Factors influencing off-take rates of small-holder cattle farming in the North West Province of South Africa

By

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A thesis submitted in partial fulfilment of the requirements for the degree of

Philosophiae Doctor (Animal Production Management)

In the

Department of Animal and Wildlife Sciences

Faculty of Natural and Agricultural Sciences

University of Pretoria

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June 2017

Declaration

I declare that the thesis which I hereby submit for the degree of PhD Animal Production Management at the University of Pretoria, is my own work and has not previously been submitted by me at any other tertiary institution.

Signature…….

Date…….

Dedication

To my late brother and parents who could not live to celebrate this achievement

Acknowledgements

I give thanks to the Almighty for giving me the strength and courage to complete this important milestone.

The magnitude of this work involves support from a lot people too many to mention by name. My sincere thanks go to Professor Edward Webb for his patience and guidance during the course of the study. I am grateful to Dr R Thomas for his assistance in the formatting of this thesis. I thank Ms B Mogane and Ms T Phasha for their assistance in the formatting of the data collection instrument.

I am grateful for the support I received from the Dr Ruth Segomotsi Mompati Agricultural District Office for its assistance during the planning phase of this study. I thank all farmers who participated in the study for their patience and willingness to be part of this study. Thanks to Messrs. O Itumeleng and M Mothibedi, and Ms T Rapuleng and Ms K Sebolaneng for their assistance with data collection.

The financial support from the AgriSITA and the Agricultural Research Council is greatly appreciated.

Words cannot be enough to express my gratitude to my family for their unconditional support and love. To my friends, thank for your trust in my effort.

I dedicate this thesis to my late brother and parents who could not live to celebrate this achievement.

Abstract

This study investigated cattle off-take decision models for small-holder cattle producers in South Africa. The aim of the study was to provide empirical evidence on off-take decisions and contribute to the formulation of policy and development interventions to address the constraints that impede small-holder producers from participating fully in the commercial cattle industry. Cattle off-take incentives and disincentives differ among households. Off-take patterns are influenced by the socio-economic environment, asset base, husbandry practices, and access to market, institutional arrangements and extension support. The main hypothesis of the study was that off-take decisions of small-holder cattle producers depend on an interface between production practices and socio-economic factors.

A sample of 308 small-holder cattle producers participated in a survey to test this hypothesis. Variations in cattle off-take are mainly associated with the household's livelihoods needs and alternatives even though the attitude of the market may contract or expand participation. Principal component analysis was used to identify the main factors underlying this intricate relationship between the household dynamics and cattle off-take.

The demographic analysis showed that older persons who have passed the prime age of forty dominate the study area. Taung North extension ward had both the highest proportion of women as well as small herds and generally women operated smaller herds than men. Men tended to keep indigenous breed types and reported lower mortality rates. Men also belonged to and held office in community associations, which was positively correlated with herd productivity.

Results of principal component analysis showed that herd size had the most influence on cattle off-take. Owners of small herds sell the highest proportion of their herds, resort to the sale of sheep, and engage in small businesses to supplement cattle income, which suggests that income from these sales may be insufficient to meet the needs of these households. These sales are compounded with high mortality resulting in extremely high herd exits that lead to herd shrinkage. Diseases were mainly liable for most stock losses in the study area, which requires elevated attention.

The farmer's cattle rearing objective was the second most important factor underlying cattle off-take in the study area. Farmers whose main objective was to build wealth by keeping cattle, depended on cattle income and sold more animals to achieve this objective. Poor herd performance especially calving rates was the third most important factor influencing cattle off-take rates in the study area. Low calving rates pose a high risk to the sustainability of small-holder cattle businesses in the study area. In most instances, farmers who experienced low calving rates, depended on non-farm income such as social grants to meet their household needs. There is an urgent need for an introduction of record keeping as part of cattle production in the study area, to monitor the productivity of breeding cows.

Results also showed that current extension modalities such as mass and farmer-to-farmer extension suppressed herd off-take in the study area. It seems that extension messages are generally devoid of entrepreneurship and efforts to instill a commercial orientation among small-holder farmers. This implies that there is a need for a new paradigm of focusing on improved off-take as the ultimate goal of cattle production.

This study has identified several constraints, which need to be addressed in order to improve herd productivity and off-take rates in the study area. Proposed solutions for empowering vulnerable groups such as women and the youth require rural development and land reform policy interventions while the improvement of general productivity requires a focused extension intervention programme.

Thesis outputs

Scientific publications:

Peer-reviewed publications

Motiang, D. M. and Webb, E. C. (2015). Sources of information for small-holder cattle farmers in Dr Ruth Segomotsi Mompati District Municipality in the North West Province, South Africa. Appl. Anim. Husb. Rural Develop. Vol 8, p. 26-33: www.sasas.co.za/aahrd/

Motiang, D. M. and Webb, E. C. (2016). Herd mortality and cattle off-take rates among small-holder producers in the North West Province of South Africa. African Journal of Agriculture. Vol. 11(11), p 930-934.

Motiang D M and Webb E C. (2016). The influence of household characteristics on cattle off-take rates in the North West Province of South Africa. Livestock Research for Rural Development. Vol. 28(6), Article #118

Congresses:

National

Motiang, D.M., Botisme, B.D., Choche, B.J. and Webb, E.C. (2012). Small-holder cattle producer profile and herd sizes in the Dr Ruth Segomotsi Mompati District Municipality of the North West. Proceedings of the 45th Conference of the South African Society of Animal Science, East London, 1-4 July, 2012.

Motiang, D.M. and Webb, E.C. (2013). Herd mortality and cattle off-take among small-holder producers in the North West Province. Proceedings of the 46th Conference of the South African Society of Animal Science, Bloemfontein, 23-26 June, 2013.

Motiang, D. M. and Webb, E. C., (2014). Utilization of Indigenous and Adapted Cattle by Small-holder Producers in South Africa: A Socio Economic Perspective. Proceedings of the 47th Conference of the South African Society of Animal Science, Pretoria, 6-8 July 2014.

Motiang, D. M. and Webb, E. C. (2015). Sources of information for small-holder cattle farmers in Dr Ruth Segomotsi Mompati District Municipality in the North West

Province, South Africa. Proceedings of the 48th Conference of the South African Society of Animal Science, Empangeni, 21-23 September 2015.

International

Motiang, D.M. and Webb, E.C The Influence of Socio-economic Characteristics on Herd Off-take Rates: The Case of Small-holder Cattle Producers from the North West Province in South Africa. Proceedings of the 11th World Congress on Animal Production, Beijing, China, 15-20 October 2013.

Motiang, D. M. and Webb, E. C., (2014). Utilization of Indigenous and Adapted Cattle by Small-holder Producers in South Africa: A Socio Economic Perspective. Proceedings, 10th World Congress on Genetics Applied to Livestock Production. Vancouver, Canada, 17-22 August 2014.

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CHAPTER ONE

INTRODUCTION

1.1. Background

This study is about cattle off-take rates among small-holder producers in South Africa. Cattle contribute 60% of edible livestock products in Africa (FAO, 2006) and are therefore a critical aspect of the livestock sector. Livestock production is an important part of livelihoods in sub-Saharan Africa where approximately 70% of the poor own livestock (Sere, 2005). On average, livestock contributes 35% to gross domestic product (GDP) from agriculture on the sub-continent (Otte and Knips, 2005).

Globally, sub-Saharan Africa has the slowest growth in meat production than other developing regions (IFPRI, 1999; Gregory, 2007). The sub-continent owns 14% of the world's livestock resources but produces only 2.8% of the world's meat and milk (Otte and Chilonda, 2002). This low productivity has implications for Africa's ability to meet the millennium development goals. In order to meet the Continent's agricultural growth target of 6% by 2015, the livestock sector should grow by 4%, annually (FAO, 2006). This is double the current meat supply in sub-Saharan Africa, which is growing at 2.6% per year (Ogle, 1996).

Cattle off-take is a measure of voluntary exits from the herd in the form of sales, slaughter or donation. National cattle off-take rates are determined through annual slaughters for a particular country. Cattle off-take for South Africa ranges between 25% and 30%, which is the highest in sub-Saharan Africa (WTO, 2007). The high national cattle off-take rate is comparable with those of the World's largest beef producing countries such as Brazil and Australia (Meissner et al., 2013).

In South Africa, the livestock sector epitomises a dualistic economy characterised by a prosperous commercial sub-sector on one side and the less developed small-holder sub-sector on the other. The former consists of mainly large-scale operations while the latter is skewed towards small herds. The small-holder producers are generally less efficient than their commercial counterparts (Meissner et al., 2013).

The recent population census showed that 78% of cattle producers own small herds of between one and 10 head of cattle (Statsa, 2013). Small-holder producers own

approximately 40% of the national herd (RMRDT, 2008) but make a negligible contribution to the market. According to Tapson (1990) the monetary per capita output in typical small-holder cattle sector in South Africa could be as low as one tenth of the national potential. Interventions in this sub-sector would therefore make enormous impact on South Africa's economic growth.

Moreover, agricultural development is a priority programme in South Africa and the growth of the cattle industry ranks high in the North West provincial growth and development strategy (North West Provincial Government, 2004). Cattle production is an important economic activity in the North West Province especially in areas such as Dr Ruth Segomotso Mompati District Municipality, which has the highest number of cattle in South Africa. However, the biggest concern is that cattle off-take rates remain low in the small-holder sector (Tapson, 1990; RMDT, 2008; Scholtz and Bester, 2010) hence the need to determine the underlying socio-economic causes.

1.2. Problem statement

National cattle off-take rates are extrapolated from slaughter data (WTO, 2007) and not farm level sales, which follow several paths in the beef value chain. Several farm level studies reported extremely low off-take rates of between 5% and 7% in South Africa (Tapson, 1990) and other parts of the Southern African Region (Colvin, 1985; Düvel and Stephanus, 2000). It is clear that there is disparity between small-holder cattle producers and their established commercial counterparts.

It is generally accepted that small-holder producers make their off-take decisions under a complex environment but no study has been conducted to determine the interface between management practices, institutional, cultural socio-economic factors as well as off-take decisions of small-holder cattle producers. This knowledge gap about small-holder cattle production systems results in piece meal extension solutions. A comprehensive study is therefore needed to identify the key dynamics of these production systems and foster behavioral change among cattle farmers.

1.3. Purpose

The purpose of this study was to investigate the cattle off-take decision models for small-holder cattle producers in South Africa.

1.3.1. The objectives of the study were:

I. To describe the cattle production systems among beef cattle farmers in North West Province

II. To identify factors that determine cattle off-take among beef cattle farmers in North West Province

III. Recommend a strategy to improve the efficiency of beef cattle production in the North West Province

1.3.2. Hypotheses

The main hypothesis of the study was that off-take decisions of small-holder cattle producers in the North West Province depend on an interface between production practices and socio-economic factors. Although it is well accepted that cattle play multiple roles in small-holder production systems, producers' off-take patterns may concentrate cattle off-takes outside rationale marketing norms.

The following specific hypotheses were tested in the study

I. Institutional arrangements of small-holder cattle producers do influence off-take rates. Farmers who belong to associations will be more emendable to change and engage in commercial off-take activities.

II. Non-farm income suppresses herd off-take. Income from other sources will suppress farmers' participation in cattle sales.

III. Producers' management practices determine herd dynamics such as calving and mortality rates, which influence the number of stock available for sale.

IV. Producers' socio-economic environment such as family size, household headship, education and employment influences their willingness and ability to sell stock.

V. Extension is an important catalyst in enhancing farmers' ability to make rational decisions. This brokering role follows various modalities with different outcomes.

Layout for presentation of the Thesis

In this document, results are presented in the form published chapters

I. Chapter four

This chapter presents an overview of production systems in the study area and highlights important features of those systems. It analyses the implications of herd dynamics in the study area and concludes that the high herd exit rates threaten the sustainability of small-herds.

II. Chapter five

This chapter elaborates on the socio-economic characteristics of the study area. It compares herd performance between women and men and compares preferred marketing channels as well as off-take levels and disposal patterns of different classes of livestock according to demographic characteristics. It concludes that financial burdens in households with smaller herds compel those households to sell potential breeding stock

III. Chapter six

This chapter evaluates the practices of farmers in the study area and compares differences among the breeds kept by these producers. It shows low proportion of indigenous breed types in the study area and reveals breed preferences according to gender with men, experienced farmers and community leaders showing preference for indigenous genotypes. It concludes that demographic attributes should be considered when designing in situ conservation programs.

IV. Chapter seven

This chapter evaluates the influence of herd mortality on cattle off-take rates. It assesses causes of deaths, vulnerability of households according to size as well as coping strategies of farmers in the study area. Results showed different correlation patterns between deaths of different classes of animals and off-take rates and concluded that herd mortality be monitored to improve the competitiveness of small-holder production systems.

V. Chapter eight

This chapter describes sources of information used by small-holder cattle enterprises and evaluates their influence on productivity of those enterprises. Results showed that farmers used different modalities to complement extension. The use of these channels also differ with demographic characteristics and tend to influence off-take rates in various ways. It concludes that the extension content be enriched to include markets and entrepreneurship in the study area

VI. Chapter nine

This chapter presents results of principal component analysis and identifies three main determinants of off-take decisions. It states implications of off-take decisions on the sustainability of production systems in the study area and concludes that current norms for herd structure should not be used for small-holder production systems.

VII. Chapter ten

This chapter summarises preceding chapters, draws conclusions and makes recommendations for future studies and interventions. Conclusions are based on stated hypotheses where some hypotheses are accepted and others are rejected.

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CHAPTER TWO

LITERATURE REVIEW

2.1. The definition of cattle off-take

Off-take rates are an estimate of proportions of both voluntary or planned and involuntary or unintended disposal of individual animals from a cattle population (Hubbard, 1986). Voluntary off-takes include sales, slaughters and donations such as lobola and involuntary off-takes include deaths and theft as well as losses (Scholtz and Bester, 2010). In this study, off-take is used to denote voluntary off-takes in the form of sales while the aggregate off-take is referred to as herd exit. The formula for calculating off-take rates requires precise animal records, which is often lacking in small-holder production systems.

The off-take formula has been applied to calculate herd mortality rates in different production systems (Otte and Chilonda, 2002; Swai et al., 2010; Mansour et al., 2014) based on the number of animals exiting the herd in a specific period divided by the number of days the animal spent in the herd. However, crude herd exit for each type of animal can be calculated by dividing the number of animals leaving the herd with the average of the opening and the closing herd sizes (Otte and Chilonda, 2002). The latter requires that animals purchased during that period as well as donations such as gifts be excluded to reduce bias.

The conceptualization of cattle off-take rates varies among scholars. For example, Colvin (1985) and Muma et al. (2009) defined commercial off-take as disposal through sale and consumption. Colvin (1985) reported a huge difference between sales and other forms of voluntary exit in some regions of Swaziland. In a study of communal small-holder farmers in Kwa-Zulu Natal, Tapson (1990) restricted cattle off-take to sales only and excluded rituals such as lobola. It is clear that the true estimation of off-take is confounded by cultural practices.

2.2. Global herd off-take trends

National cattle off-take rates are extrapolated from slaughter data (WTO, 2007). Globally, the Sub-Saharan Africa has the slowest growth in meat production than other developing regions (Table 2.1). There seems to be an iterative relationship between cattle off-take and productivity. It is logical that cattle sales would release

capital, which can be used to finance production and achieve growth. Otte and Chilonda (2002) highlighted the fact that sub-Saharan Africa's livestock sector is less productive than other developing regions. It is well accepted that because of multiple roles of cattle in sub-Saharan Africa, small-holder production systems are complex and so is marketing in these systems.

Table 2.1 Meat production and cattle off-take rates

Region	Meat production growth % 1982-94	Cattle off-take %
World	2.9	21.75
Developed World	1.1	36.04
Developing World	5.4	20.91
China	8.4	43.40
India	3.7	6.40
Latin America	2.9	21.86
Sub-Saharan Africa	2.1	6-12

Source: IFPRI (1999); Otte and Chilonda (2002); Gregory (2007)

2.3. Regional cattle off-take rates

South Africa has the highest cattle off-take on the Continent (Table 2.2). However, the regional comparison shows no difference between the SADC and other regions on the Continent. Most countries have higher goat and sheep off take rates. The low cattle off-take rates among small-holder farmers in South Africa may be attributed to discrimination by the feedlot dominated market against mature animals commonly kept in small-holder production systems as well as institutional barriers to market access. However, the same may not be adequate to explain reasons for low off-take in Botswana, which has access to export market for grass-fed beef.

Table 2.2 Livestock off-take rates in Africa

Region	Country	Off-take (%)		
		Cattle	Goats	Sheep
East Africa Community (EAC)	Kenya	10.2	33	28.1
	Rwanda	14	27	27
	Uganda	16.9	35	20
	Mean	13.7	31.67	253
Economic Community of West African States (ECOWAS)	Burkina Faso	12	32	26
	Côte d'Ivoire	23	37	37
	Ghana	11	30	30
	Senegal	12	25	25
	Mean	14.5	31	29.5
Economic Community of Central African States (ECCAS)	Cameroon	11	7	9
	Chad	13	25-30	25-30
	Mean	12	7	9
Southern African Development Community (SADC)	Botswana	7	5	7
	Malawi	27	64	43
	Tanzania	10	15	15
	South Africa	25-30	30-35	30-35
	Zambia	8	35-40	20
	Zimbabwe	10	8	13
	Mean	14.92	24.8	21.75
	Ethiopia	7.7	37	33
	Sudan	20	37	45

Source: WTO (2007)

2.4. The role of cattle in small-holder production systems

Cattle play multiple roles in the livelihoods of many African communities even though the majority of producers keep cattle for commercial reasons. As in the case of Botswana (Nkhori, 2004), cattle are still used for traction in the southern provinces of South Africa (Musemwa et al., 2007) while that role is diminishing in Northern provinces. Nkosi and Kirsten (1993) reported lower proportion of farmers keeping cattle for traction, 3% compared to 8% and 9% reported by Nkhori and Musemwa et al., respectively. In the North West Province, Swalbach et al. (2001) reported no use of cattle for traction while all studies showed that social activities such as lobola play an insignificant role (1-4%). However, although regional variations exist, these studies show that farmers keep cattle mainly for commercial reasons with 81% of farmers in Botswana keeping cattle for sales compared to between 46% and 59% in South Africa. This paradigm shift will enable small-holder producers to contribute significantly to Africa's food demand by 2025 (FAO, 2006). For this to be achieved the livestock sector should grow by 4% (FAO, 2006).

Despite the commercial orientation of small-holder producers, the multiple roles of cattle complicate selection traits for small-holder producers resulting in incongruence between producer preferences and market requirements. The tension between farmer preferences and market requirements has been highlighted in recent studies (Ouma et al., 2005; Ndumu et al., 2008). Coetzee et al. (2005) confirmed that the market discriminates against cattle from small-holder producers because of phenotypic appearance.

Critical in these tensions is the need for the farmer to allocate his/her resources optimally. This is referred to allocative efficiency (Bogetoft et al., 2006). For example, the farmer keep cattle breeds that he/she derives maximum utility from. The breed may or may not be adapted to the natural environment in which case the operation may become both technically and economically inefficient. In other words, the farmer may be unable to derive maximum outputs from a given set of inputs (his/her type of cattle) because cattle are not used optimally according to existing price and technology (Andreu, 2008). Figure 2.1 summarises reasons for keeping cattle by small-holder producers in Southern Africa

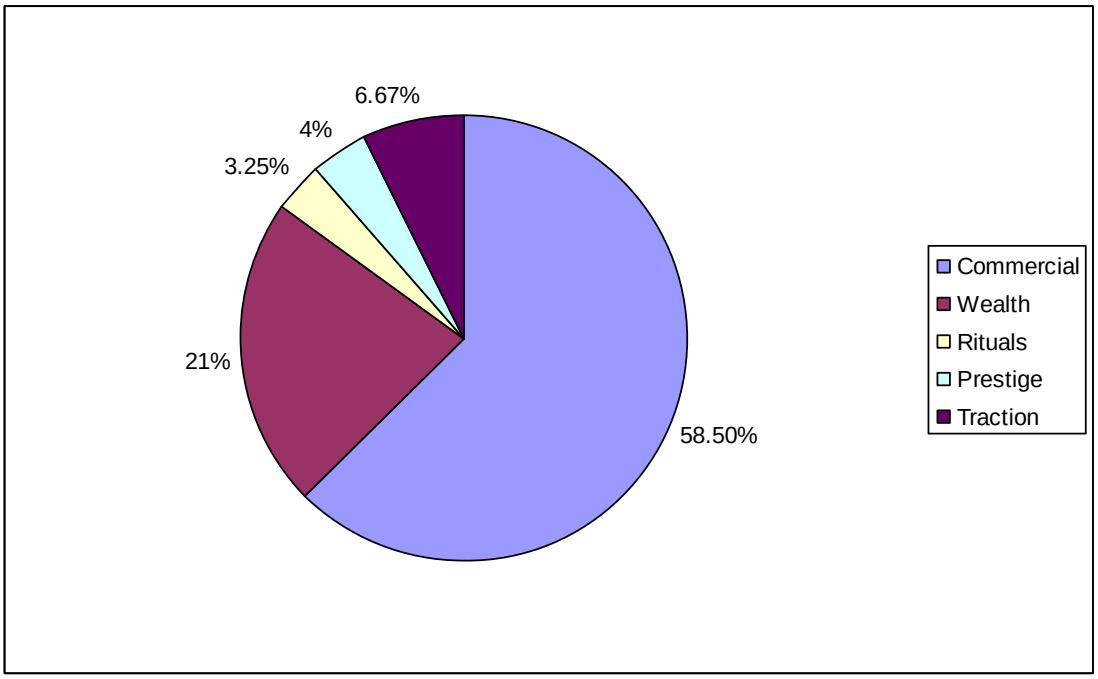

Figure 2.1 Reasons for keeping cattle in some parts of Southern Africa Source: (Nkosi and Kisten, 1993; Scwalbach et al., 2001; Musemwa et al., 2007; Nkhori, 2004)

The fact of the matter is that small-holder producers keep cattle for multiple purposes. As a store of wealth, cattle represent a sense of prestige, security and utility. Even under uncompetitive market prices, small-holder producers market their cattle to meet household needs. In situations where the store of wealth declines due to drought or animal diseases, producers maintain the prestige of owning cattle until other assets are disposed of. It is apparent that prestige and wealth connote that there is a commercial threshold for cattle off-take.

2.5. Cattle production systems in South Africa

The high participation in cattle production is associated with the fact that most of South Africa's land area (69%) is suitable for grazing (DAFF, 2011). According to Otte and Chilonda (2002) Southern Africa has 10% average cattle off-take rate compared to 13.6% for Central Africa. The South African beef industry is described in the National Beef Cattle Sector Strategy and Implementation Framework (Department of Agriculture, 2004) as dualistic, comprising the commercial sector, which is characterised by large herds on private land, the use of scientific technologies and is comparable to developed countries, and the small-holder sector, which mainly operates low input small herds on communal and leased land. These

sectors can also be distinguished through the cattle breeds they keep where the commercial sector tends to keep synthetic breeds and crossbreeds while the small-holder sector keeps indigenous crossbred and exotic type animals with a major influence from Brahman. Another distinguishing feature of these production systems is the type of output markets. On one hand, small-holder farmers produce oxen and old cows from the veld while on the other hand approximately 70% of cattle, mainly weaner calves are finished through feedlots. As a result of this market structure, small-holder farmers tend to have limited access to the beef market. This is so despite the fact that South Africa imports beef similar to that produced by small-holder farmers (SAMIC, 2007).

2.6. Implications of low cattle off-take

Tapson (1990) stated that the monetary per capita output in typical small-holder cattle sector in South Africa could be as low as one tenth of the national potential. It is logical to conclude that low cattle off-take in South Africa has cyclic knock on effect on the growth of the small-holder beef sector. Therefore the vicious poverty cycle among small-holder cattle producers can be partly attributed to low off-take rates, which result in little income to meet family needs /or invest in the growth of the cattle enterprise, to the detriment of herd productivity and the natural resource base due to overstocking (Figure 2.2).

On the contrary, higher cattle off-take could reduce overstocking, provide capital for farmers to acquire vital inputs to grow their enterprises thereby increasing economic efficiency of their herds. Failure to improve cattle off-take could result in the continent not achieving its goal of achieving a 6% agricultural growth by 2015 (FAO, 2006) as well as the North West Province not achieving its 6.7% growth target for the District in question by 2014 (North West Provincial Government, 2004). A systematic analysis of the small-holder beef sector would therefore enable the identification of leverage points for turn around.

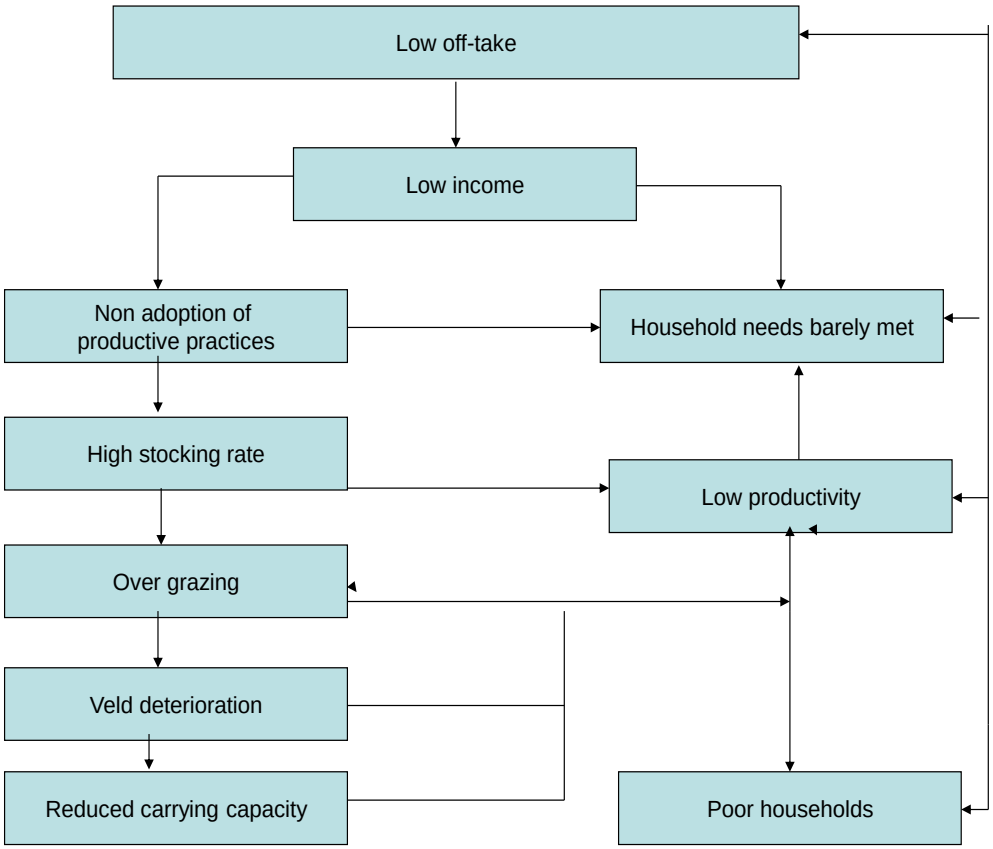

Figure 2.2. A logical link between cattle off-take rates and sustainable development

2.7. The influence of the household on cattle off-take

Household attributes such as headship, size, gender, education, employment, aspirations and attitude determine the extent to which the household can utilise the physical asset at their disposal. According to Scully (1962) there is a strong interdependence between the social economic ends of the firm-household.

2.7.1. Household size

The influence of the household has been confirmed in recent off-take studies (McPeack, 2004; Nkhori, 2004), showing a positive correlation between cattle off-take and household size. In this study, it was presumed that the influence of family size on cattle off-take would also be dependent upon the herd size. Tapson (1990) concluded that a threshold for becoming a commercial cattle farmer in relatively purely livestock subsistence economies is approximately 30 head of cattle but less than 20 for mixed systems. It was presumed that family size would not be significant where households possess larger herds of cattle.

2.7.2. Household headship

Inherent in a household is an institutional arrangement. In this regard, each household has its unique decision making pattern. Household headship is an important element of this institution, which either provides leadership to determine or express the household utility maximisation problem. However, the influence of the household head's gender on the efficiency of small-holder agriculture is insignificant (Idiong, 2007; Tchale, 2009). It therefore follows that the gender of the household head would not influence off-take.

2.7.3. Age of household head

Some studies reported significant impact of the age of household head on efficiency (Tchale, 2009) and cattle off-take (Nkhori, 2004) implying that older farmers would have more experience to make rational decisions for selling cattle. Because of the tendency of new farmers to enter the industry at late age, sometimes after retirement, this study presumed that the age of household head would not influence off-take. Rather, business objectives, which also occur on a continuum, would. A young farmer would tend to sell less animals because he/she is still accumulating capital to build his/her desired herd size while an older farmer may have reached his/her target herd size and make profit maximization his/her priority. In other words, regardless of the age of the head, a household with smaller herds may be inclined to focus on increasing stock, even though they will sell to meet basic needs.

2.7.4. Education

Studies by Idiong (2007) and Tchale (2009) showed that education does increase efficiency of small-holder famers but this has not been determined for cattle off-take. The current study argues that education per se may not influence off-take but the application of knowledge/ technology will. In this regard, the measure of adoption of "appropriate practices" can predict off-take.

2.7.5. Employment

Because of the high unemployment rate, it is logical to conclude that most households in the North West province make a living out of cattle production. Because of the apparent interaction between unemployment and the threshold for commercial production, this study presumed that most households would participate in stock sales even though their main objective might be to build their ideal herd

size. It was anticipated that households in the study area would be aspiring for a higher commercial threshold.

Baldwin et al. (2008) reported a negative correlation between employment and off-take rates while McPeack (2004) reported a negative correlation between food aid and off-take. It was postulated that households with high unemployment rates would be receiving social grants, which could equally suppress cattle off-take. Wages and alternative forms of income have also been reported to suppress off-take (Colvin, 1985; Baldwin et al., 2008). Therefore, the study anticipated that there would be an interaction between household size and income to determine off-take rates.

2.8. The influence of l tenure on cattle off-take

Land size and land ownership are closely related to finance and credit. In particular, Tapson (1990) regards land tenure in sub-Saharan Africa as complicated. This is true for South Africa today. However, Anim (2008) concluded that land title provides incentives for investment. As in the case of finance, on farm investment could increase productivity and cattle off-take.

The study area has a diverse land tenure system ranging from communal holdings to different forms of private holdings. Private titles include some of the land acquired through the land reform programme and that acquired privately. It was presumed that off-take will be suppressed on land that was acquired through the land reform process for a group of beneficiaries because of the complexities of the decision-making institutions. On the other hand, individually owned private land should have higher off-take than communal land.

2.9. Market

Nkosi and Kirsten (1993) reported that low prices offered at auction sales deter small-holder farmers from participating in the market. Tapson (1990) had reported market participation rate of 21% while Randela (2003) reported a high participation rate of 64% but confirmed earlier findings by Nkosi and Kirsten that most farmers disposed their cattle through other means than auctions, which also offer lower prices. The dissatisfaction with formal marketing channels was also reported in Namibia (Düvel and Stephanus, 2000), Botswana (Nkhori, 2004) and Malawi (Workman et al., 1998). It is therefore logical to conclude that access to market would influence off-take rates.

The location of farmers influences off-take because of a variety of factors. First, the difference in climatic conditions will obviously result in different output levels. Some regions may have experienced drought and other disasters such as veld fires more than other areas thus reducing grazing and animal growth. The occurrence of these events would influence farmers' off-take decisions (Kinsey et al., 1998).

Second, several authors (Makhura, 2001; Nkosi Kirsten, 1993; Coetzee et al., 2005; Senyolo et al., 2009) have identified marketing infrastructure as an impediment to off-take. Aspects such as distance to formal markets including auctions determine price and off-take. This also interacts with knowledge of farmers. With interventions such as the Comprehensive Agricultural Support Programme (CASP) (DoA, 2003), which inter alia upgrades infrastructure, it is apparent that the high market participation through auctions in the Eastern Cape (Musemwa et al., 2007), is a result of reduced transaction costs due to the improvement of market infrastructure

Kyeyamwa et al. (2008) reported that proportional transaction costs have a huge impact on market participation in Uganda. Senyolo et al. (2009) also showed the suppressing effect of transaction costs on market participation in South Africa. In both studies, it was concluded that infrastructural development would improve the situation. Meanwhile, Coetzee et al. (2005) ascribed a lack of market participation to small volumes of cattle from smallholder farmers. It is clear that there are many opportunities for identifying parameters for predicting cattle off-take.

2.10. Extension support

Tchale (2009) reported increased efficiency due to extension contacts in Malawi. Extension contacts and quality is also an important input to farmer's knowledge and therefore influence off-take. This study contends that extension practitioners face a dilemma of disseminating messages for improving technical efficiency while farmers are constrained by extraneous factors such as market environment. According to Rogers (1983), farmers would adopt innovations they perceived as having superior economic value. Market challenges suppress off-take and subsequent economic benefit and therefore provide no logical incentive for farmers to adopt technology.

2.11. Policy environment

The policy environment interacts with other elements of the small-holder cattle production system. Outputs of empowerment policies such as CASP could lead to

improved infrastructure, which enables farmers to improve efficiency and off-take. The current study argues that the notion that off-take is suppressed by farmers' inability to raise sufficient volumes for the market (Coetzee et al., 2005) does not hold where infrastructural improvement has been effected to facilitate communal production and marketing through improved economies of scale.

Finally, it is clear that cattle off-take rates are influenced by multiple variables. The question is why are cattle off-take rates among South Africa's small-holder farmers still low despite policy shifts and government interventions. It is therefore important that these complexities be described to inform future extension programmes.

2.12. Production practices

One of the major gaps in cattle off-take studies is the limited data on the influence of production practices. Muma et al. (2009) and Hüttner et al. (2001) have reported the impact of adopting animal health practices on off-take. On the other hand, although not significant, Baldwin et al. (2008) measured the impact of breed type on off-take. With reference to production systems, breed type and production practices should be considered for predicting cattle off-take in North West province.

2.13. The influence of drought on cattle off-take

In general, cattle off-take rates are circumstantial and therefore subject to covariance. Düvel and Stephanus (2000) ascribed the negative correlation between herd size and off-take to drought suggesting that farmers could be rebuilding stock when off-take rates are measured. The effect of drought, other sources of income and asset shocks has been widely reported (Kinsey et al., 1998; Fafchamps et al., 1998; McPeak, 2004). Two of the longitudinal studies found no significant shifts in cattle sales during droughts in West Africa (Fafchamps et al., 1998) and Kenya (McPeak, 2004).

In contrast, the Zimbabwean study reported increased cattle sales during drought (Kinsey et al., 1998). However, the latter showed that farmers build cattle stock overtime to sell during drought. This reinforces the notion of a commercial threshold for off-take as suggested by Tapson (1990). Although the covariate effect of time according to the foregoing literature is inconclusive, it has implications for the design of the future study. .

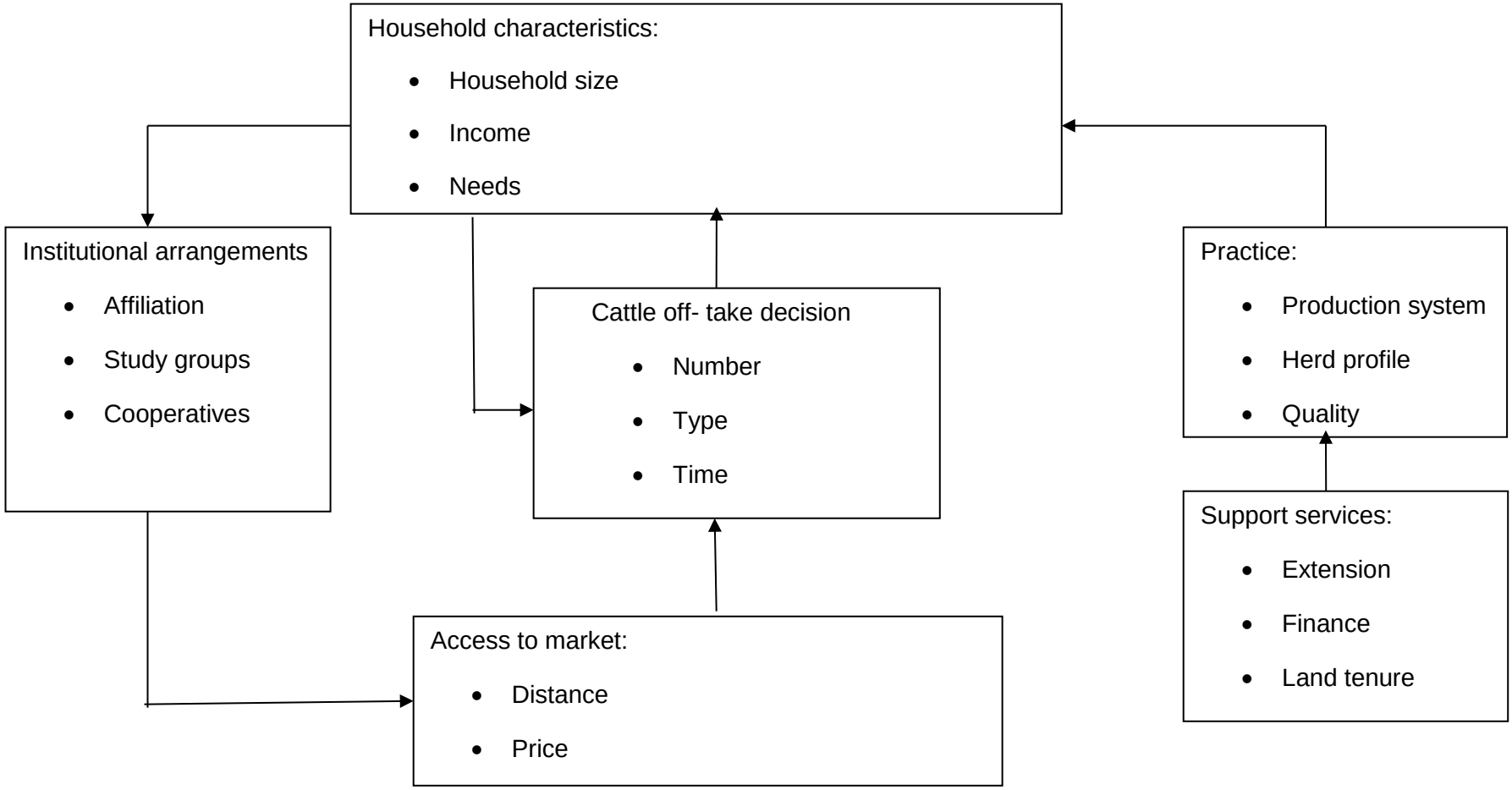

Figure 2.2 A logical link between factors influencing cattle off-take decisions in small-holder production systems

2.14. Summary

There has been slight variation in approach and definition of cattle off-take rates. In general, some important variables influencing farmers' decisions to dispose of cattle have been identified. This provides the basis for extension services to set priorities for interventions. The main limitation with off-take studies has been a lack of a standardised model that could replicate in different situations. Another important lesson from the literature is the need for precise animal records to improve the accuracy of off-take estimates. This calls for expansion of animal recording practices to small-holder farming areas. The formula for calculating off-take rates is inappropriate for production systems with limited animal records. Models from related fields such as economics and farmer behaviour, could be used to construct a credible model. Variables ranging from household characteristics to policy environment may influence farming efficiency as well as herd off-take. This study identified five hurdles that prohibit cattle off-take among small-holder producers i.e., household characteristics, production practices, the market, institutional arrangements as well as development support intervention programmes. Figure 2.2 presents the complex interactions between off-take and the five hurdles.

Access to resources such as land and finance also affects off-take. Farmers who have access to credit will have higher off-take rates with a view to service debt. However, with a growing tendency for retired professionals to invest in cattle in the North West, access to credit may be negated by savings and nullify the foregoing theory. Furthermore, because of the land reform programme, off-take rates could vary between communal and private land. The form of occupation on private land varying between individuals and groups may influence off-take differently. However, it must be emphasized that a lack of improvement in the performance of small-holder beef systems is an indication of the inefficiency of current extension approaches

The current study presumed a cyclic relationship between cattle off-take, herd management and grazing. This implies that increased commercial off-take will take pressure from the land and thus meet the prescripts of policies advocating for judicious use of natural resources, using the benefit approach. Producers need to be persuaded from the benefit side to change attitudes and practices. The benefit of improved productivity serves as a long term indirect incentive while that of cattle off-take is direct and immediate. Logically, producers pursue immediate benefits to

invest in long term activities. Change agents need to understand this iterative relationship between cattle off-take and production efficiency to formulate intervention strategies to change the behaviour of small-holder producers. The importance of this study can therefore not be overemphasised.

CHAPTER THREE

MATERIALS AND METHODS

3.1. Study area

The study was conducted in the Western District (Dr Segomotso Ruth Mopmati District Municipality) of the North West Province, which is South Africa' largest beef producing district. The District is the most arid in the province with cattle production being the main agricultural industry. The district is the poorest in the province with a high unemployment rate. Agriculture plays an important role in the district contributing more than 17% to the district's gross domestic product. With livestock growth being a priority for the continent (FAO, 2006), the study area was most suited for this investigation.

3.2. Study design

Borg and Gall (1989) differentiate between quantitative and qualitative designs showing their strengths and limitations. On the other hand, proponents of mixed methods (Patton, 1982; Morgan, 2007) discourage the choice of either of the paradigms over the other; rather advocate the optimum balance between the two.

Creswell (2007) illustrates how a qualitative research design could be employed to identify new variables while Tashakkori and Creswell (2007) show guidelines for mixed methods designs. The current study employed a sequential mixed method starting with a qualitative study to identify new variables from extension agents, followed by a quantitative study. A focus session was conducted with officials of the Department of Agriculture in the district, which identified that there is a need to exploit the complex environment of small-holder cattle producers and determine their off-take decision making models. In this regard, the important role of extension as a change agent was taken into account to determine the link between intervention programmes with farmers' expectations.

3.3. Sampling method

Borg and Gall (1989) describe the sampling procedure starting by defining the sampling frame. A list of 1700 farmers cattle obtained from the district office of the Department of Rural, Environment and Agricultural Development, was used as a sampling frame. Referring to Tapson's experience (1990) of sample attrition due to

incomplete schedules, a sample of 320 farmers was initially selected to ensure sufficient data. Only 308 questionnaires were fully completed and subjected to statistical analysis.

3.4. Data collection

A structured questionnaire was designed to obtain standardized information from farmers (Borg and Gall, 1989). Tapson (1990) highlighted the need to cater for illiteracy among small-holder cattle producers when designing questions. Questions were constructed using Patton (1982) guide for designing questions, to reduce the interview time usually experienced with open ended questions. A questionnaire aimed at capturing cross-sectional data on factors affecting cattle off-take for 2011 breeding season was developed and administered through face-to-face interviews with respondents between May and July 2012. The interviews lasted for 45 minutes with each respondent. Narratives by farmers were noted as questions were probed for clarity.

Besides the demographic variables, the questionnaire was divided according to Patton (1982) categories for evaluation questions i.e., knowledge, feeling and behaviour. The demographic section addressed variables relating to farmer's age, gender, family size, members of household at school, education and employment.

The behaviour section focused on variables relating to herd size, calving rates, mortality rates, herd composition, cattle breed, land ownership, ownership of other livestock, affiliation, leadership role, access to finance, access to extension, sources of information, frequency of extension contacts, types of contacts, type of messages, adoption of animal production practices, access to market and market information as well as causes of mortality, slaughters and sales frequency.

The feeling section addressed variables relating to farming objectives, reasons for keeping cattle, aspirations and utility, ideal herd size, perceived constraints, competitiveness of prices, reasons for current price, rating of marketing channels, relevance of extension, quality of extension, quality of institutional arrangements and alternative solutions.

The knowledge section addressed variables relating to extension programme, government policy, scope of market channels, product quality, institutional arrangements and governance.

3.5. Data analysis

Data were analysed using IBM SPSS statistics 22 (2013). Descriptive statistics were computed using frequencies and means to determine patterns between variables. Ranking scales were transformed into dummy variables to enable statistical tests. Males were coded 0 while females were coded 1. Herd sizes were classified according to categories suggested by Tapson (1990) where herds of less than 11 were regarded as small.

Crude herd mortality was calculated using the following equation: number of deaths during 2011/average of opening and closing herd sizes in 2011 x 100. Calculations for mortality were first made according to animal categories within the herd to distinguish suckling calves (pre-wean) from weaners and adult animals. Off-take rate was calculated as number of sales during 2011/ average of opening and closing herd sizes during 2011 x 100. For this purpose, animals were categorised as bull, ox, cow, heifer, bullock and steer. In both instances, purchases and donations were excluded from the calculation.

The GLM multivariate analysis was performed to test effect of farming area and farm level variables on herd mortality and off-take rates. Means were separated using least significant differences (LSD) tests. Correlation analysis was performed to measure associations between off-take and other variables. Principal component analysis was performed to identify the main factors underlying variances in cattle off-take rates.

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CHAPTER FOUR

DESCRIPTION OF THE PRODUCTION SYSTEM

4.1. Introduction

This chapter presents summary statistics highlighting important features of the production system in the study area. The analysis is based on geographic demarcation for execution of public farmer support services as well as herd size categories. An extension ward is used for this demarcation because it is a unique management unit capable of reflecting variations in efficiency among producers. In this study, these variations were analysed assuming that farmer efficiency should be used as a proxy to measure the quality of extension. Results of socio-economic characteristics of farmers are elaborated in chapter 5 while chapter 6 presents results on use of animal breeds. Chapters 7 and 8 present results of herd mortality and sources of information, respectively. Principal component results are presented in chapter 9.

4.2. Household characteristics

4.2.1. Age of household heads

Table 4.1 shows that the majority (76%) of respondents were males, 82% of whom lived at home. The age of household heads ranged from 24 to 86 with an average of 57 years. Farmers from Taung North were older than those from other extension wards (Table 3). The majority (46%) of respondents belonged to middle age of between 45 and 65 although seniors (>65) constituted a significant proportion of the population (34%). The preponderance of middle aged farmers has implications for sustainable growth of the cattle industry in the study area. According to Tauer (1995) farmer productivity increases with age as the farmer gains experience but starts to plummet as the farmer passes his/her prime age of late 40. In a study involving the majority (73%) of Nigerian female maize farmers in their prime age, Okpachu (2014) reported a positive correlation between age and productivity. On average, farmers in the study area had 20 years of cattle rearing experience ranging from one to 62 years with the majority (80%) having more than 20 years' experience. Although more experienced farmers owned larger herds than other farmers, this study found no difference in the productivity indicators such as calving rates, mortality as well as herd off-take rates of farmers in different age categories and years of experience.

Table 4.1 Distribution of household heads by age gender

Gender	Age category				Total
	<36	36-44	45-65	>65	
Male	20	29	93	80	222
Female	6	3	45	22	76
	26	32	138	102	298

4.2.2. Gender

The marginalization of women in agriculture industries is a universal hassle. Despite contributing over 40% and 50% of the World's and Africa's agricultural labour force, respectively (FAO, 2011; ICA, 2012), women control less land and livestock even though they play a prominent role in poultry and dairy. Women constitute 27% of livestock owners in Europe (European Commission, 2012) and just under 25% in the United States of America of America (USDA, 2007). The national average proportion of female headed agricultural households involved in livestock production is 45% for South Africa and 33% for North West (Statsa, 2013), which is significantly higher than the level obtained in this study. The low ferminisation rate (24%) in this production system is a matter for concern because women are a catalyst for social transformation. Previous studies have shown that there is a strong correlation between women's economic opportunities and access to affordable and safe food (EIU, 2012; MuGeDe, 2014) and that women are as productive as men in some agricultural industries when afforded equal access to productive resources as men (FAO, 2011). With the exception of findings from a recent study involving maize farmers in Ethiopia (Ragasa et al., 2012), many studies show a dire situation where women participation was below 10% (Table 4.2). However, Table 4.3 shows an upward trend for women participation in the Taung North extension ward (46.7%) but extreme marginalization for Morokweng (11%). FAO (2011) reported that cocoa women farmers tend to be older and less educated than their male counterparts. The present study shows that women farmers were older than their male counterparts even though their education levels did not differ. Moreover, as elaborated in the subsequent chapters, women tend to own smaller herds than men. Nonetheless, barriers to women participation in the Morokweng extension ward need to be probed further.

Table 4.2 Comparative analysis of demographic characteristics of small-holder farmers

Country	Gender distribution of household heads		Source
	% Male	% Female	
South Africa	84	16	Lehloenya et al. (2007)
South Africa	80	20	Musenmwa et al. (2007)
Nigeria	91	9	Omobolanle (2008)
Malawi	87	13	Chirwa Matita (2012)
Namibia	93	7	Kapimbi Teweldemedhin (2012)
Ethiopia	70	30	Ragasa et al. (2012)
Ethiopia	82	18	Elias et al. (2013)

4.2.3. Household size

Table 4.3 shows an average household size of 4.9 for the study area, which is slightly higher than both the national and provincial averages. The 2011 population census for South Africa reported an average national household size of 3.4 and 3.2 for North West province (Statsa, 2013). According to the Integrated Development Plan (IDP) (Dr RSM, 2015) the average household size for the district municipality was 3.6. This study found that household sizes ranged from one to 15 with seniors maintaining larger households with more persons attending school. Ganyesa

extension ward had the largest average household size (5.2) while Morokweng had the smallest (4.5). With the exception of Taung North, female headed households were larger than those headed by men.

4.2.4. Education

According to the South African general household survey, the literacy rate for persons 20 years and older increased to 91% (Statsa, 2015). This study shows that at least 79% of household heads attended school for between one and 17 years with an average of 7.6. No significant differences were detected between extension wards and gender but farmers from Morokweng tended to have more years of schooling than the rest. Unlike Morokweng, women in Taung North and Ganyesa had more years of schooling than men (Table 4.3). Persons are regarded as functionally literate after completing grade seven (Huebler, 2006; Statsa, 2015). The functional literacy of 79% for the study area is slightly below the national level of 85% reported in the general household survey (Statsa, 2015). Previous studies have shown a positive correlation between education level and productivity (Weir, 1999; Okpachu, 2014). The present study found that persons with more years of schooling had less cattle rearing experience but owned larger herds than others did. However, this study found no difference in the productivity indicators such as calving rates, mortality rates of farmers with different years of schooling.

As reported in the general household survey that older women and persons 60 years and above tend to be functionally illiterate, this study found that seniors had the least years of schooling (5.15) than other age categories but tended to have more members enrolled for tertiary education. This result suggests that there is a high level of awareness about the importance of education and skills development as well as their potential impact on economic growth. The number of persons attending school ranged from one to 13 with an average of 4.3 persons per household.

4.2.5. Employment.

The IDP shows that Dr RSM has the highest unemployment rate (35.8%) than other districts in the North West Province. Table 4.3 shows that Morokweng had the highest proportion of economically active persons (74%) while Ganyesa had the lowest (37%). Twenty four percent of household heads regarded themselves as unemployed while the majority (58%) regarded farming as a form of self-

employment. Most households (69%) used members of the household to herd cattle, 75% of whom were household heads, which indicates that cattle play an important role in livelihoods in the study area. Only 2% of households in Taung North were employed compared to 29% in both Ganyesa and Morokweng. McPeack (2004) reported a negative correlation between food aid and off-take while wages and alternative forms of income have also been reported to suppress off-take (Colvin, 1985; Baldwin et al., 2008). It was therefore anticipated that there would be an interaction between household size and income to determine off-take rates. Instead, this study showed that income from outside livestock only suppressed the sale of steers.

4.2.6. Land tenure

Land size and land ownership are closely related to finance and credit. Tapson (1990) regarded land tenure in sub-Saharan Africa as complicated while Anim (2008) concluded that land title provides incentives for investment. According to Tenaw et al. (2009) a lack of secure land tenure in sub-Saharan Africa affects productivity among farmers. Table 4.3 shows that most farmers (77%) operate under a communal tenure system without titles varying between 76% for women and 78% for men. Ganyesa had the highest proportion of communal farmers (81%) compared to 68% for Taung North. Although farmers who operated private land had more experience and larger herds, neither land tenure nor extension ward influenced productivity indicators such as calving rates, mortality as well as herd off-take rates of farmers.

Table 4.3 Demographic characteristics of small-holder producers by extension ward

Extension Ward	Number farmers	Family size	Age of head	Mean education	No. persons in school	Economic active %	Employment %	Communal tenure %
	M/F	M/F	M/F	M/F	M/F	M/F	M/F	M/F
Taung North	41 36	5.1 4.5	63.7 53.9	6.6 8.2	5.2 4.7	42.2 57.8	28.6 71.4	77 29
Mean	77	4.8	59.2a	7.6	4.8a	66.75	2.35	68.0
Ganyesa	105 30	5.1 5.3	55.1 60.7	7.4 7.9	5.1 4.9	79.5 20.5	80 20	78 22
Mean	135	5.2	56.3[b]	7.4	5[a]	37.7	29.6	81
Morokweng	86 10	5.1 5.4	48.6 63.1	8.2 5.1	6.5 8	89.6 10.4	100 0	91.5 8.5
Mean	96	4.5	50.8[b]	8.3	6.5[b]	74.0	29.0	73.0
Sub total	232 76	5.1 5.9	54.3 58.4	7.6 7.8	5.6 5	74 26	70.3 29.7	76.7 23.3
Total	308	4.9	56.8	7.7	4.3	66	17.6	76.6
SE		0.21	0.97	0.38	0.16			

4.3. Production practices

4.3.1. Herd structure

The number of cows and bulls determine the number of calves to produce and hence the productivity and profitability of beef enterprises. The recommended proportion of cows within a herd in South Africa is 60%, 50% and 40% for weaner system, long weaner and two year ox system, respectively. However, as noted by Scholtz and Bester (2010), the low productivity of small-holder farming may be partially attributed to less optimal herd structure. These authors estimate that the proportion of cows in typical small-holder beef enterprises is less than 40%. The average proportion of cows in the study area was 54% ranging from 5% to 100% (Figure 4.1). In a study of pastoralist production system in Kenya, Bekure et al. (1991), reported that the proportion of cows and bulls declines as herd size increases. The present study also shows a high proportion of cows (63%) for Taung North extension ward, which is dominated by small herds but an inverse for bulls. The average proportion of heifers of 26% found in this study is higher than the recommended replacement rate of 20%. However, Taung North showed slightly lower replacement rate of 15%.

Even though the average proportion of bulls is within the recommended range of between 3% and 4% of bulls per 100 cows (1:25-1:35), only 27% of the herds in Taung North had a bull, the majority (85%) of which were 5% and above. The bull proportion in the majority (81%) of 78% of herds in Ganyesa, which had bulls was 4% and above. Sixty three percent of herds in Morokweng had bulls with the majority (90%) recording bull proportion of 3.3% and above. Although a lack of bulls in the study area is a course for concern, this study found no correlation between the absence of bulls and calving rates suggesting that the unrestricted animal movements in the open communal system could be compensating for this challenge. However, the proportion of bulls was positively correlated ($r=0.136$) with calving rates ($P<0.05$). This correlation coefficient means that means that the two variables account for only 13.6% observed relationship.

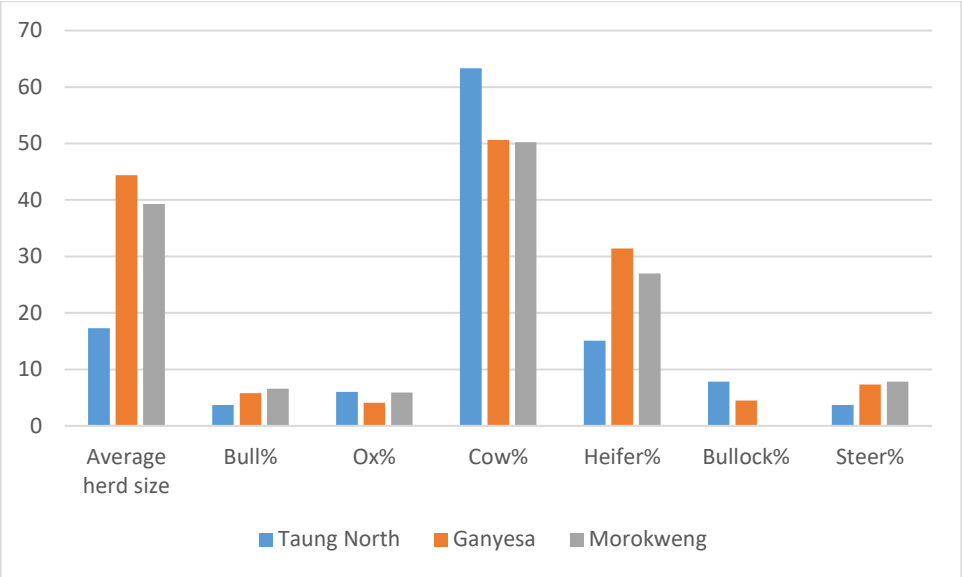

Figure 4.1 Analysis of herd structure by extension ward

Contrary to the expectation that the proportion of bulls in small herds would be larger, this study found that small herds of 1-10 had the smallest proportion of bulls (2.7%) than others (Table 4.4). This could be attributed to the small number of herds, which had bulls. However, the proportion of bulls declined as herd sizes increased beyond medium size of 11-30. However, small herds of 1-10 had significantly high cow percentage than other herd size categories except the largest category of >70 head of cattle. Five herds did not have cows for various reasons. One herd in the small category of 1-10 was left with heifers after the cow died due to drought while four herds were established recently through a donation and purchase of heifers. The result showing a low proportion of replacement heifers (14%) among small herds agrees with those reported by Chikura (2006) for small herds of 1-20 in Zimbabwe. However, the present study shows that the proportions of heifers among medium and large herds surpassed the recommended levels of between 18% and 20%. In general, the proportions of males in herds suggest that there are two distinct production systems in the study area. The proportion of 12% for immature males indicates that the animals are destined for a weaner market where some farmers explained that the reason for keeping bullocks was to obtain faster growth rates. Oxen result from the retention of steers when there is enough grazing or when market prices are low.

Table 4.4 Herd composition of small-holder cattle farmers by herd size category

Herd size category	Number of farmers	Average herd size	Bull%	Ox%	Cow%	Heifer%	Bullock%	Steer%
1-10	57	5.9	2.7[a]	5.4 [ab]	65.1 [a]	14.7 [a]	8.2 [a]	4.8 [a]
			(6)	(11)	(56)	(28)	(150	(11)
11-30	121	20.1	6.2[b]	6.4 [a]	52.4 [b]	26.8 [b]	4.9 [ab]	6.7 [ab]
			(66)	(55)	(119)	(111)	(44)	(58)
31-70	94	45.6	6.4 [b]	4.4 [ab]	47.3 [c]	31.6 [b]	4.1 [b]	8.3 [b]
			(77)	(39)	(93)	(91)	(42)	(68)
>70	36	105.7	5.6 [ab]	2.4 [b]	55.3 [abc]	28.8 [ab]	4.9 [ab]	4.2 [a]
			(36)	(8)	(36)	(31)	(17)	(21)
Total	308	35	5.6	5.1	54	26.3	5.3	6.6
SE		0.7	0.5	0.6	1.2	1.1	0.6	0.6

Values with different superscripts differ significantly (P <0.05)

Values in brackets indicate number of farmers

4.3.2. Herd performance

Scholtz and Bester (2010) estimated calving rates for South Africa's small-holder farmers at below 40% while Chikura (2006) reported a calving rate of 36% for this category of farmers in Zimbabwe. Overall, cows in 82% of the herds in the study area calved, 70% incurred mortality while another 82% sold some cattle in 2011. The average calving rate for the study area was 55% ranging from 5.6% to 100% (Table 4.5). Although calving rates did not differ significantly across herd size categories, small herds of 1-10 consistently had relatively higher values for other performance traits than larger ones. Herd mortality rates for small herds of 18% was above average (10%) and differed significantly with mortality rates for the rest of herd size categories ($P<0.05$). High mortality rates in small herds are a course for concern because the huge proportionate losses stifle herd expansion depriving farmers the benefits of commercial farming.

The average off-take rate of 15% found in this study is higher than the 12% reported by Musemwa et al. (2010) for some parts of the Eastern Cape as well as 6% reported for some parts of Namibia (Enkono et. al., 2013) and Zimbabwe (Chikura, 2006). Although the average off-take rate of 22% for small herds is commendable, it may contribute to further stock shrinkage when considering the high herd mortality and slaughter rates as reflected in the high herd exit rate (43%). Overall, as discussed in chapter 7, the high herd mortality suppressed herd off-take. Herd slaughters were performed for different ceremonies such as burial and wedding celebrations. On average, owners of small herds slaughtered 2.3% of the herd for own household ceremonies while owners of larger herds did so to assist destitute families during bereavement. These slaughters increased voluntary exit to 18% with the highest proportion observed for small herds. Chapter 5 elaborates on herd dynamics as well as marketing channels used in the study area. Figure 4.2 presents herd pliability curve for the study area.

Table 4.5 Herd performance of small-holder cattle farmers by herd size category

Herd size category	Number of farmers	Calving %	Herd mortality%	Herd Off-take%	Herd Slaughter%	Voluntary exit%	Total exit %
1-10	57	53.8	18.16[a]	22.5 [a]	3.2 [a]	26.9 [a]	43.5 [a]
		(42)	(30)	(38)	(10)	(38)	(11)
11-30	121	51.5	8.63[b]	12 [b]	2.7 [ab]	14.3 [b]	21.6 [b]
		(101)	(77)	(87)	(48)	(98)	(58)
31-70	94	53.7	8.12[b]	13.8 [b]	1.9 [abc]	15 [b]	23.3 [b]
		(77)	(74)	(87)	(54)	(89)	(68)
>70	36	58	6.12 [b]	16.4 [b]	1 [c]	16.2 [b]	20.7 [b]
		(34)	(27)	(36)	(21)	(36)	(21)
Total	308	55	10	15	2.3	18	27.3
SE		1.86	1.16	0.81	0.28	0.66	1.18

Values with different superscripts differ significantly (P <0.05)

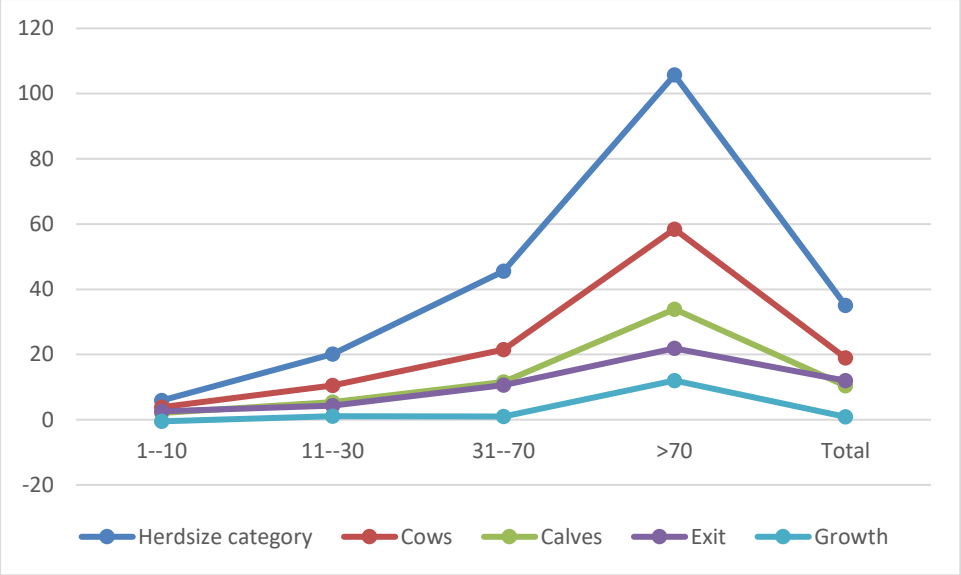

Figure 4.2 Herd Pliability curve for Dr Ruth Segomotsi Mompati District Municipality

4.3.3. Herd management

Jelani et al. (2015), reported low adoption scores for improved management as well as health practices by dairy farmers in India. Table 6 shows that most farmers (99%) identified their animals using brand mark. This is an important milestone for the study area because animal identification and traceability is becoming more important for product traceability. Furthermore, most farmers (90%) also reported that they controlled parasites and vaccinated their animals against Anthrax, Brucellosis and Blackqaurter.

Despite the advantage of controlled calving season for feeding and marketing, most small herds do not use this practice. Only 20% of the farmers in the study area implemented a breeding season while the rest left the bull with cows all year round. However, this did not influence productivity indicators such as calving rates, mortality as well as herd off-take rates of farmers. In an experiment comparing three calf weaning ages ranging from five to nine months, Story et al. (2000) reported some advantages with early weaning. Only 53% of farmers in the study area weaned their calves at seven months with no correlation with breeding season but showing a positive correlation between late weaning and herd off-take (r=0.192).

Table 4.6 shows that 31% of farmers in the study area, most (80%) of whom were men, milked some cows. On average, these households milked 43% of cows ranging

from 17% in large herds of >70 to 69% for small herds of 1-10. The average milk yield was 2.3 litres per day, which is higher than 1.2 litres reported by Bekure et al. (1991) for the assessment of the small-holder farmers in Kenya. This higher yield may be partly attributed to the adoption of dairy and dual purpose breeds such Jersey, Brown Swiss and Simmental for cross breeding. These breed types constitute 10% of herds as part of cross bred herds. Neither the proportion of cows being milked nor the amount of milk produced influenced herd productivity indicators. The analysis of breed types used in the study area is presented in Chapter 6.

Table 4.6 Herd management of small-holder cattle farmers by herd size category

Herd size category	Number of farmers	No Identify animals	Breeding season No.	No. wean calves	No vaccinate	No control parasite	No milking
1-10	57	57	7	32	53	55	15
11-30	121	119	20	62	111	114	46
31-70	94	92	19	50	83	88	26
>70	36	36	15	22	33	34	10
Total	308	304	61	166	280	291	97

4.3.4. Reasons for keeping cattle

The one dimensional view that African farmers keep cattle for non-commercial purposes persists despite it being refuted over decades (Steele, 1981; Tapson, 1990) and unblemished by evidence that cattle play multiple roles in livelihoods of African communities (Orskov, 1987; Düvel, 1994). Previous studies in other parts of the North West Province reported that only 5% of respondents kept cattle for prestige whilst none were used for traction purposes (Schwalbach et al., 2001). This was confirmed in the present study showing low ranking of traction objective by all respondents and high scoring for prestige by only 6% of respondents. Unlike other regions, only 47% of respondents gave a high ranking for commercial or income generation objectives

compared to 81% for Botswana (Nkhori, 2004) and >50% for Eastern Cape (Musemwa et al., 2007). Instead, most farmers (94%) gave a higher ranking for wealth creation followed by cultural ritual reasons (71%) compared to an average of 27% and 3%, reported in previous studies for the two attributes, respectively (Musemwa et al., 2007; Kapimbi and Teweldemendhin, 2012).

Table 4.7 shows that the income objective was negatively correlated with calving rates, steer and overall herd off-take but positively correlated with ox off-take ($P<0.05$). It must be noted that there was a positive correlation between the income objective and aspiration for herd growth. This implies that farmers, who regard income as their main objective, may be holding on to stock with a view to increasing herd size. However, the ranking for wealth was negatively correlated with calving rates and cow off-take but positively correlated with ox and overall herd off-take ($P<0.05$). This result is consistent with off-take patterns for herd management principles where cows and replacement heifers are withheld at the expense of surplus males. Farmers who gave a high ranking for ritual objective, experienced low calving rates while those who ranked the prestige objective high had a higher cow off-take than steers ($P<0.05$).

Table 4.7 The relationship between cattle rearing objectives and herd off-take

	Calving rate	Cow sale	Steer sale	Ox sale	Herd sale
Income	-.211**	-.078	-.378**	.129*	-.138*
Wealth	-.171**	-.186**	.025	354**	.137*
Ritual	-.180**	-.101	-.004	-.068	-.097
Prestige	-.056	.195**	-.153*	-.020	.60

4.4. Discussion

The finding on the age of household heads in this study area belonging to middle to old age bracket concurs with studies conducted in other parts of the continent (Chirwa and Matita, 2012; Adensehinwa et al., 2004). Even though the present study did not

observe significant productivity difference between younger farmers and older ones, wealthier (in terms of herd sizes) and more experienced ones, the dominance of old farmers in the study area signals a watershed moment. Cattle productivity will plummet if younger persons do not enter the industry in a near future. Special attention is required to increase the current youth participation rate of 9% as a succession strategy. Literature shows that the exclusion of women from agriculture is a global challenge; and some instances can be effectively addressed through decisive policies. Overall, the finding of 24% women participation rate falls short of South Africa's equity plan as well as North West province's statistics of 33% participation. While the high women participation rate in Taung North is commendable, the 11% participation rate for Morokweng is complex and could be a function of a unique production system where farmers stay at cattle posts to man their stock. With their multiple domestic chores, women may not afford to stay away from family as men.

The result showing that most farmers (58%) regard farming as self-employment coupled with above average household sizes, imply a heavy burden for larger households who should logically sell more animals. However, contrary to literature showing that income from outside livestock suppresses off-takes, this study found no links between general household characteristics and herd off-take. This implies that alternative sources of income may be playing a role in the sustainable livelihoods of households in the study area. A lack of land ownership among the majority of farmers in the study area epitomises the country's national challenge of landlessness. Although the type of land tenure did not influence productivity in the study area, the preponderance of communal farming calls for new interventions to simultaneously improve the amenities in communal areas as land reform farms are capitalised.

In general, herd structures in the study area were within the recommended ranges of 40% to 60% for cows. An important finding was the correlation between bull: cow ratio and calving rate. Comparison of herds according size of operation showing a superior cow percent for small herd confirms previous finding in some parts of the continent (Bekure et. al., 1991). The low proportion of bulls and replacement heifers among small herds is a matter for concern with implications for both expansion of herds and improved productivity. This brings to light the need to increase the number of breeding bulls among small herds in order to improve productivity. Herd performance also

followed a similar pattern showing higher values for small herds including mortality rates. The mortality rate among small herds indicates a deficiency in herd management, which needs attention. The high mortality rates among small herds occur despite high adoption of herd management practices such as animal identification and vaccination.

The finding showing a positive correlation between late weaning and off-take rates suggests that farmers delay the sale of animals in anticipation of higher incomes for free range long weaners. This is reinforced by the proportion of exotic breeds, which are used in crosses to increase weaner weight. Exotic breeds are also used in dairy ranching to improve milk yield, which according to the volumes produced, is meant for home consumption.

The use of a ranking scale for cattle rearing objectives provides additional insight into off-take patterns. The low ranking of traction and prestige eliminates these alternate roles as impediments to commercial participation, which implies that future development of this tool should focus on other attributes especially for application in the North West Province. The correlation results for cattle rearing objectives coupled with farmers' aspirations for larger herds, suggest that cattle are kept as a store of wealth with withdrawals made when need for cash arises. Other withdrawals may be in the form of cultural slaughter while owners of large herds will earn prestige by receiving respect from members of the community.

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CHAPTER FIVE

THE INFLUENCE OF HOUSEHOLD CHARACTERISTICS ON CATTLE OFF-TAKE RATES IN THE NORTH WEST PROVINCE, SOUTH AFRICA

Published in: Motiang D M and Webb E C. (2016). The influence of household characteristics on cattle off-take rates in the North West Province of South Africa. Livestock Research for Rural Development. Vol. 28(6), Article #118

Abstract

This paper evaluated the socio-economic characteristics of small-holder cattle producers in the North West Province and investigated the relationship between these characteristics with cattle off-take. A questionnaire aimed at capturing cross-sectional data on factors affecting cattle off-take for 2011 breeding season was administered through face-to-face interviews of 308 respondents. Results showed that respondents were predominantly middle and old age males. Household headed by seniors (>65 years) tended to be larger than others. The majority (58%) of household heads regarded farming as their form of self-employment while only 15% had temporary or permanent employment outside agriculture. Most (82%) households relied on income from cattle followed by other livestock (55%) and social grants (47%). Female-headed households relied on small businesses, which correlated positively with the sale of cattle and sheep. Households that depend on employment had less number of persons attending tertiary education and sold more cows. As expected, farmers sold more male animals (62.8%) than females mainly through auction sales. Unlike previous studies, this study shows that income from outside agriculture supplements cattle off-take. Households owning herds smaller than 11 head of cattle had higher overall herd off-take, as well as higher off-take for females than steers. Affiliation to and official position in community associations suppressed the cow sales but induced steer off-take. It is concluded that financial burdens in households with smaller herds compel those households to sell potential breeding stock. This study recommends the development of an animal recording system and that future interventions focus on the strengthening of women and community associations.

5.1. Introduction

Although cattle production forms an important part of the livelihoods strategy amongst agricultural households in South Africa, it is well known that these physical assets earn less economic returns amongst small-holder producers compared to the commercial sector. Recent population census shows that more than 600000 agricultural households own cattle (Statistics South Africa, 2013). Cattle in the hands of small-holder producers constitute 40% of the national herd (RMRDT 2008). The biggest concern is that the cattle off-take rate, which measures the amount of voluntary exits, remains low in the small-holder sector (Tapson, 1990; RMDT 2008; Scholtz and Bester, 2010) hence the need to determine the underlying socio-economic causes.

According to Tchale (2009) both the age and education levels of household heads have a positive impact on efficiency. Meissner et al. (2013) attribute the low off-take rates among small-holder producers to poor production efficiency. Otte and Chilonda (2002) reported high average herd performance levels for sub-Saharan Africa while Scholtz et al. (2010) illustrate disparities in production efficiency between the South African commercial and small-holder sectors. Some studies have reported a positive correlation between cattle off-take and demographic characteristic such as the age of household head and household size ((Nkhori 2004) while extraneous attributes such as employment (Baldwin et al., 2008) and food aid (McPeak 2009) were found to suppress off-take rates.

Dr Ruth Segomitsi Mompati District Municipality is South Africa's largest beef producing district. Thus, investigation of off-take patterns of the District may provide a useful insight into challenges facing the small-holder sector. The objective of this paper was to describe the socio-economic characteristics of small-holder cattle producers in the North West Province and investigate the relationship between these characteristics and herd dynamics as well as cattle off-take.

5.2. Materials and methods

5.2.1. Data collection

This study was conducted in the Dr Ruth Segomotsi Mompati (RSM) District Municipality of the North West Province. A random sample of 308 cattle farmers was selected from a list of 1700 from the District Department of Agriculture and Rural Development. Three wards of Taung North (25%), Morokweng (31%) and Ganyesa (44%) were used as strata to draw proportionate samples. A questionnaire aimed at capturing cross-sectional data on factors affecting cattle off-take for 2011 breeding season was developed and administered through face-to-face interviews with respondents. The instrument containing 73 questions ranging from demographic data to production data including sources of information and sales was administered between May and July 2012. Off-take rate was calculated as number of sales during 2011/ average of opening and closing herd sizes during 2011 x 100. For this purpose, animals were categorised as bull, ox, cow, heifer, bullock and steer.

5.2.2. Data analysis

Data were analysed using IBM SPSS statistics 22 (2013). Descriptive statistics were computed using frequencies and means to determine patterns between variables. Ranking scales were transformed into dummy variables to enable statistical tests. Males were coded 0 while females were coded 1. Herd sizes were classified according to categories suggested by Tapson (1990) where herds of less than 11 were regarded as small. The GLM multivariate analysis was performed to test effect of farming area and farm level variables on herd mortality and off-take rates. Means were separated using least significant differences (LSD) tests. Correlation analysis was performed to measure associations between demographic characteristics, sources of information as well as herd off-take.

5.3. Results and discussions

5.3.1. Household characteristics

The majority (76%) of households were headed by men even though Taung North had the highest (46%) of female headed households than other extension wards (Table 5.1). The high proportion of male farmers in the study area agrees with findings from

other parts of the region (Kapimbi and Teweldemedhin, 2012; Chirwa and Matita, 2012) showing that males constituted more than 80% of farmers. The average age of household heads was 57 ranging from 24 to 86 years with household heads from Taung being older than those from other extension wards. However, all extension wards had similar household sizes, number of economically active members as well the years of schooling for the household head. The average household size was five ranging between one and 15 members with three economically active members on average, ranging from one to 14. About 79% of household heads attended school for between one and 17 years with an average attendance of 7.6 years. This education level suggests that these farmers completed primary school and are therefore literate (Huebler, 2006).

Table 5.1 Distribution of households by extension wards

Parameter	Extension ward					
	Taung North	Ganyesa	Morokweng	Mean	SE	Prob.
Number of farmers	77	135	96	102	0.04	
Household size	4.8	5.2	4.5	4.9	0.21	0.58
Average Age of head	59.2[a]	56.3[b]	50.8[b]	56.8	0.97	0.002
Percent female heads	46.70[a]	21.48[b]	9.37[b]	24	0.024	0.001
Economically active members	2.46	3.04	3.06	2.99	0.30	0.63
Years of schooling	7.6	7.4	8.3	7.7	0.34	0.79

Means in the same row without common letters are different at $P<0.05$

Table 5.2 shows that the production system is dominated by middle aged farmers (46%) of between 45 and 65 years of age, followed by seniors (34%). Similar age distributions of household heads have been reported in other parts of sub-Saharan Africa such as Malawi (Chirwa and Matita, 2012) and Nigeria (Adensehinwa et al., 2004), which confirmed the low participation rate of the youth in agriculture. Households headed by seniors (>65 years) were larger than those whose heads were in younger age categories. These extended families provide a context that larger households could be a function of social dynamics associated with migrant labour and mortality among young parents, which leave seniors with the burden of

multigenerational guardianship. Although seniors had the least years of schooling (5.15) than other age categories, households headed by seniors tended to have more members enrolled for tertiary education. This result suggests that there is a high level of awareness about the importance of education and skills development as well as their potential impact on economic growth.

Table 5.2 Distribution of households by age of the head

Parameter	Age category						
	<36	36-44	45-65	>65	Mean	SE	Prob.
Frequency	26	32	138	102			
% Male	77.00	90.62	69.57	78.43	76.00		0.44
Household size	4.20 [a]	4.85 [a]	5.73 [a]	6.73 [b]	5.92	0.67	0.05
Years school	10.80[ab]	11.39[a]	7.89[b]	5.15[c]	7.6	0.80	0.01
Persons basic ed.	1.40 [a]	3.15 [ab]	3.79 [b]	3.90 [b]	3.65	0.64	0.07
Persons higher ed.	1.20 [ab]	1.07 [a]	1.66 [b]	2.00 [b]	1.69	0.66	0.01
Total in school	2.60[a]	4.23[ab]	5.45[bc]	5.90[c]	5.34	0.68	0.01
Herd size	31.40	39.62	42.42	45.18	35	1.74	0.81

Means in the same row without common letters are different at P<0.05

5.3.2. Employment

Figure 5.1 shows that the majority (58%) of household heads regarded farming as their form of self-employment while only 15% had temporary or permanent employment outside agriculture, and 24% regarded themselves as unemployed. The public service was the main source of employment accounting for 60% compared to 24% for mining. The attitude to regard agriculture as a form of employment is consistent with the finding that 69% of households used members of the household to herd cattle, 75% of whom were household heads. This indicates that cattle play an important role in livelihoods in the study area.

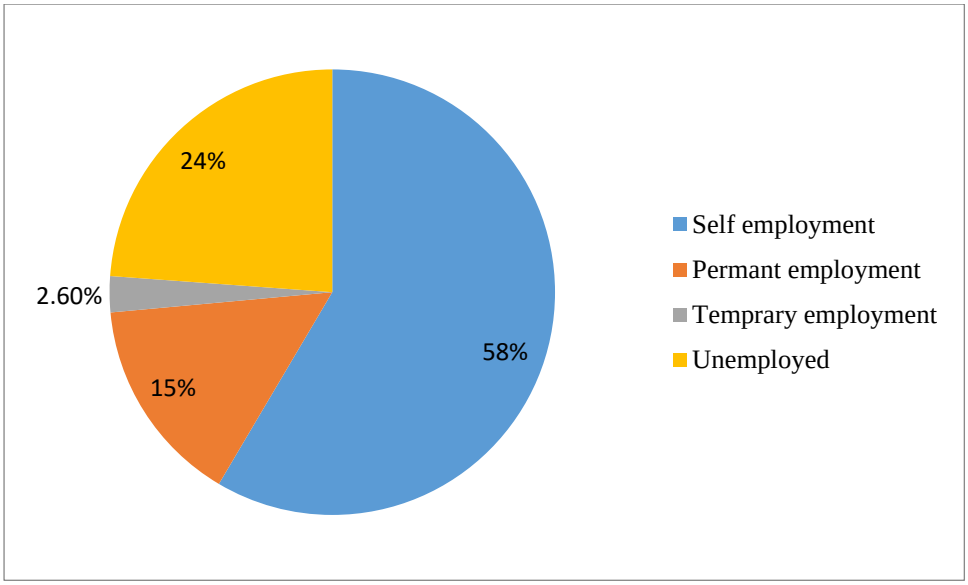

Figure 5.1 Employment status of household heads

5.3.3. Sources of income

The role of agriculture as a form of employment was confirmed by a high reliance on cattle in the study area. Figure 5.2 shows that cattle production was the major source of income for most households (82%) followed by small stock (55%) while crop production played the least role in income provision, accounting for only 11%. This is not surprising because only 4.5% of households had access to arable land, 64% of which was cultivated in 2011. Social grants were a source of income for 47% of households compared to 16% and 6% for remittance and small businesses, respectively. The high reliance on social grants could be attributed to the high proportion of seniors among household heads.

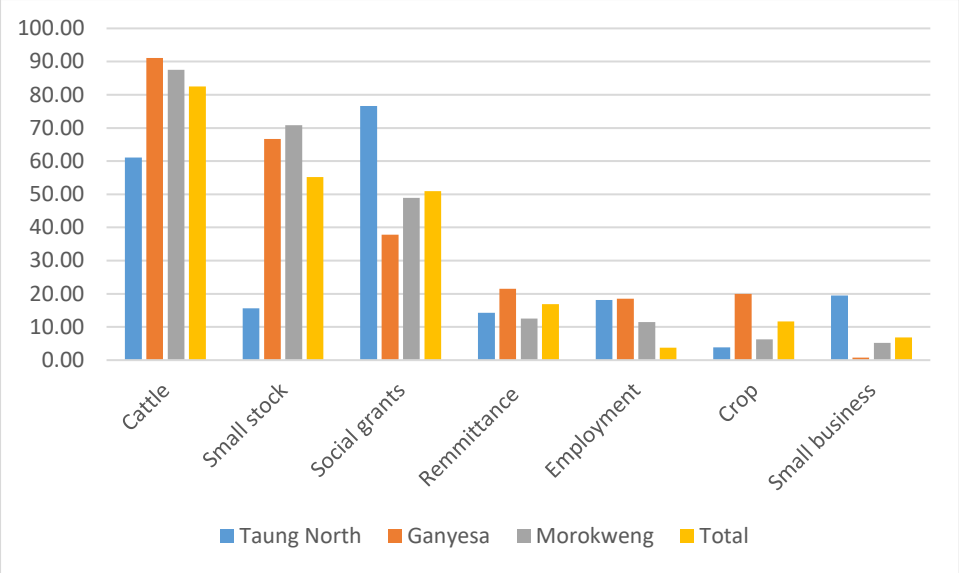

Figure 5.2 Sources of income of household heads

5.3.4. Herd composition

The average herd size was 35 ranging from one to 169 with smaller herds found in Taung North. The average calving rate was 55% ranging from 5.6% to 100% whilst herd mortality ranged from 0.5% to 94.8% with an average of 10% (Table 5.3). Herd off-take rates ranged from 2.7% to 66.7% with an average of 15%. Small stock flocks ranged between one and 181 with an average of 40 animals per flock. Most households (71%) owned chicken ranging between one and 200 with an average flock of 17 birds. More households owned donkeys than horses, which could signify the role of donkeys as a source of draught power. The average number of horses was 5.07 ranging from one to 32 while the number of donkeys ranged from one to 20 with an average of 5.18. The prevalence of horses in the study area may be attributed to the use of these animals for herding. However, pigs play a minimal role in the study area with only 3.6% of households owning between one and 14 pigs.

Table 5.3 Average herd sizes for small-holder cattle producers in three extension wards

Extension ward	Animal category					
	Cattle	Small stock	Chicken	Pigs	Horses	Donkeys
Taung North	15.90 (77)	15.81 (42)	21.18 (50)	5.50 (4)	5.60 (5)	3.50 (10)
Ganyesa	42.70 (135)	43.02 (124)	17.42 (103)	4.80 (5)	5.49 (78)	5.58 (89)
Morokweng	42.60 (96)	49.06 (92)	14.24 (66)	3.00 (2)	4.55 (66)	5.16 (75)
Total	35.00 (308)	40.75 (258)	17.32 (219)	4.73 (11)	5.07 (149)	5.18 (174)
SD	1.81	2.05	0.37	1.28	0.37	0.21

Values in brackets represent the number of farmers

5.3.5. Market channels

Previous studies in South Africa showed market participation rate of between 21% (Tapson, 1990) and 64% (Randela, 2003). This study showed that 82% of respondents sold their cattle in 2011 with an average herd off-take rate of 15% ranging between 2.7% and 66.7%. Table 5.4 shows that males constituted the majority (62.8%) of cattle sales in the study area. Most (57%) animals were sold through auction sales whilst direct sales to feedlots was minimal (4.9%). Despite being perceived as providing better prices by the majority (62%) of farmers than auction sales (38%), only 16.7% of the cattle in the study area were sold out of hand. The high price associated with out of hand sales may be due to ability to negotiate prices between buyers and sellers. However, the low proportion of sales could be a result of the unreliability of this market. Most sales in this category were of females slaughtered for ceremonies such funerals. This study also shows that a significant proportion of animals (21.2%) was sold through other sources such as speculators. Most (87.8%) respondents regarded the price offered by speculators to be poor. The relatively higher sales through speculators suggest that farmers in the study area could be selling cattle to address urgent financial needs. This hardship could be addressed by improving auction sales facilities in the study area.

Table 5.4 Market channels for disposing of different categories of animals in Dr RSM District Municipality

Category	Marketing channel				Percent
	Auction	Feedlot	Out of hand	Other	
Bulls	54	8	14	12	9.9%
Oxen	108	2	2	40	17.2%
Cows	130	22	54	38	27.5%
Heifers	34	8	28	12	9.2%
Bullocks	48	2	28	8	9.7%
Steers	132	2	22	78	26.5%
Total	506	44	148	188	100%

5.3.6. Income and demography

Table 5.5 presents the correlation results between demographic attributes of households and sources of income. Results reveal distinct livelihoods strategies between male and female headed households showing a positive correlation between women and employment (r= 0.248), social grants (r= 0.169) as well as small businesses (r= 0.185). As expected, older household heads depended less on employment (r=0.259) than remittance (r=0.223) and social grants (r=0.510). Furthermore, as shown in Table 5.2 that older household heads tend to have more members, larger households also depended more on remittances (r=0.221) than employment (r=0.187). On the other hand, households who depended more on income from crops (r=0.199) than employment (r=0.189) had more members enrolled for higher education. This suggests that households who depend on income from employment tend to be less capable of enrolling their members at institutions of higher learning. Household heads who held office in community associations also depended more on crop income (r=0.386) than employment (r=0.596), social grants (r=0.275) and small business (r=0.211). This result supports observations by Pica-Ciamarra et al. (2011) indicating that small-scale farmers in Vietnam tend to have multiple sources of income including farm and non-farm income

Table 5.5 Correlation between demographic attributes and sources of income

Herd size and Income sources	Demographic attributes				
	Gender	Age of household head	Household size	No. persons in tertiary education	Affiliation
Employment	. 248**	-.259**	-.187**	-.189*	-.596**
Cattle	-.015	-.066	.023	.077	.104
Crops	-.068	-.035	.093	.199*	.386**
Remittances	.051	.223**	.221**	.145	-.005
Social grants	.169**	.510**	.115	.115	-.275**
Small business	.185**	-.056	-.111	-.085	-.211*

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed)

5.3.7. Influence of socio-economic attributes on off-take rates

Previous studies by Idiong (2007) and Tchale (2009) found no significant effect of the gender of household heads on efficiency of small-holder agriculture. In contrast, this study shows that male headed households tend to achieve higher calving rates (r=0.202) and sold more steers than their female counterparts (r=0.184). Scholtz and Bester (2010) estimated calving rate for small-holder producers between 30% and 48%, percent adult females of 25-49% and mortality of 5.5-35%. With the exception of calving rates where men achieved significantly higher calving rates (56.88%) than women (47.53%), this study found no significant gender differences in herd performance parameters. This means that women farmers are as efficient as male farmers and should be afforded equal opportunities to participate in the cattle industry.

Dependence on income from cattle showed a high awareness for herd management. These households sold more oxen (r=0.284), steers (r=0.123) and overall number of animals (r=0.159) but withheld bulls (r=0.184). This result suggests that these households could be withholding some stock for breeding and replacement purposes.

On the other hand, there was a negative correlation between calving rate and dependence on income from employment (r=0.426), social grants (r=0.230) and small business (r=0.132). Farmers who depended on income from employment withheld

steers (r=0.220) but sold more cows (r=0.119), bullocks (r=0.187), overall herd (r=0.129) and sheep (r=0.231). Dependence on social grants was also positively correlated with the sale of oxen (r=0.214) but negatively correlated with the sale of steers (r=0.195). These results suggest that farmers who experience low calving rates tend to adopt a long weaner system where steers are withheld and sold as oxen and fetch higher price. This implies that two production systems, one focusing on weaner production and the other focusing on oxen are in place in the study area. Furthermore, small businesses also induced the sale of oxen (r=0.231), bullocks (r=0.162), overall herd off-take (r=0.228) as well as the sale of sheep (r=0.292). The result on small businesses contrasts those by Colvin (1985) and Baldwin et al (2008) who reported a negative correlation between alternative sources of income and off-take as well as suppressive effect of food aid reported by McPeack (2004). These findings suggest that small businesses complement rather than substitute cattle production, in the study area.

From a herd dynamics point of view, households owning smaller herds of less than 11 sold more cows (r=0.207), heifers (r=0.135), bullocks (r=0.182) and overall herd (r=0.254) than steers (r=0.179). The sale of sheep also appears to supplement incomes for these households (r=0.211). The tendency of households with small herds to dispose of cows and heifers has implications for livestock development in the study area. Although this study did not obtain empirical evidence regarding the culling criteria to establish reasons for the high sale of females, it is obvious that this action will suppress the growth of herd sizes among small-herds. This calls for the introduction of more efficient culling criteria in the study area such as herd improvement and performance recording scheme.

Furthermore, institutional arrangements tended to play an important role in the study area. Only 22% of respondents reported to be affiliated to community associations. Household heads who were affiliated to associations sold less cows (r=0.217) than steers (r=0.384).This apparent willingness by households affiliated to some institutions to sell livestock suggests the potential influence of those institutions on farmer opinion. This implies that these institutions could be used as part of the strategy to improve cattle off-take in the study area.

Table 5.6 Influence of socio-economic attributes on cattle off-take rates

Herd dynamics	Socio-economic attributes						
	Gender	Herd size	Employment	Cattle income	Social grant	Small business	Affiliation
Calving rate	-.151*	-.234**	-.126*	-.117	-.230**	-.132*	-.011
Bull sale	.016	.061	-.047	-.154**	-.081	-.051	.052
Ox sale	.067	-.059	.071	.284**	.214**	.231**	-.048
Cow sale	.069	-.207**	.119*	-.091	-.012	.034	-.217*
Heifer sale	.062	-.135*	.043	.004	-.044	-.094	-.167
Bullock sale	.042	-.182**	.187**	-.082	-.043	.162**	-.048
Steer sale	-.184**	.179**	-.220**	.123*	-.195**	-.001	.354**
Herd off-take	.058	-.254**	.129*	.159**	.017	.228**	-.149
Sheep sale	.067	-.211*	.231*	-.086	-.088	.292**	-.096

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed)

5.4. Conclusions

This study has provided an analysis of demographic characteristics of small-holder cattle producers in Dr Ruth Segomotsi Mompati District Municipality. It confirms previous findings in the region showing male dominance and low youth participation rates. Women farmers tended to own smaller herds, which compelled them to engage in other forms of livelihoods such as small businesses as a complementary strategy. An encouraging finding was on the tendency of small business dependent households, a forte for women, showing a higher level of efficiency, which suggests the need for extended opportunities for women participation in the industry.

The inclination of women and households owning smaller herds to dispose of potential breeding stock such as cows and heifers implies that these categories of farmers may be selling under pressure. This might be corroborated by the high presence of speculator market in the study area, which suggests distressed marketing. This happens despite the supplementary role of other income sources. It is concluded that there is a need for a structured culling plan based on animal recording for the study area to promote growth among small herds. Furthermore, efforts should be focused

on improving auction sales facilities with a view to improving cattle price for small-holder farmers.

Finally, the correlation between affiliation and off-take rates indicates that community organisations could play an important role in farmer mobilization for change. It is recommended that future farmer development strategies focus on women empowerment with a view to growing herd sizes among this section of the population. Community organisations should be utilised as a platform to facilitate cattle and livestock marketing.

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CHAPTER SIX

UTILIZATION OF INDIGENOUS AND ADAPATED CATTLE BY SMALL-HOLDER PRODUCERS IN SOUTH AFRICA: A SOCIO ECONOMIC PERSPECTIVE

Published in: Motiang, D. M. and Webb, E. C., (2014). Utilization of Indigenous and Adapted Cattle by Small-holder Producers in South Africa: A Socio Economic Perspective. Proceedings, 10th World Congress on Genetics Applied to Livestock Production. Vancouver, Canada, 17-22 August 2014

Abstract

The objective of this study was to evaluate the practices of small-holder cattle breeders in South Africa and investigate differences among the breeds kept by these producers. Cross-sectional data of the 2011 breeding season was collected from 308 cattle farmers from Dr Ruth Segomoti Mompati District Municipality in the North West Province of South Africa. The average age of household heads was 57 ranging between 24 and 86, most of whom were men staying at home. Cattle of non-descript genetic provenance had significantly lower calving rates and greater mortality than other breeds ($P<0.05$). Although not different from the Bonsmara, exotic breed types had significantly lower pre-wean mortality rates than the rest of the breeds ($P<0.05$). Women owned exotic as well as non-descript breeds ($P<0.05$). Men owned larger herds of cattle, were highly dependent on income from other livestock, and affiliated and held office in community associations ($P<0.05$). Ownership of indigenous breeds correlated with experience, number of persons attending school, dependence on livestock income, as well as affiliation and office bearing in community associations ($P<0.05$). Results suggest that there is acumen for rearing indigenous cattle and that the demographic attributes should be considered in design of in situ conservation programme.

6.1. Introduction

Despite their adaptability to local conditions, indigenous cattle are largely discriminated against by mainstream feedlot requirements for large-framed animals. This makes the introduction of exotic genotypes an inevitable practice if small-holder producers, who remain the custodians of indigenous genotypes, are to become

competitive in the cattle industry. In an effort to meet requirements, the proportion of non-descript and exotic breed types among small-holder herds is growing at the expense of indigenous breeds (Scholtz et al., 2008). Because small-holder producers own 40% of the national herd (RMRDT, 2008), improved use of indigenous cattle can make a significant impact on the South African economy.

The question whether the efficiency of small-holder producers differs between low input production systems of indigenous cattle and the relatively intensive systems of exotic breeds is yet to be addressed. However, previous efficiency studies showed that demographic characteristics such as age (Tchale, 2009) and education level of household heads (Idiong, 2007; Tchale, 2009) do affect farmers' efficiency. With regard to market participation, alternative income as well as food aid also influence off-take rates among livestock producers (Colvin, 1985; Baldwin et al., 2008; McPeack, 2004). Further insight into these dynamics will enable the development of appropriate interventions for improving productivity of small-holder cattle producers with a view to improving conservation and utilization of indigenous genotypes. The objective of this paper was to determine if the efficiency of South African small-holder cattle producers in managing indigenous as well as exotic cattle breeds differs. The second objective was to establish the relationship between efficiency levels and socio-economic characteristics of producers.

6.2. Materials and Methods

6.2.1. Study area

This study was conducted in the Dr Ruth Segomotsi Mompati District Municipality of the North West Province, South Africa. This municipality has the highest concentration of cattle in the country as well as a wide spectrum of locally-adapted breeds. A questionnaire aimed at capturing cross-sectional data on factors affecting cattle off-take for 2011 breeding season was developed and administered through face-to-face interviews with a sample of 308 randomly selected respondents. This paper focuses on variables such as cattle breed types as well as those depicting efficiency such as herd size, calving rates, mortality and herd off-take. Demographic variables were also measured to determine household profiles.

6.2.2. Data

Interviews were conducted between May and July 2012. Data were analyzed using IBM SPSS statistics 22 (2013). Breed types were initially coded into 20 different nominal classes describing utilization as either purebred or crosses. These data were then transformed into four categories of animals of local provenance i.e., Afrikaner, Nguni, Bonsmara, and Non-descript, as well as exotic breed types. Non-descript breed types are crosses of an unknown mix of breeds. These categories were used as treatments to enable the analysis of variance. The second transformation was done to create dummy variable distinguishing indigenous breed types from exotic types, crosses and non-descript types

6.2.3. Statistical analyses

Descriptive statistics were computed using frequencies and means to determine patterns between variables. A completely randomized design was used to measure performance variables with differences among means detected using least significant differences (LSD) tests. The Pearson correlation test was used to determine the relationship between demographic attributes of producers and cattle management.

6.3. Results and Discussion

6.3.1. Herd performance

Table 6.1 shows that the exotic breed types constitute the majority (41%) of herds in the study area while the large-framed South African composite breed has the smallest proportion of herds (9%). However, the latter had the largest average herd size (67). The less common ownership of indigenous breed types of Afrikaner and Nguni (16%) relative to non-descript breeds (33%) is evident in this study. As expected, herd performance results suggest that there could be acumen for rearing both indigenous as well as exotic breed types but not for non-descript breeds, which showed significantly poorer calving and mortality rates ($P<0.05$). Although not different from the Bonsmara, exotic breed types had significantly lower pre wean mortality rates than the rest of the breeds ($P<0.05$). Previous studies have illustrated that the adoption of animal health practices could improve efficiency of herds (Muma et al., 2009; Hüttner et al., 2001). Although this study did not observe significant differences in the adoption

of practices such as vaccination among herds, owners of both indigenous as well as exotic breed types spent significantly greater amounts of money on cattle (P<0.05) than those of non-descript types. It may be inferred that higher spending on herds led to reduced mortality. This study did not detect any difference in cattle off-take among breeds.

Table 6.1. Distribution of breed types by herd performance (n=305)

Parameter	Breed type				SE
	Afrikaner, and Nguni	Bonsmara	Exotic Breeds	Non-descript	
Proportion	16.40	9.20	41.30	33.10	
Average herd size	31.60[a]	67.04[c]	43.31[b]	21.51[a]	1.935
Calving rate	60.67[a]	60.96[a]	57.22[a]	48.55[b]	1.636
Pre-wean mortality	5.00[a]	3.57[ab]	3.25[b].	4.79[a]	0.263
Wean mortality	4.01	2.43	3.69	4.27	0.261
Adult mortality	4.93[a]	4.70[a]	4.83[a]	7.49[b]	0.319
Herd mortality	7.28[a]	7.20[a]	7.26[a]	10.25[b]	0.368

Values on same row with different superscript are significantly different (P<0.05)

6.3.2. Socio-economic analysis of breed utilization

Descriptive statistics show that the majority (76%) of respondents were male, 82% of whom stayed at home. The average age of household heads was 57 ranging between 24 and 86. Table 2 shows the correlation between the demographic characteristics of respondents with breed utilization patterns. Male-headed households own larger herds of cattle and are more dependent on income from other livestock (P<0.05) than are households headed by women. Male household heads also tend to be more commonly affiliated with community associations where they hold office (P<0.05). On the other hand, female producers are more inclined to rear exotic and non-descript breed types (P<0.05). The inclination of small-holder producers to select animals for market requirements has been reported in some parts of Africa (Ndumu et al., 2008).

Indigenous cattle tend to be of the preference of producers with greater experience in cattle rearing, households with large numbers of persons attending school, households dependent on livestock income, as well as of producers belonging to and holding office in community associations (P<0.05). From the herd management point view, owners of indigenous breeds tend to practice calf weaning while those rearing exotic and non-descript breeds do not wean their calves (P<0.05). This result shows the vulnerability of female headed and small households to the negative effect of genetic introgression such a reduced performance of offspring as cautioned by (Alemayehu, 2013). On the other hand, the affinity of male as well as experienced households heads to indigenous breed types provide an opportunity for the implementation of in situ conservation programmes.

Table 6.2 The relationship between herd performance and demographic characteristics of producers

	Gender	Education	Income	Years	Breed	Herd size	Wean age	Calving rate	Affiliation
Education	**-.092**								
Income	**-.192****	**.124**							
Years	**-.085**	**.133***	**-.007**						
Breed	**.159****	**-.124***	**-.234****	**-.153****					
Herd size	**-.189****	**.113**	**.070**	**.155****	**-.138***				
Wean age	**.033**	**-.027**	**-.150***	**-.129**	**.162***	**-.100**			
Calving rate	**-.110**	**-.048**	**-.020**	**.086**	**-.124***	**.002**	**-.023**		
Affiliation	**-.181***	**.209***	**.552****	**.115**	**-.266****	**.291****	**-296****	**-.043**	
Office	**-.247****	**.078**	**.497****	**.142**	**-.233****	**.378****	**-390****	**-.074**	**.909****

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

6.4. Conclusions

Results suggest that herds consisting of genetically non-descript cattle, which constitute a third of the population had poorer performance in terms of calving rates and mortality than other breeds. Female livestock keepers seem to have a preference for exotic breed types, suggesting that these producers may be responding to feedlot

market demand for large-framed cattle. However, the correlation between experience of male producers and ownership of indigenous breed types suggests that these producers should be targeted for a conservation programme to reverse the erosion of indigenous genotypes. These producers could also act as opinion leaders in communities for the promotion of the envisaged conservation programme because of their leadership roles.

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CHAPTER SEVEN

HERD MORTALITY AND CATTLE OFF-TAKE RATES AMONG SMALL-HOLDER PRODUCERS IN THE NORTH WEST PROVINCE OF SOUTH AFRICA

Published in: Published: Motiang, D. M**.** and Webb, E. C. (2016). Herd mortality and cattle off-take rates among small-holder producers in the North West Province of South Africa. African Journal of Agriculture. Vol. 11(11), p. 930-934

Abstract

The study was done to determine the influence of herd mortality on cattle off-take rates through face to face interviews of 308 smallholder cattle producers from Dr RSM District Municipality, North West. Most deaths were caused by diseases (50%) and drought (34%). Producer's gender had no influence on herd performance and off-take even though extension ward with higher proportion of women had higher mortality and lower off-take rates. The sale of steers decreased significantly ($P<0.05$) as the death of adult animals as well as that of the overall herd increased. Herd off-take also declined as mortality of suckling calves as well as that for overall herd, increased. Herd mortality logically reduces stock and therefore suppresses sales. It is recommended that herd mortality be monitored through animal recording to improve the competitiveness of small-holder production systems.

7.1. Introduction

Recent population census revealed that cattle production especially small herds comprising 1-10 head of cattle, plays an important role in rural livelihoods (Statistics South Africa, 2013). Small-holder cattle producers in South Africa own 40% of the national herd (RMRDT, 2008) but are less productive than commercial producers. Even though the low competitiveness of this sector has been partially attributed to low off-take rates (Tapson, 1990, Scholtz and Bester, 2010), risk factors contributing to this poor performance have not been identified. According to Swai et al. (2010) tick-borne diseases were the main cause of deaths in small-holder dairy cattle in Tanzania. It is well known that high mortality of young stock is an indicator of low productivity among small-holder producers in Africa (ILCA, 1982). Diseases causing deaths among young calves are often attributable to poor management (Mansour et al. 2014;

Wudu et al., 2008). Scholtz et al. (2010) also estimate high herd mortality amongst South Africa's small-holder cattle producers while Meissner et al. (2013) concluded that high mortality rates in this sector are liable for poor productivity and low off-take rates. The calculation of herd mortality requires elaborate data (Woodbury et al., 2005; Swai et al., 2010). However, crude death, which is the total number of animals, found dead in a specified population during a specified period divided by the average number of animals in that population in that specified period is the most commonly used form of measuring mortality (Putt et al., 1988). The North West Province is prone to drought, which tends to be severe in the western areas. Previous studies found no significant shifts in cattle sales during droughts in West Africa (Fafchamps et al., 1998) and Kenya (McPeak, 2004). It was hypothesised that cattle producers would dispose other categories of animals in favour of females. The purpose of this study was to determine the relationship between crude herd mortality and off-take rates.

7.2. Materials and methods

This study was conducted in the Dr Ruth Segomotsi Mompati (RSM) District Municipality of the North West Province. A random sample of 308 was selected from a list of 1700 cattle farmers from the District Department of Agriculture and Rural Development. Three wards of Taung North (25%), Morokweng (31%) and Ganyesa (44%) were used as strata to draw proportionate samples. A questionnaire aimed at capturing cross-sectional data on factors affecting cattle off-take for 2011 breeding season was developed and administered through face-to-face interviews with respondents. The instrument containing 73 questions ranging from demographic data to production data including mortality and sales was administered between May and July 2012. The interviews lasted for 45 minutes with each respondents. Crude herd mortality was calculated using the following equation: number of deaths during 2011/average of opening and closing herd sizes in 2011 x 100. Calculations for mortality were first made according to animal categories within the herd to distinguish suckling calves (pre-wean) from weaners and adult animals. Off-take rate was calculated as number of sales during 2011/ average of opening and closing herd sizes during 2011 x 100. For this purpose, animals were categorised as bull, ox, cow, heifer, bullock and steer.

Data were analysed using IBM SPSS statistics 22 (2013). Descriptive statistics were computed using frequencies and means to determine patterns between variables. Herd sizes were classified according to categories suggested by Tapson (1990) where herds of less than 11 were regarded as small. The GLM multivariate analysis was performed to test effect of farming area and farm level variables on herd mortality and off-take rates. Means were separated using least significant differences (LSD) tests. Correlation analysis was performed to measure associations between herd mortality and herd off-take.

7.3. Results and discussions

The majority (76%) of respondents were males, 82% of whom lived at home. The age of household heads ranged from 24 to 86 with an average of 57 years. The majority (46%) of respondents belonged to middle age of between 45 and 65 although seniors (>65) constituted a significant proportion of the population (34%). These households owned herds ranging from one to 169 with an average of 35 head of cattle. The average calving rate was 55% ranging from 5.6% to 100% whilst herd mortality ranged from 0.5% to 94.8% with an average of 10%. Herd off-take rates ranged from 2.7% to 66.7% with an average of 15%. The herd dynamics in the study area were atypical of the lower levels reported in other studies of South African small-holder cattle (Tapson, 1990; RMDT, 2008; Scholtz and Bester, 2010).

Table 7.1 shows that female farmers owned significantly smaller herds than men ($P<0.05$). However, except tendencies for women experiencing lower calving rates ($P<0.09$), no significant differences were observed between men and women regarding herd performance. However, farmers from the Taung North extension ward had the highest proportion of female farmers than other wards and also owned smaller herds than other farmers ($P<0.05$). Previous studies have shown that there is a strong correlation between women's economic opportunities and access to affordable, safe food (EIU, 2012; MuGeDe, 2014). The predominance of female farmers in Taung North suggests that cattle production plays an important role in meeting household needs. Although not significantly different from the Morokweng ward, farmers from Taung North were less experienced than those from Ganyesa ($P<0.05$). Furthermore, these farmers experienced higher herd mortality but sold the highest proportion of

stock than other farmers (P<0.05). This apparent low herd performance in the Taung North extension ward is a matter of concern because it affects female headed households with relatively limited resources.

Table 7.1 Distribution of farmers according to extension ward and gender

Extension ward	Number farmers		Age head		Years Experience		Herd size		%Herd Mortality		%Herd sales	
	M/F		M/F		M/F		M/F		M/F		M/F	
Taung North	41	36	63.7	53.9	19.7	15.2	16.1	15.6	16.6	9.6	25.6	20.1
Mean	77		59.2[a]		17.7[a]		15.9[a]		13.4[a]		23.1[a]	
Ganyesa	105	30	55.1	60.7	23.0	21.1	45.1	31.2	7.6	9.0	13.7	14.6
Mean	135		56.3[b]		22.6[b]		42.7[b]		7.9[b]		13.9[b]	
Morokweng	86	10	48.6	63.1	20.9	24.9	50.0	26.5	8.6	10.2	10.9	4.4
Mean	96		50.8[b]		21.2[ab]		46.5[b]		8.9[b]		9.9[b]	
Total	232	76	54.3	58.4	20.9	20.9	42.6[a]	24.1[b]	9.4	9.5	14.6	15.0
	308		56.8		20.9		35.3		10.0		15.0	
SE			0.97		1.02		1.99		1.18		0.96	

Values with different superscripts differ significantly (P <0.05)

Most (41%) of respondents utilized exotic cattle breeds and non-descript types (33%) in their herds while only 26% utilized indigenous breeds. Approximately 70% of the herds experienced 10% average mortality during 2011 ranging from 0.5% to 94.8%. Figure 7.1 shows that most deaths were caused by diseases (50%) followed by drought (34%). The study area has experienced severe drought since 2008, which may explain the high incidence of drought related deaths among adult animals as well as high mortality among small herds. The incidences of dystocia related deaths could also be attributed to the high adoption rate of exotic breeds, which produce large framed calves.

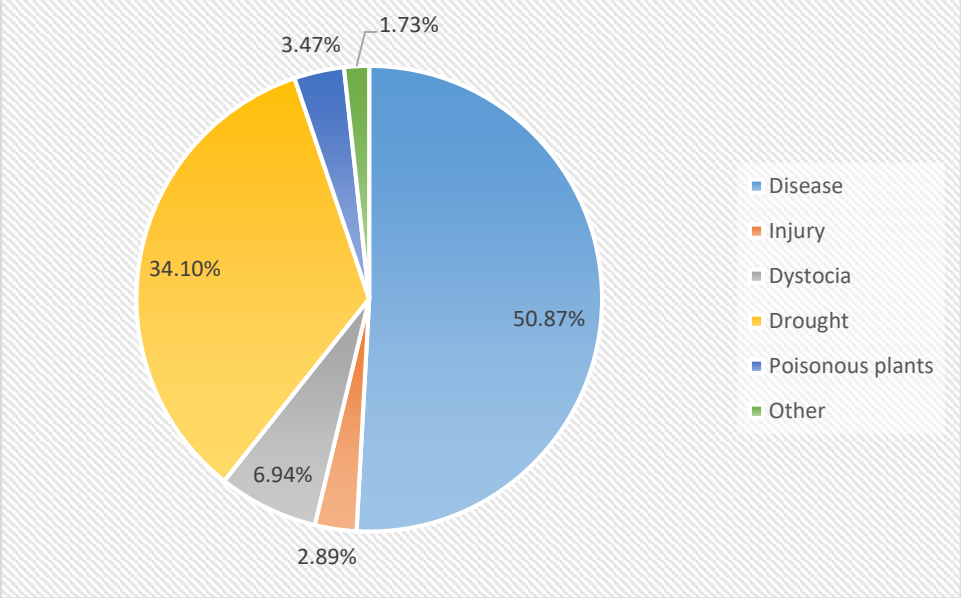

Figure 7.1 Distribution of herds according to causes of deaths among small-holder herds in Dr Ruth Segomotsi Mompati District Municipality (N=173)

Previous studies showed that most deaths occur among young animals (Wudu et. al., 2007; Swai et al., 2010) and tend to decline for yearlings and rise afterwards (Fiore et al., 2010). This trend is confirmed in this study showing higher mortality rates for pre-wean calves, a decline for weaners and a rise for adults (Table 7.2). Small herds had significantly higher crude herd mortality rates (18.16%) than other herd size categories, and mortality rates improved significantly with larger herd size categories ($P < 0.05$). Weaner mortality rates of small herds differed significantly ($P<0.05$) with those for all herd size categories except medium size (11-30). Small herds (1-10) had significantly higher mortality rates for both old animals and total herd than other herd size categories ($P<0.05$).

Table 7.2 Average crude herd mortality rates by herd size

Herd category	Pre wean (n=101)	Weaner (N=94)	Adult (n=176)	Herd (N=214)
1-10 (n=57)	2.51	3.14[a]	12.23[a]	18.16[a]
11-30 (n=121)	1.99	1.99[ab]	4.84[b]	8.63[b]
31-70 (n=94)	2.16	1.72[b]	4.75[b]	8.12[b]
>70 (n=36)	2.02	1.01[b]	3.08[b]	6.12 [b]
SE	0.30	0.30	0.77	1.06

Values with different superscripts differ significantly (P <0.05)

The effect of drought and other sources of income as well as asset shocks has been widely reported (Kinsey et al., 1998; Fafchamps et al., 1998; McPeak, 2004). Some of these studies found no significant shifts in cattle sales during droughts in West Africa (Fafchamps et al., 1998) and Kenya (McPeak, 2004). Contrary to expectation, this study did not find a significant correlation between herd mortality and the sale of cows. However, the sale of steers decreased significantly (P<0.05) as the death of adult animals as well as that of the overall herd increased (Table 7.3). Furthermore, herd off-take also declined as mortality of suckling calves as well as that for overall herd, increased. These results imply that the loss of calves reduces the number of available steers for the markets. Similarly, the death of old animals especially cows reduces the number of calves to be raised for the market thus affecting the overall herd off-take. This means that fewer animals become available for sale when herds experience high mortality. Some studies reported high off-take rates associated with the adoption of animal health practices (Muma et al., 2009; Hüttner et al., 2001) where stock is culled to acquire remedies. In this study, 90% of respondents reported that they always

vaccinate their animals for notifiable diseases and dose animals for parasites. It can therefore be inferred that the adoption of animal health practices is in place, which suggests that cattle producers in the study area use disease incidences as a herd management tool. These results imply that herds with high mortality rates have limited stock to sell.

Table 7.3 Relationship between crude mortality rates and cattle off-take rates

	Pre wean mortality	Adult mortality	Herd mortality	Steer off-take
Adult mortality	.242**			
Herd mortality	.595**	.881**		
Steer of sale	-.036	-.123*	-.131*	
Herd off-take	-.150**	-.103	-.147*	.265**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

7.4. Conclusions

This study has provided a descriptive analysis of crude herd mortality rates in the study area. Even though the Taung North extension ward has a high proportion of female farmers and smaller herds, gender did not show significant influence on both herd mortality and off-take. These results confirm previous findings showing curvilinear pattern where mortality rates plummet for weaner calves. Diseases are the main cause of deaths in the study area followed by drought. It is also concluded that the considerable mortality incidences resulting from dystocia is a sign of a high adoption of exotic breeds, which are liable for large-framed calves.

Larger herds of more than 10 head of cattle had significantly lower mortality rates than smaller ones. It is therefore concluded that larger herds are more efficient than small herds in terms of mortality rates across all animal age categories. Finally, it is evident that herd mortality influences herd off-take rates. The inclusion of herd mortality data

in animal recording systems may enhance the monitoring of small-holder production systems and thus improve competitiveness. The high mortality rates for old animals should receive focused extension efforts to improve disease management and implement a drought management strategy.

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CHAPTER EIGHT

SOURCES OF INFORMATION FOR SMALL-HOLDER CATTLE FARMERS IN DR RUTH SEGOMOTSI MOMPATI DISTRICT MUNICIPALITY IN THE NORTH WEST PROVINCE, SOUTH AFRICA

Published in: Motiang, D. M. Webb, E. C. (2015). Sources of information for small-holder cattle farmers in Dr Ruth Segomotsi Mompati District Municipality in the North West Province, South Africa. Appl. Anim. Husb. Rural Develop. Vol 8, p 26-33: www.sasas.co.za/aahrd/

Abstract

The purpose of this paper was to identify sources of information used by small-holder cattle enterprises and evaluate their influence on productivity of those enterprises. Results showed that public extension is the main (85-87%) source of information for small-holder cattle producers, followed by radio (52%) and other farmers (47-48%). More educated farmers preferred magazine and TV to extension officers while women prefer office visits to magazine, TV and commercial farmers ($P<0.05$). Older farmers tend not to rely on magazine, radio, TV, commercial farmers and veterinarians while owners of larger herds prefer these sources to office visits ($P<0.05$). Sources commonly used by more educated farmers, men, younger farmers and owners of large herds such as radio, TV and commercial farmers, suppressed the sale of cattle and small stock ($P<0.05$). Reliance on other small-holder farmers for agricultural information, resulted in lower calving rates while reliance on both commercial and small-holder farmers suppressed the sale of small stock ($P<0.05$). Sources preferred by women such as office visits and telephonic communication stimulated the sale of sheep and small stock in general. It is recommended that age, gender, education and herd size should guide the selection of channels for disseminating information to small-holder cattle producers and that the extension content be enriched to include markets and entrepreneurship in the study area.

8.1. Introduction

The South African government has prioritized the development of the small-holder agriculture since independence. Small-holder farmers own a substantial proportion

(40%) of the cattle population in the country (RMDT, 2008) but continue to be plagued by low productivity (Scholtz and Bester, 2010), which limits their ability to realise their full potential. As in the case of other developing countries (Ahmad et al., 2007; Adetayo and Eunice, 2013), these farmers depend on public extension services for agricultural information. However, the efficacy of agricultural extension has been put to question since the past three decades (Rivera, 1991). Generally, agricultural development in developing countries is hamstrung by structural inadequacy of extension delivery systems, which are characterised by weak linkages between research and extension (Kaimowitz, 1991).

Globally, the inadequacy of public extension necessitated a policy shift towards reduced funding for public extension services (Kidd et al., 2000; Contado, 2013) such as the introduction of private extension delivery systems in some developed countries (Rivera, 1993). It is recognised that privatisation is not a simple alternative to monolithic public extension (Chapman and Tripp, 2003), which still plays an important role in agricultural development in developing countries (Ahmad et. al., 2007; Omobolanle, 2008; Lashgarara and Hosseini, 2011). Moreover, Rivera (1993) noted that private extension hardly benefits small-holder farmers and that it is important to focus attention on this category of farmers. It is therefore important to devise modalities to improve efficiency of extension to become more responsive to farmers' needs (Adetayo and Eunice, 2013). Extension efficiency can be enhanced by employing a holistic knowledge systems approach where stakeholders including farmers are important parts of a single agricultural knowledge and information system (Röling, 1990).

Meanwhile, evidence from developing countries shows that various modalities of public extension services have improved the productivity of small-holder farmers (Haq, 2011; Elias et al., 2013; Hasan et al., 2013). In South Africa, the state introduced mentorship programmes, to enable lead farmers to complement the public extension service to facilitate the establishment of small-holder farmers (AgiSETA, 2012). However, the preferred sources of information for small-holder cattle producers in South Africa have not been investigated. The purpose of this paper was to identify sources of information used by small-holder cattle enterprises and evaluate their influence on productivity of those enterprises.

8.2. Materials and methods

This study was conducted in the Dr Ruth Segomotsi Mompati (RSM) District Municipality of the North West Province. A random sample of 308 was selected from a list of 1700 cattle farmers from the District Department of Agriculture and Rural Development. Three wards of Taung North (25%), Morokweng (31%) and Ganyesa (44%) were used as strata to draw proportionate samples. A questionnaire aimed at capturing cross-sectional data on factors affecting cattle off-take for 2011 breeding season was developed and administered through face to face interviews with respondents. The instrument containing 73 questions ranging from demographic data to production data including sources of information and sales was administered between May and July 2012. Off-take rate was calculated as number of sales during 2011/ average of opening and closing herd sizes during 2011 x 100. For this purpose, animals were categorised as bull, ox, cow, heifer, bullock and steer.

Data were analysed using IBM SPSS statistics 22 (2013). Descriptive statistics were computed using frequencies and means to determine patterns between variables. Ranking scales were transformed into dummy variables to enable statistical tests. Males were coded 0 while females were coded 1. Herd sizes were classified according to categories suggested by Tapson (1990) where herds of less than 11 were regarded as small. The GLM multivariate analysis was performed to test effect of farming area and farm level variables on herd mortality and off-take rates. Means were separated using least significant differences (LSD) tests. Correlation analysis was performed to measure associations between demographic characteristics, sources of information as well as herd off-take.

8.3. Results and discussions

The majority (76%) of respondents were males, 82% of whom lived at home. This result confirms finding by Ragasa et al. (2012) who reported that men constituted 70% of farmers in some parts of Ethiopia. As outlined in Table 7.1, Taung North had the highest proportion of women (46%) compared to 22% and 10% for Ganyesa and Morokweng, respectively. The age of household heads ranged from 24 to 86 with an average of 57 years. The majority (46%) of respondents belonged to middle age of between 45 and 65 although seniors (>65) constituted a significant proportion of the

population (34%). The low participation of youth in cattle production agrees with findings from other parts the Continent (Chirwa and Matita, 2012; Adensehinwa et al., 2004; Omobolanle, 2008). Results show that these demographic differences were amplified at ward level indicating that farmers from Taung North were older and owned smaller herds than the rest but had less cattle production experience than those from Ganyesa ($P<0.05$). In terms of herd performance, the former had higher mortality and off-take rates than the rest but experienced lower calving rates than those from Morokweng alone ($P<0.05$). The low participation of both women and youth in the study area implies that there is a need to identify barriers to entry into the cattle industry. It is worth noting that the majority of household heads (79%) attended school for between one and 17 years with an average schooling years of 7.6. Furthermore, household sizes in the study area ranged from one to 15 with an average of 5.1 members. No significant differences were observed for education levels and household sizes between the three extension wards.

These households owned herds ranging from one to 169 with an average of 35 head of cattle (Table 8.1). The majority (71%) of herds can be described as medium comprising 11-30 (40%) and 31-70 (31%) while small herds (1-10) constituted only 13% of the population. The average calving rate was 55% ranging from 5.6% to 100% whilst herd mortality ranged from 0.5% to 94.8% with an average of 10%. Herd off-take rates ranged from 2.7% to 66.7% with an average of 15%. The herd dynamics in the study area were atypical of the lower levels reported in other studies of South African small-holder cattle (Tapson, 1990; RMDT, 2008; Scholtz and Bester, 2010), which reported lower calving and off take rates as well as higher mortality rates.

Table 8.1 Distribution of respondents by herd dynamics

Herd size category	Number of farmers	Percent frequency	Calving rate	Herd mortality rate	Herd off-take rate
1-10	57	18.5	55.5	18.1	22.5
11-30	121	39.3	51.7	8.8	12
31-70	94	30.5	57.5	8.6	13.8
>70	36	11.7	55.6	6.1	16.4
Total	308	100	55	10	15

Figure 8.1 shows that extension officers (85%) and animal health officers (87.3%) are the main source of information for small-holder cattle producers in the study area. Ahmad et al. (2007) also reported that 87% of farmers in some villages of Pakistan use extension as their main source of information while Adetayo and Eunice (2013) reported a 90% reliance for Nigeria. Furthermore, the high reliance on public extension suggests that focused efforts aimed at improving the skills of extension officers may have a great impact on productivity of farmers. Chapman and Tripp (2003), Contado (2013), and Adetayo and Eunice (2013) advocate for pluralistic modalities of extension to enable cooperation between the public and the private sector. In South Africa, the public extension is complemented by model farmers who provide advisory services either formally or informally. This study shows that farmers rely on their peers (48%) and established commercial farmers (47%) for agricultural information. This pattern is reminiscent of the diffusion theory by Rogers (1983), which suggests an accelerated technology uptake when some farmers learn from innovators and early adopters. In addition, radio is the main (52%) form of mass communication while magazines are the least (28%) used medium. As illustrated in the subsequent sections of this paper, the low use of magazines is related to literacy. Ahmad et al. (2007) also reported a 53% use of radio by farmers in Pakistan. The high access to radio is partially attributable to the proliferation of community radio stations resulting from South Africa's public broadcast policies.

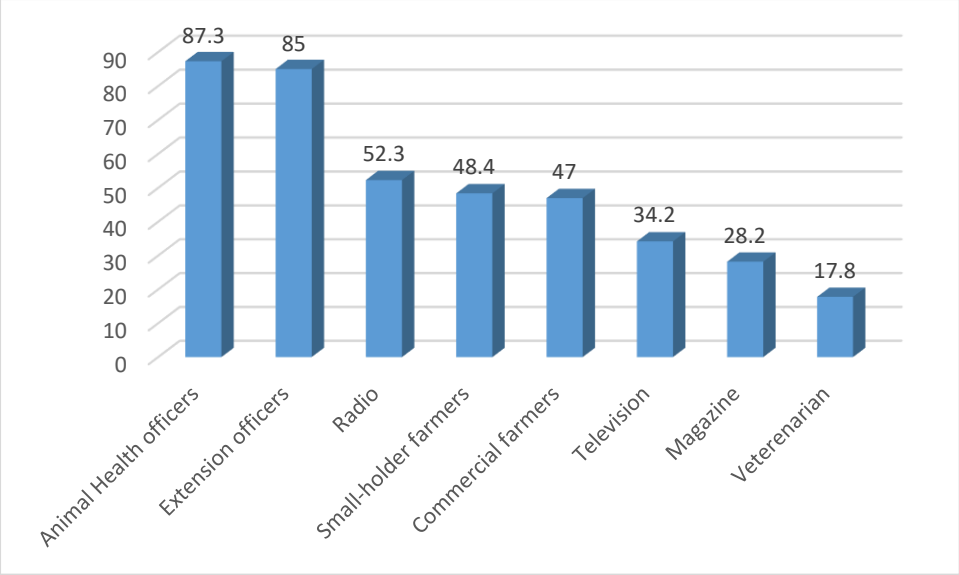

Figure 8.1 Sources of information for small-holder cattle producers in Dr Ruth Segomotsi Mompati District Municipality.

Table 8.2 presents correlation between household attributes and sources of information. As expected, the education level of farmers was positively correlated ($P<0.05$) with the use of magazine ($r=0.328$) and television ($r=0.139$) but negatively correlated with extension officers ($r=0.193$). On the contrary, there was a negative correlation between the age of household head with the use of magazine ($r=0.363$), radio ($r=0.183$), TV ($r=-0.298$) as well as commercial farmers($r=0.128$) and the veterinarian ($r=0.175$) as the source of information ($P<0.05$). Results also show that male farmers used magazine ($r=0.130$) and TV ($r=0.183$) while women used office visits ($r=0.216$) for agricultural information ($P<0.05$). It can be inferred from these results that small-holder farmers in the study area obtain agricultural information through alternative modalities of extension.

Previous studies in other developing countries showed varying correlation between extension, household demographics and productivity. Participation in extension has been reported to improve productivity among crop farmers in Pakistan (Ahmad et al., 2007), Ethiopia (Elias et al., 2013) and Uganda (Hasan et al., 2013). Haq (2011) reported a positive correlation between extension contacts and productivity in Bangladesh. This study found no significant correlation between reliance on both extension and animal health officers for agricultural information on productivity. However, Ragasa et al. (2012) showed that lower productivity of female farmers in Ethiopia was partially attributable to limited access to extension. Despite insignificant

correlation with extension, as shown in Table 8.2 this study indicates that female farmers tend to experience lower calving and high mortality rates. On the other hand, Obomolanle (2008) reported a positive correlation between farmer's age and affiliation as well as adoption of technology in Nigeria. However, this study found no significant correlation between farmers age and herd performance. A lack of significant correlation between extension and productivity in this study suggests that variations in productivity might be associated with alternative modalities of executing extension in the study area.

Table 8.2 Correlation between household attributes and sources of information

Sources of information	Age	Years of schooling	Gender	Herd size
Magazine	-.364**	.328**	-.130*	.179**
Radio	-.183**	.067	-.109	.186**
Television	-.298**	.139*	-.183**	.225**
Commercial farmers	-.128*	.113	-.179**	.174**
Small-holder farmers	.023	-.034	-.081	-.005
Extension officers	-.101	-.193**	-.096	-.014
Veterinarian	-.175**	.033	-.042	.126*
Study groups	-.075	-.080	.168	-.006
Office visits	.008	.071	.216**	-.268**
Telephone	.155	.097	.140	-.164

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

In this regard, alternative extension methods had an influence on herd performances. Herd size was positively correlated with the use of magazine (r=0.179), radio (r=0.186), TV (r=0.224), commercial farmers (r=0.174) and veterinarian (r=0.126) but negatively correlated with the frequency of office visits (r=0.268) ($P<0.05$). This is understandable because these preferred modalities are less interruptive on routine farm activities than office visits, which tend to halt production. The result on the use of commercial farmers suggests the existence of mentorship programme (AgriSETA, 2011) indicating close cooperation either formally or informally between commercial and small-holder farmers in the study area. Moussa et al. (2011) reported that radio

broadcast reinforced other extension methods and increased adoption rates of cowpea storage technologies among West African farmers. Table 8.3 shows a negative correlation between the use of radio and herd off-take rates (r=0.161) and the sale of small stock (r=0.169) (P<0.05). The negative correlation suggests that radio programmes put less emphasis on issues of market and trade.

In addition, reliance on other small-holder farmers for agricultural information, resulted in lower calving rates (r=0.200) and lower small stock sales (r=0.161), which is a combination of both sheep and goat (P<0.05). The sale of small stock also declined (r=0.194) as respondents relied on commercial farmers for information (P<0.05). While the depressed calving rates could be attributed to the limited scope of agricultural technology among small-holder producers, the suppression of small stock sale by both commercial and small-holder farmers raises a question whether there is sufficient commercial orientation in the study area towards small stock farming. The foregoing is reinforced by the negative correlation (r=-0.418) between the frequency of extension contacts and the sale of sheep (P<0.01). On the other hand, there was a positive correlation (r=308) between office visits and the sale of sheep (P<0.01), which suggests that extension officers may use other experts in the office to persuade farmers to sell livestock during the face-to-face sessions. Furthermore, the use of telephonic communication including cell phones also increased the sale of both sheep (r=0.393) and overall small stock (r=0.296), which implies the use of individual communication methods might induce a commercial orientation amongst small-holder farmers. The apparent entrepreneurial orientation associated with alternative office visits and telephonic communication is commendable suggesting that such methods may reinforce extension efforts to transform small-holder farmers to become commercially oriented.

Table 8.3 Correlation between sources of information and herd performance

Sources of information	Calving	Mortality	Herd off-take	Sheep sale	Small stock sale
Magazine	.019	-.050	-.046	.015	-.043
Radio	-.027	-.113	-.161**	-.137	-.169*
Television	.072	-.114	-.105	-.190	-.186*
Commercial farmers	-.095	-.053	-.107	-.112	-.194*
Small-holder farmers	-.200**	.006	-.110	-.050	-.161*
Extension officers	.036	-.056	-.075	-.418**	-.053
Veterinarian	-.014	-.098	.050	-.088	-.101
Study groups	.066	-.001	.141	.135	.049
Office visits	-.147	.130	.114	.348**	.094
Telephone	-.127	-.035	.088	.393*	.296*

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

In terms of farmer perception of extension, 79% of farmers reported that their contact with extension always addresses cattle production while 72% regarded the extension information to be relevant. Furthermore, 80% of the farmers attributed their new knowledge about cattle production to extension while 72% felt that extension improved their competence in cattle production. As noted by Bahn and McAleer (2007), modern day extension has to address farming problems including markets and economics. Despite the high ranking of extension, this study revealed that extension seldom addresses issues of markets and agri-business. This finding suggests that there is a positive image about extension in the study area. However, there is need to adopt a market orientation if extension has to become relevant to changing farmer needs.

8.4. Conclusions

This paper evaluated the sources of information used by small-holder cattle farmers. Results show that public extension through extension and animal health officers remains the main source of information for farmers. The preference of sources of information is associated with demographic attributes of farmers, which determined the choice of information sources in varying ways. For instance, more educated farmers preferred magazine and TV to extension officers while women preferred office

visits to magazine, TV and commercial farmers. Older farmers tend not to rely on magazine, radio, TV, commercial farmers and veterinarian while owners of larger herds prefer these sources to office visits. It is concluded that age, gender, education and herd size should be used when selecting appropriate channels for disseminating information to small-holder cattle producers in the study area.

However, some preferred sources for more educated farmers, men, younger farmers and owners of large herds such as radio, TV and commercial farmers, suppressed the sale of cattle and small stock. Reliance on small-holder farmers also suppressed calving rates and the sale of small stock in general while extension contacts suppressed the sale of sheep in particular. On the other hand, sources preferred by women such as office visits and telephonic communication stimulated the sale of sheep and small stock in general. The negative influence of mass media such as radio and TV on off-take rates implies a lack of market focused content in the broadcast programmes targeting small-holder farmers. The same applies for the subjects addressed through farmer to farmer extension using both commercial and small-holder farmers. It is recommended that extension efforts be directed towards improving calving rates among small-holder farmers. Furthermore, the scope of radio and TV programmes should be extended to include markets and entrepreneurship with a view to increasing the off-take rates among small-holder farmers.

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CHAPTER NINE

RESULTS OF PRINCIPAL COMPONENT ANALYIS

9.1. Introduction

This chapter addresses the second objective of the study to identify main factors influencing cattle off-take in the study area. As demonstrated in the conceptual framework of this study, cattle off-take is influenced by numerous sets of sub-systems. The result shows intermediate average cattle off-take rate of 15% between the 5-8% estimated by Scholtz and Bester (2010) and the country's 25-30% average reported by WTO (2007). Because South Africa imports approximately 5% of beef (DAFF, 2014), an improvement in herd off-take rate among small-holder farmers may slit the current 10-15% slot. This chapter blends the preceding sections of this manuscript and identifies the main factors underlying off-take decisions.

9.2. Clustering of factors

Preceding chapters illustrated an iterative interaction of factors within and between sub-systems with diverse influence on cattle off-take rates. Eleven variables were included in the principal component analysis to identify key factors that determine cattle off-take in the study area. Variables representing the sale of different classes of animals were clustered into two groups as females and males while other variables were used in their original forms.

Initial eigen values indicated that the first three factors explained 23%, 19.6% and 14.6% of the variance, respectively. The fourth factor had an eigen value of just over one and explained 11% of the variance. The three factor solution, which explained 57.7% of the variance was retained because it is well known that eigen values on the scree plot level off after three factors, and primary loadings become insufficient beyond this level. Another reason for retaining this solution was to facilitate the ease of interpretation. The varimex method was used to rotate the components. The variables "Herd mortality" and "Sale of females" were removed because they loaded below 0.5 for the first three factors even though they had a primary factor loadings of 0.83 and 0.66, respectively, on the fourth factor.

Table 9.1 Correlation matrix for principal factor analysis

	Cattle	Social grant	Small business	Herd size	Calving rate	Herd mortality	Sale of males	Sale of females	Commercial objective	Wealth objective
Social grant	.138									
Small business	.050	-.245								
Herd size	-.050	.044	-.637							
Calving rate	-.151	-.498	-.023	-.133						
Herd mortality	.066	-.205	.156	-.080	.084					
Sale of males	.191	-.162	.423	-.481	.019	-.066				
Sale of females	-.367	-.217	.174	-.200	.258	.311	-.320			
Commercial objective	-.154	.319	.075	.124	-.318	.129	-.213	.045		
Wealth objective	.561	.044	.088	-.088	-.217	.062	.160	-.176	-.274	
Sale of sheep	-.058	.008	.354	-.386	-.147	-.026	.508	.229	-.139	.101

9.3. Results of rotated components

As reported in chapter five, smaller herds had higher herd off-take than larger ones. The negative loading of -0.8 herd size on factor one confirms this finding that herd size plays a major role in farmers' off-take decisions. This implies that herd sale is an integral part of the livelihood strategy among owners of small herds of 1-10. Table 9.2 also shows a 0.78 loading of small businesses on factor one, which means that owners of small herds engage in small businesses to complement cattle sales in the study area. In general, these findings on alternative sources of income, differ from previous studies (Colvin, 1985; Baldwin et al., 2008), which reported a negative correlation between alternative sources of income and herd off-take. The loading of 0.75 for sheep sale on factor one also indicate that owners of small herds sell more sheep to complement cattle sales. Finally, the 0.74 loading of the sale of males on factor one also implies that these farmers spare female stock at the expense of males with a view to growing herd sizes.

The foregoing statement is corroborated by the farmers' reasons for rearing cattle. Chapter four reported that most farmers reared cattle as a store of wealth. Table 9.2 shows a 0.84 loading of wealth objective on factor two implying that in general, farmers in the study area rear cattle to create wealth. As evidenced through a 0.87 loading of reliance on income from cattle on factor two, an average farmer in the study area mainly rely on cattle for livelihood. Although the loading of -0.43 does not meet the criterion of 0.5, it is evident that farmers sell less female animals in pursuit of herd growth. The finding showing a logical link between farmer wealth creation objective and rationale management decisions is a unique discovery and an important departure from the notion that small-holder farmers are less keen to participate in the market for cultural reasons.

Chapters five and six respectively illustrated a negative correlation between the high ranking for income generating (commercial objective) and dependence on cattle income, with calving rates. Calving rate had a -0.81 loading on factor three, which implies that farmers sell less animals as calving rates decline. With less animals to sell, farmers in this cluster depend highly on social grants to augment household income as indicated by the 0.77 loading on factor three. Nevertheless, this category

of farmers regarded income generation as their main objective for rearing cattle as indicated through a 0.71 loading on herd performance. This finding calls for a focused attention to households who depend on social grants to improve productivity within the observed financial constraints. The complementary role of social grant is in contrast with finding from Botswana where these grants and other forms of transfers are cited for suppressing off-take (Mmopelwa and Seleka, 2011). Although discarded from the analysis, factor four elaborates on herd performance showing a 0.84 loading for mortality rate and 0.66 for the sale of females. This implies that herd productivity is negatively affected by high mortality rates, which in turn reduces herd off-take. With less stock available for sale, farmers resort to selling females, which adversely affect herd growth as well as well as productivity. Figure 9.1 presents off-take drivers for Dr Ruth Segomitsi Mompati District Municipality.

Table 9.2 Factor loadings and commonalities based on principal component analysis of herd off-take rates

	Herd size	Producer objectives	Herd performance	Mortality
Herd size	-.80			-.16
Small business	.78			.30
Sale of sheep	.75			
Sale of males	.74	.237	-.16	-.35
Cattle		.87		
Wealth objective	.10	.84		
Calving rate		-.23	-.81	.12
Social grant	-.10		.77	-.24
Commercial objective		-.29	.71	.29
Herd mortality		.19		.84
Sale of females	.14	-.43	-.16	.66

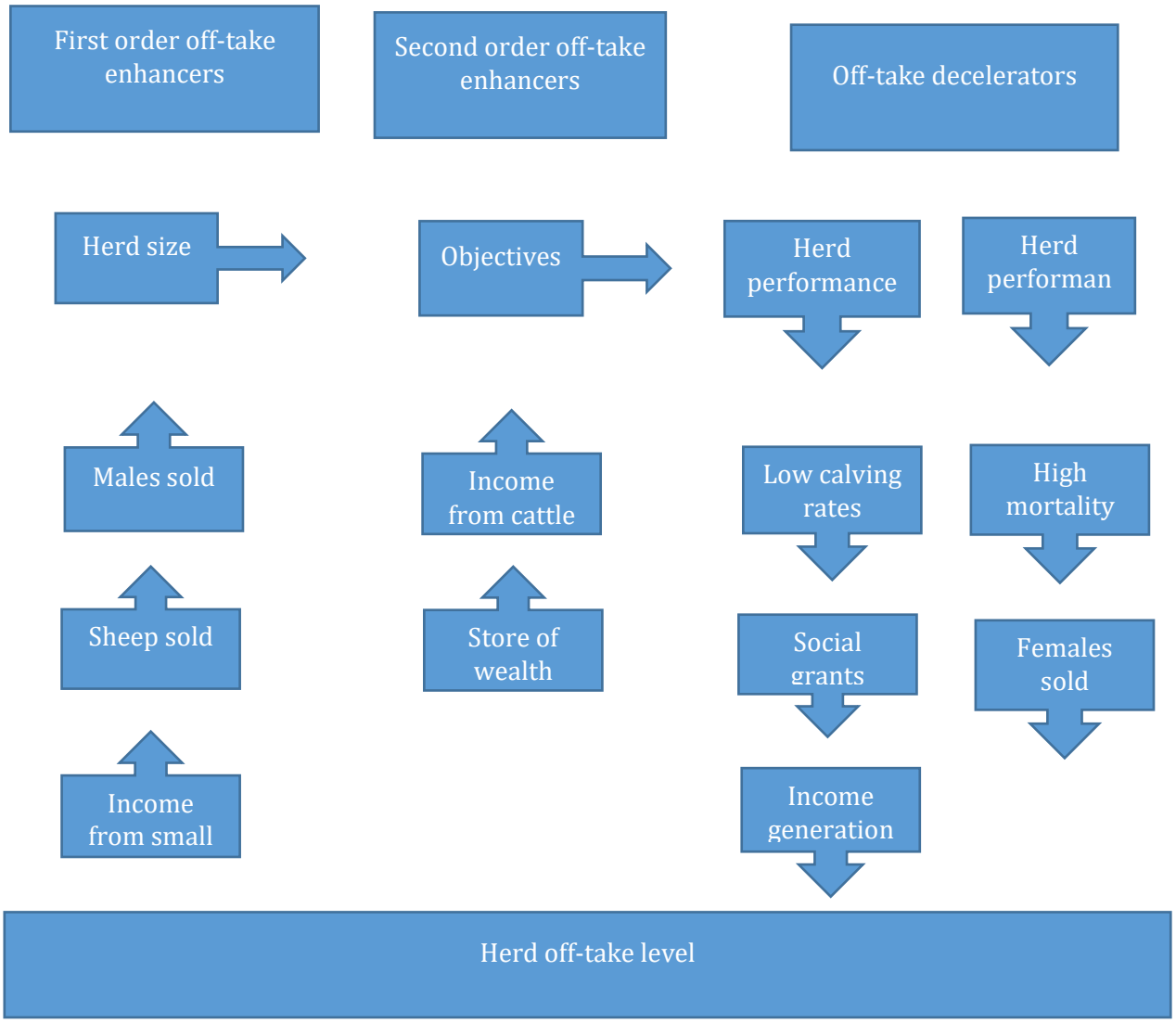

Figure 9.1 Dr Ruth Segomotsi Mompati District Municipality Cattle of-take drivers

9.4. Discussion

Overall, this analysis indicates that there are three distinct factors underlying cattle off-take in the study area. Herd size, which explained the most variance of the analysis has several socio-economic ramifications for the study area. It was established in previous chapters that Taung North extension ward had more women farmers, women own smaller herds, and owners of smaller herds in general, have proportionately higher herd off-take rates. It can be inferred from the herd dynamics presented in chapter four (Table 4.4) that based on an average herd size of 5.9 and 22% off-take rate for small herds of 1-10, farmers in this category may be able to sell only 1.2 head of cattle per annum. The cumulative herd exit of 43% including mortality and slaughter,

imply that at least 2.5 head of cattle exit annually from this herd size category. Furthermore, a herd structure consisting of 65% cows with a 53.8% calving rate, means that these herds grow by only two head of cattle annually. The foregoing evidence shows that this category of farmers is shrinking at a rate of 0.7% (0.4 animals) per year and may demise in the next decade if the status quo remains. This negative growth is attributable to the high mortality rate of 18% for this herd category. The same calculation shows that medium size herds of 11-30 and 31-70 grow at a rate of 0.5% (1.1 animal) and 0.2% (1 animal) per year, respectively. Only large herds of >70, which represent 11% of sampled herds grow by 11% (12 animals) per year. Meanwhile, the cumulative herd exit of all herds showed an average growth rate of 0.8% (2.5 animals) per year. However, owners of small herds engage in small businesses and the sale of sheep to augment income from cattle sales and meet their livelihoods needs. This unique complementary relationship between sales and non-farm income was reported by Makhura (2001) for small-holder horticulture farmers. Moreover, the imperative to reverse the adverse herd growth trend of small-herds needs urgent attention.

The farmer's cattle rearing objective is the second factor determining herd off-take in the study area. Evidence from chapter four (Table 4.6) shows that farmers who depend on income from cattle sold more steers and oxen. Furthermore, farmers who regarded cattle as a store of wealth also sold more oxen and less cows in an effort to increase stock.

Herd performance is the third factor determining herd off-take in the study area. The low calving rate is the 'Achilles heel' for the study area. When considering a 27% exit and 55% calving rate based on an average herd of 35 with 54% cows, only 10.3 enter the herd annually while 9.5 exit. This implies an annual herd growth of 0.8 animals. Again, this indicates that the production system has reached a pinnacle and will begin to decline with increased exits, should calving rates not be improved. The demographic analysis of the study area showed that older farmers dominate the production system. Having reached the optimal off-take rates for sustainable production, these farmers depend on social grants to augment income from cattle sales. Generally, farmers regard income generation as their main objective for rearing cattle.

It is clear from the above evidence that the improvement of herd off-take rates in the study area needs a comprehensive approach. First, the low herd performance has to be addressed in general. Particular attention has to be paid to vulnerable herds of 1-10, which are already on a decline especially to reduce herd mortality. Special attention is needed to improve herd structure by improving the proportion of cows beyond the accepted norm. Improved calving rates may accelerate the current herd growth and create more opportunities to increase off-take.

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CHAPTER TEN

CONCLUSIONS AND RECOMMENDATIONS

10.1. Introduction

The purpose of this study was to investigate the cattle off-take decision models for small-holder cattle producers in South Africa. Previous chapters described the research problem and provided empirical evidence about the study. This chapter summarises the findings and recommends alternatives to improve the herd off-take rates.

10.2. General conclusions

This study was premised on the importance of cattle production in socio-economic transformation of small-holder farming in South Africa. With livestock being the livelihood base for most households on the continent, the transition of small-holder farmers towards commercial orientation may facilitate the realization of a meaningful social change. This intent for improving the livelihoods of resource poor farmers is articulated in policy statements at all spheres of government in the Republic as well as on the continent.

Literature showed efficiency disparities between the South Africa's small-holder producers and their commercial counterparts. At national level South Africa has the highest cattle off-take rate on the continent but disaggregated statistics showed a threefold gap between the two sub-sectors in the Republic. Similarly, the continent lags far behind its developing counterparts in terms of herd growth and productivity.

From a methodology point of view, because of a lack of accurate animal records, the crude herd off-take formula was used to calculate both voluntary and involuntary off-takes in the study. The use of the off-take concept varied across previous studies, hence this study opted for a more commercial approach and restricted off-take to sales only. Even though they are a form of involuntary off-take, for the purpose of this study, deaths were not referred to as off-take but treated as part of aggregate exits. An important departure from previous studies, which used a soft option approach to

measure reasons for rearing cattle, was the use of ranking scale to accommodate the multiple roles of cattle in small-holder systems.

Few studies exist on the subject of interest for this study, hence references included other facets of agricultural production. A theoretical framework was derived from a variety of previous studies to formulate hypotheses discussed below. For instance, the strong institutional arrangements is known to enhance farmers' efficiency and was therefore presumed to affect off-take rates positively. Ample evidence illustrated the interdependence of the social and economic ends of the household. It was for this reason that the study presumed that family characteristics would influence herd off-take decisions. Based on existing evidence of the suppressing effects of non-farm income on cattle off-take it was presumed that the same effect would occur in the current study. The other two hypotheses of this study were based on the assumptions that management practices including objectives, production practices as well as herd structure would influence herd off-take. It was also anticipated that the brokering role of extension would have an influence.

The hypotheses of this study were be tested as follows:

I. Producers' socio-economic environment such as family size, household headship, education and employment influences their willingness and ability to sell stock.

The demographic analysis shows that the study area is dominated by older persons who have passed the prime age of late forties. Although the low participation of the youth in agriculture is a universal phenomenon it poses a serious threat to the sustainability of cattle production in the study area. As established from literature that women control less land and livestock, this study also revealed that women operated smaller herds than men. Taung North extension ward had both the highest proportion of women (47%) as well as small herds. It is concluded that women as well as farmers in Taung North extension ward are vulnerable groups in the study area.

An encouraging finding was on the tendency of small business dependent households, a forte for women, showing a higher level of efficiency, which suggests the need for extended opportunities for women participation in the industry. As illustrated in previous studies that women are as efficient as men when afforded equal opportunities, this study also found no gender based differences in productivity as well

as off-take rates. Neither, did this study find a significant correlation between household attributes such as age of the head and family size, and overall herd off-take. For this reason, the study rejects its alternate hypothesis on household socio economic situation and accept the null hypothesis. The limitation of this study was its inability to estimate stocking rates of the rangelands. First, most farmers operate in communal areas, which made it difficult to estimate current stocking rates to make logical conclusions on the ideal directions to adjust the growth and shrinkage of herds from a sustainable rangeland management perspective. However, the type of land tenure did not influence herd off-take rates in the study area.

II. Non-farm income suppresses herd off-take. Income from other sources will suppress farmers' participation in cattle sales.

From a livelihood perspective, the majority (58%) of household heads regarded farming as their form of self-employment while 82% of farmers regarded cattle production as their major source of income. Small stock sales and social grants ranked second and third as sources of income for 55% and 47% of households, respectively. Unlike previous studies, evidence from this study shows that non-farm income such as small businesses and social grants complements rather than suppress cattle sales. For this reason, the alternate hypothesis that non-farm income does change cattle off-take decisions is accepted even though the sign differs.

The market infrastructure is a limiting factor in the study area showing that most farmers use livestock auctions to dispose of their cattle. As established in previous studies that small-holder farmers obtain lower prices from this market channel, farmers in the study area also perceived prices obtained from auctions to be poor. Another limitation with the market infrastructure is the inherent marketing costs that would be associated with the long distances towards the sales points. It is concluded that auction facilities in the study area should be improved to increase market prices.

III. Institutional arrangements of small-holder cattle producers do influence off-take rates. Farmers who belong to associations will be more emendable to change and engage in commercial off-take activities.

The breed utilization assessment revealed that women and owners of small herds tend to adopt exotic and non-descript breeds resulting in reduced performance such as low calving rates. On the other hand, the inclination of more experienced male farmers to operate indigenous breeds, affiliate to and hold office in community associations and achieve higher productivity, imply that these producers could be targeted for a conservation programme to reverse the erosion of indigenous genotypes. The conservation of indigenous breeds is important for mitigating the negative effects of climate change as well as ensuring sustainable production. The study therefore accepts the alternate hypothesis that farmers off-take improves as they affiliate to community association.

IV. Extension is an important catalyst in enhancing farmers' ability to make rational decisions. This brokering role follows various modalities with different outcomes.

    Results show that public extension through extension and animal health officers remains the main source of information for farmers. The preference of sources of information is associated with demographic attributes of farmers, which determined the choice of information sources in varying ways. Preferred sources for more educated farmers, men, younger farmers and owners of large herds such as radio, TV and commercial farmers, suppressed the sale of cattle and small stock. Reliance on small-holder farmers also suppressed calving rates and the sale of small stock in general while extension contacts suppressed the sale of sheep in particular. On the other hand, sources preferred by women such as office visits and telephonic communication stimulated the sale of sheep and small stock in general. The negative influence of mass media such as radio and TV on off-take rates implies a lack of market focused content in the broadcast programmes targeting small-holder farmers. The same applies for the subjects addressed through farmer to extension using both commercial and small-holder farmers. This study accepts the above alternate hypothesis and concludes that sources of information do influence herd off-take.

V. Producers' management practices determine herd dynamics such as calving and mortality rates, which influence the number of stock available for sale.

Principal component analysis indicated that there are three distinct factors underlying cattle off-take in the study area. Herd size, which explained the most variance of the analysis has several socio-economic ramifications for the study area. The result confirms that owners of small herds sell more cattle probably to meet household needs. As a result of the high off-take farmers in this category resort to both small businesses and the sale of sheep to supplement cattle income. The cumulative herd exit including slaughters and deaths was at record high (43%) resulting in a negative herd growth rate of 0.7%. As discussed earlier, women and farmers from Taung North extension ward are most vulnerable to this trend. The reversal of this trend should receive priority attention especially by focusing on reducing the high mortality rate. On the other hand, middle size herds grow at a rate of between 0.2 and 0.5 while the larger herd, which constitute only 11% of the farmers, grow at a rate of 11%. Overall, the average herd in the study area grows at a rate of 0.8%. Because of the relatively low mortality rates in the latter categories, there is need to specifically focus on raising the below average off-take rates of medium size herds. There is also an opportunity to pursue an equilibrium point between herd inflow and exit. This could be achieved by using the current national off-take rate and the recommended herd mortality of 3% as benchmarks.

The farmer's cattle rearing objective was the second factor determining herd off-take in the study area. The use of a ranking scale for cattle rearing objectives provided additional insight into off-take patterns. The high loading of dependence of cattle income on the second factor imply that farmers would logically sell more animals. This is also corroborated by the earlier finding that this category of farmers sold more steers and oxen. Furthermore, farmers who regarded cattle as a store of wealth also sold more oxen and less cows in an effort to increase stock.

Herd performance was the third factor determining herd off-take in the study area. The result showed that the low calving rate was the 'Achilles heel' for the study area. When considering a 27% exit and 55% calving rate based on an average herd size of 35 with 54% cows, only 10.3 animals enter the herd annually while 9.5 exit. This implies an annual herd growth of 0.8 animals. Again, this indicates that the production system has reached a pinnacle and will begin to decline with increased exits should calving rates not be improved. The demographic analysis

of the study area showed that older farmers dominate the production system. Having reached the optimal off-take rates for sustainable production, these farmers depend on social grants to augment income from cattle sales. However, farmers who are highly dependent on cattle income, generally regard income generation as their main objective for rearing cattle. The study therefore accepts the alternate hypothesis stated above and conclude that the farmer's management practices do influence cattle off-take rates.

It is clear from the above evidence that the improvement of herd off-take rates in the study area needs a comprehensive approach. First, the low herd performance has to be addressed in general. Particular attention has to be paid to vulnerable herds of 1-10, which are already on a decline especially to reduce herd mortality. The improvement of herd mortality in medium and large herd categories should be traded off with increased off-take rates. Special attention is needed to improve herd structure by enhancing the proportion of cows. Improved calving rates may accelerate the current herd growth and create more opportunities to increase off-take.

10.3 Recommendations

This study investigated factors influencing cattle off-take decisions among small-holder farmers. The main aim was to contribute new knowledge about small-holder production systems. The demographic analysis showed dominance by experienced males who have passed prime age and are in a sliding productivity phase. No difference was detected based on gender and age groups in terms of productivity and off take rates. It is concluded that women must be afforded equal opportunities as men and that incentives should be provided to entice the youth into cattle farming. There are existing policy instruments to redress the plight of vulnerable groups including women and youth.

Firsts, a holistic approach to the cattle and livestock value chains to address issues such as markets and logistics may suffice to inculcate a positive attitude among the youth. The Landbank and the Department of Small Enterprise Development should support the establishment of youth auctioning and transportation companies and cooperatives to strengthen forward linkages of the value chain. This localisation of

the value chain should improve the value of livestock in the study area and motivate farmers to improve productivity, which should in turn entice younger persons to participate in primary cattle production.

Second, the current land reform programme should prioritise women and youth to improve their participation in the cattle value chain. Because communal land tenure dominates the production system in the study area, intervention programmes such as the recapitilisation of land reform farms should be extended to communal areas to increase women's entry into the industry as well as increase herd sizes of current participants. Institutions such as the Landbank should design special interventions to enable women and youth to capitalise their enterprise.

Principal component analysis showed that herd size had the most influence on herd off-take with owners of small herds experiencing the highest herd exit, which results in shrinking herds. Owners of small herds resort to the sale of sheep and engage in small businesses to supplement cattle income. This category of farmers also experienced the highest mortality rates, which indicates that they were most vulnerable. Diseases were mainly liable for most stock losses in the study area, which requires elevated attention. It is clear that this farmer category has passed the off-take pinnacle requiring other strategies to improve the farming system. This can be achieved by implementing the following recommendations:

The veterinary services should design a primary animal health management programme to empower both extension officers and farmers in identifying, preventing and controlling animal disease incidences. This sequential intervention can be implemented through short courses for extension officers who should initially raise farmers' awareness through a focused campaign followed by group extension methods.

In some instances, these delicate herds sold cows as mortality rates increased, which further threatened their existence. These herds were also characterised by inferior herd composition in terms of low proportion of replacement heifers. The heifer replacement gap of 6% below the recommended rate of 20%, implies that a 6% herd mortality reduction target should be set to reverse the current herd shrinkage among the small herds of 1-10. The outcome of these interventions could reverse the

plummeting herd size trend among poor farmers by trading off the high herd exit of 43% and 37% with a view to retaining between 0.177 and 0.35 head of cattle per year. Ideally, the gains of reducing herd mortality of small herds to 12% should be split into 70:30 in favour of retentions to achieve a herd growth equilibrium.

The weakness of this study was a lack of sufficient data for both sheep and agri-businesses as supplementary enterprises to cattle production systems. Results revealed that these enterprises are an integral part of small herds' production systems. Further research should therefore be conducted to investigate herd off-take interfaces in mixed production systems of cattle and sheep. An elaborate analysis of the types, structure and size of common small businesses that complement cattle production should also be conducted.

Results of this study showed that farmer's cattle rearing objective was the second important factor underlying cattle of-take in the study area. This illustrated that those farmers generally kept cattle as a store of wealth even though they highly depended on sales for income. This has therefore provided a new insight from a methodological point of view with ranking scale to measure cattle rearing objectives simultaneously. It is recommended that future studies use ranking scales to measure applicable cattle rearing objectives.

Poor herd performance especially calving rates was the third important factor influencing cattle off-take rates in the study. Calving rates pose a high risk to the sustainability of small-holder cattle businesses in the study area. In most instances, farmers who owned small herds, depended on non-farm income such as social grants, employment and small-businesses and had lower calving rates. The high off-take rates among small herds compounded with low calving rate may stagnate or even deplete stock in the study area. There is an urgent need for the introduction of record keeping as part of cattle production in the study area, to monitor the productivity of breeding cows. Other interventions could include continuous bull fertility evaluation as well as diagnosis for the presence of reproductive diseases in herds.

The threat of herd depletion in the study area is so serious that further analysis of principal factors showed that poor herd performance results in the sale of breeding

cows. This indicates the desperation that farmers in the study area endure to meet their basic household needs. It is therefore imperative for the extension service to prioritise the improvement of calving rates and reduction of herd mortality in order to ensure the sustainability of cattle production in the study area.

One of the objectives of this study was to recommend an extension intervention strategy for the study area. Results showed that some preferred sources for more educated farmers, men, younger farmers and owners of large herds such as radio, TV and commercial farmers, suppressed the sale of cattle and small stock. Reliance on small-holder farmers also suppressed calving rates and the sale of small stock in general while extension contacts suppressed the sale of sheep in particular. It was concluded that the negative influence of mass media such as radio and TV on off-take rates implies a lack of market focused content in the broadcast programmes targeting small-holder farmers. The same applies to the subjects addressed through farmer-to-farmer extension using both commercial and small-holder farmers. It is recommend the following extension interventions for the study area:

- As stated, above efforts must be directed towards improving calving and reducing mortality rates in the study area. These should include:
    - A thorough disease monitoring and control programme including vaccination for controlled diseases and primary animal health training to enable farmers to detect early disease signs
    - Introduction of an animal recording programme to monitor herd productivity including cow efficiency, bull fertility as well as prenatal losses.
- The scope of radio and TV programmes should be revised to include markets and entrepreneurship with a view to increasing the off-take rates among small-holder farmers.
- The use of digital technology especially cell phones should be intensified to facilitate easy access to information for farmers in lieu of office visits with minimal interruption of farming activities.
- In general, all stakeholders including both commercial and small-holder farmers need to be introduced to a new paradigm of focusing on improved

off-take as the ultimate goal of cattle production. Important focus areas should include:

- Access to and sharing of market information such as prices, demand and trends
- Coordination of herd sale and distribution activities such as economics of collection and transportation as well as customized sales.

This study has raised an important question about the appropriate approach to increase the off-take rate of smallholder farmers. The high off-take rates among small herds of 1-10 indicates a transition in purpose towards commercial orientation. The use of digital technology to facilitate information sharing as well as economies of scale will be required to create new farmer empowerment platforms such as virtual cooperatives.

CATTLE OFF-TAKE QUESTIONNAIRE

1. Respondent Number — V.1

Personal questions

2. Name of farm /Location — V.2

3. Gender of respondent — V.3
   1. Male
   2. Female

4. Relationship of respondent to household head — V.4
   1. Self
   2. Wife
   3. Son
   4. Daughter
   5. Other

5. Marital status of household head — V.5
   1. Married
   2. Single
   3. Divorced
   4. Widowed

6. Number of persons in household

	Male	Female				
6.1. Number of persons < 7 years old			V.6M		V.6F	
6.2. Number of persons 7-12 years old			V.7M		V.7F	
6.3. Number of persons 12-18 years old			V.8M		V.8F	
6.4. Number of persons 18-35 years old			V.9M		V.9F	
6.5. Number of persons >35 years old			V.10M		V.10F	

7. Age of household head

Male	Female				
		V.11M		V.11F	

Education

8. Number of years of schooling of household head _____ V.12 [ ]
9. Number of household members attending school (basic education)

	Male	Female				
9.1. Number of persons < 7 years old			V.13M		V.13F	
9.2. Number of persons 7-12 years old			V.14M		V.14F	
9.3. Number of persons 12-18 years old			V.15M		V.15F	
9.4. Number of persons >18 years old			V.16M		V.16F	

10. Number of household members attending school (tertiary education)

1. Male		V.17	
2. Female		V.18	

Employment

11. Employment status of household head
    1. Self employed [ ]

2. Temporary employment
3. Permanent employment
4. Unemployed

V.19

12. Type of business if self employed
    1. Farming
    2. Retail
    3. Construction
    4. Service
    5. Other

V.20

13. Type of work if employed
    1. Agriculture
    2. Retail
    3. Construction
    4. Public service
    5. Mining
    6. Other

V.21

14. How often does the head of household come home
    1. Daily
    2. Weekly
    3. Monthly
    4. Quarterly
    5. Semester
    6. Yearly

7. Less than yearly		V.22	

Household income

15. What are the main sources of income for the household

	Always	Sometimes	Seldom	Never		
15.1. Employment	4	3	2	1	V.23	
15.2. Cattle sales	4	3	2	1	V.24	
15.3. Crops	4	3	2	1	V.25	
15.4. Other livestock	4	3	2	1	V.26	
15.5. Remittances	4	3	2	1	V.27	
15.6. Pension/social grants	4	3	2	1	V.28	
15.7. Small business	4	3	2	1	V.29	
15.8. Other	4	3	2	1	V.30	

16. What is the gross household income per annum (R)

1. 0-50k			
2. 50k-100k			
3. 100k-300k			
4. 300k-500k			
5. 500k-750k			
6. 750k+		V.31	

Household expenditure

17. What are the main expenses of the household

	Always	Sometimes	Seldom	Never		
17.1. School fees	4	3	2	1	V.32	

17.2. Groceries	4	3	2	1	V.33	
17.3. Crops	4	3	2	1	V.34	
17.4. Other livestock	4	3	2	1	V.35	
17.5. Cattle	4	3	2	1	V.36	
17.6. Small business	4	3	2	1	V.37	
17.7. Other	4	3	2	1	V.38	

18. How much is the household's monthly expenditure on the following items

18.1. School fees		V.39	
18.2. Groceries		V.40	
18.3. Crops		V.41	
18.4. Other livestock		V.42	
18.5. Cattle		V.43	
18.6. Small business		V.44	
18.7. Other		V.45	

Land

19. What size of arable land do you have access to _____		V.46	
20. What is the size of arable land you cultivated in 2011 _____		V.47	
21. What size of grazing land do you have _____		V.48	
22. What size of grazing land do you have grazing rights on _____			
23. Is your grazing land divided into camps			
1. Yes		V.50	
2. No			

24. What is the of tenure on your land

1. Communal			

2. Freehold
3. Lease
4. Other

V.51

Experience

25. How many years have you been involved in agriculture
    - 25.1. Crop production — V.52
    - 25.2. Cattle production — V.53
    - 25.3. Other livestock — V.54
    - 25.4. Other — V.55

Herd profile

26. Breed/breed type of cattle _____ V.56
27. What is the total herd size _____ V.57

28. What is the number of cattle in different categories
    - 28.1. Bulls — V.58
    - 28.2. Oxen — V.59
    - 28.3. Cows — V.60
    - 28.4. Heifers — V.61
    - 28.5. Bullocks — V.62
    - 28.6. Steers — V.63

29. How many other livestock do you have
    - 29.1. Sheep — V.64
    - 29.2. Goats — V.65

29.3. Horses		V.66	
29.4. Donkeys		V.67	
29.5. Pigs		V.68	
29.6. Chickens		V.69	
29.7. Other		V.70	

Production practices

30. Are your cattle herded during the day

1. Yes		V.71	
2. No			

31. Who herds your cattle

1. Self			
2. Wife			
3. Son			
4. Daughter			
5. Hired herd man			
6. Other		V.72	

32. Do you identify your cattle

1. Yes			
2. No		V.73	

33. What type of identification do you use?

1. Brand mark			
2. Other types			

3. Brand mark and others types | | V.74 | |

34. In which month of the year do you put the bull/s into the herd _____ V.75

35. Do you give your cattle supplementary feed

1. Yes
2. No

V.76

36. How frequent do you provide supplementary feeding

	Always	Sometimes	Seldom	Never		
36.1. Hay	4	3	2	1	V.77	
36.2. Silage	4	3	2	1	V.78	
36.3. Mineral licks	4	3	2	1	V.79	
36.4. Others	4	3	2	1	V.80	

37. At what age are your calves weaned _____ V.81

38. Do you vaccinate your cattle

	Always	Sometimes	Seldom	Never		
38.1. Anthrax	4	3	2	1	V.82	
38.2. Brucellosis	4	3	2	1	V.83	
38.3. Blackquarter	4	3	2	1	V.84	
38.4. Others	4	3	2	1	V.85	

39. Do control parasites in your herd

1. Yes
2. No

V.86

40. If yes how often do you dip your animals

1. Weekly			
2. Fortnightly			
3. Monthly			
4. Less than monthly			
5. Never		V.87	

41. Which type of remedies do you use to control diseases in your herd

	Always	Sometimes	Seldom	Never		
41.1. Commercial remedies	4	3	2	1	V.88	
41.2. Traditional remedies (IKS)	4	3	2	1	V.89	
41.3. Others	4	3	2	1	V.90	

42. Do you measure animal performance using criteria below

	Always	Sometimes	Seldom	Never		
42.1. Birth weight	4	3	2	1	V.91	
42.2. Wean weight	4	3	2	1	V.92	
42.3. Age at first calving	4	3	2	1	V.93	
42.4. Inter calving interval	4	3	2	1	V.94	
42.5. Others	4	3	2	1	V.95	

43. Which criteria do you use to select and cull animals from the herd according the categories below

	Always	Sometimes	Seldom	Never		
43.1. Animal growth	4	3	2	1	V.96	
43.2. Colour	4	3	2	1	V.97	

43.3. Horns	4	3	2	1	V.98	
43.4. Pedigree	4	3	2	1	V.99	
43.5. Adaptability	4	3	2	1	V.100	

Animal performance

44. How many cows calved between January and December 20101 _____ V.101
45. How many calves were born from your herd between

    January and December 2011 _____ V.102

46. How many calves died before weaning between January and December 2011 _____ V.103

47. How many calves died after weaning between January and December 2011 _____ V.104

48. How many old animals died between January and December 2011 _____ V.105

49. What was the main cause of animal deaths 2011 _____ V.106

Purpose of keeping cattle

50. What is/are your reason/s for keeping cattle. Please rate the correctness of the reason using the scale below

	Always	Sometimes	Seldom	Never		
50.1. Commercial	4	3	2	1	V.107	
50.2. Wealth	4	3	2	1	V.108	
50.3. Prestige	4	3	2	1	V.109	
50.4. Rituals	4	3	2	1	V.110	

50.5. Traction	4	3	2	1	V.111	

51. How many head of cattle do you aspire to own _____ | V.112 | |

Off take

52. How many animals were slaughtered in 2011 according to categories below

	Number	Ritual/purpose		
52.1. Bulls			V.113	
52.2. Oxen			V.114	
52.3. Cows			V.115	
52.4. Heifers			V.116	
52.5. Bullocks			V.117	
52.6. Steers			V.118	

53. How many animals were sold in 2011 according to the categories below

53.1. Bulls		V.119	
53.2. Oxen		V.120	
53.3. Cows		V.121	
53.4. Heifers		V.122	
53.5. Bullocks		V.123	
53.6. Steers		V.124	

54. How many animals were donated in 2011 according to the categories below

	Number	Purpose (optional)		
54.1. Bulls			V.125	
54.2. Oxen			V.126	
54.3. Cows			V.127	
54.4. Heifers			V.128	
54.5. Bullocks			V.129	
54.6. Steers			V.130	

55. How many animals were brought into the herd in 2011 according to the categories below

55.1. Bulls		V.131	
55.2. Oxen		V.132	
55.3. Cows		V.133	
55.4. Heifers		V.134	
55.5. Bullocks		V.135	
55.6. Steers		V.136	

56. What is the number of other livestock that was sold in 2011?

56.1. Sheep		V.137	
56.2. Goats		V.138	
56.3. Pigs		V.139	
56.4. Chickens		V.140	
56.5. Other		V.141	

57. What is/are the common market for selling cattle

1. Auction	

2. Butcher
3. Feedlot
4. Abattoir
5. Out of hand sales
6. Others

V.142	

58. How many animals in categories below did you sell through these markets in 2011

	Auction		Butcher		Feedlot		Out of hand		Others	
58.1. Bulls		V.143		V.144		V.145		V.146		V.147
58.2. Oxen		V.148		V.149		V.150		V.151		V.152
58.3. Cows		V.153		V.154		V.155		V.156		V.157
58.4. Heifers		V.158		V.159		V.160		V.161		V.162
58.5. Bullocks		V.163		V.164		V.165		V.166		V.167
58.6. Steers		V.168		V.169		V.170		V.171		V.172

V.143	
V.144	
V.145	
V.146	
V.147	
V.148	
V.158	
V.149	
V.159	
V.150	
V.160	
V.151	
V.161	
V.162	
V.163	
V.164	
V.165	
V.166	

59. Rate your satisfaction about market prices using the scale below

	Very good	Good	Fair	Poor		
59.1. Auction	4	3	2	1	V.173	
59.2. Butcher	4	3	2	1	V.174	
59.3. Feedlot	4	3	2	1	V.175	
59.4. Abattoir	4	3	2	1	V.176	
59.5. Out of hand	4	3	2	1	V.177	
59.6. Others	4	3	2	1	V.178	

60. What is/are the distance/s towards the market/s

60.1. Auction		V.179	
60.2. Butcher		V.180	
60.3. Feedlot		V.181	
60.4. Abattoir		V.182	
60.5. Out of hand		V.183	
60.6. Others		V.184	

61. Explain how you transport animals to market

61.1. Auction		V.185	
61.2. Butcher		V.186	
61.3. Feedlot		V.187	
61.4. Abattoir		V.188	
61.5. Out of hand		V.189	
61.6. Others		V.190	

62. What do you think should be done to improve transportation and marketing of animals?_____

V.191	

Sources of information and extension

63. Which sources of information do you use

	Always	Sometimes	Seldom	Never		
63.1. Magazine	4	3	2	1	V.192	
63.2. Radio	4	3	2	1	V.193	
63.3. Television	4	3	2	1	V.194	
63.4. Commercial farmers	4	3	2	1	V.195	
63.5. Other small holder farmers	4	3	2	1	V.196	
63.6. Extension officers	4	3	2	1	V.197	
63.7. Veterinarian	4	3	2	1	V.198	
63.8. Animal health officers	4	3	2	1	V.199	
63.9. Others	4	3	2	1	V.200	

64. How often do you have contact with the extension officer

	Weekly	Fortnightly	Monthly	<Monthly		
64.1. Farmers day	4	3	2	1	V.201	
64.2. Farmer groups	4	3	2	1	V.202	
64.3. Office visit	4	3	2	1	V.203	
64.4. Farm visit	4	3	2	1	V.204	
64.5. Telephone/electronic	4	3	2	1	V.205	
64.6. Other	4	3	2	1	V.206	

65. Which subject matter areas were addressed in your contact with extension

officers in 2011

	Always	Sometimes	Seldom	Never		
65.1. Crop production	4	3	2	1	V.207	
65.2. Cattle production	4	3	2	1	V.208	
65.3. Pasture management	4	3	2	1	V.209	
65.4. Other livestock	4	3	2	1	V.210	
65.5. Market information	4	3	2	1	V.211	
65.6. Small business	4	3	2	1	V.212	
65.7. Other	4	3	2	1	V.213	

66. Which subject matter areas were addressed in your contact with sources of information in 2011

	Always	Sometimes	Seldom	Never		
66.1. Crop production	4	3	2	1	V.214	
66.2. Cattle production	4	3	2	1	V.215	
66.3. Pasture management	4	3	2	1	V.216	
66.4. Other livestock	4	3	2	1	V.217	
66.5. Market information	4	3	2	1	V.218	
66.6. Small business	4	3	2	1	V.219	
66.7. Other	4	3	2	1	V.220	

Institutional arrangements

67. Are you a member of a group or network for self-help and/or economic development?

	1 Yes	2 No		
67.1. Community			V.221	
67.2. Farmers association			V.222	
67.3. Livestock commodity			V.223	
67.4. Crop commodity group			V.224	
67.5. Farmer study group			V.225	

67.6. Other			V.226	

68. Are you an office bearer in the organisation

	1 Yes	2 No		
68.1. Community			V.227	
68.2. Farmers association			V.228	
68.3. Livestock commodity			V.229	
68.4. Crop commodity group			V.230	
68.5. Farmer study group			V.231	
68.6. Other			V.232	

69. Does your organisation contribute to access to information regarding the subjects below

	Always	Sometimes	Seldom	Never		
69.1. Crop production	4	3	2	1	V.233	
69.2. Cattle production	4	3	2	1	V.234	
69.3. Pasture management	4	3	2	1	V.235	
69.4. Other livestock	4	3	2	1	V.236	
69.5. Market information	4	3	2	1	V.237	
69.6. Small business	4	3	2	1	V.238	
69.7. Other	4	3	2	1	V.239	

70. Please assess the relevance of information you obtain from the sources below

	Always	Sometimes	Seldom	Never		
70.1. Magazine	4	3	2	1	V.240	
70.2. Radio	4	3	2	1	V.241	
70.3. Television	4	3	2	1	V.242	

70.4. Commercial farmers	4	3	2	1	V.243	
70.5. Other small holder farmers	4	3	2	1	V.244	
70.6. Extension officers	4	3	2	1	V.245	
70.7. Veterinarian	4	3	2	1	V.246	
70.8. Animal health officers	4	3	2	1	V.247	
70.9. Others	4	3	2	1	V.248	

71. As a result of the different sources of information how do you rate your competence in cattle production?

	Excellent	Good	Satisfactory		
71.1. Magazine	3	2	1	V.249	
71.2. Radio	3	2	1	V.250	
71.3. Television	3	2	1	V.251	
71.4. Commercial farmers	3	2	1	V.252	
71.5. Other small holder farmers	3	2	1	V.253	
71.6. Extension officers	3	2	1	V.254	
71.7. Others	3	2	1	V.255	

72. Which sources of information have contributed to your current knowledge regarding cattle production (business as a whole)

	Strongly agree	Agree	Disagree	Strongly disagree		
72.1. Magazine	4	3	2	1	V.256	
72.2. Radio	4	3	2	1	V.257	
72.3. Television	4	3	2	1	V.258	
72.4. Commercial farmers	4	3	2	1	V.259	

72.5. Other small holder farmers	4	3	2	1	V.260	
72.6. Extension officers	4	3	2	1	V.261	
72.7. Veterinarian	4	3	2	1	V.262	
72.8. Animal health officers	4	3	2	1	V.263	
72.9. Others	4	3	2	1	V.264	

73. Do you milk your cows?

	1 Yes	2 No		
			V.265	
73.1. If yes, how many cows do you milk?			V.266	
73.2. How many litres do you sell per day?			V.267	

Thank you for taking the time to complete the questionnaire.