INFLUENCE OF SOCIO-ECONOMIC FACTORS ON SHEEP MORTALITY AND SALES CONSTRAINTS FACED BY SMALL-SCALE SHEEP PRODUCERS IN NKANGALA DISTRICT, MPUMALANGA PROVINCE, SOUTH AFRICA

MINI DISSERTATION

Submitted in partial fulfillment of the requirement for the degree of

Masters of Agricultural Management

in

Animal Production

in the

FACULTY OF SCIENCES AND AGRICULTURE

(School of Agriculture and Environmental Sciences)

at the

UNIVERSITY OF LIMPOPO

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2015

DECLARATION

I declare that the dissertation hereby submitted to the University of Limpopo for the degree of Master of Agriculture Management (Animal Production) has not previously been submitted by me for a degree at this or any other University, that is my own work in design and execution and that all material contained therein has been duly acknowledged.

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Signature…… Date……

ACKNOWLEDGEMENTS

This study was made possible through the help and support from parents, teachers, family, friends, and in essence, please allow me to dedicate my acknowledgment of gratitude towards the following significant advisors and contributors: First and foremost, I would like to thank my supervisor Dr. BJ Mtileni for his support, guidance, patience, encouragement and leadership during the course of the study. My sincere thanks to Nkangala district municipality for allowing me to conduct this study. I wish to convey my sincere thanks and acknowledgements to veterinary officials (Ms GG Mosagale, Mr P Mthimunye and Mr J Matshe) for their assistance during data collection. I would like to express my thanks to my friend and MSc Student University of Limpopo Mr TL Tyasi and Mr M Mthunzu for their valuable advices and technical guidance during the course of the study. I wish to extend my gratitude to my wife Phomelelo, my grandmother Mrs E Letsoalo and my spiritual mentor Bishop MB Mphahlele for their moral support and prayers. Above all, I thank Almighty God for ushering my soul for me to accomplish this study. This study would not be possible without all of them.

DEDICATION

This dissertation is dedicated to my lovely late mother Ms AR Mogashoa for raising and encouraging me to study hard to make life easier. She used to say “perseverance is a mother of success

ABSTRACT

The study was carried out to determine influence of socio-economic factors on sheep mortality and sales constraints faced by small-scale sheep farmers of Nkangala District in Mpumalanga province. A field survey was carried out in six local municipalities of Nkangala District. Individual interviews were conducted in 132 households who owned sheep using semi-structured questionnaire. Flock size ranged from 1 – 32 sheep (mean flock size was 21.1). The estimated odds ratio shows that variables such as type of sheep housing, production methods adopted by the farmers, availability of supplementary feed and accessibility of veterinary services and extension service had high probabilities of influencing both sheep mortality and sales, whereas variables such as gender and wealth status of the farmer affected sheep sales, but not significant in affecting sheep mortality. The age of the farmer and sheep breed owned by the farmer were not significant in affecting both sheep mortality and sales. About 90 % of farmers keep sheep for income generation in order to meet family expenditures. Over 70 % of male owned large proportion of sheep across all municipalities, while females and youth were less involved in sheep production across all municipalities. Natural veld was the major source of feed for sheep flocks. In general, majority of farmers sourced their breeding stock from auction while few sourced from commercial farms. About 95 % of respondents kept indigenous sheep breeds. Particular breed of sheep was kept for various reasons which included multiple births, adaptation to environment, good temperament, and good mothering ability. Undefined breeding and lambing seasons across all municipalities was common. The majority of respondents practiced extensive production system with improper sheep housing structures and were more likely to experience feed shortage, high percentage of sheep mortality and low sheep

sales. Low income, inadequate access to veterinary and advisory services affected most of sheep producers and as a result, farmers were not able to provide supplementary feeds and medication for their animals to enhance profitability. Diseases and feed shortage contributed to sheep mortality and low sheep sales. As a result, less number and poor quality of sheep were produced. Lack of financial support and distance to market had negative effect on sales and mortality of sheep on small scale sheep producers. It was concluded that government should strengthen accessibility of veterinary and advisory services by small scale sheep producers, initiate accessible credit schemes and arrange accessible markets for these farmers to ensure sustainable sheep farming.

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LIST OF ABBREVIATIONS

EARO = Ethiopian Agricultural Research Organization

ILCA = International Livestock Centre for Africa

FAO = Food and Agricultural Organisation

SAS= Statistical Analysis Systems

SPSS = Statistical Package for Social Sciences

GLM = Genera Linear Model

PROC FREQ = Procedures Frequencies

IFAD = International Fund for Agricultural Development

PPR = Peste des Petits

NGO = Non-Governmental Organization

IBC = Institute of Biodiversity Conservation

IFSA GLO = International Farming Systems Association Global Learning Opportunity.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND OF THE STUDY

In South Africa, sheep are widely distributed across the country where they contribute to the livelihoods of the rural population as a source of protein, wool, food security and poverty alleviation (Gatenby *et al*., 1997; Otte, 2012; Bela and Haile, 2009). Sheep play a role on cementing social relationships and are also recognized as a cornerstone for development and support of livelihoods among rural households (Kitalyi and Ong, 2006; Obinne *et al.,* 2006). They are a source of revenue for smallholder farmers that cannot afford to maintain large ruminant livestock such as cattle (Panin, 1993; Degen, 2006). Despite their importance and apparent advantages, sheep have not been accorded adequate attention (Joy and Wimberley, 1981). Molokwu (1982) reported that they do not meet the protein needs of the inhabitants of sub-humid zone due to high mortality rate.

There are various factors that affect sheep productivity either directly or indirectly (Ramaila *et al*., 2011). However, Odeyinka (2005) reported other constraints to small ruminant production, particularly sheep in the tropics includes: diseases, accidents, theft, lack of capital and land. Identifying the specific causes and the underlying factors of mortality on farm is essential (Tibbo, 2006). However, information is lacking in this regard, particularly in the South African part of the country (Tsedeke *et al*., 2011). Most of indigenous breeds of sheep have not been selected for high productivity. This implies low growth rates and late maturity (Bullerdiek, 1996). Hence low genetic potential is often quoted as a major constraint to meat and milk production in sub-Saharan Africa. Low productivity of indigenous breeds cannot be over-emphasized without due consideration of some important characteristics of

these breeds. Environmental conditions under which they are raised should be taken into account. However, breeds with high maintenance requirements tend to lose weight and have highest mortality rates under stress conditions such as drought (Frisch, 1984). Braker et al. (2002) reported that in rural societies religious, cultural, ethnic and economic factors are a key determinant of the distribution of resources and responsibilities between men and women. Women often tend to have limited access to resources and extension services (FAO, 2010). Small ruminant livestock production is mainly traditional and extensively characterized by minimal inputs, with greater emphasis on head count than productivity (Osaer and Goosens, 1999).

Most farmers keep their livestock until the need for cash arises. The animals are usually sold to raise cash to buy food for the family (Agyemang *et al.,* 1997). This implies that the animals are sold in their present body condition, and the price is determined by the interaction between the farmer and buyers. Chukwuka et al. (2010) argued that sheep production in tropics is constrained by low genetic potential, seasonality of feed supply, high ambient temperature and mortality.

Montossia et al. (2013) stated that lamb mortality has both economic and animal welfare implications in sheep production, especially in extensive systems. Neonatal lamb mortality is one of major factors influencing decreased productivity of sheep enterprise (Otto *et al.,* 2009; Snyman, 2010). Mortality vary with the management system (intensive versus extensive). Rowland et al. (1992) reported that large proportion of lamb mortalities occurs at birth or during the first 3 days of birth. Causes of sheep mortalities include abortion, extreme weathers, dystocia diseases, accidents and predation. Knowledge of when and how lamb mortality occurs could be helpful to keep the mortality rate to a minimum (Odeyinka, 2005).

A slow growth rate, resulting in a low market weight of indigenous sheep, as an important limiting factor on profitability of sheep has been documented in the Ethiopian highlands (Mukasa *et al*., 1994). Lambs born in the wet season have low survival rates because of cold stress and disease infection especially pneumopathies (Ibrahim, 1998; Haughey, 1991). However, profitability is largely determined by the number of lambs sold per ewe. Therefore, a great deal of effort should be put towards the care of pregnant ewes and their lambs before, during and after birth. Hence, the study was conducted to assess the socio-economic factors affecting sheep mortality and sheep sales on small-scale sheep producers of Nkangala district municipalities in Mpumalanga province.

1.2 RESEARCH PROBLEM

1.2.1 Problem statement

Small ruminants are an important source of livelihood for millions of smallholder farmers in developing countries, however their productivity remains low (Akhter *et al*., 1995). Sheep are kept with limited financial resources for poverty alleviation in many developing countries (Degen, 2006). Productivity is however, low as a results of high mortality and low sheep sales (Molokwu, 1982). Factors such as poor husbandry, feed shortages and diseases are responsible for high mortality rate. However, Upton (1984) stated that the potential returns from sheep kept under the traditional management system are high. Sheep producers usually have less support than crop producers (FAO, 2009). They find it difficult to gain access to technical information concerning livestock, credits and marketing. As a result, the likelihood of making a success of their enterprises and achieving potential benefits of their stock becomes limited (Pollott and Wilson, 2009). The involvement of men in traditional livestock production is largely marginal in village production system (Thomas-Slayter

and Bhatt, 1994). There is little information that describes the influence of socio-economic factors on small scale sheep producers. Such information is critical in devising holistic intervention strategies for improving conservation and utilisation of sheep genetic resources in communal production systems.

1.2.2 Motivation

This study assessed the extent to which socio-economic factors influence small scale sheep production. Results of the study may potentially lead to sustainable farming for sheep producers under small-scale production sector. This study could be beneficial to the Nkangala district municipality in terms of policy making. Results from this study will also assist sheep producers on small scale production to apply appropriate management practices to increase their income derive from sheep farming.

1.3 SCOPE OF THE STUDY

1.3.1 Objectives

The main goal of the study was to determine the influence of socio-economic factors on sheep mortality and sales constraints faced by small-scale producers in Nkangala District, Mpumalanga Province.

The specific objectives of the study were to:

i. Describe the socio-economic characteristics of small-scale sheep producers in Nkangala district of Mpumalanga Province.
ii. Identify the socio-economic factors affecting sheep mortality and sales in Nkangala district of Mpumalanga Province

iii. Examine challenges faced by small-scale sheep producers in Nkangala district of Mpumalanga Province

1.3.2 Hypotheses

The study formulated and tested these null hypotheses;

i. There are no significant socio-economic factors affecting sheep mortality and sales in Nkangala district of Mpumalanga
ii. There are no challenges faced by small-scale sheep producers in Nkangala district of Mpumalanga Province
iii. There are no socio-economic characteristics of small-scale sheep producers in Nkangala district of Mpumalanga Province.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Sheep are one of major small ruminants of economic value in sub-Saharan Africa (Nauer *et al*., 1982; Oluwatayo* and Oluwatayo**, 2012). They promote social values cohesiveness and recreation in the rural community (Peacock *et al*., 2005), generate revenue and contribute to rural economic activities (Campbell, 2006). According to Nuru (1996), the consumption of meat and milk reduces large animal protein deficit, and improve the overall nutritional status of poor families and many poverty reduction programmes.

In sub-Saharan Africa, majority of sheep are raised by smallholder farmers on a small-scale production level. Profitability is low due to low market weight, overall low reproductive efficiency and high mortality rate (Ibrahim, 1998). In the small-scale production, farmers depend on small ruminants for their livelihood, often to a greater extent than on cattle, because sheep are generally owned by the poorer sectors of the community. Therefore, any intervention that improves the productivity of sheep is important in creating wealth and improving the standard of living of resource-poor farmers (IBC, 2004).

Socio-economic factors have an effect on animal, management, decision-making and the general perception of breed and species of the farmers. These factors affect the design and implementation of a breeding programme. Without a good understanding of these factors, it would be very difficult to persuade the local farmers to participate and cooperate in breeding programmes (Kosgey, 2004). Cultural constraints related to gender discrimination especially in the ownership, transfer and usage of land limits women's participation in livestock production (Orodho, 2006).

Traditional structures and perceptions tend to prevent women from obtaining the necessary tools to reach their full potential in the agricultural sector. Lack of access to credit, land and technologies have impeded their abilities to quickly gain skills to become entrepreneurs (World Bank, 2015; Distefano, 2013).

Sheep are reared under different, diverse environments and production systems with different demands on resources in sub-Saharan Africa (ILCA, 1979). Each production system faces different constraints (Anon, 1991). Husbandry practices range from free range system in less populated areas, cut and carry forage, grazing and scavenging in densely populated areas and year round confinement in modern ranch or commercial system (Oladele, 2004; Aregheore, 2011).

Optimal performance requires the supply of sufficient quantity and quality of feed. In sub-Saharan, most sheep under extensive production systems graze low quality forage and needs to be supplemented (Aregheore and Perera, 2005). In wet seasons, there is adequate quantity of good quality herbage for sheep leading to subsequent weight gain. However, sheep will start to lose weight when grasses approach maturity and deteriorate progressively in the dry season (Mafwere and Mtenga, 1992). Van Vlaenderen (1985) highlighted that farmers believe that sheep have no benefit of curative medicinal treatment. Therefore, they do not offer supplementary feed, care for good management and housing.

The small size and early maturity of sheep provide farmers with several distinct economic advantages in smallholder situations. They can efficiently utilize marginal and small plots of land, the risk on investment is reduced by smaller individual size, allowing more production units per unit of investment; and there is a faster turnover of capital because they mature early (Okoli *et al*., 2005). Smaller carcasses are also

easier to market and can be consumed in a short period of time. This is important as most rural areas lack proper storage facilities. Their strong flocking instinct makes herding by younger and older members of the family possible, allowing labour to be used more efficiently (Wilson, 1991).

Because of their lower feed requirements, their rapid reproduction cycles and the ease in which they can be handled, they are particularly important for resource-poor households and are often the property of underprivileged groups, such as women and children. Sheep are essential components of pastoralists', partly because of their ability to withstand drought conditions (Gatenby, 1982). Sheep play a major role in areas where the availability of land and fodder is insufficient (Horst, 1981). Most farmers keep sheep for sales to meet family expenditure (Getachew *et al*., 2010). Meat and milk are for family consumption and sold to meet emergency needs like cash for school fees (Kosgey, 2004). Sheep also meet social and cultural needs such as payment of drowry, celebration and gifts to household members (Ibrahim, 1998)

2.2 SHEEP OWNERSHIP PATTERNS AND GENDER CATEGORY

The Majority of the sheep population in South Africa are owned by smallholder farmers (Sanni *et al*., 2004; Mbilu, 2007). Sources of owning animals include inheritance, gifts, exchange, leasing and natural increase (Mason and Maule, 1960). In the pure pastoral system, additional animals are bought with money obtained from salary. In agriculture-associated systems, the money from sales of crops surplus to subsistence is often invested in livestock. Where women own sheep, they often obtain them through dowry (lobola). Mapiliyao (2010) reported that the majority of male headed households owned sheep than female headed households and the youth. This implies that majority of male are involved in sheep farming.

The role of women in the various aspects of ownership of sheep is typical in many African countries having similar cultural background. In most African countries, culture dictates that women are subordinates to men and hence are socially marginalized (Okali and Sumberg, 1985). Ogunela and Mukhtar (2009) reported that most sheep projects that address poverty and other socio-economic challenges are successful because of women led groups. In Malawi, women who own and manage a large number of sheep are found in rural areas (Banda, 2004). Women play an important role in the small ruminant component of mixed farming systems. However, their contributions remain unrecognized (Sinn *et al*., 1999; World Bank, 2009); they have been virtually ignored by agricultural intervention programs (Asres *et al.,* 2014). Recognizing different roles that women and men play in sheep production is a key to identifying the diverse challenges they face and making projects and programmes on their specific needs (Distefano, 2013; Köhler-Rollefson, 2012; World Bank, 2007).

2.3 SHEEP PRODUCTION CONSTRAINTS

2.3.1 Sheep mortality

2.3.1.1 Production systems

Environmental factors, agro ecological opportunities and socio-cultural environments play significant roles in determining the production system to adopt. Any production system adopted should favour local environmental conditions and must efficiently use available production resources (Pagot, 1992). Husbandry practices range from free range system in less populated areas, cut and carry feeding and year round confinement in commercial system. The systems adjust to prevailing biophysical and sociocultural environments based on old-age husbandry systems. The systems need to be modified to meet the needs of consumers (Aregheore, 2005).

Ademosun (1994) reported that management practices used at the extensive production systems for sheep are not ideal because mortality rate, losses from diseases, starvation, theft, predation and accidents is comparatively high. According to Perry et al. (2002), the extensive system of rearing sheep commonly practised by rural farmers predisposes them to parasites. There is a failure of treatment against parasites under communal grazing and because not all the flocks are treated, this leads to high level of pasture contamination (Mutibvu *et al.,* 2012).

2.3.1.2 Housing

Inappropriate hygienic housing leads to higher incidence of parasites and diseases which reduce productivity (Campbell *et al.,* 2006). Olalokun (1985) observed that the extensive production system entails considerable hazards to the sheep due to lack of housing. The provision of good housing can improve the productivity of sheep by giving protection from extreme weather and predators.

2.3.1.3 Feed shortage

Feed shortage especially during adverse conditions hamper sheep productivity on small-scale production (Ahuya *et al.,* 2005). A common challenge is the seasonal nature of rainfall patterns leading to seasonal fluctuations in forage quality and quantity. Starvation accounts for a very high incidence of deaths in lambs and kids. This is often due to the non-availability of the right type of feeds or poor nutritional nature of herbage around homesteads and the consequent long distances animals have to walk to graze, losing young animals in the process (Oppong and Yebuah, 1981). Inadequate access to feed influences the severity of several infections, particularly in young animals. According to Salem and Smith (2008), field fires and seasonal droughts limit the availability of fodder in the free range production system. Sikhosana and Maphosa (1995) indicated the need to improve animal feed supply in

the free range production system. Under extensive production system, lambs birth which occurs when animals are grazing on the bush, result in the death of the offspring which usually go unnoticed. According to Wilson et al. (1984), poor nutrition increases the animals' susceptibility to diseases.

Salem and Smith (2008) stated that for survival and sustenance of sheep production during dry season, feeds should be preserved during the periods where grazing is abundant. However, majority of farmers do not have technical know-how to preserve crop residues and agro-industrial by-products for future use (Komwihangilo *et al.,* 2001). Population pressure and emerging new markets created by urbanisation have caused an increase in land under cultivation at the expense of grazing land further exacerbating the challenge (Morton and Matthewman, 1996). According to Masikati (2010), feed shortage lead to low livestock productivity. Atta-Krah (1985) indicated that poor and inadequate nutrition is one of the major constraints to small ruminant production in sub-Saharan Africa.

The nutritional constraint is due to a variety of reasons including: intensification of crop agriculture which has led to diminishing feed resources from fallow lands; inadequate resources of high nutritive value in natural pasture; overgrazing of natural pasture and, lack of resources and interest in pasture production for small ruminants such as sheep. Unavailability of water is another common constraint. In some areas, water may be available but is of insufficient quality to support healthy growth and performance. Large numbers of sheep from different flocks share grazing and water points leading to high chances of spreading diseases (Masikati, 2010).

2.3.1.4 Diseases

In Southern Africa, prevalence of diseases and parasites is high and its impact is experienced through high mortalities and abortions (Githiori *et al*., 2006). High mortality of lambs diminishes the benefits of high reproductive performance in sheep production (Ademosum, 1988). High mortality rate of sheep is mainly from poor hygiene (coccidiosis), trypanosomosis, peste des petit (PPR), bronchopneumonia, theft and predation (Okoli, 2001, 2003). According to Opara et al. (2006), the major causes of pre-weaning deaths in lambs are starvation, pneumonia, helminthiasis, bacterial infection, diarrhoea and heart water.

Younger animals seem less able to withstand attack by both physical and biological agents due to their lack of immunity (Mtenga *et al.,* 1989). According to Akerejola et al. (1979), parasitic diseases are more likely to affect matured sheep. Sheep health situation is poor due to high costs of veterinarians and vaccines and absence or limited availability of veterinary services (Asmar, 2001). The causes of mortality could be controlled if proper management practices are instituted (Etuk *et al.,* 2005). According to Mwacharo and Drucker (2005), diseases are a major constraint to the improvement of livestock industry as they decrease production and increase morbidity and mortality.

2.3.1.5 Lack of veterinary and advisory services

In sub-Saharan Africa, the majority of small ruminant are raised under small-scale production by poor resource farmers and with relatively limited skills in livestock husbandry (Wilson *et al.,* 1985). Technical constraints remain a major impediment to livestock development in sub-Saharan Africa (ILCA, 1989). Extension worker to farmer ratio has widened and extension services become less accessible, especially to the resource poor farmers (Ferrington, 1994). The primary aim of the veterinary

and extension services must be to seek and implement technical solutions to livestock production problems. The major technical constraints are known and a number of solutions have been suggested though rarely implemented.

In Africa the major burden of responsibility in seeking and applying technical solutions seems to rest on official livestock and veterinary services. These services are blamed for all sorts of failures in small-scale livestock production. Very little support has been invested by the government on research of sheep diseases and parasites on small-scale production (Alexandre and Mandonnet, 2005). The emphasis is on the need for development agents, including agricultural extension and research, to participate in meaningful ways with smallholder farmers to ensure natural resource management, sustainable production and agricultural growth (Reij and Waters-Bayer, 2001). The reasoning behind this argument is that farmers have many of the solutions to the challenges they face or can at least make meaningful contributions to solving their problems by virtue of knowledge regarding their circumstances and local environment (Scoones and Thompson, 1994).

The combination of farmers' knowledge and that of appropriately focused research and extension can be a formidable force in agricultural development as the two can complement one another (Perret and Mercoiret, 2003). This illustrates that much of the success of smallholder farmers relies on their local networks with one another and their self-initiated innovations to improve and adapt their practices in light of changing circumstances within the contexts in which they function; often marginal and risk prone environments (Scoones and Thompson, 1994). Some successful projects have been carried out in sub-Saharan Africa, the success of which involved farmer innovations and linkages amongst farmers and between farmers and agricultural development agencies (including NGOs and official extension and

research services). However, in many cases appropriate external support was lacking and farmers used whatever resources they could to compensate.

2.3.1.6 Type of breed

Low genetic potential is often quoted as a major constraint to meat and milk production in Sub-Saharan Africa (Chukwuka *et al.,* 2010). Most breed comparison studies have concentrated on quantifying performance (e.g. body weights and milk production) but not production inputs. The ability to survive under adverse environmental conditions with low inputs makes indigenous breeds a low-risk choice. The low-risk factor of resistant breeds is important where market prices are unstable or where the probability of death from environmental stress is high (Frisch, 1984). Crossbreeding of low-yielding indigenous breeds with high-yielding exotic breeds has been widely acknowledged as a valuable strategy to improve animal productivity (Birthal and Pathasarathy, 2002).

According to Petrus et al. (2011), use of improved breeds in developing countries presents farmers with a major challenge as the breeds require intensive management to realize full production potential. Attempts to improve indigenous breeds by crossing with exotic breeds have been unsuccessful due to inability to sustain initial efforts and lack of coordination (Ademusun, 1990). Using improved breeds needs to be backed up by a strong livestock extension service which, at present, is lacking. The use of locally adapted breeds can help overcome most small-scale production constraints (Musemwa *et al.,* 2008).

Mamabolo and Webb (2005) stated that there is a considerable potential for increased indigenous sheep production if proper management is employed. Kolff and Wilson (1985) stated that performance of indigenous breeds respond well to

improved husbandry. Many sheep producers struggle with low profit margins due to low level of management, feeding and selection practices as well as the use of outdated technology (Coetzee, 2012). When good practices are applied simultaneously and correctly, this will leads to superior animal performance and high profit generation. Mating of animals in extensive system is largely uncontrolled (Kosgey *et al.,* 2006). Due to deficient infrastructure, different socio-economic preferences between different farming systems, ethnic groups and gender, it is difficult to design breeding programmes for small scale farmers.

According to Amoah et al. (1996), environmental factors such as feed availability, rainfall, temperature and humidity variations affects the breeding season. Major breeding problem in small scale production system is that flocks are grazing as groups owned by several individuals (Khombe and Tawonezvi, 1995). Mamabolo and Webb (2005) reported that under free range production system, ewes and rams run together for the whole period of their lives with one or two rams kept in the flock for more than five years, eventually leading to inbreeding. According to Jaitner et al. (2001) and Kosgey (2004), earlier castration of undesired rams and rotational use of breeding rams from different flock on communal herding can minimize inbreeding.

Breeding schemes are not appropriate for smallholder systems in developing sheep industries (Gizaw *et al.,* 2013). In semi-intensive system there is little breeding management practices (Blench *et al.,* 2003). Voermol Feeds (2009) stated that most of sheep producers under extensive and semi-intensive production systems are often willing to pay considerable amount for breeding rams. Management practices in small-scale production, particularly extensive system are such that the best adapted sheep with superior genetic potential are not used as breeding stock. This is

because of the cultural or religious requirements for large fat sheep for slaughter at social and sacrificial occasions (Upton, 1984).

Olivier (1999) stated that in order to improve efficiency of production through genetic improvement of economically important traits and improved management practices, the perceptions of sheep breeders should focus on traits of economic importance to rural farmers. The most important trait to be improved is net reproduction rate under natural production environments.

2.3.1.7 Sheep sales

The livelihoods of smallholders are highly dependent on the cash income from livestock and livestock products (Ayele *et al.,* 2003). However, Nwafor (2004) reported that the prices of sheep are not determined by body weight, rather by the general appearance of the animal, market site and season of the year and grading. Farmers possess minimal marketing information and usually complain about the prices they receive for their merchandise (Gede *et al.,* 2005). Free range production system is characterised by low costs of production and its products targeted for family use and little for market (Oladele, 2004).

Sheep sales is constrained by many factors such as scarcity of feed, lack of infrastructure, high mortality rates, inadequate veterinary coverage, poor quality products and low average reproductive rates (Tsedeke, 2010). However, high reproductive wastage is the major constraint of sheep productivity, which also greatly reduces selection possibilities. Majority of producers practise extensive and semi-intensive production system which are characterised by low sheep sales due to inadequate inputs offered. Sheep under extensive or low input system result in poor

economic returns as they attract low prices at sale and slaughter due to their low body weight (Abdullahi, 2001).

Livestock are generally traded by ‘eye-ball’ pricing in small-scale production sector, and weighing livestock is uncommon (Kebede and Ray, 1992). Animals are sold on a per head basis and price agreement reached by a long one-on-one bargaining between a seller and a buyer. Under such circumstances, prices paid will reflect buyers' preference for various animal characteristics (body weight, sex, age, body condition, breed and colour), the purpose of animals purchased (for resale, slaughter, fattening or reproduction), and the bargaining skills of buyers and sellers (Ehui *et al.,* 2000). Marketing of sheep is characterized by strong seasonality and subject to fluctuation. Demand and price increases during festival periods. Factors affecting market supply, as measured by the number offered, include high demand during religious festivals, lambing season, quality and quantity of grazing,

2.3.1.8 Wealth status

Socio-economic factors that influence sheep breeding programmes should be considered to enhance their success (Verbeek *et al*., 2007). Majority of sheep producers are small-scale farmers located rural areas with lack access of markets (Bamikole *et al.,* 2009). Farmers’ capacity to transport sheep to the available slaughtering facilities is often limited due to poor communication and infrastructure, particularly access to markets (Bayer *et al.,* 2001). However, there is doubt about the capability of small-scale farmers to participate effectively and meaningfully in the market oriented production due to their limited access to markets, capital, production inputs, extension services and technology. Nasiru et al. (2011) indicated that majority of small-scale sheep producers are characterized by high marketing costs, no experience in marketing and lack of market information.

Formal marketing of sheep in small-scale production is characterised by absent or ill-functioning markets (Kusina, 1999; Seleka, 2001). Occasionally a farmer with a large flock may sell some when the number increases beyond control and personal requirements (Hoste *et al.,* 1993). Farmers market animals of different age, sex and body weight either at farm gate or local markets. Supply, demand and price of animals have clear seasonal variations (Abebe *et al.,* 2011). Marketing of sheep reaches a peak during Muslims festival and traditional ceremonies that require sacrifice of an animal (Morton and Wilson, 2000).

2.3.1.9 Gender

Gender disparities have negative consequences on women's ability to have an adverse impact on overall household income earned at the household level from livestock production. Women play a major role as farmers and producers. However, their access to resources and opportunities to enable them to move from subsistence agriculture to higher value chains is much lower than men's (World Bank, 2009; Adeniyi, 2010). Gurung (2006) indicated that women increasingly supply national and international markets with traditional and high-value produce, but compared to men, women farmers and entrepreneurs face a number of challenges, including lower mobility, less access to training, less access to market information, and less access to productive resources. Most of agricultural extension officials in developing countries of Africa are men and they tend to address themselves only to the challenge of farming as seen by male farmers. The roles that women and men play in different livestock sub-sectors vary by region, country and community, reflecting different economic, social and cultural contexts.

Women in farming face many more constraints and receive far fewer services and less support than men (World Bank, 2007 and FAO, 2011). However, resources and

incomes controlled by women are more likely to be used to improve family food consumption and welfare, reduce malnutrition and increase the overall well-being of the family (FAO, 2006; Okali, 2011; World Bank, 2011). Women mostly own sheep but they do not have a room for decision making on how to utilize their animals, e.g., they are not allowed to sell sheep in the absence of their husbands, who are migrant labourers, even though they are the ones, who own them (IFAD, 2007).

The various decision-making levels related to sheep ownership in the tropics depict a conspicuous gender imbalance, which is a product of strong cultural background bias against women. According to Okali (1998), women and men experience different challenges when accessing, managing and controlling livestock assets. Despite their important contribution and role in livestock management, women often face greater constraints than men in accessing natural resources, extension services, marketing opportunities and financial services as well as in exercising their decision-making powers. IFAD (2007) stated that the roles of women in agriculture are many but have been underestimated, undervalued and widely ignored.

Ogunlela and Mukhtar (2009) reported that projects addressing poverty and other socio-economic challenges have been successful because of women led group. Enhancing women's control over small livestock production, providing training in husbandry and animal health as well as increasing access to education, veterinary and financial services is therefore fundamental to improving household's food security and providing an additional source of income to meet household's needs.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 STUDY SITE

The study was conducted between October and December 2013 on six local municipalities of Nkangala district in Mpumalanga province. These include Thembisile Hani, Dr JS Moroka, Steve Tshwete, Emalahleni, Emakhazeni and Victor Khanye municipalities (Figure 3.1). Nkangala is at the economic hub of Mpumalanga, and is rich in terms of soil fertility and natural resources. It covers an area of 16 758km² and has a human population of about 10 000 and about 360 000 households (www.nkangaladm.gov.za). The average annual rainfall is approximately 700mm. The best-performing sectors in the province include mining, tourism and agro-processing are potential growing sectors. Agriculture in Mpumalanga is characterised by a combination of commercialised livestock and crop farming at small-scale production (Stats SA, 2002).

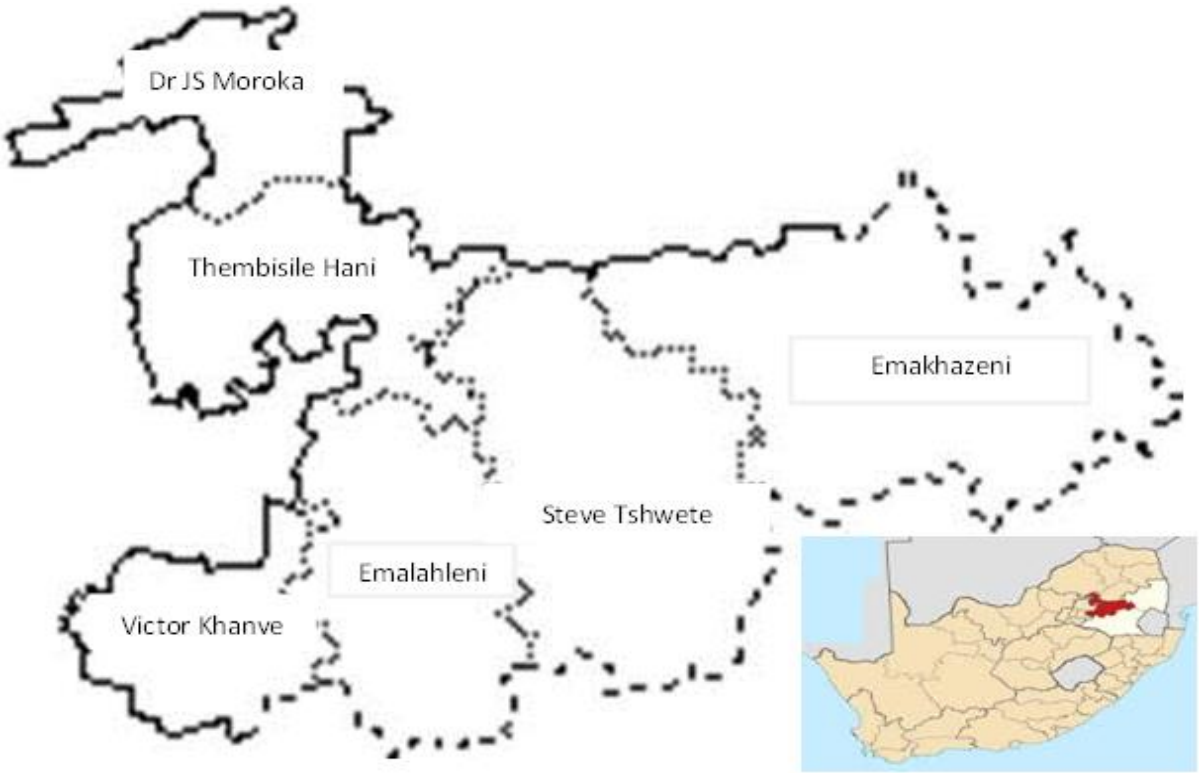

Figure 3.1 Map of Nkangala District showing six selected municipalities

3.2 SAMPLING PROCEDURE

One hundred and thirty two small-scale sheep owners were interviewed. From each municipality, six to 10 villages were selected and households within a village were selected using stratified random sampling procedure where all observations of the frame were given an equal probability of selection. Sampling of households was based on the ownership of sheep and willingness to participate in the study.

3.3 DATA COLLECTION

Participatory rural appraisal approach including group discussions with farmers and interviews with key informants were used to establish farmer's attitudes and their perceptions on sheep production. A pretested structured questionnaire was administered to 132 sheep farmers with the assistance of local agricultural extension officers. The aspects covered in the questionnaire were farmers' socio-economic profile, sheep flock sizes, reasons for keeping sheep, management practices and production constraints. A personal observation on the structural facilities and physical appearance of the sheep was made.

3.4 STATISTICAL ANALYSIS

Statistical Package for Social Science (SPSS, 2013) was used to analyse the data. Descriptive statistics (SURVEY MEANS and SURVEYFREQ PROCEDURES) generated were used to describe socio-economic characteristics of small scale sheep producers. Comparisons of herd sizes and flock composition between municipalities were done using analysis of variance (PROC GLM). Logistic regression (PROC LOGISTIC) was used to determine the odds ratio of socio-economic factors affecting sheep mortality and sheep sales on small scale sheep producers. The following logistic regression model was used to estimate the

probability of farmers experiencing mortality/sales versus those farmers that did not experience sheep mortality/sales:

$$Y = \text{Ln}\,[P/1-P] = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \varepsilon$$

Where:

Y = Probability of a farmer experiencing mortality/sales

$P-1$ = Probability of a farmer not experiencing mortality/sales

$\beta 0$ = Intercept;

$\beta_1 ... \beta_8$ = Regression coefficients of predictors

X_1 = Farmers' age

X_2 = Farmers' gender

X_3 = Wealth status

X_4 = Sheep house

X_5 = Production system

X_6 = Availability of supplementary feed

X_7 = Accessibility of veterinary and extension services

X_8 = Type of breed owned

ε = Random residual error

When computing for each predictor (β_0.....β_8), the odds ratio was interpreted as the proportion of farmers that experienced sheep mortality or sheep sales versus farmers that did not experience sheep mortality or sheep sales. Similarly, logistic regression models were used to estimate the probability of farmers experiencing low sheep sales versus those farmers that did not experience low sheep sales. The dependent variable Y is the probability of a dummy variable that takes on the value of 1 if the farmer has experienced sheep mortality and 0 if the farmer has not experienced mortality. Eight independent variables (X_1 to X_8) were included in the model. These include variable that relate to each farmer's characteristics (age and wealth) and the management information (housing, production system, supplementary feed, breed owned, veterinary and extension services).

Table 3.1 Description of variables

Independent variable		
Variable name	Description	Unit of measurement
X_1	Age of the farmer	Years
X_2	1 if the farmer is male, 0 otherwise	Dummy
X_3	1 if the farmer is rich, 0 otherwise	Dummy
X_4	1 If sheep house is open, 0 otherwise	Dummy
X_5	1 if production system is extensive, 0 otherwise	Dummy
X_6	1 if there farmer supplementary feed, 0 otherwise	Dummy
X_7	1 if the farmer have access to veterinary and extension services, 0 otherwise	Dummy
X_8	1 if the breed is exotic, 0 otherwise	Dummy

CHAPTER 4: RESULTS

4.1 DESCRIPTIVE ANALYSIS

4.1.1 Livestock species kept in different municipalities

The mean herd/flock sizes of livestock species for each municipality are shown in Table 4.1. The majority of farmers kept sheep together with goats, cattle and chickens. Sheep, goats and chickens, were the most dominant livestock species. Overall, the mean flock size was 21.1 ± 3.10 and varied from 1 to 32 sheep per household. Highest total sheep flock sizes, lambs and ewes were observed in Emakhazeni municipality compared to the other municipalities.

Table 4.1 Means (±SE) herd/flock sizes of different livestock species

Livestock species	Thembisile Hani (n=40)	Dr J.S Moroka (n=40)	Steve Tshwete (n=10)	Emalahleni (n=19)	Emakhazeni (n=14)	Victor Khanye (n=9)
Sheep	21 ± 1.7^{ab}	21 ± 1.2^{ab}	15 ± 3.3^{a}	18 ± 2.4^{ab}	32 ± 2.8^{c}	26 ± 3.5^{b}
Goats	10 ± 1.7^{c}	3 ± 1.7^{a}	15 ± 3.3^{bc}	21 ± 4^{b}	16 ± 2.8^{bc}	17 ± 3.5^{bc}
Cattle	8 ± 2.0^{ad}	6 ± 2.0^{a}	33 ± 4.0^{bc}	42 ± 2.9^{c}	32 ± 3.4^{b}	17 ± 4.2^{d}
Chickens	9 ± 1.0^{b}	3 ± 1.0^{a}	8 ± 1.9^{b}	8 ± 1.4^{b}	7 ± 1.6^{b}	10 ± 2.0^{b}

^{abcd} Means with different superscripts within rows show significant differences to other municipalities.

4.1.2 Sheep flock composition in different municipalities

Table 4.2 shows the sheep flock composition in different municipalities. Ewes dominate across all municipalities compared to rams and lambs. Results show that the majority of ewes were at Emakhazeni and Victor Khanye municipalities.

Table 4.2 Sheep flock composition in different municipalities

Sheep flock composition	Thembisile Hani (n=40)	Dr J.S Moroka (n=40)	Steve Tshwete (n=10)	Emalahleni (n=19)	Emakhazeni (n=14)	Victor Khanye (n=9)
Lambs	8±0.7[a]	8±0.7[a]	5±1.5[a]	6±1.1[a]	12±1.3[b]	9±1.6[a]
Rams	2±0.1[ab]	1±0.1[a]	1±0.2[b]	2±0.2[ab]	2±0.2[c]	2±0.2[ab]
Ewes	11±0.9[ab]	12±0.9[ab]	9±1.8[a]	10±1.3[ab]	18±1.6[c]	15±1.9[b]

4.1.3 Purpose of keeping sheep

The Majority of respondents (90 %) indicated that they raised sheep mainly to generate income, while meat for household consumption, ceremonies and manure were ranked low (Table 4.3).

Table 4.3 Reason for keeping sheep as ranked by farmers (%)

Parameters	Ranking			
	High	Medium	Low	Not ranked
Meat	6.0	4.0	2.0	88.0
Income	90.0	8.0	2.0	0.0
Ceremonies	3.0	4.0	9.0	84.0
Manure	1.0	1.0	11.0	87.0

4.1.4 Sheep ownership patterns and gender participation

Figure 4.1 shows sheep ownership by gender categories in different municipalities. Across all district municipalities' adult males were highly involved in sheep production enterprise as compared to adult females and youth. Adult males who

owned sheep dominate at Thembisile Hani (75 %) and Dr JS Moroka (80 %) municipalities.

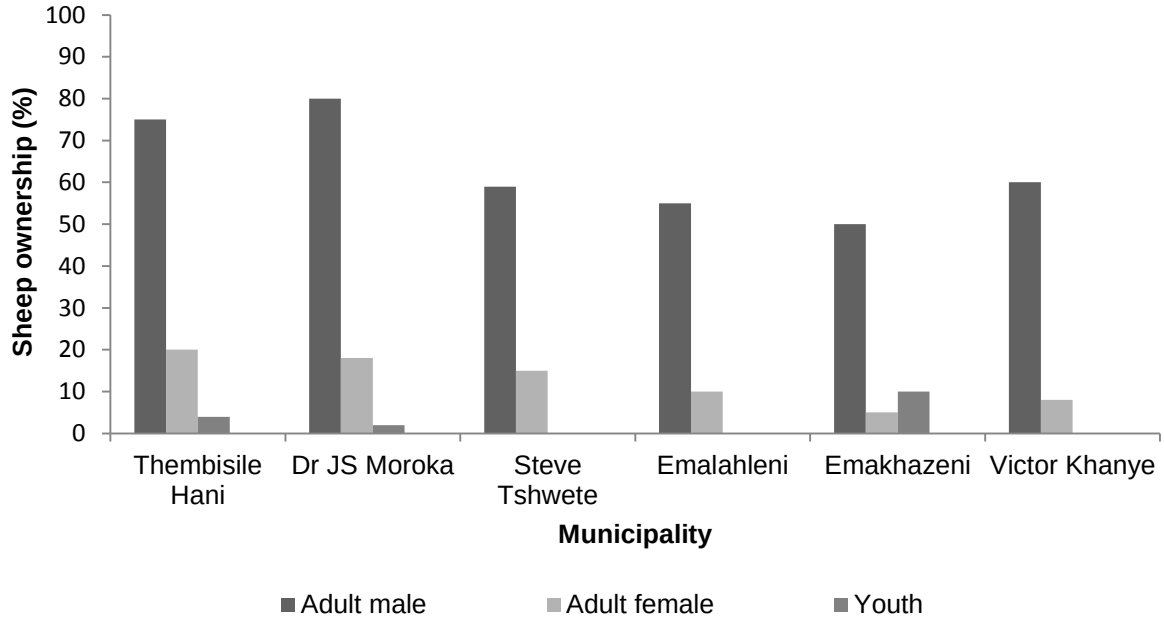

Figure 4.1 Sheep ownership (percentage of households) by gender categories in different municipalities

4.1.5 Educational background of farmers

About 65 % of the participants had never attended school, while few (6 %) had attended school up to tertiary level (Table 4.4). It was observed that majority of respondents could not read or write. Majority of respondents who never attended school dominated at Thembisile Hani municipality.

Table 4.4 Educational background of farmers across all municipalities

Education background	Frequency	Percentage
Primary	35	21
Secondary	24	8
Tertiary	11	6
None	62	65
Total	**132**	**100**

4.1.6 Farmers occupations

In general, only 6 % of the respondents are working as professionals while majority (38 %) of respondents were unemployed (Table 4.5). Emalahleni had low unemployment rate compared to other municipalities.

Table 4.5 Type of farmers' occupations across all municipalities.

Primary occupations	Frequency	Percentage
Professional	5	6
General labour	30	26
Unemployed	72	38
Other	25	30
Total	**132**	**100**

4.1.7 Wealth status of farmers

Over 70 % of farmers were poor in all municipalities, while less than 30 % were classified as rich (Figure 4.2). Respondents mostly in low income households had no access to credit services, mainly because they lack the required collateral which made them very poor credit risks.

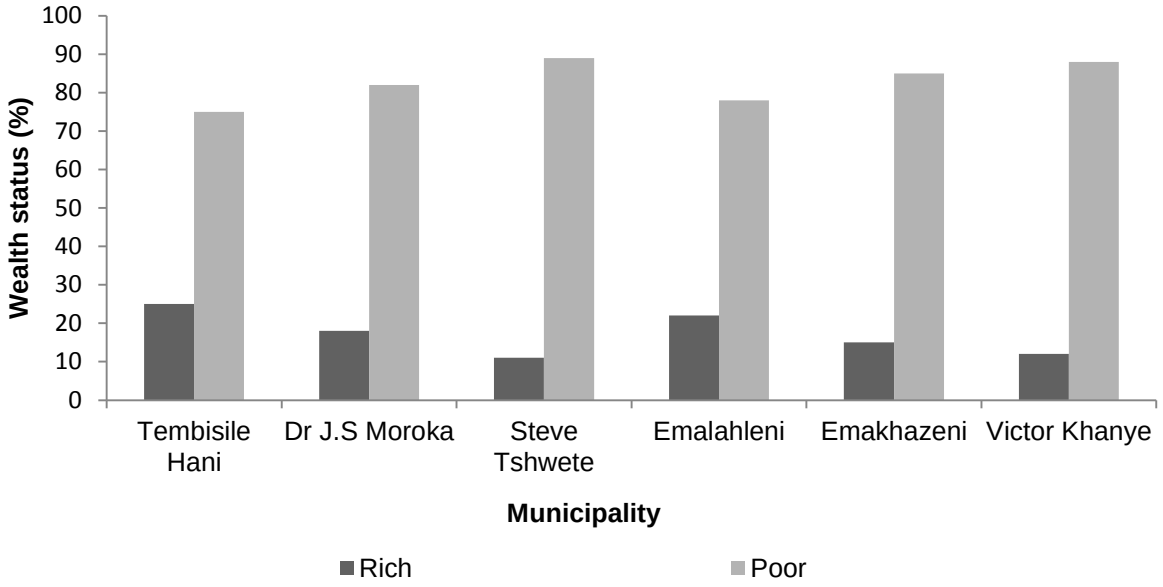

Figure 4.2 Wealth statuses of farmers in different municipalities

4.1.8 Income of farmers per month

Table 4.6 shows income ranges of farmers and about 47 % of the respondents earned between R501 and R900 per month, whereas few (6 %) earned between R3100 per month and above.

Table 4.6 Income of farmers across all municipalities

Income per month	Frequency	Percentage
R501- R900	62	47
R901- R1000	31	23
R1100- R2000	18	14
R2100-R3000	13	10
R3100 and above	8	6
Total	**132**	**100**

4.1.9 Household size

Table 4.7 present household sizes of respondents across all municipalities. About 22 % of the respondents were supporting five children and above.

Table 4.7 Family size of respondents across all municipalities

Household No	Frequency	Percentage
1	20	15
2	16	12
3	12	9
4	55	42
5 and above	29	22
Total	**132**	**100**

4.1.10 Management practices

I. Feeding

Figure 4.3 shows the production systems practiced in different municipalities. Majority of the respondents kept their sheep under extensive production system. Farmers indicated that the natural veld was the major source of feed for their sheep. Sheep kept under extensive production system were travelling long distance in search of fodder and water. Only fewer respondents indicated that they supplemented their sheep flock using different feed resources, particularly during dry season. Maize, hay and commercial feeds (pellets) were the most common supplementary feed resources across municipalities. Maize and sorghum were the most dominant supplementary grains, especially after harvesting. Sheep were mostly

grazing on communal land and along road sides. Respondents that practiced semi-intensive and intensive systems had integration of animal and crop production.

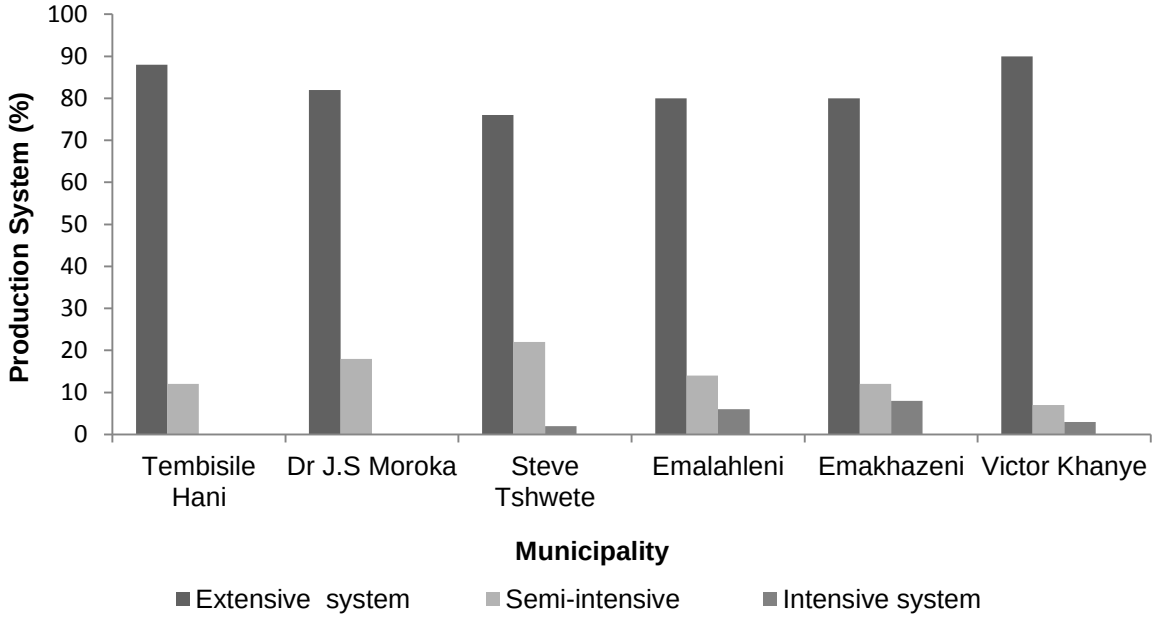

Figure 4.3 Production systems practices in different municipalities

II Breeding

Table 4.8 indicates the source of breeding stock in different municipalities. Majority (38 %) of respondents in Steve Tshwete municipality obtain their breeding stock from auction. Thembisile Hani and Dr J.S Moroka municipalities (29 %) select breeding stock from their own flocks. Majority (20 %) of respondents in Dr J.S Moroka municipality obtained breeding stock from fellow farmers. Respondents stated that this was done in the form of exchange of rams for ewes with farmers who had no breeding rams.

Table 4.8 Source of breeding stock ranked by farmers

Source of breeding stock	Thembisile Hani (n=40)	Dr J.S Moroka (n=40)	Steve Tshwete (n=10)	Emalahleni (n=19)	Emakhazeni (n=14)	Victor Khanye (n=9)
Auction	34	16	38	45	31	26
Fellow farmers	25	29	23	15	22	12
Commercial	12	21	27	19	20	30
Same flock	29	34	12	20	27	32

III Housing, Health and *Marketing of sheep*

Only few (35 %) of the respondents kept their sheep under well-constructed housing structures which protects sheep during bad weather. Roofed enclosures built of local materials such as wood and metals were popular sheep houses. The common causes of sheep mortality were diseases, predators and external parasites in that order. The major causes of sheep mortality were diseases (48 % of the farmers), particularly heart-water disease, pulpy kidney, black quarter and parasites. Over 70 % of respondents did not have access to veterinary and extension services. Marketing of sheep was largely informal in all different municipalities. Sheep were mainly sold within the local communities and to some non-farming communities such as schools, business centres and clinics. Sale of non-breeding stock, particularly rams, was common. Religious festivals and ceremonies, such as circumcision and weddings, as well as eaters and festive seasons, influenced the consumption

patterns and prices of sheep. Generally, sheep were sold at higher prices in Easters and festive seasons than in other seasons of the year.

IV Breed owned

Indigenous breeds (94 %) were the most used breed by respondents. A crossbred of different indigenous breeds was observed in majority of respondents.

V Sheep sales

Figure 4.4 presents the sheep sales throughout the year. High sales take place between May and July months, while sales reach peak during November and December months.

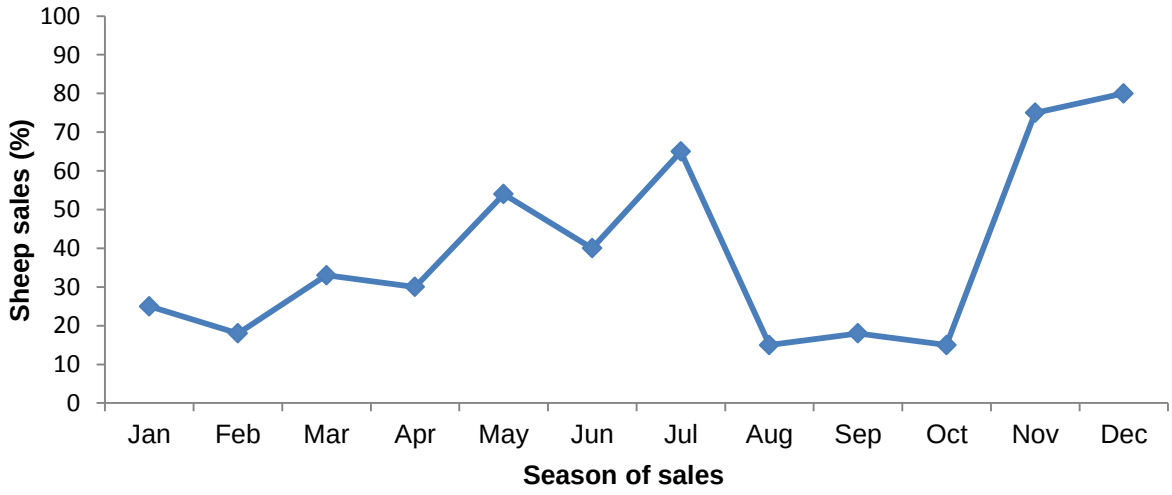

Figure 4.4 Periods of sheep sales throughout the year

VI Sheep mortality

Thembisile Hani and Dr JS Moroka had high sheep mortality rate of 60 % and 49 % respectively, while Victor Khanye has the lowest (30 %) sheep mortality rate (Figure 4.5).

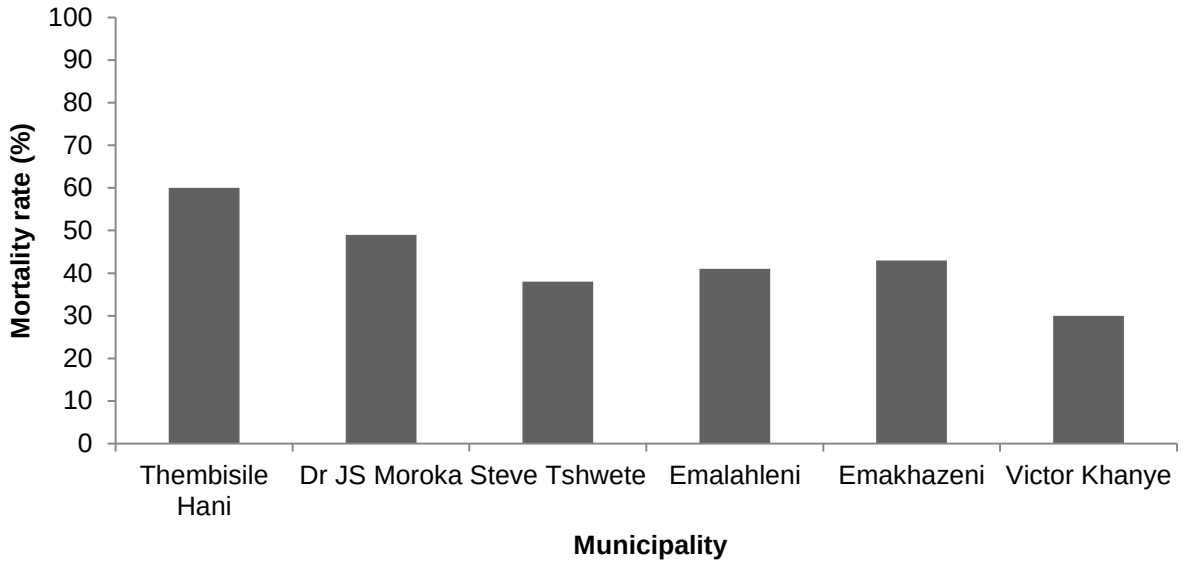

Figure 4.5 Mortality rates of sheep in different municipalities (%)

Causes of sheep mortality as ranked by farmers are shown in Figure 4.6. Disease was ranked high (48 %) by farmers, while accidents received lower rankings of 5 %.

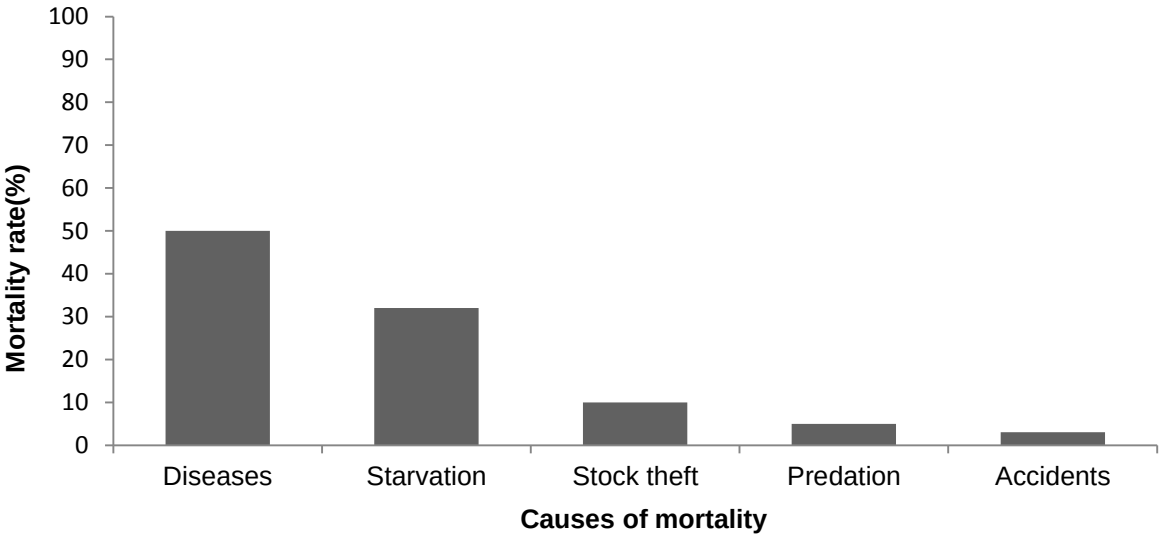

Figure 4.6 Causes of sheep mortality across Nkangala district municipalities

4.2 MORTALITY PREDICTORS

Table 4.9 shows the different estimates odds ratios and level of confidence intervals of various variables of small-scale sheep producers. The estimated odds ratio was found to be low 0.263 on age variable, 0.332 on wealth status and 0.361 on sheep breed owned variable. The lower confidence intervals were found to be 0.065 on age

variable and 0.235 on wealth status variable. The highest confidence was found to be 17.405 Availability of supplementary feed and 5.345 on sheep housing.

Table 4.9 Odds ratio estimates of household sheep mortality in different municipalities

Mortality predictor	Odds ratio	Lower CI	Upper CI
Age (youth vs adult)	0.263	0.065	1.072
Gender of household head (male vs female)	0.901	0.435	1.865
Wealth status (rich vs poor)	0.332	0.235	1.456
Sheep housing (open vs shaded)	1.662	0.517	5.345
Production system (extensive/semi-intensive vs intensive)	1.536	1.013	2.329
Availability of supplementary feed (no vs yes)	4.489	1.158	17.405
Accessibility of veterinary services and extension service (no vs yes)	1.747	0.856	3.565
Type of sheep breed owned (exotic vs indigenous)	0.361	0.104	1.251

4.3 SALES PREDICTORS

Table 4.10 shows the different estimates odds ratios and level of confidence intervals of various variables of small-scale sheep producers. The estimated odds ratio was found to be low on sheep breed owned variable (0.069) and (0.902) on age variable. The lower confidence intervals were found to be 0.171 on wealth status, 0.210 on sheep breed, 0.319 on sheep housing and 0.401 on availability of supplementary feed. . The highest confidence was found to be 3.300 on availability

of supplementary feed, 3.305 on accessibility of veterinary services and 5.464 on sheep breed variable.

Table 4.10 Odds ratio estimates of household sheep sales in different municipalities

Sales predictor	Odds ratio	Lower CI	Upper CI
Age (youth vs adult)	0.902	0.790	1.832
Gender of household head (male vs female)	1.143	0.910	1.402
Wealth status (rich vs poor)	2.012	0.171	2.594
Sheep housing (open vs shaded)	1.820	0.319	3.505
Availability of supplementary feed (no vs yes)	3.126	0.401	3.300
Accessibility of veterinary services and extension services (no vs yes)	2.139	1.452	3.305
Type of sheep breed owned (exotic vs indigenous)	0.069	0.210	5.464

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

The majority of respondents kept sheep for income generation in order to meet family needs. This finding concur with earlier findings of Ahmed and Egwu (2014) when they stated that most farmers keep sheep for sales in order to meet family expenditure while some of farmers kept sheep for traditional festivals. According to Hulela (2010) and Mandal et al. (2007), sheep play a major role in most lives of poor farmers in alleviating poverty. Small ruminants are considered a key asset for rural households worldwide and a primary livelihood resource for rural communities (Powell *et al*., 2004). Sheep are profitable and reliable business in dry, hot, deserts and mountainous areas of sub-Saharan Africa (Panin, 1993).

The findings that majority of respondents were adult agree with Mapiliyao et al. (2012) that most of sheep owners in Gaga and Sompondo communal villages were adult compared to youth. This indicates that most of youth were less involved in raising sheep. This could be attributed to migration of youth to cities in search of white-collar jobs. Most of the respondents across Nkangala district municipalities were pensioners. The situation suggests that future investments will fall short of reliable information soon after death of the aging sheep rearing population across the municipalities except younger individuals begin to take interest. In addition, technologies meant to improve agricultural production might not be well received by the aging population (Agwu *et al.,* 2008).

The findings that majority of respondents were males are similar to that of Mapiliyao et al. (2012). They reported that most of sheep owners in Gaga and Sompondo communal villages were men than women. Kunene (2006) had reported similar

findings in Northern Kwa-Zulu Natal. This indicates that most of youth were less involved in raising sheep. This could be attributed to migration of youth to cities in search of white-collar jobs. Tangka et al. (2000) reported that due to increasing commercialization, men are taking over livestock enterprise that was once female dominated.

According to Braker et al. (2002), in many African countries culture dictates that women are subordinates to men and hence are socially marginalized. Constraints such as lack of access to natural resources, extension services and marketing opportunities often prevent women from reaching their full potential within the agricultural sector, including livestock (Distefano, 2013). Evidence suggests that women tend to lose income and control as a product moves from the farm to the market (Gurung, 2006). These disadvantages reduce women's effectiveness as actors in value chains and reduce overall market effectiveness. Providing women producers and entrepreneurs with the same inputs and education as men can increase their output and incomes (World Bank, 2005). Enhancing women's control over small livestock production, providing training in husbandry and animal health as well as increasing access to education, veterinary and financial services is therefore fundamental to improving household's food security and providing an additional source of income to meet household's needs (Distefano, 2013). FAO (2014) indicated that due to rural-urban male migration, rural women have been seen to rise to the occasion and take over livestock-related tasks traditionally in the hands of men, engaging in different aspects of livestock management, from production, to processing and marketing. When given an opportunity to access natural resources, capital, skills and knowledge, women are more than capable to be successful livestock keepers and producers.

Majority of respondents were illiterate. This finding is similar with that of Ketema (2007) who reported over sixty five percent of illiterate sheep owners in Ethiopia. This could be attributed to lack of access to education in the remote located areas. Educated households tend to have higher productivity as they are better able to decode new production technology (Addisu *et al.,* 1998). Sheep are raised by low income households (Adama *et al.,* 2011). This implies that sheep are a source of food and financial security for the low income households.

The finding that majority of respondents sourced their breeding stock from auctions with no health records of animal purchased could also influenced spread of diseases from one flock to another. Uncontrolled mating and inbreeding were common to most of farmers across all municipalities. These findings could be attributed to lack of livestock breeding skills by farmers. FAO (1989) reported that majority of sheep owners are in rural areas with relatively limited skills in livestock management. There are some indigenous practices for controlling breeding such as avoiding close ram-daughter mating and indiscriminate mating.

Methods like ram isolation, castration, and tying a cord around the neck of the scrotum are used to control mating in the Afar area (Getachew *et al*., 2010). According to Jaitner *et al*. (2001) and Kosgey (2004), early castration of undesired males and rotational use of breeding males can minimise inbreeding. Low genetic potential of indigenous animals is often quoted as a major constrained to meat and milk production in sub-Saharan Africa. Consequently, most livestock improvement programmes have resorted to crossbreeding with imported exotic breeds due to increasing human population and the demand for animal products (Chukwuka *et al*., 2010). However, farmers' and pastoralists' preferences are usually influenced by

market forces to adopt cross-breeding (Gizaw *et al*., 2013). According to Petrus et al. (2011), use of improved breeds in developing countries presents farmers with a major challenge as the breeds require intensive management for them to realize full production potential. Some farmers prefer indigenous breeds because they are tolerant to diseases and utilize feed of low nutrient density to produce good quality meat and perform well even without very sophisticated management.

High productivity can be achieved if proper management is constituted (Mamabolo and Webb, 2005). Exchange of breeding rams with breeding ewes between respondents was observed. This could also influence spread of diseases from one flock to another since majority of respondents who applied this system did not vaccinate their animals. It was observed that in majority of flocks, rams ran with ewes all the times. This observation indicates that lambing occurs throughout the year, which could cause lamb death, weak lamb produced and starvation particularly for lambing which occurs during dry season where there is less quantity and poor quality of forage.

The finding that most of respondents across all municipalities relied on natural pastures as main source of feed for their flocks agrees with Aregheore (2011) who stated that in Africa the rangeland is the most important source of food. However little is known about the nutritional value, distribution, palatability and seasonal production of the forage species that characterise the natural grassland. Majority of respondents practising free range production system were more likely to experience feed shortage. The results of the study show that majority of respondents did not offer supplementary feed to their flocks. According to Aregheore (2005), extensive production system is characterised by low inputs and poor nutrition. Horst and Peters

(1983) indicated that feed production, quality and availability are dictated by weather changes and thus take a seasonal pattern. Butswaat (1994) observed climatic factors having greatly influence on productivity of sheep under free range system. During dry season the quality of natural pastures become low. Therefore when feed resources become limited, animals with highest requirements should be targeted for supplementary feed, particularly pregnant ewes. This situation suggests that provision of supplementary feed to sheep during periods of feed shortage will be of important.

Poor housing condition was observed across Nkangala district municipalities. Mapiliyao et al. (2012) reported similar observation of poorly constructed sheep houses in Gaga and Sompondo communal villages. According to Aregheore (2011), extensive production system has a high exposure to diseases, predation and theft. Sheep needs proper housing which can protect them from extreme temperatures and predation. Extensive production system entails considerable hazards to animals due to lack of housing, no rudimentary care and unavailability of records (Olalokun, 1985).

The observation that most farmers across Nkangala district municipalities housed their sheep in open kraal shows that they lacked resources and knowledge that appropriate shelter can prevent many diseases and reduce mortality rates especially for lambs. Lambs which are often born in cold or wet conditions, have low fat cover and have a high surface area to birth weight ratio, which exacerbates heat loss (Stephenson *et al*., 2001). Such lambs become highly vulnerable to cold and wet periods. Foot-rot is a common problem during the wet season when sheep are housed in muddy or waterlogged conditions. Dry and well ventilated house has been

proven as a method of reducing deaths during wet season (Adak *et al*., 2005). Sheep shelters can be built from local farm materials such as wooden poles. Heart water and pulpy kidney were common diseases across all municipalities, particularly at Thembisile Hani and Dr J.S Moroka municipalities. This could be due to high ambient temperatures occurring around these areas. High incidences of stock theft especially during initiation school, festive and New Year eve periods could be influenced by the high demand of sheep meat during those periods.

The finding that sheep produce manure for fertilization are in agreement with those of Devendra (1992), who reported that sheep have a social-economic relevance and social-cultural roles and they produce manure to fertilize the land. Sheep manure is regarded important in fertilizing soil for vegetables and lawns at Thembisile Hani, Dr JS Moroka and Steve Tshwete municipalities. A common problem in developing countries is a high mortality rate particularly amongst lambs (Salem and Smith, 2008). High incidences of mortality rate particularly amongst lambs in this study could be attributed to inadequate veterinary services and high vaccines costs.

According to Wilson et al. (1984), health interventions are an area which can have a beneficial impact on sheep productivity. Mortality of lambs between 0 – 7 days was common. Sheep produced under extensive production system are less fertile, less prolific and are constrained by higher lamb mortality compared to sheep raised under the agro-pastoral or the semi-intensive systems (FAO, 1995). There are good possibilities for reducing mortality through veterinary package comprising vaccination against PPR and a regular dipping programme to control external parasites. In the Nigerian humid zone, survival rate of lambs was increased due to veterinary package used to sheep. The main effect of these measures was to reduce mortality

in the most stressful period during the rains (Mack, 1983). The factors leading to reduced losses for individual owners need to be identified and then extended to all owners operating within the same production system.

Distances to available auction points were observed in Thembisile Hani and Dr J.S Moroka municipalities. Farmers had to travel over 50 km to Bronkhorstspruit auction point to sell their sheep. Majority of sheep producers are small-scale farmers located at under-developed areas with lack of access to markets (Bamikole, 2010). Most of farmers experienced high marketing costs caused by transportation of animals to distance auction points. This situation indicates that there is a need for farmers to form co-operatives which will give privileges to farmers in marketing their sheep. In South Africa, cooperatives have helped build up the commercial agriculture sector by supplying inputs (i.e. fertilizers and seeds), marketing commodities, and providing transport and distribution of infrastructure (Ortmann and King, 2007).

The observed lack of marketing information could be attributed to inadequate communication between extension officers and farmers. The observation agrees with earlier report of Pollott and Wilson (2009). They reported that small-stock producers mostly find it difficult to gain access to technical information concerning livestock, credits and marketing. As a result, the likelihood of realising success of their enterprise and achieving potential benefits of their stock becomes limited. Farmers in cooperatives have more bargaining power, lower transaction costs in getting loans, and better access to information compared to outsiders (Motiram and Vakulabharanam, 2007).

Low sheep sales could be attributed to quality and quantity of sheep produced. The finding that production system had an influence on sheep sales could be attributed to

the quantity and quality of sheep sold. This finding agrees with Bamikole (2010) who reported that extensive production system is characterised by low sheep sales. Fattening could play an important role in attracting interest from buyers and thus increase benefit to the farmers (Kosgey, 2004). Poor Farmers should be informed about prices, grades, quality and standards of products preferred by the markets. Respondents reported that better prices are fetched during holidays, ceremonial, Christmas and Easter seasons where demand for sheep meat is high.

Odds ratio (OR) is a measure of association between an exposure and an outcome (McHugh, 2009). The OR represents the odds that sheep mortality and sales are likely to occur given in a particular exposure, as a results the change of socio-economic factors, compared to the odds of the sheep mortality and sales occurring in the absence of that exposure (change of socio-economic factors). Odds ratios are commonly used in case-control studies, however they can also be used in cross-sectional (as in this particular study) and cohort study designs with some modifications and/or assumptions (McHugh, 2009).

Various number of socio-economic factors identified in this study to can affect the sheep mortality in Nkangala District. Out of eight variables identified, four variables (i.e. Type of sheep housing, production method adopted by the farmers, availability of supplementary feed and accessibility of veterinary services and extension service) were found to have high probabilities of influencing the sheep mortality whereas, the other four variables (i.e. Age of the farmer, gender of the farmer, wealth status of the farmer and type of sheep breed owned by the farmer) were found to have less probabilities of influencing the sheep mortality the study area. According to McHugh

(2009), in practice, the 95 % CI is often used as a proxy for the presence of statistical significance if it does not overlap the null value (e.g. odds ratio=1).

This implies that small-scale sheep farmers in Nkangala district have to seriously consider the type of sheep housing, production method adopted by the farmers, availability of supplementary feed and accessibility of veterinary services and extension service in their quest of reducing the sheep mortality. The estimated odds ratios for the type of sheep housing was revealed to be 1.662, which implies that farmers who use the shaded housing are likely to reduce sheep mortality as compared to those who use the open sheep housing. The estimated odds ratio for production systems, whether is intensive or extensive was revealed to be 1.536, implying that farmers practising intensive production system are likely to reduce sheep mortality as compared to those who use extensive production system.

The estimated odds ratio of the supplementary feed, whether is available or not was found to be 4.489, which shows that the availability of feed supplements is very important in reducing sheep mortality. This implies the farmers who have access to feed supplements are likely to reduce sheep mortality whereas, farmer who does not provide feed supplements are at risk of having high sheep mortality. The estimated odds ratio of veterinary and extension services, whether the farmer have access or not was found to be 1.747, indicating that farmers who have access to veterinary and extension services are likely to reduce sheep mortality while those who does not have access are at risk of having high sheep mortality. However, those significant variables does not work in discrete units, they need to be integrated for the farmers to reduce sheep mortality.

Age of the farmer, gender of the farmer, wealth status of the farmer and type of sheep breed owned by the farmer were revealed not to be the major socio-economic factors influencing sheep mortality in Nkangala district. However, the four variables reported odds ratios of 0.263, 0.901, 0.332 and 0.361 respectively. This implies that they are likely to influence the sheep mortality (since the odds ratio was not zero and falls within the confident interval) but the extent to which they might influence sheep mortality is at minimum. Integrating the four with the other four major/significant variables might help farmers reducing the chances of sheep mortality occurrences.

The eight socio-economic factors were identified in this study to can affect the sheep sales in Nkangala district. Out of eight variables identified, six (i.e. Gender of the farmer, wealth status, type of sheep housing, production method adopted by the farmers, availability of supplementary feed and accessibility of veterinary services and extension service) were found to have high probabilities of influencing the sheep sales whereas, the other two (i.e. Age of the farmer and type of sheep breed owned by the farmer) were found to have less probabilities of influencing the sheep sales in the study area.

This implies that sheep farmers in Nkangala district have to take the following variables into consideration in their quest for successfully selling their sheep: the gender dynamics and issues, wealth status, type of sheep housing, production method adopted by the farmers, availability of supplementary feed and accessibility of veterinary services and extension service. The estimated odds ratio of the supplementary feed, whether is available or not was found to be 3.123, which shows that the availability of feed supplements is very important in sheep sales. This implies the farmers who have access to feed supplements are likely to enhance the

sheep sales while farmer who does not have access to feed supplements are at risk of not selling their sheep or fetching low selling prices.

The estimated odds ratio for the types of sheep housing was revealed to be 1.820, which implies that farmers who use the shaded housing are likely to sell their sheep as compared to those who use the open sheep housing. The estimated odds ratio for production systems, whether is intensive or extensive was revealed to be 2.213, implying that farmers adopting the intensive production system are likely to sell sheep as compared to those who use extensive production method since, intensive production system is positively correlated to quality and good product.

The estimated odds ratio for the wealth status, whether are rich or poor was revealed to be 2.012, which implies that farmers who are rich are likely to sell their sheep as compared to the poor farmers, which indicate that access to market is positively correlated with wealth, since farmers will have money to finance the sales expenditures. The estimated odds ratio of gender, whether gender dynamics regarding male or female issues was revealed to be 1.143, implying that farmers who take gender dynamics into consideration are likely to sell sheep as compared to those who ignores gender issues.

The estimated odds ratio of veterinary and extension services, whether the farmer have access or not was found to be 2.139, indicating that farmers who have access to those services are likely to increase sheep sales while those who does not have access being at risk of not selling their sheep or fetching low selling prices. Type of sheep breed owned and age of the sheep farmers were revealed not to be important in influencing the sales of the sheep in Nkangala district. However, the two variables reported odds ratios of 0.069 and 0.902, respectively. This implies that they are likely

to influence the sheep sales (since the odds ratio was not zero and falls within the confident interval) but the extent to which they might influence sheep sales is at minimum. Integrating the two with the other six important variables might help farmers increasing the chances of selling their sheep.

5.2 CONCLUSIONS

Type of sheep housing, production method employed by the farmers, availability of supplementary feed and accessibility of veterinary and extension services were found to have high probabilities of influence both sheep mortality and sales. Gender and wealth status of the farmer affected sheep sales. Diseases, starvation, stock theft, and predation and road side accidents are the major challenges faced by the small-scale sheep producers. Therefore, the formulated null hypothesis stating that “there are no challenges faced by small-scale sheep producers in Nkangala district of Mpumalanga” was also rejected. Farmer’s gender, age, education background, wealth status, income, production system, flock size, type of sheep breed owned, sheep housing, accessibility of veterinary and extension services, influence sheep production. To improve sheep production, farmers’ socio-economic factors should be considered when planning strategies for sustainable sheep management programmes which will contribute in alleviating poverty on sheep producers.

5.3 RECOMMENDATIONS

Veterinary, extension and advisory services need to be strengthened at local level so that sheep farmers can easily access these services for improved productivity. Training programs such as farmer study groups, workshops, etc. for poor resource farmers' to access agricultural information for optimal sheep production should also be strengthened. Farmers should be encouraged to keep records, tag their animals, report stock theft cases and construct sheep housing which can be able to protect sheep against predators and extreme weather conditions. Government needs to find ways in developing easily accessible credit scheme to sheep farmers. Farmers should be trained on all aspects of market such as quantity, quality and standard. In the absence of registered marketing agents, government together with its stakeholders and other NGO's should play a role in connecting sheep farmers with potential buyers.

Farmers should dose and vaccinate their animals to lower their negative impact of parasitic on productivity. Farmers should be encourage to avoid sourcing breeding stock with no records of health status as this spreads diseases from one flock to another easily. Government should invest more on research of sheep improvement and disease control, particularly on small-scale production level. Farmers should be encouraged to form livestock cooperatives which give members easier access to essential inputs (feed, improved breeds, vaccines) and to credit, training, transportation and marketing of sheep products. There is a need for farmers to supplement their flocks during dry periods when quality of natural pasture becomes low.

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APPENDIX 1: QUESTIONNAIRE

INFLUENCE OF SOCIO-ECONOMIC FACTORS ON SMALL-SCALE SHEEP PRODUCERS OF SIX MUNICIPALITIES IN NKANGALA DISTRICT, MPUMALANGA PROVINCE, SOUTH AFRICA

This questionnaire is part of a MAgric thesis on the influence of socio economic factors on small-scale sheep producers at Nkangala District municipalities in Mpumalanga Province. Information provided in this questionnaire is strictly confidential. The objective of this study is to assess socio economic factors on small-scale sheep production and to characterise sheep production systems at Nkangala District municipalities.

GENERAL INFORMATION

Interviewing officer ……..

Date of interview……..

Municipality…….

Village/area name……

Farm/plot/property description…….....

SOCIO ECONOMIC PROFILE OF THE FARMER

Name of farmer……..
Position in the household……

Gender

Male		Female	

Age (years)

≤ 30		31-40		41-50		Not known
51-60		61-70		>70		

Educational background

Primary qualification		Secondary qualification		Tertiary qualification		None	

Occupation

Professional		General labour		Unemployed		Other	

Source of income

R501- R900	
R901- R1000	
R1100- R2000	
R2100-R3000	
R3100 and above	

Reason for keeping sheep

Meat	
Income	
Ceremony	
Manure	
Other	

Wealth status

Rich	
Poor	

Ethnic group

Ndebele		Zulu		Swati		Sotho		Tswana		Xhosa		Other:

Livestock kept

Species	**No**
Sheep	
Cattle	
Goats	
Chickens	
Other:	

Do you keep sheep as your source of income?

Yes		No	

Which production system do you use?

Intensive	
Semi-intensive	
Extensive	
Other:	

Housing condition

Shade		Open		Other:

Do you have knowledge or background about animal feeds?

Yes		No	

Which feeding practice do you follow?

Scavenging	
Tethered	
Scavenging with supplementing	
Other :	

Do you supplement your animals?

Yes		No	

In case where you supplement, what type of supplement/s do you use?

Licks	
Poultry litter	
Forage	
concentrates	
Other:	

When do you supplement?

Winter		Summer		Other:

Water source

Borehole	
Fountain	
River/stream	
Water is fetched/provided	
Other:	

Do you wean your lambs?

Yes		No	

If yes, when do you wean them?

3 weeks	
4 weeks	
5 weeks	
Other:	

Do you keep records?

Yes		No	

If yes, how do you keep them?

Sometimes		Regularly	

Where do you get your breeding stock?

Commercial farm	
Auction	
Fellow farmer	
Same herd:	
Other:	

Which breed/s are you keeping?

Exotic		Indigenous	

Which breeding system do you use?

Natural breeding		Artificial insemination	

Which criteria do you use for selecting replacements?

Pedigree		Tandem		Other :	

Do you control breeding?

Yes		No	

If yes, when is your lambing season?

Summer		Winter		Autumn		Spring	

How many lambs produced for the past 12 months?

1-5		6-10		11-15		16-20		21-25		26 and above	

How many ewes exposed to males/mated for the past 12 months?

1		2		3		4		5		Other :

How many ewes gave birth for the past 12 months?

1		2		3		4		5		Other :

How many lambs weaned for the past 12 months?

1		2		3		4		5		Other :

How many animals you lost for the past 12 months?

0		1-5		6-10		11-15		16-20		Other :

How many rams used for breeding for the past 12 months?

1		2		3		4		5		Other :

How many animals you sold for the past 12 months?

0		1-5		6-10		11-15		16-20		Other :

When does selling takes place animals?

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Are you aware of veterinary and extension services or government support in your area?

Yes		No	

If yes, do you have access to veterinarian and extension services??

Yes		No	

Where do you obtain advisory services for your sheep farming?

Extension officer		Farmers	
None receive		Other:	

In case where you obtain advices from extension services, how often do they come?

On daily basis		Once a week	
Once a month		Other :	

What is your opinion (rate) on the quality of service is provided by extension officers?

Very good		Satisfactory	
poor		Other:	

Are you aware of weather and climate advisories?

Yes		No	

If yes, how do you receive this information?

Media		Extension officer	
farmers		Other:	

How does this information come?

Regular		Rare		Other:

Is study groups conducted in your ward/area?

Yes		No	

Who provide this service?

State		Private		Other:

Do you have regional vaccination program for your

Yes		No	

sheep?

If yes, do you follow or use the regional vaccination program?

Yes		No	

Do you castrate your rams?

Yes		No	

Do you control external parasites?

Yes		No	

Do you control internal parasites?

Yes		No	

How do you sell you animals?

Informal		Formal		Both		Other:

Ranking on causes of mortality by respondent

1	Diseases	
2	Starvation	
3	Stock theft	
4	Predation	
5	Accident	
6	Other	