the selection system. In the most general sense, the components of the sample are chosen from the population universe by a process known as randomization. According to Babbie (2001), randomization means selecting a part of the whole population in such a way that the characteristics of each of the units of the sample approximate the broad characteristics inherent in the total population.

Stratification of the farmers in all study areas was performed, which entails that small-scale farmers were divided into strata based on the market distance as a yardstick (i.e. the distance from the initial point of production to the point where market transactions are settled). In this random sampling technique, the whole population is first divided into mutually exclusive strata and then units are selected randomly from each stratum.   The sampling technique used in Hammanskraal is the stratified random sampling technique.

In Ganyesa about 30 small-scale cattle farmers were sampled.   Since the population size was small, a 100 per cent sample was conducted. Leedy (1994) supports the latter and further mentioned that this kind of representation will yield statistically defensible outcomes.

In the Eastern Cape Province (Sterkspruit) the number of small-scale farmers was unknown. In view of this, a non-probability sampling technique was used to ensure that a sufficient number of respondents were reached.   Snowball sampling technique is a technique used when the desired sample characteristics are rare and rely on referrals from initial respondents to generate additional

respondents. Neuman (1994) describes this method as a multistage technique and further stresses that it begins with one or few people and spreads out on the basis of links to the initial cases.

The total sample size is 150 small-scale cattle farmers including all areas selected in this study. According to Gordon and Schaumberger (1978) the sample size must be relatively large especially when the chi-square test is used because it has a sampling distribution that approximates the true distribution.

3.3 Method of data collection

According to Fidzani (1993), primary data collection always involves the tradeoff between undertaking an intensive study in a small geographical area versus a broader examination of a larger area. In attempting to balance the requirement for capturing important details and unlimited applicability, a questionnaire was designed as a tool for data collection. According to Leedy (1994), the most important guideline for questionnaire construction is to inspect the assumptions underlying the question.

There are different ways in which a questionnaire may be administered. These include the self-administered questionnaire, face-to-face interview and telephone survey. Face-to-face interviews were considered the relevant method for data collection in this study. The following guidelines as proposed by Babbie (2001), were considered prior to the implementation of this survey:

-   Appearance and demeanor of the interviewers
-   Familiarity with the questionnaire
-   Following questionnaire wording exactly

-          Recording responses exactly

-          Probing for response

Issues addressed in the questionnaire included the following: demographic details, biographical characteristics, human capital endowments, financial management, livestock production, livestock management, marketing management, transportation, marketing channels, marketing institutional arrangements and land tenure systems.

3.4   Justification of the econometric model

Participation of small-scale cattle farmers in the mainstream cattle markets can be described in different ways, but for the purpose of this study participation means whether farmers sell or do not sell their cattle in mainstream cattle markets. The dependent variable considered takes the form of a **_Bernoulli_** or binary variable (i.e. either 1 or 0), where 1 denotes that a farmer participates in the mainstream markets and 0 denotes that a farmer does not participate. The method of estimation has been strongly and clearly guided by the form of the dependent variable considered in this study, since the objective is to determine the probability of small-scale cattle farmers participating in mainstream markets and the factors that will affect it.

Categorical dependent variables require an understanding of their nature for a reliable successful statistical analysis to be performed. The larger the number of categories used for each variable in the model, and the more variables that are being interrelated, the greater the number of cells and sub cells and thus the more complex the analysis becomes.

Data inadequacies due to non-responses and design imperfections, are likely to result in high-order interactions. Measures have been taken to ensure that such fallacies do not occur.

Ordinary least square method (OLS) is probably the most widely used statistical methodology in existence. This method has been highly successful in solving problems with a continuous dependent variable. Given the nature of the dependent variables used in this study (categorical nature), the procedure has a tendency to create problems. If there are no restrictions placed on the values of the independent variables, the predicted values of the outcome variables may possibly exceed either of the limiting values of 1 or 0.

The classical regression assumption of heteroscedasticity of the error term is also likely to be violated, especially if the proportions in the total sample are close to either 0 or 1. According to Kleinbaum (1994) this difficulty may be seen in connection with the bivariate equation $Y = \alpha + \beta\chi + \varepsilon$ and obviously generation to the multivariate case. If the Y value for any given individual must be either 0 or 1, and yet X may vary continuously, then the disturbance term cannot be normal and will of necessity be a function of X, contrary to the assumptions required by ordinary least square. Given the violation of the classical regression assumptions, OLS could not be used for the estimation of the model.

Discriminant functional analysis is also a functional form which can be used to analyse a problem with categorical dependent variables. Discriminant functional form $\Sigma L_i \delta_i$ is a linear function of the Xi that gives the smallest probability of misclassification. The Li are coefficients determined in order to satisfy this requirement. Since the Xi follow a multivariable normal, it is known from theory that $\Sigma L_i \delta_i$ is normally distributed. However, if any of the dependent variables are dichotomous or categorical in nature, then the discriminant functional method tends to give biased results, usually giving estimated odds ratios that are too

high. The difference between its mean in the two populations is **δ = ΣL$_i$δ$_i$** and its variance is **δ^2 = ΣΣL$_i$Ljδ$_{ij}$**. Discriminant functional analysis has been shown by statisticians to be essentially a least square approach (Kleinbaum, 1994). Furthermore, discriminant analysis can only be used with continuous independent variables. Taking into consideration the nature of the independent variables to be used and other aforementioned weaknesses, it therefore means that this functional form could not be employed for the analysis.

There are alternative models used in modeling the relationship between a categorical dependent variable and a set of independent variables; these include logits, probits, tobits and gompits. According to Shatland and Bartona (Online), probit models are employed when the outcome variable used reflects an underlying quantitative variables and this method uses the cumulative normal distribution. The theory of normal probability distribution in probit models renders it inappropriate when dealing with a categorical outcome variable which is strictly qualitative. For the same reason, the tobit and the double hurdle models, which are more suited to quantitative data, could not be used.

Logistic regression, on the other hand, is a predictive analysis which uses binomial probability theory. It is, however, not related to chi-square contingency analysis. Moreover, it turns out that a 2*2 contingency analysis with chi-square is really just a special case of logistic regression. However, logistic regression is a more general analysis, because the independent variable is not restricted to a categorical outcome variable only nor is the model limited to a single independent variable.

Consequently a logit model will be preferred over OLS and discriminant functional analysis, probit model and chi-square contingency analysis. Kleinbaum (1994) describes logistic regression as a mathematical modeling approach that can be used to describe the relationship of several independent

variables to a categorical dependent variable. The logistic regression model is simply a non-linear transformation of the linear regression.

The logarithmic transformation in this model stabilizes the variance if the standard deviation in the original scale varies directly as the mean. Instead of the t-statistic, the model chi-square was used to determine the overall model fit. This study used logistics regression due to it's relevance and strength in dealing with the categorical dependent variable which has independent variables that are both categorical and continuous. (Shatland and Bartona (Online) stresses the consensus that logistic regression is a very powerful, convenient and flexible statistical tool.

A typical logistic regression model is of the form:

$$Log [p/(1-p)] = b_o + b_1X_1 + \ldots\ldots + b_kX_k$$

The logistic model has the following advantages:

- It imposes a flexible non-linear relationship

- It imposes for threshold and interaction effects

- It also allows for examination of social interaction

However, like many other models, logistic models are subject to certain weaknesses which can be solved without reference to the nature of variables, be it outcome or explanatory. The following are mechanisms used to ensure that all possible pitfalls are detected:

- Likelihood test ratio will be performed to test for omitted variables.

- Wald statistics will be used to exclude irrelevant variables.

- Wald and model chi-square statistics will be used to detect errors in the functional form.

- Test will be carried out to check for multicollinearity

3.4.1 Specification and estimation of the model

The model used in this study determined the probability of small-scale cattle farmers participating in mainstream markets and also measures the impact of selected variables on the probability of participating in the mainstream cattle markets against a base group of households. The procedure of logistic regression followed in this study is based on Kleinbaum (1994):

$$\phi_i = E(y_i = 1/X_i) = \frac{1}{1 + e^{-(\beta_1 + \sum\limits_{i}^{k} \beta_i x_i)}} \quad ....(1)$$

Where: ϕ_i stands for the probability of household i to participate in mainstream[1] cattle markets, y_i is the observed participation status of household i, x_{ij} are factors affecting participation by household i, and β_j stands for parameters to be estimated.

Denoting $\beta + \sum\limits_{j=1}^{k=n} \beta ij$ as Z, equation 1 can be written so that the probability of household i can be calculated as:

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[1] Mainstream cattle markets in this context means commercially oriented markets, e.g. auctions, direct sales to retailers and/or wholesalers or selling to feedlots or speculators. Cognisance is taken of the fact that many cattle sold by small-scale farmers enter the informal market. However, this market falls beyond the scope of this study.

$$\phi_i = E(y_i = 1/X_i) = \frac{1}{1 + e^{-Z_i}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(2)$$

From equation 2, the probability of household i to participate is given by $(1-\phi_i)$ which gives equation 3:

$$(1 - \phi_i) = \frac{1}{1 + e^{z_i}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3)$$

Therefore the odds ratio, i.e. $\phi_i/(1-\phi_i)$ is given by equation 4 as:

$$\left(\frac{\phi_i}{1 - \phi_i}\right) = \frac{1 + e^{z_i}}{1 + e^{-z_i}} = e^{z_i} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(4)$$

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

$$Ln\left(\frac{\phi_i}{1 - \phi_i}\right) = \beta + \sum_{j=1}^{k=n} \beta ij + \varepsilon_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(5)$$

Rearranging equation 5 with the dependent variable (participation in mainstream markets) in log odds, the logistic regression can be manipulated to calculate conditional probabilities as:

$$\phi_i = \frac{e^{\left(\overline{\beta_o} + \sum_{i=1}^{k=n} \overline{\beta_j} x_{ij}\right)}}{1 + e^{\left(\overline{\beta_o} + \sum_{j=1}^{k=n} \overline{\beta_j} x_{ij}\right)}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(6)$$

Once the conditional probabilities are calculated for each sample household, the "partial" effects of the continuous individual variables on household participation can be calculated by the expression

$$\frac{\partial \phi_i}{\partial x_{ij}} = \phi_i (1 - \phi_i) \beta_j \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(7)$$

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

3.5   Conclusion

The study uses a logistic regression model applied on primary data collected from three areas, namely Hammanskraal, Ganyesa and Sterkspruit. In Hammanskraal a stratified random sampling technique was used, in Ganyesa all farmers were interviewed and in Sterkspruit a snow ball sampling technique was used. In total 150 households were interviewed.

Variables and their coding are further defined in detail in Chapter 5. For the purpose of the model, continuous variables take any numerical value in a real interval when measured accurately (Ramanathan, 1992) while categorical variables take a numerical value of one or zero.

CHAPTER 4

DESCRIPTIVE RESULTS OF THE SURVEY DATA

4.1   Introduction

Livestock provides important functions in the life of rural households. As a result it holds a position of great importance and is one of the agricultural sub-sectors with a significant potential for economic growth and development. The objective of this chapter is to compare and show the environment in which cattle production and marketing are taking place in the selected study areas. Moreover, an overview of the household characteristics in different study areas, with the main focus on socio-economic aspects, production and marketing of cattle by small-scale farmers are provided.

4.2.   Farming profile of the households

Table 4.1 shows the mean age of the farmers, their educational level and the distribution of their household members. Sterkspruit has the highest average age per farmer, closely followed by Hammanskraal with an average age of 61 years. The average age for Ganyesa is 5 years lower than in the other two areas. Participation of women in agriculture remains a challenge in the South African emerging red meat sub sector. Ganyesa has 16.70 per cent female farmers participating in livestock production, Sterkspruit 18 per cent and Hammanskraal is the highest with 24 per cent. The educational level of the farmers in Hammanskraal and Sterkspruit is lower than in Ganyesa, with the majority of farmers in Ganyesa schooled up to grade 8, while there is not much difference between Hammanskraal and Sterkspruit with grade 5 and 4 respectively.

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Table 4.1: **Comparisons of sampled households across the study areas ito age, household size and education**

Characteristics	Hammanskraal	Sterkspruit	Ganyesa	Aggregate
N	50	70	30	150
Mean age	60.9	61.8	55.0	60.0
	12.54*	10.4*	10.0*	11.32*
				33 – 84#
% of females involved	18	24	17	20
Household size	5	6	67	0 – 14#
Education	5	4	8	0 – 13

*Standard deviation and #Range

When asked about employment, 47.33 per cent of the respondents included farming as part of their source of employment. The others indicated non-farming occupations as employment. The average years of experience of the respondents is 17 years and the farmers also confirmed that on average they spend 22 days of their time looking after cattle in a month.

Figure 4.1 shows that out of 150 small-scale cattle farmers interviewed only 13 per cent keeps farm records. Farm records are important for farm management/decision making, obtaining credit and for legal requirements such as income tax purposes. It is therefore disturbing to see the low level of recordkeeping in the surveyed areas, and clearly shows that interventions are needed in this regard.
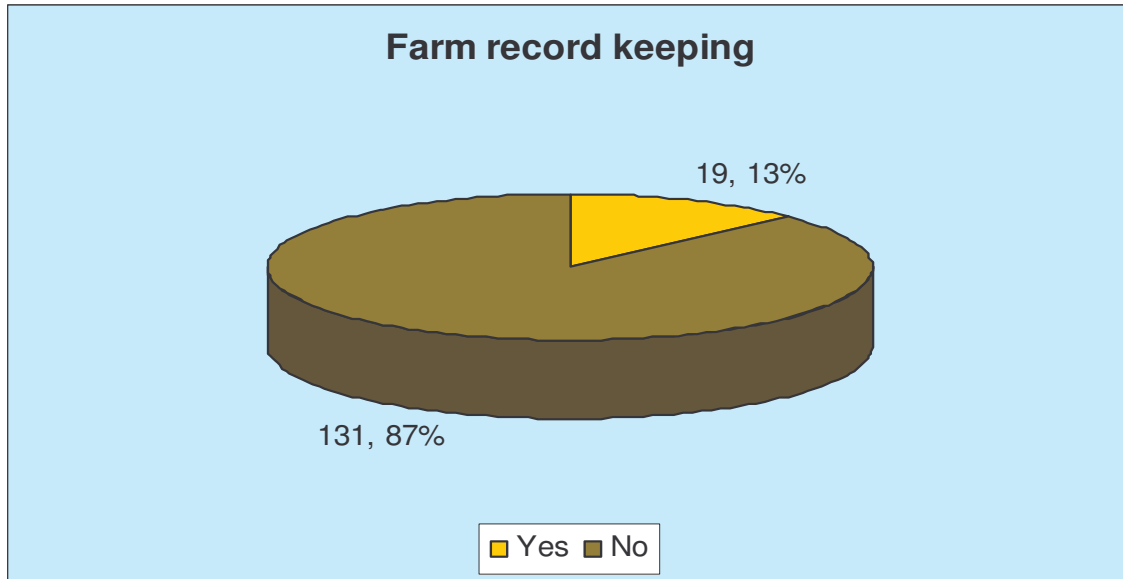
Figure 4.1:   Farm record keeping by small-scale cattle farmers

4.3   Land tenure system

Table 4.2 shows the land tenure system used by the respondents. Of the 150 households sampled, only 22 respondents' farm on leased or rented land while 128 farmers are on communal land. None of the farmers within the sample had ownership to the land. The minimum land size leased or rented is 30 hectares, with a maximum of 3000 hectares. In Table 4.2, the average land size of the 22 respondents who lease or rent land is 1393.77 hectares.

Table 4.2:   Land tenure system

Land tenure arrangements	% number of respondents	Minimum	Maximum	Average
Communal	128	N/A	N/A	N/A
Rent or Leased	22	30ha	3000ha	1393.77ha

N/A = Not Applicable

4.4   Herd size and composition

The herd size and structure are summarized in Table 4.3. The cattle herd of the surveyed households consists of calves at foot, heifers, cows, bulls and oxen. Amongst the cattle kept, the breeding females make up the largest proportion of the herd. An average of 30 breeding females is kept by a farmer in Ganyesa, while in Hammanskraal it is 10 and in Sterkspruit it is only 7 animals.   On average households in Ganyesa hold the largest number of cattle.

Table 4.3:   Average herd size and structure

Type of animal	Hammanskraal	Sterkspruit	Ganyesa	Aggregate
Calves at foot	8	5	28	11
Heifers	11	6	17	11
Cows	11	7	30	11
Bulls younger than 3 years	2	2	3	2
Bulls over 5 years	1	1	1	1
Steers/Oxen	7	6	8	7
Average number of cattle per farmer	35	20	84	38

4.5.   Cattle identification

Cattle identification is a legal requirement in South Africa. From Figure 4.2 it is clear that the majority of farmers do not comply to this legal requirement whether in the form of branding or ear tagging. Cattle of the majority of the respondents (143) were not branded, although all the respondents felt that branding was necessary. About 138 respondents did not use ear tags for livestock identification. This has a direct cost implication in terms of participation in the mainstream markets. The reason for farmers not branding their cattle might be

due to lack of branding equipments. Added to this, Coetzee *et al.,* (2004) gives the following reasons that are likely to cause reluctance to comply with identification standards:

➢ Firstly, farmers are reluctant to register a unique brand because of the costs (R100) of registration, as well as the costs of acquiring branding equipment. This state of affairs also causes problems when marketing animals.

➢ Secondly, stray animals on the roads cause accidents and loss of both animal and human lives. The owners of these animals are reluctant to register their stock in the event of legal claims being lodged against them.
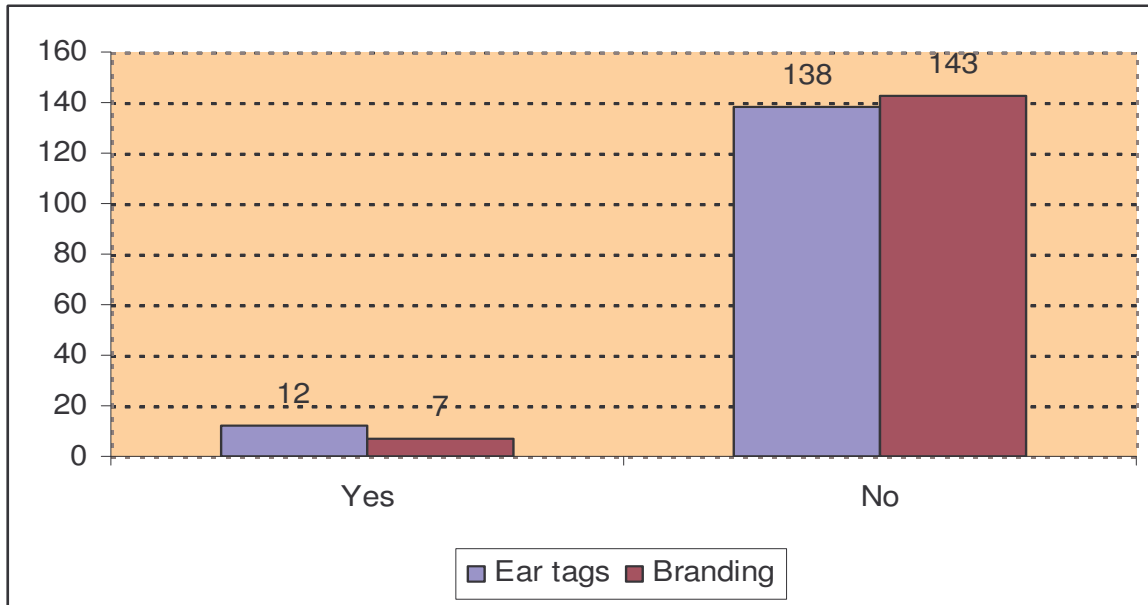
Figure 4.2: Cattle identification

4.6 Reasons for keeping cattle

In Table 4.4 different reasons for keeping cattle are presented and were treated separately from one another; only the highest percentage for the reasons was

selected. The main reason given for keeping cattle by the majority of the respondents (78%) was for sales. Consumption (70.7%) came out as the second and inheritance third (64%). Traditional slaughter (51%) was fourth. Savings, feasts and ceremonies as well as drought power were also mentioned as important although the percentage response was lower than 50 per cent.

Table 4.4:   Reasons for keeping cattle (General results)

	N	% number of respondents
Household Consumption	150	70.7
Ritual Slaughter	150	51.0
Sales	150	78.0
Savings	150	49.0
Feasts and Ceremonies	150	44.0
Draught power	150	49.0
Inheritance	150	64.0

Table 4.5 compares the different areas surveyed for the same variables. Table 4.5 shows that livestock sales in Ganyesa are the most important reason for keeping livestock, i.e. 93 per cent of the respondents gave it a rating of 4, followed by savings. In Sterkspruit household consumption is the most important reason for keeping livestock, i.e. 84 per cent of the respondents gave it a rating of 4, followed by livestock sales.   A similar observation is made in Hammanskraal.

An interesting observation is that respondents in Ganyesa and Hammanskraal do not regard cattle draught power as important for keeping cattle, while the opposite is true for Sterkspruit.   This may be indicative of the different characteristics of the environments that they farm in.

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Table 4.5:   Comparison of reasons for keeping cattle

	Hammanskraal	**Sterkspruit**	**Ganyesa**
Household Consumption	(4) 82%	(4) 84%	(1) 70%
Ritual Slaughter	(4) 56%	(4) 67%	(1) 87%
Sales	(4) 68%	(4) 77%	(4) 93%
Savings	(3) 32%	(4) 56%	(4) 77%
Feasts and Ceremonies	(4) 34%	(4) 69%	(1) 87%
Draught power	(1) 78%	(4) 57%	(1) 100%

- 4 = Very important
- 3 = Important
- 2 = Less Important
- 1 = Not important

4.7   Marketing of cattle by small-scale farmers

Table 4.6 shows the most frequently used marketing channels by the surveyed households. It is clear that marketing channels used differs greatly between the selected areas and is indicative that every area has its own needs as far as livestock marketing is concerned. In Hammanskraal and Sterkspruit the majority of farmers are selling their livestock through private sales, while in Ganyesa 46.7 per cent of the respondents are selling their cattle through auctions.

Table 4.6:   Use of different marketing channels

Marketing channel used	Hammanskraal		Sterkspruit		Ganyesa	
	Number	Percent	Number	Percent	Number	Percent
Speculators	N/A	N/A	7	10	2	6.7
Private sales	39	78	21	37.1	6	20
Butchers	N/A	N/A	1	1.4	N/A	N/A
Open Markets	N/A	N/A	4	5.7	2	6.7
Co-operatives	N/A	N/A	1	1.4	N/A	N/A
Abattoirs	2	4	1	1.4	1	3.3
Auction	4	8	5	7.1	14	46.7
Did not sell	5	10	30	35.9	5	16.6

4.8   Distance to the markets

The survey results in Table 4.7 indicate that the mean distance over which respondents sell cattle is 29.22, 5.21 and 45.73 km's for Hammanskraal, Sterkspruit and Ganyesa, respectively. Overall, respondents in Ganyesa travel the largest distances mainly because of active cattle markets in Mafikeng and Vryburg, as well as relatively good infrastructure available to move cattle to these markets.

Table 4.7:   Distance to the markets (both local and mainstream) - Km

Area	N	Min	Max	Mean	Std. Deviation
Hammaskraal	50	0	80	29	29
Sterkspruit	70	0	160	5	27
Ganyesa	30	0	250	46	52

4.9   Cattle off-take rates

Off-take rates refer to the number of animals marketed as percentage of animals kept. Table 4.8 shows that off-take rates in both Ganyesa and Hammanskraal are nearly double that in Sterkspruit with 12.05 per cent and 12.15 per cent respectively. The average off-take rate is 10.67 per cent.

Table 4.8:   Market off-take rates

Area	Percentage
Hammanskraal	12.15
Sterkspruit	6.29
Ganyesa	12.05
Average	10.67

4.10 Services required by farmers

When asked about the services required, 59 per cent indicated that animal health is the most required service, followed by information (see Figure 4.3). Dates on when auctions take place were regarded as important by more than 50% of the respondents.
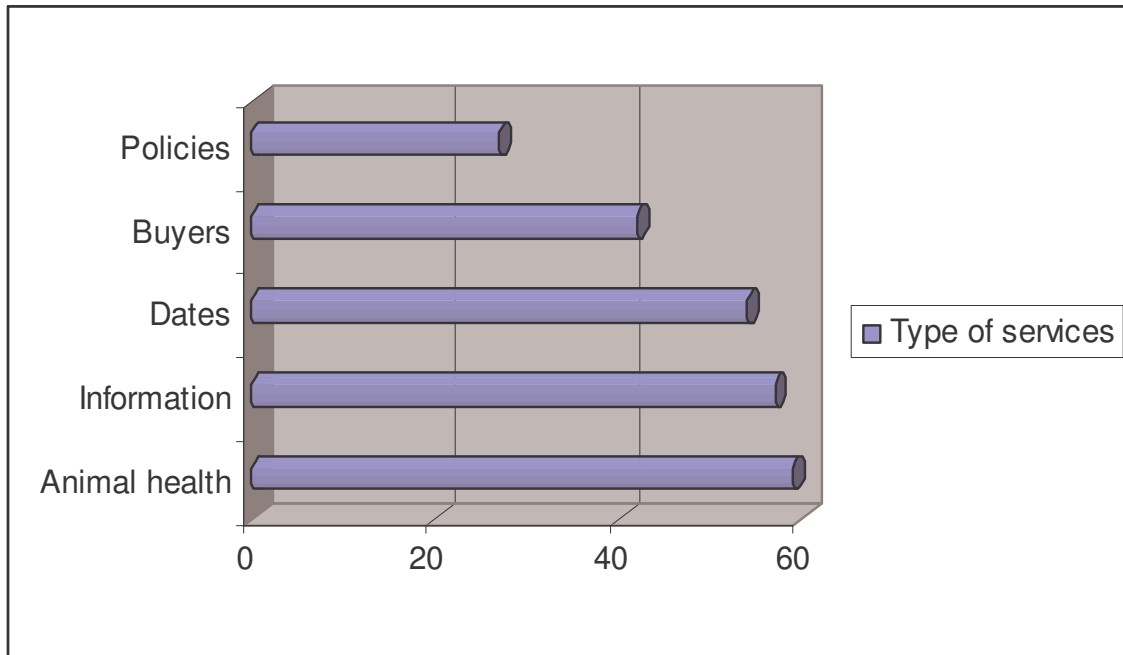
Figure 4.3: **Services required by respondents**

4.11 Summary

It is clear from Chapter 4 that small-scale cattle farmers in the surveyed areas are relatively old and farm mostly on communal land. The surveyed farmers also use different marketing channels that are probably attributable to their geographic location and relative location to vibrant commercial markets, e.g. Vryburg. Small-scale-farmers also have different reasons for keeping cattle, but an interesting observation is that a relatively large percentage keeps cattle for sales. Off-take rates are in general low if compared to those in the commercial sector.

CHAPTER 5

ANALYSIS OF FACTORS AFFECTING FARMER PARTICIPATION IN MAINSTREAM CATTLE MARKETS

"The whole of science is nothing more than a refinement of everyday thinking."

(Out of my later years, Ch.12, 1950).

5.1   Introduction

As mentioned the concern of this study is not about the number of cattle sold by the farmers surveyed. This study is concerned with the probability of small-scale cattle farmers to participate in the mainstream markets and also to measure the impact of a change in selected variables on the probability of participating in the mainstream cattle markets against a base group of households. According to Makhura (2001) a small number of small-scale farmers participate in the markets and this raises a major concern especially considering the argument by Bellemare and Barrett (2004) that if many households do not participate actively in markets or do not respond to market signals, market-based development strategies may fail to facilitate wealth creation and poverty reduction.

It is therefore vitally important to determine the factors that will have the largest potential to cause small-scale cattle farmers to participate more actively in mainstream cattle markets.

5.2.   Variables included in the study

From the discussions in Chapter 1 and 2 it is clear that participation of small-scale farmers in the mainstream cattle markets is not affected by a single factor.

This study identified 19 independent variables which are classified as categorical and continuous variables. The continuous variables take any numerical value in a real interval when measured accurately while categorical variables take a numerical value of one or zero. These are discussed below:

- **Farmer training** (TRAINING)

Farmer training refers to transferring knowledge and skills of cattle production, marketing, record keeping and general entrepreneurship. According to Coetzee *et al.,* (2004) training received by small-scale cattle farmers will improve their knowledge and understanding of livestock production and marketing, and thus will affect the level of off-take. It is hypothesized that small-scale cattle farmers who received training on production and marketing would be better able to network with buyers than those who did not receive any training, thereby increasing the sales of cattle. The categorical variable is a one for farmers with the aforementioned abilities ($X_i=1$) and zero if otherwise ($X_i=0$).

- **Total herd size** (TTHERD)

Total herd is a continuous variable that reflects the number of cattle owned by the small-scale cattle farmer. Total herd size has a direct influence on the participation of small-scale cattle farmers in the mainstream cattle markets. According to Fidzani (1993), large herds generate a higher marketable surplus than small herds. It is therefore expected that the larger the herd the higher will be the participation of small-scale cattle farmers in the mainstream cattle markets.

- **Market information** (MARKINFO)

Having access to usable information can have a significant impact on the ability of small-scale farmers to generate sustainable profits (Frick, 1999; Russell, 1983; Craig, 1979). Coetzee *et al.,* (2004) further stresses that the provision of market information will strengthen farmers' negotiating ability during transactions with buyers and consequently prevent possible exploitation by better informed buyers. It is hypothesized that increased access by households to suitable information would increase the sales of cattle. Market information is included as a dummy that reflects whether farmers have access to information or not.

- **Farming system** (FARMSYS)

Farming systems is a dummy that reflects the variation in production systems between areas (i.e. whether they produce cattle only or both cattle and crops). It is expected that households farming with cattle only are more likely to participate in the mainstream markets than those households that farm with crops and cattle. The reason for this hypothesis is that households that only farm with cattle can participate actively to increase their income, i.e. when cash is needed they are forced to sell cattle, whereas farmers farming with crops and cattle can also sell the crops to get cash. Coding for dual production is zero ($X_i=0$) and cattle production only takes the form of one ($X_i=1$).

- **Market distance** (DEMARDIS)

According to Matungul, Ortmann and Lyne (Online) distance has a major influence on transaction costs. According to Ouma *et al.*, (2003), the impact of distance which requires transport of cattle to markets results in imperfect and inefficient integrated markets and also reduces producer's profit margin as it

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results in high transaction costs. Makhura (2001) also confirms the latter. In the context of this study, market distance between small-scale cattle farmers and the mainstream markets is fixed, hence respondents were asked to indicate at what distance they would be able to participate in mainstream cattle markets. This captures, among others, their ability to move cattle from the production area to the mainstream cattle markets, as well as their ability to absorb transaction costs to move cattle. For example, a farmer not having access to transport infrastructure would indicate that buyers should preferably come to the farm. It is hypothesized that the closer a household is to the mainstream markets, the higher the tendency of small-scale cattle farmers to sell their cattle in the mainstream cattle markets. Distance is a continuous variable.

- **Remmittance** (REMITTANC)

Remittance is coded as a categorical variable. Coding for non receivers of remittances is zero ($Xi=0$) and receivers of remittance takes the form of one ($Xi=1$). According to Fidzani (1993), in the absence of any remittances, dependency forces the farmer to sell more of their cattle to meet their household needs. It is hypothesized that households receiving remittances would have a lower probability to sell cattle in mainstream cattle markets.

- **Lobola** (LOBOLA)

According to Fidzani (1993) the transaction of cattle for non-sale purpose has the effect of reducing the herd size and therefore translates into a reduced marketable surplus. It is hypothesized that the higher the rate of lobola the lower will be the participation of small-scale cattle farmers in the mainstream cattle markets.

- **Mortality** (MORTALITY)

Mortality translates into small herds from which fewer animals would be available for sales. It is hypothesized that the higher the rate of mortality the lower will be the participation of small–scale cattle farmers in the mainstream cattle markets. Mortality is measured as a continuous variable.

- **Stock theft** (STKTHEFT)

As in the case of mortality, stock theft reduces the number of animals available for sale. It is hypothesized that the higher the rate of cattle theft the lower will be participation in the mainstream cattle markets. Stock theft is coded as a continuous variable.

- **Drought risk** (DRORISK)

Drought risk refers to the possibility of a danger which might affect grazing, water and other related resources due to the absence of rainfall. High drought risk is defined by very low rainfall and the lack of natural grazing which leads to the use of alternative methods of feeding cattle during drought times. According to Barrett, Osterloh, Little and McPeak (2004), drought stimulates off-take by small-scale cattle farmers, especially in times of stress. It is hypothesized that an increase in risk will lead to increased participation in the mainstream cattle markets by small-scale cattle farmers. Households who reported that they are exposed to high risk take the value of one ($X_i=1$) and those who reported that they experienced low drought risk take the value zero ($X_i=0$).

- **Births** (BIRTHS)

Births refer to the natural increase of cattle. Changes taking place in the herd through births directly determine the availability of a marketable surplus (Fidzani, 1993). It is hypothesized that as more calves are born, the bigger the herd size will be and more marketable surplus will be available and thereby increase participation. Birth is coded in a continuous form.

- **Extension service** (EXTSERVE)

The provision of extension services to the farmers directly affects their knowledge, productivity and income. It is hypothesized that the more services are provided to the farmers the more they will participate in the mainstream markets.

- **Membership (**MEMBESHP**)**

Membership to a commodity association is coded as a categorical variable. Commodity associations are centers where information can be accessed by farmers, especially signed up members and individuals are motivated to participate in a collective action. It is therefore expected that membership to commodity association will increase participation of small-scale cattle farmers in the mainstream cattle markets.

- **Household size and number of dependents** (HHSIZE and DEPENUM)

According to Ellis (1993), a household is a useful unit of analysis given the assumptions that within the household resources are pooled, income is shared,

and decisions are made jointly by responsible household members. Households are therefore often associated with the farm as a production enterprise (Ellis, 1993). An increase in both household size and dependents can influence participation of farmers in the mainstream markets in two ways. Firstly, if the household practices are mostly traditional, the number of sons will obviously have a negative effect on the saleable cattle. Secondly, the increased demand for market goods will increase participation of the farmers in the mainstream cattle markets (Fidzani, 1993). It is therefore expected that the larger the dependency ratio the higher will be the participation of small-scale cattle farmers in the mainstream cattle markets. Household size and dependents were coded as continuous variables.

- **Income** (INCOME)

Level of income is coded as a continuous variable. This variable is relevant to the extent to which cattle will be sold in any given household. It is expected that the higher the level of income the more likely the farmer is to participate in the mainstream cattle markets.

- **Extension visits** (EXTVISIT)

Extension visits is a continuous variable that reflects the number of times that the extension service providers have visited the surveyed households. There is a difference between this variable and extension services in the sense that extension visit might not necessarily mean provision of services (some of the visits might be educational and helpful while the opposite is true, but the essence of this variable is mainly based on the frequency of the visits made by an extension officer). The assumption is that an extension officer would not frequently visit the same farmer without at least sharing some useful information.

Makhura (2001), Wheeler and Ortmann (1990) and Coetzee *et al.,* (2004) mention that interaction with extension officers tend to, amongst other things, improve farmers' access to information and technical farming skills. It is hypothesized that the more visits the extension service provider pays to the farmers, the more likely it is that the farmer would sell his/her cattle. This variable is measured by the number of extension visits that the small-scale cattle farmers received in a year at the farm or at the sales pen.

- **Land tenure** (LATENURE)

Land tenure in this study corresponds with whether the small-scale cattle farmer owns the land or not. The relationship between marketing of cattle and land tenure systems in South Africa is complex and multi-dimensional. According to Roth and Haase (2000), the theoretical model relating tenure security to agricultural performance indicates the following:

- An enhancement in tenure security would increase farmers' demand for medium- to long term land improvements;
- Greater tenure security would increase the likelihood that the operator will capture the returns from investments;
- Increased tenure security would reduce the incidence of disputes, freeing up resources, which would otherwise have been used for litigation;
- Demand for complementary short-term inputs (farm chemicals, labor) will increase as a result of enhanced tenure security or derived from land improvements (e.g., higher water retention from construction of ridges increases fertilizer profitability); and
- Assuming the existence of viable technologies, access to inputs and extension advice, participation of young people in agriculture and the

availability of household labor and financial resources, enhanced tenure security will lead to higher investment and hence higher yields.

Households reported to be farming on communal lands are considered as communal (Xi=0) and those who are not on communal land are non-communal (Xi=1). It is hypothesized that well arranged tenure is likely to improve productivity thereby increasing cattle sales.

5.3 Model specification

Before the logistic regression model is applied, the correlation coefficient matrix of independent variables must be computed (see Appendix 2). Multicollinearity was identified from equation 6 in Chapter 3. Multicollinearity may cause lack of significance of individual independent variables while the overall model may be strongly significant. It may also result in wrong signs and magnitudes of regression coefficient estimates, and consequently in incorrect conclusions about relationships between independent variables.

According to Leedy (1994), a common solution for multicollinearity has been to delete one or more of the offending variables or to use Factor or Principal Component Analysis (PCA).

In this study a principal component regression (PCR) is considered relevant for dealing with the problem of multicollinearity. However, it must be noted that PCR is an extension of PCA and it has been widely used to deal with the problem of multicollinearity. PCR solves the inverse matrix problem and has the ability to lessen principal components so as to reduce errors in the model.

This process involves calculating eigenvalues $\lambda_1, \lambda_2, ... \lambda_K$ from the correlation coefficient matrix, C, by solving the equation $|C - \lambda I| = 0$. The matrix of eigenvectors is thus given by the matrix V in equation 8.

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

The matrix is orthogonal because its columns satisfy the conditions *v'ⱼvⱼ = 1 and v'ⱼvᵢ = 0, ⱼ≠ᵢ*

The principal components analysis compresses the individual variables into new variables called principal components by reducing the number of dimensions without much loss of information. The principal component matrix Z (equation 9) contains exactly the same information as the original dataset (X^s), except that the data are arranged into a set of new variables which are completely uncorrelated with one another and which can be ordered or ranked with respect to the magnitude of their eigenvalues (Draper and Smith, 1981; Myers, 1986). Principal components, **z$_{ij}$** are computed as:

$$Z = X^S V \quad ....(9)$$

Equation 9 may be written in matrix notation as shown below. Note that VV' is equal to identify matrix I$_n$.

$$
\begin{bmatrix}
z_{11} & z_{12} & \cdot & \cdot & \cdot & z_{1k} \\
z_{21} & z_{22} & \cdot & \cdot & \cdot & z_{2k} \\
.. & & & & & \\
.. & & & & & \\
.. & & & & & \\
z_{n1} & z_{k2} & \cdot & \cdot & \cdot & z_{nk}
\end{bmatrix}
=
\begin{bmatrix}
x_{11}^s & x_{12}^s & \cdot & \cdot & \cdot & x_{k1}^s \\
x_{21}^s & x_{22}^s & \cdot & \cdot & \cdot & x_{k2}^s \\
\cdot & \cdot & & & & \cdot \\
\cdot & \cdot & & & & \cdot \\
\cdot & \cdot & & & & \cdot \\
x_{n1}^s & x_{n2}^s & \cdot & \cdot & \cdot & x_{nn}^s
\end{bmatrix}
\begin{bmatrix}
v_{11} & v_{12} & \cdot & \cdot & \cdot & v_{1k} \\
v_{21} & v_{22} & \cdot & \cdot & \cdot & v_{2k} \\
\cdot & \cdot & & & & \cdot \\
\cdot & \cdot & & & & \cdot \\
\cdot & \cdot & & & & \cdot \\
v_{k1} & v_{k2} & \cdot & \cdot & \cdot & v_{kk}
\end{bmatrix}
$$

Where X^s is n X k matrix of standardized variables; V is eigenvector matrix as defined in equation 8. The subscript i in Z_{ij} represents household number and j represents principal component corresponding to the jth eigenvalue.

The first principal component may be computed as:

$$z_{11} = v_{11}x_{11}^s \quad + \quad v_{21}x_{21}^s \quad + \quad ... \quad + \quad v_{k1}x_{k1}^s$$

Where Z_{11} denotes the first principal component, $v_{11}, v_{21}, ... v_{k1}$ are eigenvectors or coefficients calculated so that Z_{11} makes the greatest contribution to the variance as contained in the k number of the original variables (the first principal component is the combination of variables that explains the greatest amount of variation). There can be as many possible principal components as there are variables. The first element of the last principal component is computed as:

$$z_{1k} \quad = v_{1k}x_{11}^s \quad + \quad v_{2k}x_{21}^s \quad +... \quad + \quad v_{kk}x_{k1}^s$$

It can be seen from equation 9 that 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. An elimination of one or more principal components associated with the smallest eigenvalues reduces the total variance in the model and thus produce an appreciably improved diagnostic or prediction model (Draper and Smith, 1981; Myers, 1986). A number of criteria

are available to decide on the number of principal components to be retained. These include (i) discarding the component associated with the smallest eigenvalue, applying the rule that only principal components associated with eigenvalues greater than 1 are of interest, (ii) using the selection rule that keeps the first principal components whose combined eigenvalue product is greater than 1 and (iii) treating the principal component reduction as if it were a standard variable screening problem. In this study, the criterion of eigenvalue (>1) will be applied. This is believed to decrease the number of principal components to be retained from k to *l*.

After the principal components (PC) are calculated and PCs with the smallest eigenvalues are eliminated, PCR was fitted using the standardized variables[2] to improve the estimation and prediction power of the logistic regression model.

$$Ln\left(\frac{\phi}{1-\phi}\right) = \beta_o^s + X\beta^s + \varepsilon^{\circ\circ} \quad \text{...} \quad (10)$$

Equation 10 can be written in terms of eigenvectors as

$$Ln\left(\frac{\phi}{1-\phi}\right) = \beta_o^s + X^s VV'\beta^s + \varepsilon^{\circ\circ} \quad \text{...} \quad (11)$$

Equation 11 can be rewritten in terms of the retained principal components as shown below.

$$Ln\left(\frac{\phi}{1-\phi}\right) = \beta_o^s + Z\alpha + \varepsilon^{\circ\circ} \quad \text{..} \quad (12)$$

---

[2] The independent variables were standardized as $(x_i - \bar{x_i})/s_{x_i}$

Where $Z = X^S V$ and $\alpha = V'\beta^s$. Z is an n X ℓ matrix of retained principal components, V is a k X ℓ matrix of the eigenvectors corresponding to the ℓ components, α is ℓ x ℓ vector of coefficients associated with the ℓ components.

According to Fekedulegn, Colbert, Hicks and Schuker (2002), the standard errors of the estimated coefficients α may be represented by an ℓ x 1 vector:

$$Var(\hat{\alpha}) = \hat{\sigma}^2 (Z'Z)^{-1} = \hat{\sigma}^2 \, diag(\lambda_1^{-1}, \lambda_2^{-1}, ... \lambda_l^{-1})$$

Where $\hat{\sigma}^2$ is variance of residuals from equation 12. Therefore standard error of α is given by:

$$k^s = \left(s.e._{\hat{\alpha}_1} \, s.e._{\hat{\alpha}_2} ... s.e._{\hat{\alpha}_1}\right)' \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(13)$$

Results obtained using equation 12 can be transformed back to the principal component estimators of standardized variables as follows:

$$\begin{bmatrix} \beta_{1,pc}^s \\ \beta_{2,pc}^s \\ . \\ . \\ . \\ . \\ \beta_{k,pc}^s \end{bmatrix} = \begin{bmatrix} v_{11} & v_{12} & . & . & . & v_{1l} \\ v_{21} & v_{22} & . & . & . & v_{2l} \\ . & & & & & . \\ . & & & & & . \\ . & & & & & . \\ . & & & & & . \\ v_{k1} & v_{k2} & . & . & . & v_{kl} \end{bmatrix} \times \begin{bmatrix} \hat{\alpha}_1 \\ \hat{\alpha}_2 \\ . \\ . \\ . \\ \hat{\alpha}_l \end{bmatrix} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(14)$$

The constant $\beta_{0,pc}^s = \bar{y}$. The standardized coefficients evaluate the relative importance of the explanatory variables in determining the probability of participation by small-scale cattle farmers in the mainstream cattle markets. The

appropriate transformation of the coefficients back to the original or unstandardized variables is done by:

$$\beta_{j,pc} = \frac{\beta^s_{j,pc}}{S_{xj}}, \; j = 1,2,\ldots,k \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(15)$$

and

$$\beta_{o,pc} = \beta^s_{o,pc} - \frac{\beta^s_{1,pc}\overline{x}_1}{S_{xj}} - \frac{\beta^s_{2,pc}\overline{x}_2}{S_{xj}} - \ldots - \frac{\beta^s_{k,pc}\overline{x}_k}{S_{xk}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(16)$$

where S_{xj} is the standard deviation of the jth original variable X_j and $\beta^s_{o,pc}$, $\beta^s_{1,pc}$ pc, $\beta^s_{2,pc}$, $\beta^s_{k,pc}$ are coefficients of the standardized variables.

Variance of the principal component estimators in standardized variables is given by:

$$Var\left(\beta^s_{pc}\right) = \Psi^s_\ell K^S \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(17)$$

Where Ψ^s_l contains the squares of the elements of V^s_l in equation 8, and K^s contains the squares of the elements of K^s in equation 13. The corresponding standard errors for the estimators of principal components of standardized variables are given by:

$$s.e.\left(\beta^s_{pc}\right) = \left[Var\left(\beta^s_{pc}\right)\right]^{\frac{1}{2}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(18)$$

The standard error of the principal component estimator associated with the jth original variable is

$$s.e.\left(\beta_{j,pc}\right) = \frac{s.e.\left(\beta_{j,pc}^{s}\right)}{S_{x_{j}}}$$

The "partial" effects of the continuous individual variables on household participation can be calculated by the expression:

$$\frac{\partial \phi_{i}}{\partial x_{ij}} = \phi_{i}(1 - \phi_{i})\beta_{j} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(19)$$

The" partial" effects of the discrete variables are calculated by taking the difference of the probabilities estimated when value of the variable is set to 1 and 0 ($x_{i} = 0, x_{i} = 1$), respectively. Finally simulations were done to determine the impact of individual variables on the probability of participating in the mainstream cattle markets.

5.4   Results and discussions

5.4.1 Procedures

The National Council of Statistics Software (NCSS) 2000 was employed to run the model described and tests were performed in order to ensure that the use of PCA is statistically justifiable.

The Gleason-Staelin redundancy measure test (phi) indicated that the independent variables are interrelated at 0.1922. A zero value indicates no correlation and perfect correlation is shown by 1. Bartlett's sphericity test was used to test the null hypothesis that all correlations are zero; if a probability value is greater than 0.05 then PCA should be aborted. The results of the Bartlett's

sphericity test had a value close to zero (0.0000). The tests suggested that PCA can be used. Outliers were identified using the values of T2 that are significant at 5%. The elimination of outliers reduced the number of observation to 134.

Seven principal components were selected using the criterion of eigenvalue (>1). These components appeared both statistically and logically reasonable (See Appendix 3 for PC's). Table 5.1 presents the retained principal components. The first principal component, PC_1, explained 18.47 per cent of the total variability in the sample and represents productivity and information for farming households. PC_2 accounts for 12.06 per cent of the variability and represents association while PC_3 through to PC_7 contribute 9.71 per cent through to 5.78 per cent. The principal components explained 67.22 per cent of the variance and this is significantly higher than the cutoff percentage of 50 per cent which then gives a positive verdict to accept the results of the PCA.

Table 5.1: Principal components retained and percentage of variance explained

Principal Components	Eigenvalues	Individual percent	Cumulative percent
PC_1 - **Productivity**	3.5100	18.47	18.47
PC_2 - **Association**	2.2910	12.06	30.53
PC_3 - **Demographic**	1.8447	9.71	40.24
PC_4 - **Market support**	1.5116	7.96	48.2
PC_5 - **Land tenure**	1.3582	7.15	55.35
PC_6 - **Support services**	1.1569	6.09	61.44
PC_7 – **Attrition**	1.0988	5.78	67.22

5.4.2 Results of the principal component regression (PCR)

This section presents the results of the estimated logistic regression model within the principal component regression framework. The results of the unstandardised and standardised regression coefficients are presented in Table 5.2. In this section only the significant variables are discussed and to what extend they conform with *a priori* expectations. The interpretation of the results focus on the unstandardised coefficients.

Table 5.2: Unstandardized and standardized logistic regression results

Variables	Unstandardized coefficients	Standard Error	T – ratio	Standardized coefficients	Standard Error	T – ratio	Standard Deviation	Mean
CONSTANT	-3.16361			0				
TRAINING	2.2789***	0.4493	5.0717	0.9300	0.1834	5.0717	0.4081	0.2090
TTHERD	0.0079**	0.0044	1.7985	0.2909	0.1617	1.7985	36.9089	32.9030
MARKINFO	0.8908**	0.4010	2.2216	0.3483	0.1568	2.2216	0.3910	0.1866
FARMSYS	0.3426*	0.2134	1.6059	0.1649	0.1027	1.6059	0.4813	0.3582
DMARDIS	0.0274***	0.0046	5.9201	1.3009	0.2197	5.9201	47.5437	39.4701
REMITTA	0.9862***	0.3261	3.0242	0.3453	0.1142	3.0242	0.3501	0.1418
LOBOLA	0.8261***	0.1546	5.3443	1.2433	0.2326	5.3443	1.5050	1.4552
MORTALITY	0.5085***	0.0913	5.5713	1.1150	0.2001	5.5713	2.1925	1.4627
THEFT	0.3723***	0.1422	2.6170	0.5196	0.1985	2.6170	1.3957	0.6343
DRORISK	0.1539	0.3031	0.5076	0.0712	0.1402	0.5076	0.4625	0.6940
BIRTHS	0.0063	0.0105	0.5959	0.0932	0.1563	0.5959	14.8414	11.9403
EXTSERVE	-0.1758	0.3063	-0.5739	-0.0829	0.1444	-0.5739	0.4714	0.3284
MEMBER	-1.3182***	0.3396	-3.8818	-0.4512	0.1162	-3.8818	0.3423	0.8657
HHSIZE	0.1090***	0.0387	2.8190	0.3275	0.1162	2.8190	3.0039	5.7910
DEPENDEN	0.1300***	0.0504	2.5815	0.3688	0.1429	2.5815	2.8362	4.2612
INCOME	0.0117	0.1942	0.0604	0.0088	0.1462	0.0604	0.7528	2.4701
HHASSIS	-0.0997***	0.0430	-2.3184	-0.2885	0.1244	-2.3184	2.8947	5.5896
EXTVISIT	-0.0339	0.0498	-0.6814	-0.1279	0.1876	-0.6814	3.7689	4.7164
TENURE	-0.4517	0.4850	-0.9313	-0.1429	0.1535	-0.9313	0.3165	0.1119

The * represents the significance level:

1%=***; 5% = ** and 10% = *

Farmer training:

Keeping everything else constant, farmer training increased the participation of small-scale cattle farmers in the mainstream cattle markets. The positive relationship was expected since marketing through the mainstream cattle markets requires knowledge in terms of product specification, price determination and timing. In addition, the descriptive results in chapter 4 indicated that 87 per cent of the respondents did not keep farm records, implying that their business management skills are poor. This suggests that training in marketing should be conducted together with business management which entails aspects such as record keeping, developing basic financial statements and debt management. At this stage it is not clear as to what is the impact of a change in the level of training as a categorical variable on the probability of participating in the mainstream cattle markets.

Total herd size:

Results show that a unit increase in the herd size will increase participation of small-scale cattle farmers in the mainstream cattle markets. Herd size exerts a positive effect on the market participation variable; this is similar to the findings by Bellemare and Barrett (2004) in Kenya and Nkhori (2004) in Botswana. Chapter 4 showed that the average total herd size for the small-scale cattle farmers is 38 units while on the other hand the market off-take is found to be 10.67 per cent. With the market off-take of 10.67 it means the small-scale cattle farmers will on average sell 4 cattle which sum up to 600 cattle per annum when using the sample size of 150. It should be noted that the commercial market off-take for cattle is 25 per cent and therefore this pose a challenge as to how the situation within the small-scale sector could be converted into an opportunity.

Market information:

As expected, access to market information, and the use thereof, results in increased participation of small-scale cattle farmers in the mainstream cattle markets. The results are consistent with the findings by Nkhori (2004). Cognizance should be taken that at this stage the results are not indicating the impact of change when market information is supplied either to receivers or non-receivers.

Farming system:

The results indicate that there is a significant and positive relationship between farming systems and participation in the mainstream cattle markets. The positive relationship was expected since households which farm with cattle only were expected to participate more actively to increase their income.

Market distance:

The results suggest that market distances have a positive effect on participation of small-scale cattle farmers in the mainstream cattle markets. Note should be taken that the condition for increased participation is when the real distance to the markets is reduced by bringing buyers closer to the small-scale cattle farmers, i.e. visits by speculators with the necessary transport to move animals or having auctions in or very close to were production occurs.

Remittance:

This variable has shown a positive impact on participation of small-scale cattle farmers in the mainstream cattle markets; this is not as expected. The reason for

the unexpected results could firstly be due to the fact that households use their remittances for purchasing production inputs which eventually translates into increased marketable surplus, thereby increasing cattle sales. Secondly, remittances may not be enough to sustain livelihoods and thirdly it does not necessarily cover occasional costs such as those associated with sending children to school. Nevertheless, the impact of remittances on rural households, and particularly the livestock sector needs to be investigated further..

Lobola:

The results indicate that there is a significant and positive relationship between lobola and participation in the mainstream cattle markets; as with remittances this is not in line with what was expected. This could be due to the fact that lobola is not strictly paid in terms of cattle, i.e. cattle can be converted into cash. The tradition of lobola is still widely practiced, but in cases where the "to be married couple" reside in urban areas where they cannot keep cattle, cash is preferred.

Mortality:

The propensity to participate within the mainstream cattle markets increase with an increase in mortality, *ceteris peribus*. This again is not as expected. This result needs to be interpreted with the necessary caution. This result suggests that since mortality is a source of risk, it will stimulate farmers to participate in mainstream markets as a mechanism to avoid further losses, i.e. in the absence of the ability to combat mortality at a certain threshold level of animals farmers will market any animals above this threshold to avoid the risk of losing such animals due to mortality. The ability to combat mortality could be a function of managerial skills, access to veterinary services and medicines, but this was not investigated in this study.

A study conducted by the Independent Development Trust (2005) in the Eastern Cape Province (Nyandeni and Port St Johns Local Municipalities) indicated that mortality remains the single major cause of herd off-take, accounting for almost 20 per cent. This will obviously push small-scale farmers to sell a portion of their herds as a way of averting risk. Since the demand of cattle by the informal market (private sales) depends on ceremonies, emergencies and traditional activities, it make sense that when farmers dispose their animals as a way of averting risk they might go beyond the informal markets as its demand pattern is not reliable or consistent. Of course, this type of participation is not sustainable and it implies that mortality should be mitigated by implementing pro-active strategies such as para-veterinary programmes in rural areas.

Theft:

As is the case with the former three variables the results pertaining to theft are not as expected, and hence the result needs to be interpreted with the necessary caution. Theft is also a source of risk and hence it could stimulate small-scale cattle farmers to participate more in the mainstream cattle markets as a mechanism of avoiding losses, i.e. similar to the case of mortality farmers may choose rather to market animals that exceed a certain threshold of animals that exceeds their ability to avoid theft of such animals due to limited resources to protect larger number of animals.

Selling of animals to avoid financial losses due to theft is not a new phenomenon in South Africa. Theft was, for example, one of the main reasons for the liquidation of the sheep herds in large parts of the Eastern Cape and Eastern Free Sate in the 1990's (CIAMD, 2002).

The implication of this state of affairs is that the occurrence of theft inhibits the ability of farmers to expand herds to economically viable herd sizes. This in turn

reduces the potential for increased off-take in the long run, i.e. off-take numbers will remain low and hence reduce potential benefits from increased participation in markets. The impact of stock theft on farming dynamics and livestock development programmes needs further investigation to get a better picture of its micro, meso and macro impacts.

Household size:

The results show that larger households are more inclined to participate in the mainstream cattle markets. Similar results were found by Ouma *et al.,* (2003) in Kenya. This was expected since a bigger household size translates into an increased demand for market goods which will increase participation of the small-scale cattle farmers in the mainstream cattle markets (Fidzani, 1993). This does not mean that larger households should be promoted, but rather that any initiatives to increase participation in mainstream markets should be targeted at larger households initially. In addition, since the larger households will be more inclined to sell animals in mainstream markets these households should be targeted first for training, market information, etc.

Variables including drought risk, extension visit, extension service, income level, birth and land tenure did not show any significant impact on market participation. Household assistance and membership of a commodity association were found to have a significant but negative relationship with participation by the small-scale farmers in the mainstream cattle markets. The reason for a negative sign, specifically for the membership variable could be due to the fact that the majority of the small-scale cattle farmers did not affiliate to any commodity association at the time of the interview.

5.4.3 Partial effects

The impact of changes in statistically significant variables on the probability of participating in mainstream markets was determined by means of the partial effects of the respective independent variables on conditional probabilities. Table 5.3 shows partial effects of the continuous variables.

Table 5.3:   Partial effects for the significant continuous variables

Determinants	Partial effects
TOTAL HERD	0.001664
DESIRED MARKET DISTANCE	0.005777
HOUSEHOLD SIZE	0.023019
LOBOLA	0.174424
DEPENDENTS	0.027457
THEFT	0.078598
HOUSEHOLD ASSISTANCE	-0.02104
MORTALITY	0.1074

Total herd size: Total herd size has a positive and significant relationship with the probability of participating in the mainstream markets, i.e. the probability of participating increases with an increase in the herd size. The partial effect of a unit increase in the herd size on the conditional probability for participation in the mainstream markets is 0.001664. Thus, a unit increase in the herd size will increase the probability to sell cattle by 0.001664.

Market distance: Desired market distance is positive and significantly related to the probability of participating in the mainstream cattle markets. The partial effect of the desired market distance on the conditional probability for participation is 0.005777, i.e. each unit that the desired market distance improves will increase the probability of participation by 0.005777. Logically it makes sense since the mainstream markets are not readily available in rural areas. Thus, the results suggest that those households which can "reach" the desired

marketing distance are more likely to participate mainly due to high producer margin and low variable transaction cost. Clearly, this presents a challenge since households cannot merely be re-allocated to areas close to markets, and even if this was possible, it would not guarantee higher sales due to other impediments also discussed in this study. An option in this regard is getting buyers (speculators or auctioneers) to visit production areas more regularly and/or to have more regular auctions in such areas. Note should be taken of problems associated with these two options as discussed by Coetzee *et al.*, (2004). Furthermore, cognisance should be taken that commercial farmers' that are the same distances from markets do participate on a regular basis. In this regard the differences in transaction costs to sell cattle over long distances may enlighten the issue and needs further investigation. Transaction costs include, amongst other things, availability of loading facilities, the number of animals marketed that impacts on the per unit cost to move one animal from one location to another, etc.

Household size: The partial effect of a unit increase in the household size on the conditional probability of participating in the mainstream markets is 0.023019. This means that an additional household member will increase the probability that the farmer will sell cattle by 0.023019. In other words, in the absence of other income additional household members will force small-scale farmers to market more animals to sustain current livelihoods. This holds serious implications for households since it will inhibit their ability to increase herd size to a more economically viable size from which they could extract economic benefits. Furthermore, one could realistically expect that to avoid complete liquidation of the household herd that livelihoods will be affected negatively with additional household members.

Mortality: Mortality was found to have a positive relationship with participation in the mainstream cattle markets. The partial effect of a unit increase in the

mortality on the conditional probability for participation in the mainstream markets is 0.1074. This result provides insight into the propensity of small-scale cattle producers to avoid financial risk due to mortality. It furthermore holds serious implications for the development of this sub-sector in that small-scale producers will rather sell animals to avoid mortality risks than build their herd to more a economically viable size, which in the long run could translate into overall increased off-take. Clearly much can be done to provide services in this regard. Such services can be provided by government veterinary officers and the private sector (feedlots). The small-scale cattle sector has the potential to become a large source of animals for the feedlot sector, but feedlots should then be willing to invest in this sector; combating mortality and improving the health status of animals in the small-scale cattle sector is one option for such investment. The economic viability and potential economic returns to both small-scale cattle producers and feedlots need to be investigated further.

Theft: The partial effect of a unit increase in stock theft on the conditional probability of participating in the mainstream markets is 0.078598. As in the case of mortality this result should be interpreted as the small-scale cattle farmer's inclination to avoid risk; in this case risk associated with stock theft. In the absence of other economically viable farming options (non-livestock), or limitations thereof, stock theft will remain an impediment to further develop the small-scale cattle sector.

Other variables such as household assistance, dependents and lobola also have an impact on the participation of small-scale cattle farmers in the mainstream cattle markets and their magnitude and direction are presented in Table 5.3 above.

Table 5.4 shows the partial effects of the categorical variables, i.e. the change in the probability of participating in the mainstream markets when $X_i = 0$ and $X_i = 1$.

Table 5.4:   Partial effects for the significant discrete variables

Determinants	Probabilities	Change in probabilities

Market information (%)
  • Non-receivers
  • Receivers
	
	0.2093
	0.5129
		
		0.3037

Remittance (%)
  • Receivers
  • Non-receivers
	
	0.1945
	0.3037
		
		0.3269

Training (%)
  • Not trained
  • Well trained
	
	0.0685
	0.6692
		
		0.6007

Farming systems (%)
  • Dual
  • Only cattle
	
	0.1171
	0.5868
		
		0.4696

Market information: Keeping all other variables constant, market information is positively and significantly related to the probability of participating in the mainstream cattle markets, i.e. receivers of market information are likely to sell more cattle than non-receivers. The results indicate that a unit increase in receiving market information defined by the shift from non receivers (Xi=0) to receivers (Xi=1) increases the probability of participation in the mainstream cattle markets from ϕ_i = 0.2093 to ϕ_i = 0.5129.

Training: The results indicate that the probability of participating increases with the level of training received. A unit change in the level of training increases the probability of participating by 0.6007. The implication of this is that efforts to mainstream this sector should put a high priority on training related to general management of livestock and marketing.

Farming system: A household only farming with cattle is likely to participate more than households that have a dual farming system (cattle and crops). A unit change defined by the shift from a household producing both cattle and crops to a

household producing only cattle increases the probability of participation in the mainstream cattle markets from ϕi = 0.3234 to ϕi = 0.4584.

Remittance: A small-scale cattle farmer who receives remittance is likely to participate more than the small-scale cattle farmer who relies on his/her own income source. A unit change defined by the shift from not receiving to receiving remittances increases the probability of participation from ϕi = 0.1945 to ϕi = 0.3037.

5.4.4 Simulation

In this section the impact of changes in selected variables on the probability of participating in the mainstream cattle markets is measured against a base group of households. The base group is considered representative of the non-selling households in the farming communities surveyed and was selected by setting dummy variables at zero and the continuous variables at the mean value. The base group has the following characteristics: They only farm with cattle without using market information; the average distance from the market is 39.47 kilometers[3]; the average herd size is 32.90; the average household size is 5.79; they farm on communal land, and they do not have any training.

Table 5.5 shows the results of the simulation. The conditional probability for participation in the base group is **0.0866**. This should be interpreted that 9 out of hundred households will participate in the mainstream cattle markets given the abovementioned characteristics.

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[3] In Sterkspruit, for example, small-scale cattle farmers travel a distance of more than 150 kilometers to reach well established markets. In line with this the simulation was conducted using a distance of 39.74 kilometers as benchmark.

Table 5.5:   Simulated impact of variables on the probability to participate

Variables	Predicted probability
Base	**0.0866**
Desired market distance	**0.6517**
Total herd	**0.1048**
Farming system	**0.1790**
Market information	**0.1384**
Household size	**0.3394**
Household size	**0.1651**

The rest of the results in Table 5.5 can be summarized as follows:

−   An increase in the rate of small-scale cattle farmer training will increase the probability of participating from 0.0866 to 0.6517.

−   Increased access to market information will increase the probability of participating from 0.0866 to 0.3394.

−   A reduction in the average distance to desired markets by 10 per cent will increase the probability of participating in the mainstream cattle markets from 0.0866 to 0.1048.

−   A 50 per cent increase in the current herd size will increase the probability of selling cattle from 0.0866 to 0.1790.

−   An increase in the average number of household size by 5 per cent will increase the probability of participating from 0.0866 to 0.1651.

The results show that an improvement in the initial conditions will significantly increase the probability of small-scale cattle farmers participating in the mainstream cattle markets. Of great importance in this regard is the impact that training, access to market information and distance will have.

5.5   Summary

In this Chapter the probability of small-scale cattle farmers participating in the mainstream cattle markets were analysed. The variables that will have the most likely chance to increase the marketing of cattle by small-scale cattle producers through mainstream markets are training, access to market information and distance. Training on management issues pertaining to financial, production and marketing is vitally important. Information pertaining to dates of auctions, prices of animals, etc is important. Cognisance should be taken that small-scale cattle farmers usually sell live animals and do not necessarily understand the way how, for example, price information is reported, i.e. Rand per kg carcass per grade; they would rather have price information reported per live animal. In addition, the availability of information on a timely basis creates problems.   In terms of distance it should be realized that small-scale cattle farmers do not necessarily have access to transport, like trucks, nor are they in many cases located to regular auctions or active livestock buyers, like abattoirs in urban areas. Speculators can play a vitally important role, but their current profile amongst small-scale cattle producers are not good due to reasons mentioned. Feedlot agents can also alleviate the distance problem, but this would mean own investment, and problems regarding scale will have to overcome.

CHAPTER 6

SUMMARY AND RECOMMENDATIONS

6.1   Introduction

The livestock sector in South Africa has tremendous potential to contribute to much needed growth in rural areas, and in by so doing contribute to the economic growth goals set by government. It is therefore not a coincidence that the Integrated Sustainable Rural Development Strategy (ISRDP) and Accelerated Shared Growth Initiative in South Africa (ASGISA) identifies livestock farming as the agricultural enterprise with the most likely chance of improving household food security and addressing poverty alleviation in the developing areas of South Africa. The reality in South Africa is that the small-scale cattle sector has not achieved its full potential despite many efforts through research and market promotion access programmes. Various factors contribute to this state of affairs and include, amongst others, poor infrastructure, low off-take rates (a productivity problem), lack of training and information, traditional reasons for keeping cattle, etc.

As highlighted in this study many research efforts have identified the reasons and causes why small-scale cattle farmers battle to access mainstream markets. The purpose of this study was to investigate the probability of small-scale cattle farmers to participate in mainstream markets and measured the impact of changes in selected variables on the probability to participate.   This is a departure from previous research in that the study attempts to identify those factors that have the greatest probability to increase participation in mainstream markets by small-scale farmers. By identifying these factors provides insight into where intervention is needed most so that this sub-sector can play its rightful role in the South African economy.

6.2 Summary

6.2.1 Literature review

Low productivity and production in many African farming systems are a function of utilization of low yielding agricultural technologies. The latter has remained a large challenge in developing areas for both governments and the private sector. Productivity can be increased by changing from a technologically static agricultural production dependent on traditional practices to a dynamic, market-oriented agriculture dependent on continuously produced agricultural technology. This situation is no different for small-scale cattle producers in South Africa. Challenges facing the small-scale cattle sector in South Africa include, amongst others:

- Lack of market access;

- Cattle are a form of productive capital that provide a stream of desired goods and services, including milk, transport, and traction;

- Cattle are seen as a form of insurance and wealth;

- Inadequate infrastructure;

- Low off-take rates; and

- Lack of institutional support

Many of the challenges fall beyond the scope of direct intervention by small-scale cattle farmers themselves and require interventions by both the industry role players and government. Important is that small-scale cattle farmers must identify those areas where they could have a direct impact and engage in serious efforts to address such challenges. The problem however is that many of the challenges that can be addressed directly are dependant on those challenges

that must first be addressed by government in collaboration with the industry role players. Hence, government and industry role players should take a holistic and integrated view of the development challenges faced by small-scale cattle producers if any development programmes are to achieve any significant successes.

6.2.2 Research methodology

The study was conducted in three different areas, namely Hammanskraal, Ganyesa and Sterkspruit. The sampling technique used in Hammanskraal is the stratified random sampling technique. In Ganyesa all the identified farmers were interviewed. Since the number of small-scale farmers was unknown in the Sterkspruit area the snowball sampling technique was used. The total sample size is 150 small-scale cattle farmers.

A logit model is used in this study over OLS and discriminant functional analysis, probit model and chi-square contingency analysis because the independent variable is not restricted to a categorical outcome variable only nor is the model limited to a single independent variable.

Since multicollinearity in the data was identified, PCA was used to deal with this problem. After PC's were calculated and PCs with the smallest eigenvalues were eliminated, PCR was fitted using the standardized variables to improve the estimation and prediction power of the logistic regression model.

6.2.3 Descriptive results

The respondents in the survey are relatively old and farm mostly on communal land. They make use of different marketing channels that are probably attributable to their geographic location and access to specific markets. Small-scale farmers have different reasons for keeping cattle, but an interesting observation is that a relatively large percentage keeps cattle for sales. Off-take rates are in general low if compared to those in the commercial sector; this is concerning given the potential that exist for this group of farmers to market their cattle in mainstream markets.

6.2.4 Results

The estimated logistic regression model within the principal component regression framework revealed the following:

- Farmer training will increase participation in mainstream cattle markets;

- A unit increase in the herd size will increase participation of small-scale cattle farmers in the mainstream cattle markets.

- Access to market information, and the use thereof, results in increased participation of small-scale cattle farmers in the mainstream cattle markets.

- Households which farm with cattle only were expected to participate more actively to increase their income.

- If the real distance to the markets is reduced by bringing buyers closer to the small-scale cattle farmers it will result in increases participation in mainstream markets;

- Remittances have a positive impact on participation. This is not as expected. The reason for this could be that households use their remittances for purchasing production inputs which eventually translates into increased marketable surplus and/or that remittances may not be enough to sustain livelihoods.

- Lobola has a positive relation with increased participation. This could be due to the fact that lobola is not strictly paid in terms of cattle, i.e. cattle can be converted into cash.

- This result for mortality and theft suggests that these are sources of risk; it will stimulate farmers to participate in mainstream markets as a mechanism to avoid further losses. Farmers may choose rather to market animals that exceed a certain threshold of animals that exceeds their ability to avoid risk due to limited resources to protect larger number of animals from disease and theft. This result provides insight into the propensity of small-scale cattle producers to avoid financial risk due to mortality and theft.

- An increase in household size and number of dependents both increase participation of small-scale cattle farmers in the mainstream cattle markets. This is as expected since the more members of the household now rely on cattle for a livelihood. In other words, in the absence of other income additional household members will force small-scale farmers to market more animals to sustain current livelihoods. This holds serious implications for households since it will inhibit their ability to increase herd size to a more economically viable size from which they could extract economic benefits.

- Household assistance and membership of a commodity association were found to have a significant but negative relationship with participation by the small-scale farmers in the mainstream cattle markets.

Partial effects for the significant continuous variables (i.e. herd size, desired market distance, household size, lobola, dependents, theft, household assistance and mortality) are relatively small, meaning that their impact on the probability to increase sales through mainstream markets is small. However, partial effects for the significant discrete variables (market information, remittances, training and farming systems) are more significant. The increase in the probability to participate in mainstream markets if the initial conditions are addressed range between 0.3 and 0.6.

Simulations with regard to a base group of households revealed the following:

- Increased access to market information will increase the probability of participating from 0.0866 to 0.3394.

- An increase in the rate of small-scale cattle farmer training will increase the probability of participating from 0.0866 to 0.6517.

- A reduction in the average distance to desired markets by 10 per cent will increase the probability of participating in the mainstream cattle markets from 0.0866 to 0.1048.

- A 50 per cent increase in the current herd size will increase the probability of selling cattle from 0.0866 to 0.1790.

- An increase in the average number of household size by 5 per cent will increase the probability of participating from 0.0866 to 0.1651.

The variables that will have the most likely chance to increase the marketing of cattle by small-scale cattle producers through mainstream markets are training, access to market information and distance. Training on management issues pertaining to financial, production and marketing is vitally important. Information pertaining to dates of auctions, prices of animals, etc is important and cognisance should be taken of the specific information needs of this group of farmers. In terms of distance it should be realized that small-scale cattle farmers do not necessarily have access to transport, like trucks, nor are they in many

cases located to regular auctions or active livestock buyers, like abattoirs in urban areas. Speculators can play a vitally important role, but their current profile amongst small-scale cattle producers are not good due to reasons mentioned. Feedlot agents can also alleviate the distance problem, but this would mean own investment, and problems regarding scale will have to overcome.

6.3 Recommendations

- **Increased involvement of youth in agriculture**

One of the findings of this study is that the average age of the small-scale cattle farmers is sixty (60) years. For the total sample size, 40 per cent of the respondents were found to be pensioners, hence it will be difficult for them to access some of the available support because of their age (e.g. access to finance). It is recommended that active and informed participation of youth be encouraged. This can be done in many forms (i.e. through co-operatives, equity partnerships or development projects).

- **Dissemination of market information to the small-scale cattle farmers**

Access to available information that is user friendly and relevant remains a problem in the small-scale sector. Assuming that the information needs of small-scale cattle farmers are known, one can safely assume that a user-pay information system will not suffice to address the problem of information access. Thus, from a development point of view this state of affairs clearly needs strong government intervention. Not only does it require setting up an information gathering and analysis system, but a strong emphasis will have to be put on ways to disseminate such information to ensure optimal access. The main thrust

for this would ideally be to train farmers on how to use information (e.g. price determination and market requirements and/or product specifications) and also to supply information to the small-scale cattle farmers.

Different and practical approaches of dissemination methodologies can be applied according to the specific needs of both the farmers and the market. It is recommended that a system for dissemination of research, production and market information be set up and this be coordinated by relevant industry role players in conjunction with the National Agricultural Marketing Council (NAMC), Department of Agriculture, and Agricultural Research Council (ARC) as supporting structures.

- **Viability of the herd size**

In terms of the total herd size, an economically viable herd size is important in unlocking opportunities within the small-scale cattle sector. This entails research pertaining to the optimal herd size given scarce resources. There is a need to link small-scale cattle producers to programmes that are targeting cattle improvement in terms of health, breeding, nutrition and animal husbandry (e.g. the Nguni project led by various Universities across the country should target beneficiaries of land reform, particularly the LRAD beneficiaries). Existing structures, such as producer organizations, extension officers, feeders and breeder associations can facilitate the process of engaging farmers in cattle improvement schemes. Failing to actively pursue such initiatives will prove to be detrimental for the industry at large in the medium to long run.

- **Training programme for the small-scale cattle producers**

Training of the small-scale cattle farmers is an important aspect of commercialization of the small-scale sector. The results in chapter 4 and 5 have indicated that majority of farmers do not keep records and that training can

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significantly increase their probability of participation in the mainstream markets. There are various methods which can be used to transfer knowledge to the small-scale cattle farmers. A product demand-led type of training will be very crucial as it will attempt to balance what the small-scale cattle farmers are currently producing and what the market requires.

It is fundamental that the Department of Agriculture should play a leading role by supporting farmer training through CASP while the industry role players like research institutions and producer organization should mobilize the small-scale farmers, assess the specific training needs and implement the training programmes for the small-scale cattle farmers.

- **Establishment of para-veterinary programmes**

The results pertaining to theft and mortality have important implications since it suggest that economic value of cattle for small-scale farmers has increased, i.e. they would rather liquidate their herd to gain additional economic value than suffer further losses. High mortality and stock theft could therefore impede on the efforts to mainstream the cattle sub sector. It is therefore essential to support the farmers and extension officers through the establishment of a Community-Based Livestock Worker programme (CLW). The purpose of the CLWs would be to assist farmers with day to day management of their livestock such as branding, administration of curative and preventative services, disease surveillance and facilitation of livestock marketing. The programme could be linked to the dip tank committees and other such community based organisations. Generally such community-based organisations seem to have a high chance of success in some areas like Sterkspruit, judging from the fact that most farmers are already organized in one form or another.

- **Strengthen existing producer organizations towards a collective action**

The study revealed that the market off-take for the small-scale cattle farmers is low compared to the commercial sector while on the other hand the average number of cattle held by a farmer does not justify optimal marketable surplus. This implies that generally farmers need to be encouraged to work cooperatively in the procurement of production inputs, managing their shared grazing land and infrastructure, obtaining marketing-related information and collectively marketing their livestock. Since producer organizations have a very important role to play in mobilizing the farmers towards collective action, it is critical that they should be strengthened in terms of human and financial resources.

- **Establishment of one-stop service centres**

Distance to the desired output markets by small-scale farmers have shown to have a positive impact on increased participation of the small-scale cattle farmers. It is recommended that one-stop services centres from which the cattle farmers could sell their cattle and obtain inputs such as livestock remedies and animal feeds and supplements, sell their hides and skins and attend training courses be established at municipality level or ward in the case of deep rural areas (e.g. some of the rural areas in Sterkspruit are located more than 100 kilometres away from town). Other activities such as market information dissemination and auctions could be linked to the centre. In areas like Ganyesa there is already some baseline infrastructure and only proper coordination is required while in some areas of Sterkspruit infrastructural development will be necessary but not a pre-requisite.

- **Repackaging of MAFISA for the small-scale cattle farmers**

The small-scale cattle farmers have over many years struggled to access financial support due to factors such as lack of collateral and age. MAFISA is one of the funding mechanisms that aim at broadening access by small-scale farmers to finance. It is noted that the interest rate for MAFISA is high and the programme still applies the conventional principles used by other financial institutions and therefore lacks differentiation. It is recommended that MAFISA should be reviewed to suit the financial needs of the small-scale cattle farmers.

- **Capacity building for extension officers**

The extension officers are qualified as specialists in a particular area of study (e.g. animal production or crop science) and are quite often faced with a challenge of providing services to farmers with mixed farming enterprises or specific enterprise which they have not been trained for. This challenge is excercebated by the fact that the extension officers do not have adequate background and/or understanding of business management and knowledge of economic/market intelligence. It is recommended that as a way of increasing participation of the small-scale cattle farmers in the mainstream markets, extension officers undergo a program that entails revitalization of skills and new skills development, particularly in the area of marketing.

- **Broadening access to cattle identification equipments for small-scale cattle farmers**

In terms of the Animal Identification Act No 6 of 2002 all livestock should have a registered identification mark which shows to who the animal belongs. A legal identification mark is very useful because it can be used to trace lost or stolen

animals. It is recommended that there should at least be one registered person for animal marking (must be provided with equipments) in all the cattle producing areas. Support should be given by stakeholders to the local person marking livestock in order to reach the deep rural areas.

6.4 Recommendations for further research

- The risk profile and how small-scale cattle farmers react to risky events is largely unknown. A deeper understanding of their risk perceptions and the way they mitigate risk would provide valuable insight in how this group of farmers manage their farming enterprises. This in turn will contribute to the understanding of why certain decisions are taken to eliminate some misconceptions that exist about this sector.

- It is widely known that the small-scale cattle sub-sector market animals through the informal sector. There is however very little information available on the operation and dynamics (for e.g. reliability and consistency) of this sector. Research into the informal sector would aid in the over understanding of the livestock sector and particularly how it impacts on the formal sector.

- There is a need to study the impact of remittances and lobola on livestock sales.

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APPENDIX 1: Questionnaire for the small-scale cattle farmers

Questionnaire for the small-scale cattle producers		
All information provided will be treated as **STRICTLY CONFIDENTIAL**		
CATTLE MARKETING WITHIN THE SMALL-SCALE SECTOR **FACTORS AFFECTING PARTICIPATION OF SMALL-SCALE CATTLE FARMERS IN MAINSTREAM CATTLE MARKETS**		
Particulars of interviewer:		
GENERAL INFORMATION		
Date of interview		1
Name of respondent		2
District		3
A. DEMOGRAPHIC DETAILS		
A. 1 Specific Location		
A. 2 Marital status of the household head		
	Single	1
	Married	2
	Widowed	3
	Divorced	4
	Other	
A. 3 Household size at the time of the interview		

		Age
	Children	< 15
	Teenagers	16--21
	Young Adults	22--39
	Mid aged	40--64
	Elders	> 64

A. 4 How many household members are dependent on you		
A. 5 How many of the dependents assist with domestic work		
A. 6 In a day, how long does it take for an individual to complete domestic work (Time in hours)		
A. 7 How many household members assist with cattle farming		
A. 8 Do you use some of your cattle to pay for your sons lobola		
	Yes	1
	No	2
A. 9 If yes, how many sons do you have		

B. BIOGRAPHICAL CHARACTERISTICS		
B.1 Gender	Male	1
	Female	2
B. 2 Age of the respondent		
B. 3 How will you rate your health status	Excellent	1
	Good	2
	Average	3
	Poor	4
	Very poor	5
B. 4 How will you categorise the health status of the family		

		Good	Average	Poor
	Teenagers	1	2	3
	Young adults	1	2	3

	Mid aged	1	2	3
	Elders	1	2	3

B. 5 How will you rate the health status of your herdman

	Excellent	1
	Good	2
	Average	3
	Poor	4
	Very poor	5

C. HUMAN CAPITAL ENDOWMENTS

C.1 Indicate your employment status

	Pensioner	1
	Employed	2
	Farmer	3
	Unemployed	4
	Part time Farmer	5
	Business	6
	Other (Specify)	

C. 2 What is your educational level

None	Primary school		Secondary school		Tertiary	
0	1	2	7	8	13	
	3	4	9	10		
	5	6	11	12		

C.3 Have you ever attended any short course related to your cattle business

	Yes	1
	No	2

C. 4 If yes, Which course	Budgeting	1

	Marketing	2
	Animal Husbandry	3
	Other (Specify)	

C. 5 If no, what specific training do you need

	Budgeting	1
	Marketing	2
	Record keeping	3
	Animal Husbandry	4
	Other (Specify)	

C. 6 How will you rate your knowledge in terms of the following

		Poor	Fair	Good
	Price survey	1	2	3
	Planning	1	2	3
	Decision making	1	2	3
	Financial mangmnt	1	2	3
	Pasture mangmnt	1	2	3
	Risk management	1	2	3

C. HUMAN CAPITAL ENDOWMENTS (Continues)

C. 7 Is there any household member with any of the following skills

		Yes	No
	Financial managnt	1	2
	Economics	1	2
	Pasture managnt	1	2
	Marketing	1	2
	Animal production	1	2

C. 8 State where they have acquired their skills	University	1
	Technikon	2
	Technical	3
	Ext officer	4
	NGO's	5
	Other	

C.9 Indicate your proeffiency on the following languages (speaking)

		GOOD	POOR
	English	1	2
	Tswana	1	2
	Sotho	1	2
	Zulu	1	2
	Xhosa	1	2
	Afrikaans	1	2

D. FARMING

D. 1 Type of farming

	Cattle	1
	Mixed livestock (inc cattle)	2
	Crop and livestock (inc cattle)	3

D. 2 Do you keep farm records	Yes	1
	No	2

D. 3 How long have you been farming (nearest year)

D. 4 How many days in a month do you spent with your cattle

D. 5 Why do you keep cattle	**Not impo**	**Less impo**	**Important**	**Very important**
Household consumption	1	2	3	4
Ritual slaughter	1	2	3	4
Sales	1	2	3	4

Savings	1	2	3	4
Feasts and ceremonies	1	2	3	4
Drought power	1	2	3	4
Other specify	1	2	3	4

D. 6 How many do you keep for	Household consumption	
	Sales	
	Savings	
	Feasts and ceremonies	
	Drought power	
D. 7 Land tenure system	Communal	1
	Rent or lease	2
	Privately owned	3

D. 8 What is the number of hectares used by you for cattle herding		
D. 9 Do you have a herdman	Yes	1
	No	2
D. 10 If yes, how many are they		
D. 11 What is his/her educational level	Informal	1
	Formal	2
D. 12 How much is the herdman paid per month		

D. 13 How do you rate his knowledge on the following

		Good	Fair	Poor
	Mating	1	2	3
	Gestation	1	2	3
	Weaning	1	2	3
	Handling	1	2	3
	Pasture management	1	2	3

E. CATTLE-BEEF PRODUCTION MODULE				
E. 1 What changes took place in your herd over the last 12 months				
	Number		Number	
Births		Sales		
Received gifts		Death		
Purchases		Theft		
		Slaughterings		
		Gift made		
E. 2 How many cattle do you own : Fill in the following categories			**Number**	
		Calves at foot (< 1 year)		
		Heifers (1-3 years)		
		Breeding females 3-6 yrs		
		Old cows > 6		
		Bulls younger than 3 years		
		Bulls over 5 years		
		Steers / Oxen		
E. 3 How many cattle do you keep that you don't own				
E. 4 Do you want to increase your herd size		Yes		1
		No		2
E. 5 If yes, give three main strategies on how you will increase your herd				
	By not selling for a while			1
	By improving the breeding stock			2
	Both			3
	Other (Specify)			
E. 6 Type of breeds		Afrikaaner		1
		Bonsmara		2
		Jersey		3

	Nguni		4
	Charolais		5
	Brahman		6
	Unknown		7
	Other (specify)		

E. 7 What are the benefits of keeping the mostly prefered breed

	Earn high returns	1
	Body weight is heavy	2
	Not easily stolen	3
	Easily adapt to harsh conditions	4
	Other	

E. 8 What is the main factor creating risk when producing livestock

	Drought	
	Theft	
	Predators	
	Others	

E9How many times over the last ten years has the one that you regard as

the main factor caused increased production risk

E. 10 How do you know that a cow is on heat(2 signs)			
E. 11 Is the gestation period always completed		Yes	1
		No	2

E. 12 If no, what are the two main reasons

	1
	2

E. 13 How old are your heifers when they concieve their first calves

E. 14 How many calves does one cow concieve before it is slaughtered

or sold.

E. 15 Do you milk your cows		Yes	1
		No	2
E. 16 If yes, what do you use the milk for			
	Home consumption		
	Sales		
	Other		
E. 17 If sold, how many litres per day			
E. 18 How much is the price per litre			
E. 19 If no, give a reason			
E. 20 Do you have water points in the areas of grazing		Yes	1
		No	2
E. 21 How long does your cattle walk to reach a water point (km or m)			
E. 22 Do you dip your cattle		Yes	1
		No	2
E. 23 If yes, provide the following information	Type of dip		
	Price		
	Quantity		
E. 24 Do you apply vaccines to you animals			
	Name	Price	Quantity
	Ivomac		
	Terramicine		
	Anthrobax		
	Other		
E. 25 If you are not using vaccines, what is the main reason			
E. 26 Do you use supplement to feed your cattle(e.g licks, fodder etc.)			
	Supplement	Quantity	Price
	Fodder		
	Licks		

	Bonemeal		
	Other		

E. 27 If not using supplements**,** what is the main reason		
	Expensive	1
	Market is far	2
	Other	3

E. 28 Give a list of cattle production equipment you have		
	Castrator	1
	Dehorner	2
	Feedlot	3
	AI	4
	Other	

F. MARKETING MANAGEMENT MODULE

F. 1 What is the main reason for selling cattle	
Drought	1
I need cash for home consumption	2
I need cash for cattle purchases	3
I need money to pay school fees	4
I want to repay a loan	5
Other (specify)	

F. 2 Which channel do you use to sell your livestock		
	CHANNEL	
	Speculators	1
	Private sales	2
	Butchers	3
	Open markets	4

	Co-operatives	5
	Abattoirs	6
	Auction	7
	Other (specify)	

F. 3 Are you satisfied with the channel through which cattle are marketed

CHANNEL	Satisfied	less satis	Not
Speculators	1	2	3
Private sales	1	2	3
Butchers	1	2	3
Open markets	1	2	3
Co-operatives	1	2	3
Abattoirs	1	2	3
Auction	1	2	3
Other (specify)			

F.4 Which of the channel do you regard as the most rewarding & state

kilometers for each of the channel used

	CHANNEL	
	Speculators	1
	Private sales	2
	Butchers	3
	Open markets	4
	Co-operatives	5
	Abattoirs	6
	Auction	
	Other (specify)	

F.5 State kilometers for each of the channel used

F. 6 In terms of the channel you use regularly, what are the main benefits

	Receive high price	
	Understand the contract	

	Nearer	
	Other	

F. 7 Do you slaughter and sell carcass

	Yes	1
	No	2
F. 8 If yes, where do you sell it	Consumers	1
	Butchers	2
	Other	

F. 9 When do you slaughter them

F. 10 Did you ask for any professional inspection before slaughtering

	Yes	1
	No	2

F.11 How many did you slaughter in the past 12 months

F. 12 How much per kilogram did you get

F. 13 How many live cattle did you sell in past 12 months

	Category	Period	units	Price
	Calves at foot (< 1 year)			
	Heifers (1-3 years)			
	Breeding females 3-6 yrs			
	Old cows > 6			
	Bulls younger than 3 years			
	Bulls over 5 years			
	Steers / Oxen			

F. 14 How do you distribute animals when selling over a 5KM distance

	Hire transport(individual)	1
	Hire transport(Group)	2
	Use Own transport	3

	Move animals by foot		4
	The buyer transport it		5
	Do not sell far away		6
	Other (Specify)		
F. 15 What type of transport do you use		Bakkie	1
		Truck	2
		Trekking	3
		Tractor	4
		Other	
F. 16 How much do you pay for transport			
F. 17 How do you distribute animals when selling less than a 5KM distance			
	Hire transport(individual)		1
	Hire transport(Group)		2
	Use Own transport		3
	Move animals by foot		4
	The buyer transport it		5
	Do not sell far away		6
	Other (Specify)		
F. 18 How much do you pay for transport			
F.19 What general problem do you experience when moving your cattle			
	Small size of transport		1
	Lack of transport		2
	High transport costs		3
	Other (Specify)		
F. 20 When selling, do you combine your cattle with that of other farmers			
		Yes	1
		No	2
F. 21 If no, state the main reason			
	You don't sell at the same time		1

	You don't sell at the same market	2
	They will make your herd unreproductive	3
	You have a conflict with them	4
	Other (Specify)	
F. 22 Do you mainly travel on a	Gravel road	1
	Tarred road	2
	Both	3
F. 23 Do you have access to any of the following, indicate more than one		
	Sales pen	1
	Loading ramps	2
	Off loading ramps	3
	Good roads	4
	Value adding	5
	Market info	6
G. MARKETING INFORMATION MODULE		
G. 1 Do you receive market information prior to sales		
	Yes	1
	No	2
G. 2 If yes, what is/are your source(s) of information		
	Radio	1
	Television	2
	Extension publications	3
	Co-farmer	4
	Government extension officers	5
	Cooperate extension officer	6
	Other (Specify)	
G. 3 What type of information does the he/she provide		
	Market information	1

	Production information	2
	Financial management	3
	Animal husbandry	4
	Other (Specify)	

G. 4 If you don't receive market information, would you like to have a

regular source in the future

| | Yes | 1 |
| | No | 2 |

G. 5 What type of information would you like to receive

	Dates for sales	1
	Sales price	2
	Buyers	3
	Production information	4
	Financial management	5
	Pasture management	6
	Other (Specify)	

G. 6 How often would like to receive it

	Weekly	1
	Monthly	2
	Bi-annually	3
	Other (specify)	

G. 7 Which language would you prefer

	Own language (What is own language)	1
	English	2
	Afrikaans	3

G. 8 How do you want it to be delivered

	By Post	1
	By internet	2
	Cellphone SMS	3

	Extension officers		4
	Producer organisation		5
	Annual calender		6
	Tribal meetings		7
	Commodity groups		8
	Other (Specify)		

G. 9 In what form would you like the price information to be delivered

	Price per head	1
	Price per kilogram	2
	Other (specify)	

G. 10 What type of market information do you receive

		Dates	Prices	Buyers	None
1	Auctioneers	1	2	3	4
2	Speculators	1	2	3	4
3	Farmers Union	1	2	3	4
4	Extension officers	1	2	3	4
5	Other specify	1	2	3	4

G. 11 Do you normally buy agricultural magazines	Yes	1
	No	2

G. 12 How much do you buy it/them

G. 13 How do you communicate with other farmers

	Tribal meetings	1
	Commodity groups	2
	Telephone	3
	Farmers unions	4
	Other specify	

H. PLANNING		
H. 1 Do you have a marketing plan	Yes	1
	No	2
H. 2 If yes,to what extend do you plan		
	Rough, incomplete plan	1
	Thorough planning	2

I. INSTITUTIONAL SUPPORT SERVICES		
I. 1 Are you aware of role player organisations within the red meat industry		
	Yes	1
	No	2
I. 2 Are you a member of any organisation		
	Yes	1
	No	2
I. 3 If yes, what is the name of the organisation		
I. 4 How does it help you with livestock production, improvement		
and marketing		
	Provides market information	1
	Subsidise vaccines	2
	Have a life insurance	3
	Lobby with policy makers	4
	Setting one objective	5
	Other (specify)	
I. 5 If you are non member, would you like to be an affiliate		
	Yes	1
	No	2
I. 6 If Yes, What services do you expect		

	Provides market information	1
	Subsidise vaccines	2
	Have a life insurance	3
	Lobby with policy makers	4
	Setting one objective	5
	Other (specify)	
I. 7 Do you receive extension services	Yes	1
	No	2

I.8 If Yes, How many times did he visit in a production and marketing period

	Once	1
	Twice	2
	Three	3
	> Three	4

I. 9 What services does he/she provide

	Advise on animal husbandry
	Advise on marketing
	Advice on record keeeping
	Advice on breeding
	Other (specify)

I. 10 If there are no services, would you like some

	Yes
	No

I. INSTITUTIONAL SUPPORT SERVICES	
I. 11 What services do you expect from extension officers	
Animal husbandry	1
Provides information on marketing channels	2
Provides information about auction dates	3
Should provide contact details of buyers	4

They should communicate our problems to the policy makers		5
Other (Specify)		
I. 12 Who assists you with decision making		
	Extension officers	1
	Private agents	2
	Family members	3
	Co-farmers	4
	Other specify	

I. 13 What type of information does he give you		Yes	No
	Weaning of calves	1	2
	Breeding selection	1	2
	Control of parasites	1	2
	Carring capacity of the veld	1	2
	Control of burning veld	1	2
	Others		

I.14 Do you have any financial institution in your area	Yes	1
	No	2

I.15 If yes, name the source		
	Commercial bank	1
	Agricultural cooperative	2
	Land bank	3
	Agri-mark	4
	Credit union	5
	Stokvels	6
	Family and friends	7
	Credit club	8
	Other (Specify)	

I. 16 What are the services received from the source used

	Short term loam	
	Medium term loan	
	Long term loan	
	Others	
I. 17 Do you have a bank account	Yes	1
	No	2
I. 18 Have you applied for a loan before	Yes	1
	No	2
I. 19 Did you receive the loan	Yes	1
	No	2
I. 20 If yes, what was the purpose of the loan.		
I. 21 If you were denied a loan, did they explain why	Yes	1
	No	2
I. 22 If yes, what was the reason		
I. 23 What information do you need from the bank		
	Information about investment	1
	Information about interest rates	2
	Information about savings	3
	Other (Specify)	
I. 24 What is the distance to the Bank		
I. 25 Is the distance a problem to get credit Yes No	Yes	1
	No	2

J. PRICING AND PROMOTION

J. 1 Do you perform price surveys, before selling	Yes	1
	No	2
J. 2 Are you satisfied with the farm gate prices		

	CHANNEL	Yes	No
	Private sales	1	2
	Speculator	1	2

	Butcher	1	2
	Abattoir	1	2
	Auction	1	2
	Open market	1	2

J. 3 How is a price set during the sales		
	We negotiate	1
	It is market driven	2
	It is dictated by buyers	3
	Other (specify)	

J. 4 What forms your expectation on cattle prices		
	Judging by the body confirmation	1
	Take it from other farmers	2
	Other specify	3

J. 5 Have you ever declined a selling price and ended up not selling

	CHANNEL	Yes	No
	Speculators	1	2
	Private sales	1	2
	Butchers	1	2
	Open markets	1	2
	Co-operatives	1	2
	Abattoirs	1	2
	Auction	1	2
	Other (specify)	1	2

J. 6 Have you ever sold an injured or sick animal		Yes	1
		No	2

J. 7 If yes, was the farm gate price satisfactory	Yes	1
	No	2

J. 8 When negotiating prices, which language do you use	Mother tongue	English

CHANNEL		
Speculators	1	2
Private sales	1	2
Butchers	1	2
Open markets	1	2
Co-operatives	1	2
Abattoirs	1	2
Auction	1	2
Other (specify)	1	2
J. 9 If not mother tongue, are you able to negotiate as well as you would do if you were to use your own language		
J. 10 When you sell cattle, how is the fat condition		
J. 11 Do you promote your products		
J. 12 If no, do you realise a need for promotion		

K.AGRICULTURAL STATISTICS MODULE				
K.1 How will you rate the following information in order of importance				
	Not import	Less import	Important	Very impo
Number of animals in feedlots	1	2	3	4
Abattoir slaughter volumes	1	2	3	4
Farm slaughter volume	1	2	3	4
Producers price of products	1	2	3	4
Consumption of products	1	2	3	4

Consumer price of products	1	2	3	4
Volume of imports and export	1	2	3	4
Value of imports and exports	1	2	3	4
Prices of production inputs	1	2	3	4
Others (specify)	1	2	3	4
K.2 Do you need forecasts of the mentioned statistics			Yes	1
			No	2
K. 3. How will you rate the relevance of the received statistics				
			Poor	1
			Average	2
			Good	3
			Excellen	4
K.4 What current decisions are based on the statistics				
K.5 What future decision will be based on statistics				
K.6 What is the level of accuracy you need for the statistics				
			Less	1
			Exactly	2
			More	3

M. ARABLES

M. 1 Do you have a crop enterprise	Yes	1
	No	2
M. 2 Which cultivar do you plough		
	Maize	1
	Sorghum	2
	Beans	3
	Wheat	4

	Other (Specify)	
M. 3 How many hectares are used for crop		
M. 4 How many tons do you produce		
M. 5 How many tons/kg consumed		
M. 6 How many tons are used for cattle livestock		
M. 7 How many tons are sold		
M. 8 How much is the price per ton		

L INCOME AND EXPENDITURE MODULE		
L. 1 Under which income class do you fall (Month/Year)		
	< 700.00	1
	700 - 2000	2
	2001 - 5000	3
	5000 - 10000	4
	> 10 000	5
L. 3 If yes, do you have surplus income for savings	Yes	
	No	
	<1500	
	1600-2500	
	2600-3500	
	>3600	
L. 5 What do you do with your surplus	Investment	
	Savings	
	Use for livestock	
	Miscelleneous	
	Other (Specify)	
L. 6 If no surplus, which of these can you not afford	Clothing	
	Food	

	Medicines
	Transport
	Education
	Electricity
	Water
	Other

APPENDIX 2: Correlation coefficient: t-critical = 1.98

|	DRORISK	TRAINING	LOBOLA	PMARDIS	TTHERD	BIRTHS	EXTSERVE	REMMITT	MEMBER	HHSIZE	MORTALITY
DRORISK		1.18	0.41	1.97	1.10	0.52	1.79	1.51	0.82	**3.34**	1.55
TRAINING			0.46	**5.19**	**2.02**	1.07	0.99	1.23	1.39	1.50	0.29
LOBOLA				**2.39**	0.06	0.08	0.97	0.43	1.90	0.38	**2.12**
PMARDIS					**3.20**	1.02	0.04	1.84	**2.50**	1.55	0.89
TTHERD						**13.18**	0.23	**2.01**	0.51	0.30	1.43
BIRTHS							1.72	**2.66**	0.55	0.47	0.28
EXTSERVE								**3.41**	**3.29**	1.46	0.39
REMITTA									**9.97**	1.07	0.25
MEMBER										0.61	0.54
HHSIZE											1.13
MORTALITY											
DEPENDEN											
FARMSYS											
THEFT											
MARKINFO											
INCOME											
HHASSIS											
EXTVISIT											
TENURE											

APPENDIX 2: Correlation coefficient : t-critical = 1.98 (Continuation)

|	DEPENDEN	FARMSYS	THEFT	MARKINFO	INCOME	HHASSIS	EXTVISIT	TENURE
DRORISK	**2.66**	0.90	1.35	0.31	0.68	1.11	0.42	1.54
TRAINING	0.77	1.34	0.64	**2.08**	0.80	1.44	0.40	1.26
LOBOLA	0.08	1.95	0.34	0.09	0.33	0.91	0.82	1.25
PMARDIS	**2.31**	0.58	0.96	**2.72**	**2.18**	0.47	1.16	0.53
TTHERD	1.54	3.83	1.71	**19.13**	**5.65**	1.29	**4.52**	1.20
BIRTHS	1.41	**4.76**	0.01	**9.92**	**4.86**	1.29	**4.11**	1.56
EXTSERVE	**2.07**	0.67	0.80	1.04	0.32	0.82	0.17	**2.94**
REMITTA	1.13	0.10	1.07	**2.90**	1.01	1.10	0.89	0.10
MEMBER	0.38	0.29	1.54	1.06	1.17	1.80	1.27	0.01
HHSIZE	**11.93**	0.24	0.07	0.13	0.57	**2.96**	0.70	1.39
MORTALITY	1.47	1.72	1.10	2.31	0.62	1.21	0.50	0.12
DEPENDEN		0.35	0.41	0.98	0.75	1.76	0.35	**2.57**
FARMSYS			0.72	**4.45**	**4.46**	1.97	1.18	0.78
THEFT				1.95	0.99	0.49	1.96	0.49
MARKINFO					**6.49**	0.82	**2.91**	1.26
INCOME						0.83	1.10	1.86
HHASSIS							1.91	0.11
EXTVISIT								0.60
TENURE								

APPENDIX 3: Principal components

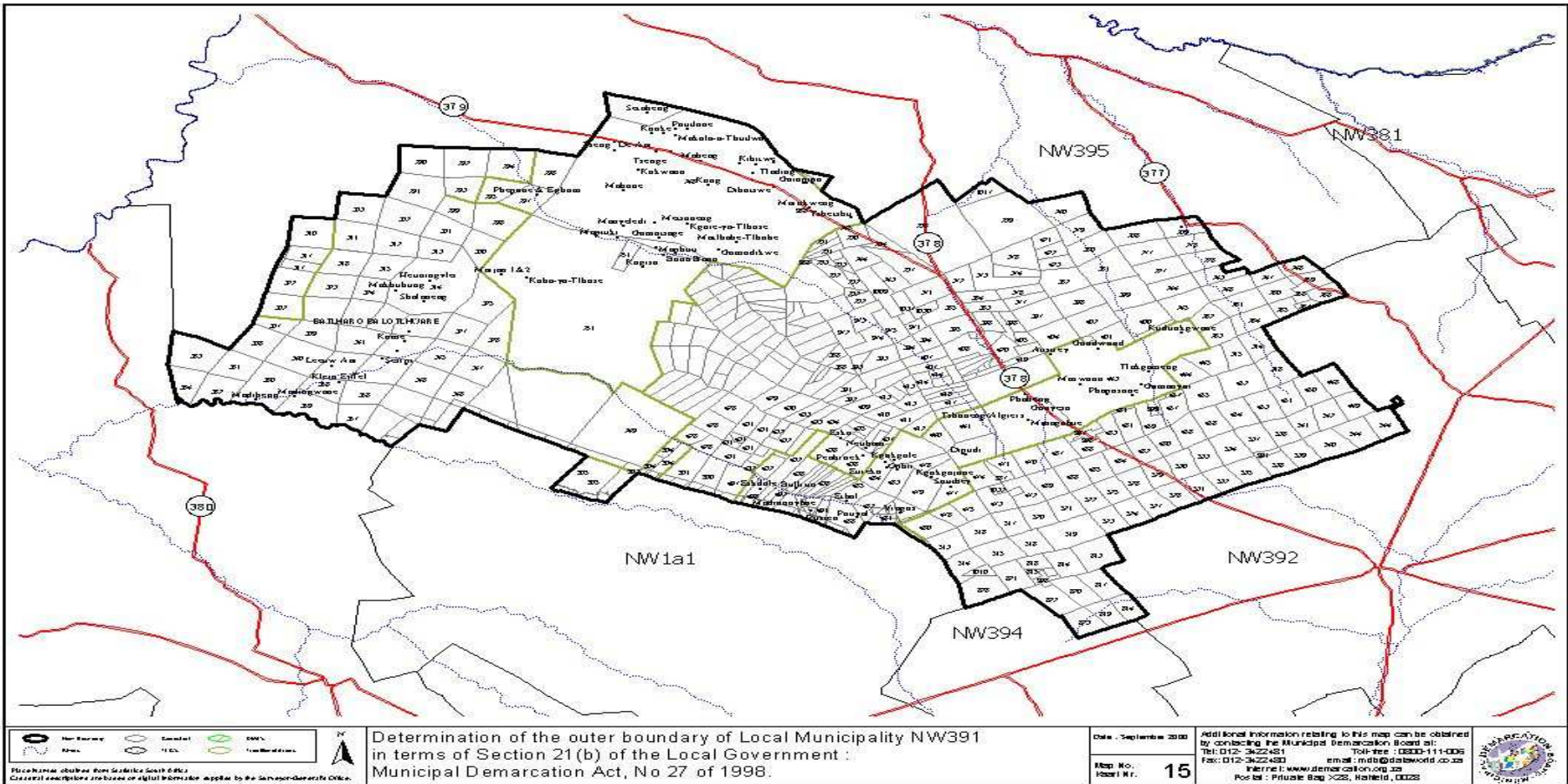| Variables	PRODUCTIVITY	ASSOCIATION	DEMOGRAPHIC	MARKET SUPPORT	LAND TENURE	SUPPORT SERVICES	ATTRITION
DRORISK					-0.586448		
TRAINING				0.792117			
LOBOLA					0.583282		
PMARDIS				0.771836			
TTHERD	0.882749						
BIRTHS	0.805498						
EXTSERVE		-0.545563					
REMITTA		0.819399					
MEMBER		-0.855325					
HHSIZE			0.83161				
MORTALITY							-0.52289
DEPENDEN			0.859632				
FARMSYS	0.497125						
THEFT							-0.82648
MARKINFO	0.856349						
INCOME	0.667856						
HHASSIS						-0.68622	
EXTVISIT						0.526028	
TENURE					-0.649642		

APPENDIX 4: Topographical Maps of study areas
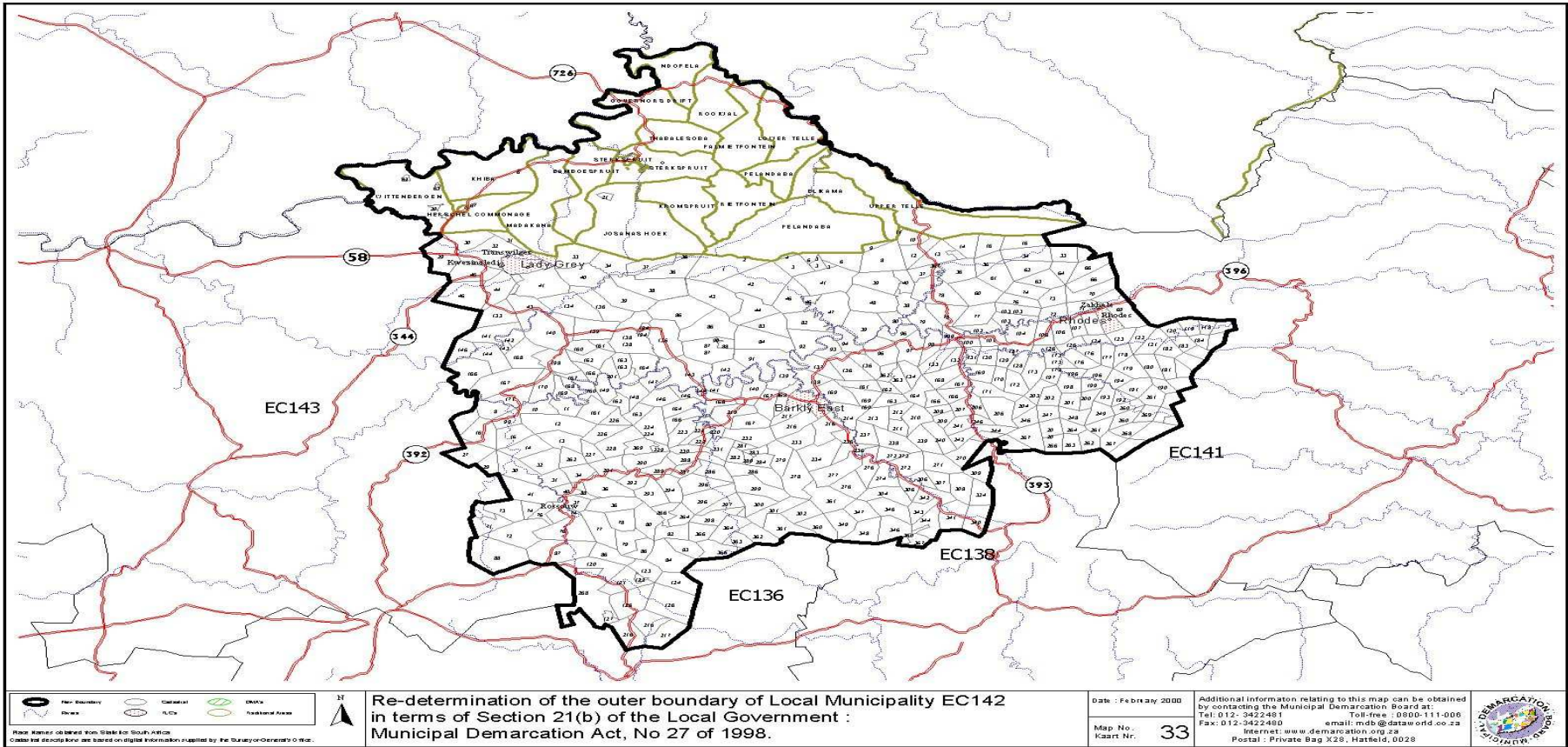
Map for Sterkspruit
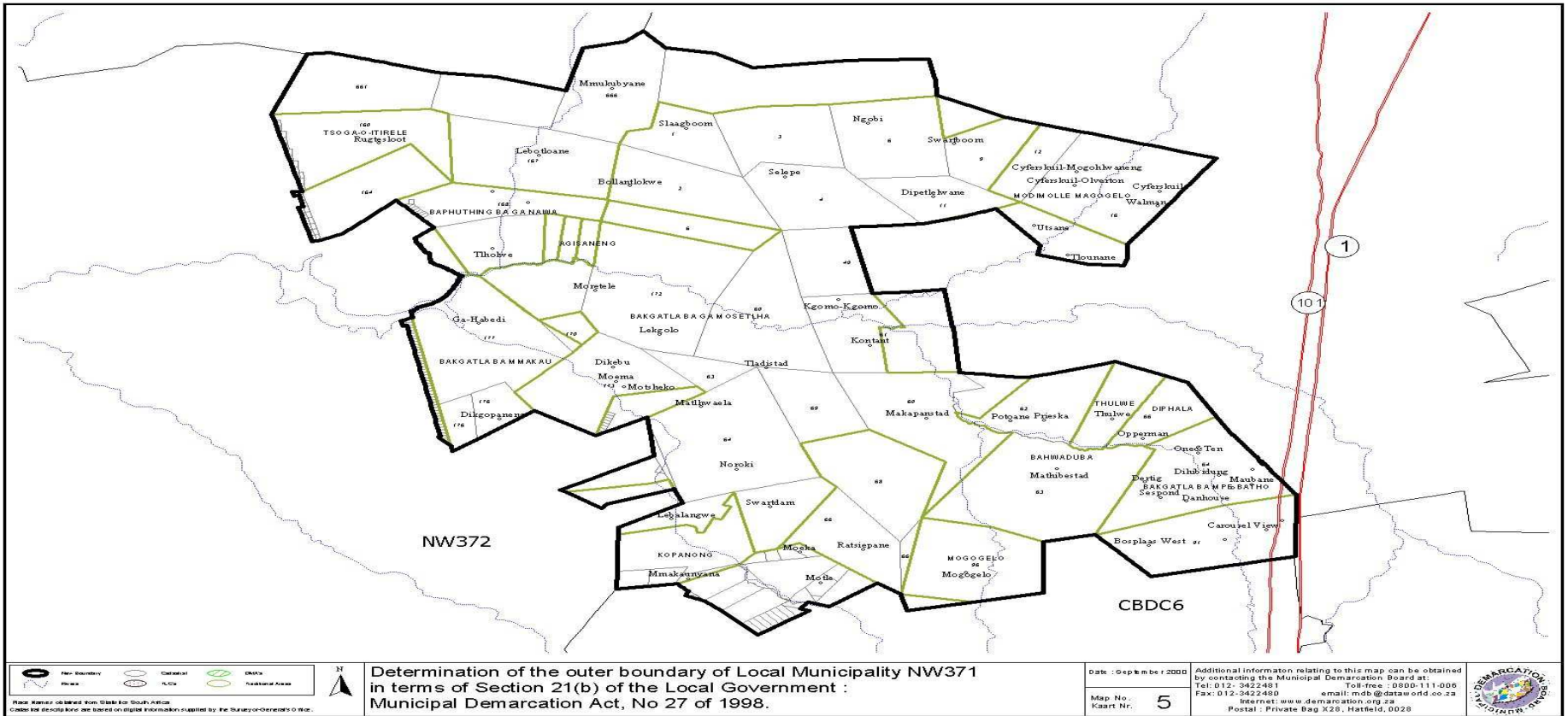
Map for Hammanskraal

Map for Ganyesa