Assessment of production practices of emerging cattle farmers in the selected districts of the Eastern Cape Province, South Africa

by

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DECLARATION

I, **Aphiwe Katikati**, identity number _ _ and student number , do hereby declare that this research project submitted to the Central University of Technology, Free State for the Degree MAGISTER TECHNOLOGIAE: AGRICULTURE, is my own independent work; and complies with the Code of Academic Integrity, as well as other relevant policies, procedures, rules and regulations of the Central University of Technology, Free State; and has not been submitted before to any institution by myself or any other person in fulfilment of the requirements for the attainment of any qualification.

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Prof PJ Fourie **Date**

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LIST OF ABBREVIATIONS

AA	Angus Advantage
ARC	Agricultural Research Council
CSG	Controlled Selective Grazing
CSGWG	Cattle Standards and Guidelines Writing Group
DAFF	Department of Agriculture, Forestry and Fisheries
DC	Directorate Communication
DRDLR	Department of Rural Development and Land Reform
ECSER	Eastern Cape State of the Environment Report
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GRSA	Government of the Republic of South Africa
HPG	High-Production Grazing
HUG	High-Utilization Grazing System
ILRI	International Livestock Research Institute
LLM	Landless Monogastric
LLR	Landless Ruminant Systems
MI	Irrigated Mixed Farming Systems
MR	Rain-fed Mixed Farming Systems
NF	Nguni Facts
PD	Pregnancy Diagnosis
RSA	Republic of South Africa
SABMVC	A profile of the South African beef market value chain
SAFA	South African Feedlot Association
SAI	South Africa.info
SAS	Statistical Analysis Software
SAY	South Africa Yearbook
SRG	Short Rotational Grazing
USAID	United States Agency for International Development

ABSTRACT

Assessment of production practices of emerging cattle farmers in the selected districts of the Eastern Cape Province, South Africa

A survey to assess the production management practises and challenges facing the developing cattle farmers was conducted by consulting with a total of 60 smallholder cattle producers in Amathole and Chris Hani districts situated in the Eastern Cape Province of South Africa. The results of the current study are bringing evidence that our respondents are elderly people, with a lot of farming experience, sufficient land and being dominated by men. Extensive farming was the most (67%) recorded practised. A small proportion of the respondents were keeping farm records (n=21), as result they cannot really track the trend of their business. Most of them had infrastructures that were in poor condition such as fencing, farm houses and access roads, while handling facilities in most of the farms did not exist.

Cows experiencing calving problems or failing to have a calf per year were culled and sold in most cases. Basic cattle management practices were followed by almost all the respondents with the exception of deworming that was practiced by only 33%. The findings show that developing farmers are aware of the importance of animal health management as there were very few individuals that were not vaccinating (11.7%) and controlling parasites in their herds. When farmers were experiencing grazing shortages they were supplementing, some were feeding animals with farm produced forage while others culled less productive animals. These results show that there are only a few emerging farmers (25%) that are conserving forage, which might be due to a lack of knowledge or resources for example shortages of infrastructures and implements.

Lick supplementation was a common practise amongst farmers. In our study, many respondents had camp divisions regardless of their functionality and condition. There were no proper precautions in place for both bush encroachment and moribund grass. Breeding was done seasonally and throughout the year. Reproduction capability measuring (bull fertility and pregnancy testing) was an uncommon practise unlike parturition observation that was done by the majority of farmers. The respondents had good conception and calving rates.

In many farms there were people that were permanently employed. Most sales of livestock were done through private buyers (53%), auctions (30%) and speculators (20%). The furthest marketing places from farms on average were butcheries, abattoirs and feedlots. Nevertheless, some farmers were not marketing their cattle. Over and above cattle sales, there were also other sources of income for the respondents. The farmers were spending significant amounts (R73861.67 on average) on fuel and labour payments. On average, respondents' farming income was higher than their expenses. Thirty-seven percent of respondents reported an increase in cattle sales over the past three years while, 36% did not experience any improvement in their cattle enterprise. Poor fencing, stock theft and drought were challenges that were facing our respondents. Lastly, respondents were obtaining agricultural advises from DAFF, DRDLR and agricultural magazines.

DEDICATION

This dissertation is dedicated to my parents, my siblings, and my close friends. Their love, support and encouragement gave me the strength and ability to believe that anything is possible and to believe in myself.

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CHAPTER ONE
General introduction

1.1 Introduction

Livestock production according to Thornton (2010) occupies about 30% of the planet's ice-free terrestrial surface area. As a part of agriculture, it plays a vital role in the natural economy of South Africa and beyond, it provides sustenance for the most metropolitan and rural communities. In some countries in the West Africa, cattle are used as the symbol of an individual's wealth and status although in developed countries (Australia, United States and Canada) beef, mutton, dairy and wool production are said to be very advanced and sophisticated while on the other side there are developing countries (Brazil and Argentina) that also have advanced meat and dairy production systems (Sejian *et al*., 2012).

Worldwide animal production has taken a part in employing about 1.3 billion people; in the developing countries, it has supported approximate 600 million of smallholding farmers. According to Sejian *et al*. (2012) animal production is the most vital component of world agriculture as people are mostly dependent on domestic animals for many important needs (meat, fat, milk, and other dairy products, eggs and fibres like wool or cashmere as well as for other purposes such as transport, draft, and provision of fertilizers, especially in developing countries). Sikhweni & Hassan (2013) found that most farmers keep their livestock as a source of income and as an insurance against unexpected conditions like loss of employment or severe droughts.

In 2008, according to South African Information (SAI, 2008) South Africa produces 85% of its meat requirements while the other portion (15%) is imported from other countries like Namibia, Botswana, Swaziland, Australia, New Zealand and the European Union (EU). Musemwa *et al*. (2008) found that cattle production contributed about 25 and 30% to the national agricultural Gross Domestic Products (GDP). Cattle farms are dominated in the following provinces and regions; Eastern Cape, parts of Free State and KwaZulu-Natal, Limpopo and the Northern Cape. It has been documented that in South Africa almost 50 000 commercial farmers own 8.2 million cattle while 240 000 smallholders and three million subsistence farmers own 5.6 million cattle (RSA, 2011), out of all these numbers the Eastern Cape has 23% of

South Africa's cattle (GRSA, 2007). Figure 1.1 shows the beef production per the provinces during 2010 production year (SABMVC, 2011).

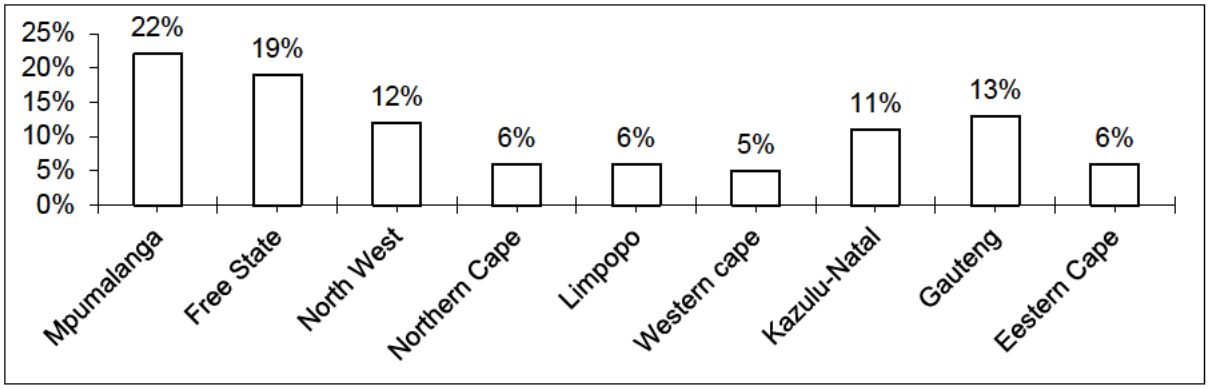

Figure 1.1: *Distribution of beef production figures across provinces.*

Out of all agricultural products meat is regarded as the most important foods in the world therefore it is regarded as the most essential product with a very high consumption rates. Meat is essential in supplying fatty acids, vitamins, minerals and other bioactive compounds (FAO, 2013). Consumers have different views with regards to the consumption of meat, some consider it as healthy and important component in the diet while others consider it as an agent associated with cardiovascular disease, diabetes and some types of cancer (Verbeke *et al*., 2010).

The South African beef industry is divided in subgroups according to the resource they have, method and scale of production (Scholtz, *et al*., 2008). These groups include:

(a) large commercial sector which is mostly dominated by white farmers where the production is quite high and comparable with that of developing countries;
(b) the emerging farmers are those famers who own or lease the land and
(c) the communal sector is where cattle are run on communal land.

For communal farmers to be able to obtain reasonable income and expand their herds efficiently, marketing channels should be established. Coetzee *et al*. (2005) stated that the high growth of population and income, urbanization, globalization and their associated changes in lifestyles and consumer preferences have resulted to a high integrated increase in the beef industry. Emerging cattle farmers are currently having a variety of channels where they can market their livestock (Musemwa *et al*., 2010). These channels are auctions, speculators/agents, butcheries, abattoirs, and private

buyers. In South Africa, auctions are regarded as the most progressive cattle marketing, especially for the smallholders as cattle usually fetch better prices than the ones sold in other channels (Ndoro, 2015).

World population develops in a very rapid rate; however, it has been found that per day it grows by more than 200 000 people. Currently it is close to seven billion and that has increased the demands for food production (FAO, 2013) and climatic changes have adversely affected the African agriculture. This has been supported by Apata *et al*. (2009) who noted that Africa is generally acknowledged to be the continent that is mostly vulnerable to climatic change. Montshwe (2006) revealed that in rural areas there are challenges that are facing communal farmers that limit them from making a reasonable income from their livestock. These challenges are lack of access to land, water and marketing channels, smaller herd size, risks associated with animal diseases, draught and theft. Musemwa *et al*. (2007) also identified high transaction costs as impeding communal farming to develop into a vibrant market. Degradation of rangelands is also a challenge (GRSA, 2007).

1.2 Problem Statement

There are opportunities for small-scale farmers to expand their farms towards commodities that have strong potential for higher returns to land, labour and capital demand. Due to the limited access capital, inputs, technology and extension services of small-scale farmers, it is not possible for them to participate effectively and meaningfully in the market oriented production. In the Eastern Cape Province, 65% of the 3.1 million cattle are owned by small-scale farmers and less than 43% of the 350, 000 households' own cattle (Grant *et al,* 2004). Meissner *et al*. (2013) stated that, a generous portion (70%) of the South African agricultural land can be used for all the livestock and game species that are found in every province. The Eastern Cape is one of the lowest (6%) beef producing provinces (SABMVC, 2011) even though it was found to have a higher number of cattle (see figure 1.2) than other provinces (DAFF, 2012). Therefore, it would be important and useful to do an assessment of production practices of emerging cattle farmers in the selected districts of Eastern Cape Province, South Africa.

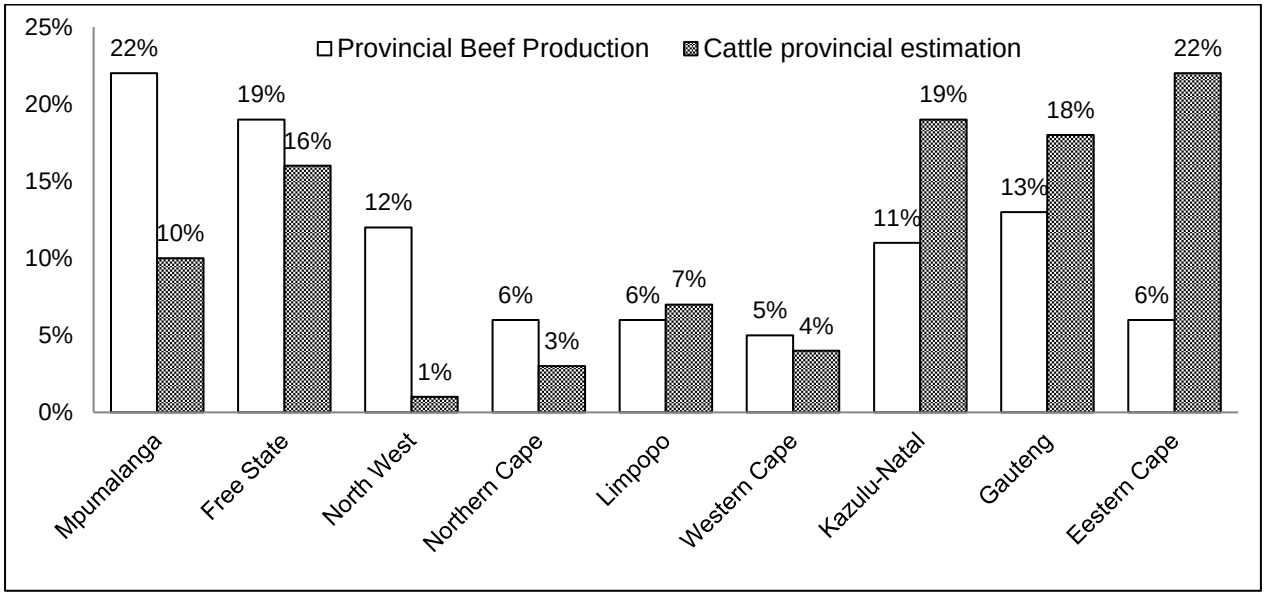

Figure 1.2 *Cattle estimation (DAFF, 2012) & beef production (SABMVC, 2011) per province (The number of cattle was 13 853 000).*

1.3 Rational/Motivation

In 2014, it has been published by the Department of Agriculture, Forestry and Fisheries that in South Africa there are roughly 50 000 commercial producers, 240 000 emerging farmers, and three million subsistence farmers who are producing beef (DAFF, 2014). Annually they produce approximately 823 million kilograms of beef, therefore these producers have made the country to be the net importer of beef because per year South Africa imports about seven million kilogram and exports 4.4 million kilograms. The imports are mainly from Australia and exports are mainly to Mozambique. Here in South Africa there are 48.6 million people who consume 15.8 kg beef per capita per year (DAFF, 2014).

The Government of the Republic South Africa in 2007 (GRSA, 2007) has realized the key role that is played by livestock production as sub–sector of agriculture and its contribution to rural livelihoods sustainability and food security. In South Africa, approximately 40 percent of the beef cattle are owned by black emerging and communal farmers however it's only five percent that goes through the formal marketing channels (GRSA, 2007). The knowledge and capacity of farmers to take part in the mainstream economy influences the economic development (GRSA, 2007). There is a potential that needs to be unleashed in communal and black emerging

farmers so that they can make important contributions to poverty alleviation and economic development (GRSA, 2007).

The study will provide detailed information on the current status and production practises of cattle emerging farmers in the selected district. The information that will be obtained from this study will be freely available to researchers, farmers and other people that will need such information.

1.4 Aims and Objectives

1.4.1 The aim

The aim of the current study was to evaluate the farming practises and to give a descriptive analysis of challenges facing the developing cattle farmers in Amathole and Chris Hani districts situated at the Eastern Cape Province of South Africa.

1.4.2 The objectives

a) To determine cattle production and management practices of developing cattle farmers in the two selected districts (Amathole and Chris Hani) of the province of Eastern Cape and compere their production,
b) To establish the role of cattle farming in the social and economic lives of people in rural areas of Amathole and Chris Hani district,
c) To assess the efficiency, constrains and opportunities of cattle farming in the selected areas.

1.5 Research question

The study will answer the below research question:

How and to what degree does the farming of emerging cattle farmers in the Amathole and Chris Hani districts of the Eastern Cape Province, South Africa contribute to the improvement of the people's livelihoods that are living there?

1.6 Project Hypotheses

- Cattle farming contribute to people's livelihoods and in fighting poverty in the Amathole and Chris Hani districts of the Eastern Cape Province.

- The efficiency of most of these farmers is relatively low.

1.7 Limitation of the study

Since the respondents of the study were originating far from each other, some were refusing to attend the meetings that were not involving their business. There was a challenge with those that were not attending as they had to be visited in their farms individually. Some farmers were suspicious about revealing accurate figures relating to livestock numbers; this was avoided by emphasizing the confidentiality of information during the interviews.

Sometimes it was a challenge to get answers from some respondents as they were afraid of what will happen after their details had been taken. There were even some that were panicking for the duration of a questionnaire. Some were not willing to participate. Where respondents were visited in their places, interviews were sometimes interrupted by domestic issues and that was delaying the length of the interviews.

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CHAPTER TWO
Literature Review

2.1. Introduction

This chapter examines the literature on cattle farming in South Africa and beyond. Specifically, it has discussed: agricultural activities, livestock production systems, production areas, beef cattle breeds, types of cattle operations, facilities, factors affecting cattle production, breeding seasons for beef cattle in South Africa, herd structure and composition, herd entries and exits, marketing and the management practises in cattle farming.

2.2. Agricultural activities

It has been documented in agriculture statistics (GSAS), 2013 that there are many families that are involved in livestock farming in the Eastern Cape (30%) and Kwazulu-Natal (25%) provinces. Poultry and vegetable production are the most dominating farming practises in these provinces. In these provinces, there are also families that own cattle even though the most dominating ones are those that own one to ten heads of cattle (small scale farmers). Eastern Cape, Kwazulu-Natal, Limpopo and Mpumalanga are regarded as rural provinces that have many households keeping one to ten heads of cattle as well as pigs and goats (GSAS, 2013). Figure 2.1 shows the statistics of cattle per province during the year 2011, where the Eastern Cape had highest number among all the province and Western Cape had least number.

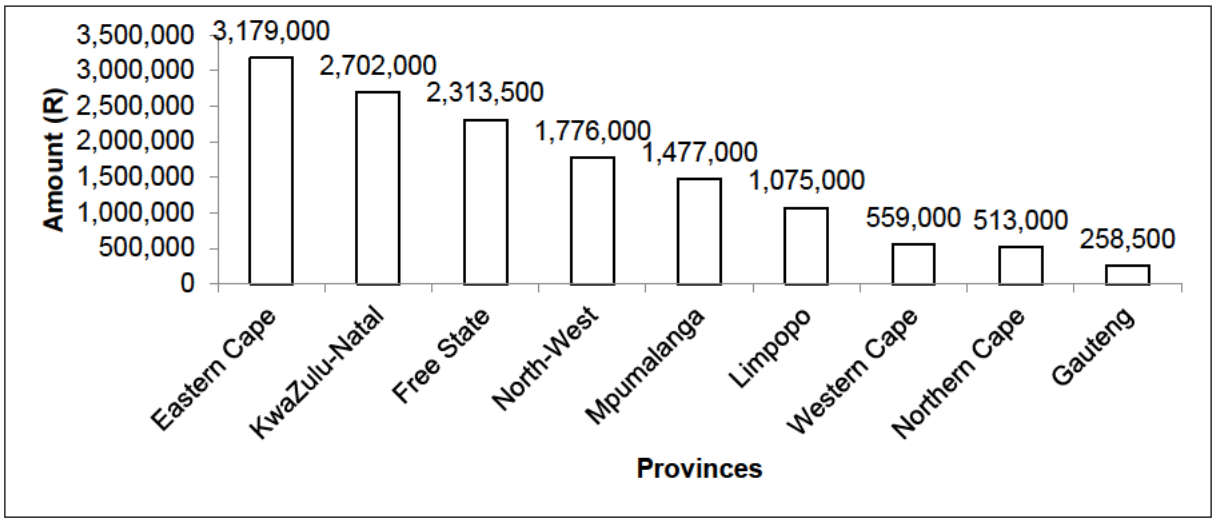

Figure 2.1: *Cattle and estimates by province in August and November 2011 (DAFF, 2012).*

2.3. Livestock production systems

Due to different production environments, agro-ecological zones, main environment and purpose of production, countries and farms have different livestock production systems. Seré *et al.* (1995) classified livestock production systems to five groups, namely: solely livestock systems, landless livestock production systems, grassland-based systems and mixed farming systems.

A solely livestock system is a system where animals are fed with a portion that is less than 10% of the total value of production coming from non-livestock farming activities. Livestock in this system are mostly fed on rangelands, pastures, annual forages and purchased feeds.

Landless livestock production systems are where the yearly average stocking rates are more than 10 livestock units and the dry matter (less than 10%) for feeding livestock is produced from the farm. This system is divided into landless monogastric (LLM) and landless ruminant systems (LLR). With the LLM system the value of pig or poultry enterprises are higher than that of ruminant production, whereas in LLR system the value of pig production is lower than that of production of ruminant enterprise Grassland-based Systems are systems where the farms' stocking rates are less than 10 livestock unit per hectare, in these systems farms normally produce more than 10% of feed required to feed animals.

Mixed farming systems are systems where the income generated from activities that are non-livestock farming related is added up to the value of production from crops; while stubbles are used as animal feed. This system is further divided in to Rain-fed Mixed farming systems (MR) and irrigated mixed farming systems (MI). In MR system, more than 90% of the value of non-livestock farm production is generated from rain-fed land use. Irrigated mixed farming is a system where more than 10 % of the value of non-livestock farm production comes from irrigated land use.

2.4. South African cattle sectors

According to Scholtz *et al.* (2008) South Africa has dualistic livestock production that have commercial sector with farmers that are operating on private ranches and smallholder sector that consist of few farmers on smallholdings along with a huge group farming on communal land. The group of smallholders entails subsistence-oriented producers that are only farming on communal land and farmers that are commercially-oriented and predominately on smallholdings (Scholtz *et al.,* 2008). The Department of Agriculture, Forestry and Fisheries in 2010 estimated that from the South African cattle population (13.8 million) 40% belongs to the emerging sector.

Emerging cattle farmers according to Animal and Aquaculture Production (AAP, 2006) are still facing challenges of poor fencing and resting of grazing lands, uncontrolled movement of animals, stock theft and very little infrastructure. These challenges limit these farmers from competing in the commercial environment. Nevertheless, South Africa is still importing beef. Therefore, there is still a need to empower the developing farmers so that they can shift from being emerging farmers to become commercial farmers.

Scholtz *et al.* (2008) further described the smallholder sector by revealing that the herds of emerging commercial farmers and communal farmers are having less proportion of female cattle than the proportion of females in the commercial farmers' herds. Smallholders achieve a calving percentage that was three quarters and less than half of that achieved by commercial farmers (Scholtz *et al.,* 2008). These authors have depicted the level of productivity of cattle herds in commercial, emerging commercial and communal grazing farmers of South Africa (see table 2.1).

Table 2.1: *The cattle herds' productivity in different South African sectors (commercial, emerging commercial and communal farmers).*

Description	Commercial sector	Emerging sector	Communal sector
Total No. (excluding calves)	28,726	7,749	11,426
% Adult females	52%	49%	33
% Active females	47%	48%	31%
No. of calves born	8,276	1,770	940
Calculated calving %	61%	48%	27%

Source: Scholtz *et al.,* 2008

For the South African red meat output to attain competitive levels of production, smallholder farmers should be given support from state agricultural extension and veterinary services that will improve the productivity of their herds. A special attention should be given to communal land and state services should ensure that all livestock farmers on communal land have access to rely on.

Montshwe (2006) discovered that most smallholder farmers consider cattle farming as an operation that provide draught power, sign of household wealth, assets of inheritance and many other socio-cultural roles and cash from cattle sales they do not considered it as major reason for cattle production. As a result, herds of smallholder farmers stay on farms for a prolonged period and they often sell older cattle that are not in good condition (Randolph *et al.,* 2007). If opportunities can be created to improve smallholder cattle farmers access into the formal beef markets that can increase household food security, income and assist the country to meet its local beef consumption level (Coetzee *et al.,* 2005).

2.5. South African beef breeds

Scholtz *et al,* (2008) indicated that in South Africa cattle beef breeds are divided into three main categories namely: Sanga type (47%), Brahman type (30%) and European breeds (23%). In the communal farming of Southern Africa areas, there is a future challenge of conserving these indigenous breeds. The importation of European breeds to Southern Africa according to Bengis *et al.* (2004) has increased the beef production while on the other side it weakens the traits of disease resistance in indigenous breeds,

and unmasking many prevalent diseases that were attacking the neighbouring wildlife. These European breeds need more management and disease treatments than local breeds. So, their involvement in the herd influences the farming inputs that are necessary for their maintenance (Mapiye *et al.,* 2009).

In South Africa, there are many popular beef breeds, namely: Brahman, indigenous Afrikaner, Nguni, Tuli, Boron, Bonsmara, Drakensberger, Simbra, Beefmaster, Angus and Braford (SAY, 2015). Other breeds are classified as hump less and humped, they are further classified as indigenous (Nguni, Afrikaners, Bonsmara, Tuli, and Hagenoot) and exotic. Some exotic breeds are used for cross-breeding and they are maintained as pure breeds (Charolais, Hereford, Angus, Simmentaler, Sussex, Brahman and Santa Gertrudis) (SAY, 2015).

2.6. Beef production areas in South Africa

Beef in South Africa is produced nationwide. The number of cattle is the factor that determines the amount of beef produced, but that depends on the infrastructure that is used (feedlots and abattoirs). South African beef is mostly produced in Mpumalanga (22%) followed by Free State (19%), Gauteng (13%) and North West (12%). Due to highly developed infrastructure, cattle and calve in South African can be transported from far place (such as Namibia) (SABMVC, 2011). In the olden days when the formal land tenure system was still in place farms were mostly extensive and large commercial operations. In drier areas towards the west, beef cattle and sheep farming were common along with goats and game farming. Agricultural activities in the former homeland areas were mixed mostly subsistence and communal and include croplands, vegetables and sheep, goat and cattle grazing lands (ECSER, 2009). In farmers that are still farming with traditional system it has been estimated that in average they are owning ten cattle per farmer, nevertheless communal farmers in Southern Africa (68%) are owning less than ten where the average is six cattle per household (Casey & Maree, 1993).

2.7. Types of beef production operations

Cattle operations according to Stull *et al.* (2007) are divided into four traditional types, which are: Cow-calf operation, Seed stock production, Stocker operations and feedlot.

In details cow-calf operation is an operation that is focusing on keeping a breeding herd of cows, replacement heifers, and bulls and other groups are sold. Steer calves are sold, and some heifers are selected to enter the breeding herd. This operation is also focusing on selling calves at weaning or reserved in the form of stockers, as well as old unproductive cows and bulls (Stull *et al.*, 2007).

Seed stock production is the operation that is focusing on producing purebred and registered cattle. In the beef industry, this operation plays a significant role of promoting genetic improvements in cattle. Cow-calf producers buy herd sires and replacement females from this operation (Stull *et al.*, 2007). Stocker operations refer to the using of annual rangelands, desert, forest lands, and irrigated pasture to graze their heifers and weaned steers. Mostly they can graze through one growing season so that they can gain additional weight and size. Temperature, rainfall and location are the main factors that determine the time and length of the growing (grazing) season. When the nutritional quality of the forage declines, cattle in here are normally sold to feedlot (Stull *et al.,* 2007).

Since Stull *et al.* (2007) stated that the feedlot is an operation where large numbers of cattle are kept in a confined environment and given feed until they reach market weight (450-500kg). For farmers to produce a carcass that is acceptable and have all the necessary characteristics in this operation, they need to determine the correct feeding period Oltjen (2012) revealed that in the feedlot operation there is an important relationship between cattle types, market demand, and prices.

The primary objective most of South African feedlots is to generate a maximum profit on the pens through purchasing calves from other ranches. These operators ensure that they use a fixed and predetermined feeding periods so that they can generate a required carcass and profit. Most factors that really need a specific consideration are carcass weight, quality, defects, and feed efficiency. South African Feedlot Association SAFA (2008) revealed that in South Africa there are approximately 70 feedlots and to the amount of beef that is produced inside the country these feedlots contribute 75-85%.

2.8. Systems of beef production

Casey & Maree (1993) documented that there are three basic systems of beef production which are, weaner production, production of steers and speculative beef production.

2.8.1. Weaner production

In this system calves are sold when they are six to nine months old. Even though this system is not always the most profitable, it is the most popular system. The system is highly affected by drought because when the number of cows is reduced and the available ones are thin, that decrease the price and demand (Casey & Maree, 1993). The challenge with this system, there are risks that are inherent such as: calf mortality, bull fertility, and reproductive disease. For weaner production, there are most important requirements that one should consider. Casey & Maree (1993) has summarised these requirements as follow:

- An area where this enterprise will be running must have an annual rainfall that is sufficient for the long pasture growing season and if the area is not having enough rainfall, the producer needs to come up with alternatives for feeding such as crop residues.
- The breed that is used must be adapted to the production system and environment of the area where the business will be the existing so that the fertility and ability to give birth to heavy calves is maintained.
- This system requires good pasture management, good supplementary feeding program, meaning high skilled manager is needed.
- Also for this system to be productive, good record keeping, proper reproduction management and disease control are very important.
- The system should be considered when breeding herd gives calving above 75%
- Calving season is another factor that needs to be given attention; it needs financial input because it might have an influence on the reproduction rate of the herd.
- During calving all breeding cows should be in a good condition, however if the fails re-conception rate will be affected (Casey & Maree, 1993).

2.8.2. Steer production system

The most crucial factor in this system is the breeding selection. When selecting a breed to be conceded it is important to go for a breed that matures early as lead better economic return even under extension range condition. The reproduction is not important as in weaner production system. Since the system is mainly focusing on steer production, the herd must be dominated by steers and the female component of the herd must be reduced (Casey & Maree, 1993).

2.8.3. Cow/calf speculation system

Casey & Maree (1993) documented that Cow/calve speculation system become profitable when it is done properly even though it is not realised by many beef producers. Price fluctuation in cattle and rangeland quality can be exploited with this system. Maximum grazing on the farm enhances weight gaining. Between cows and calves the most marketed ones are calves, however cows can be sold when they are pregnant, here in this system great skills are required, the understanding of cattle and beef prices. Transition of disease is a challenge, but it can be minimised by doing the proper separation of speculated herds from the breeding herd.

2.9. Cattle farming facilities

2.9.1. Water Availability

Water is an important nutrient for livestock as it plays a part in their feed intake and the overall health; therefore, it is vital that both confined and grazing cattle to have access to clean, fresh water every time. Jordan (2003) stated that when planning the stock watering system, attention should be given to: water source (borehole, fountain or a permanent stream), Inlet pipe to the main storage location and the distribution of water to the trough.

(a) Water requirements of cattle

Water intake of animals can be affected by a number of factors which are; insufficient space for animals to drink, low flow rates, low storage capacity, elevated temperatures and high mineral content (Stull *et al.*, 2007). It has been documented by Jordan (2003) that the time of the year and the nature of the grazing have also the effect on the daily

water requirement of cattle. According to Larson (2015) the environmental temperatures and humidity, salt content of the diet, amount of moisture in the diet, and whether the animal is lactating or not has the effect on the amount of water required by cattle per day. Jordan (2003) has used table 2.2 to depict the water requirements of cattle under normal circumstances.

Table 2.2 *Water requirements of livestock under normal circumstances*

Type of cattle	Water requirements per head per day (litre)
Small stock	5
Large stock	50
Lactating milking cow	90
Ostrich	10

(b) Total number of cattle dependent on a drinking trough

For water point distribution, it is important to note the number of cattle that will be depended on each water trough. Water can be distributed well if in all camps more than one water point can be provided. Table 2.3 shows, that the more is the number of water points in each camp, the percentage of cattle drinking in one trough decreases (Jordan, 2003).

Table 2.3: *Water distribution over watering points.*

Number of water Points	Percentage of stock loading for which provision must be made at each water point
One	100
Two	66
Three	50
Four	33
Five	25

(c) Watering times for cattle

Daily water requirement of external grazing cattle is determined by the type and number of cattle that drink there. The way cattle graze determines their daily drinking time however the size of the camp is the one that determine (Jordan, 2003). Minimum

water requirement for cattle is 22 litres per day in cool weather whereas adult bulls, feedlot cattle and lactating cows requires up to 75 litres per day during hot weathers. Water intake in cattle reduces when they eat feed with high water content (silage or green pasture, or if snow is readily available) (Jordan, 2003).

In smaller camps animals normally graze near the water troughs, so that they can drink any time they want, and enough water should be provided daily. For design purposes ten hours of drinking time per day is recommended. In large camps drinking occurs within a short time due to the way they graze. They normally graze in groups and drink as groups. The provided water must be able to capacitate usage of the large amount of water within a brief time. Four hours, or five litres per animal per hour is recommended for design purposes (Jordan, 2003).

2.9.2. Cattle Handling Facilities

Tulloch (2010) reviled that livestock handling facilities are an important part of a successful farming operation. To reach maximum efficiencies and performances with livestock they need to be properly handled. These facilities play an important role in properly managing and restraining livestock and moving them for distinct reasons. Because of the increased size and the increased number of cattle in each operation now cattle handling facilities have been under further scrutiny. It is a must for the facilities to grow because the industry has grown over the years to meet the needs of the population.

Proper facilities, equipment, and attitude are required for the proper handling of livestock. Equipment and facilities are the most sources of hazards (nails, loose boards) on a farm so they must be kept in a good condition and cleaned regularly. This will reduce stress and provide efficient movement when working with cattle. In beef production, there is high a demand of equipment that are used to restrain cattle quickly and secure their movement. Well-designed, functional and maintained handling facilities add an easy, efficient handling of the cattle and safety in the farm (both cattle and handlers). When designing, these handling facilities, the environment of the farm should be considered (Stull *et al.*, 2007).

Makgatho (2004) stated that handling facilities are very important for both communal and emerging farmers especially for the treatment and prevention of diseases. The most important facilitates are include crush-pens and dipping tanks and on the farms and communities are built with state expenses, but due to vandalism in some of these areas they are no longer existing. Since these farmers shear most facilities, Sekokotla (2005) reviled that the sharing of handling facilities enhances the spreading of the ticks *(Boophilus microplus)* into new grazing areas. In most instances, according to Simela & McCrindle (2012) both communal and emerging farmers operate with small herds and that lead them to not invest in livestock handling facilities and equipment and, they have get used to get free services provided by the state.

2.10. Factors affecting cattle production

2.10.1. Herd health

Prevention and treatment cost of cattle diseases have a significant impact on the profitability of beef herds, that is why all cattle producers throughout the world are concerned about their herd heath (ILRI, 2010). The affordable and profitable source of bovine feed is the public grazing lands; however, this type of grazing can expose herds to some health problems brought about by plants (Ranson, 2011) and animals that may cause stress, disease or death (Clark & Johnson, 2009). Carter (2010) revealed that the beef production enterprise can also be affected when calves are weaned as weaning causes stress to calves which may lead to weight loss, disease and even death.

The grazing of cattle in rangelands limits herd health management and the herd monitoring as animals spread out the grazing lands with large space (Marsh, 1952). This exposes cattle to disease, adverse weather, theft, and predation which end up impacting the profitability of herds. Beef herds need transportation when they are to be taken from one place to another far place. Transportation can be done through shipping, even though it imposes stress to cattle concurrently bring an effect on their profitability. Shipping leads to stress that causes cows to abort (Fields & Perry, 2009), to have respiratory diseases, impact on performance and weight loss (Richeson *et al.,* 2008).

2.10.2. Feed cost, availability, and quality

Feed cost for beef producers is determined by a variety of factors and Torell (2007) revealed the factors that positively or negatively affect feed cost, these factors are: feed type, geographic location of the beef producer, and competition for feed from other industries, climate (Rushton, 2010) and world grain markets (Schmahl, 2010). Supplemental feeds according to Torell (2007) are expensive and they affect the profitability of the farm but it is a must to buy when the grazing is limited like in dry or winter seasons. Urbanization has a negative effect on the profitability of beef herds through urbanite and cattlemen conflict. Due to the development of human activities land (pastures and range) for agricultural use become scarce for cattlemen as a results it becomes expensive to buy or rent for pasture and the operation cost increases.

2.10.3. Herd genetics

Beef herd genetics might have a positive or negative impact on the beef production as it has been stated that it influences feed efficiency, ease of calving, maternal characteristics, beef quality and hardiness to climate. All these factors can either increase or reduce profits of cattlemen (AA, 2011).

2.11. Breeding seasons for beef cattle in South Africa

A breeding cow is a cow that is ready to be mated (Mokantla *et al.,* 2004). To improve the reproductive performance of a breeding herd and their offspring growth, it is important to have a good breeding season management as it positively affects the profit margin of a beef cattle enterprise. A well-managed breeding season minimizes cost in the farm and maximizes female pregnancy in an abbreviated period. In South Africa summer grazing is used because it usually helps with the provision of quality feed at a lower cost. Breeding season should commence on an appropriate time as if it has started too late, low weights at weaning are possible. Chances of dystocia are high as calves are born later in summer season when cows are usually in good body condition. On the other hand, re-conception rate becomes low when the breeding and calving occurred too early than normal (Bergh, 2004).

Bergh (2004) also stated that breeding season is done in separate ways, meaning it can be done throughout the year, but there are disadvantages associated with this

practise. More expenses are incurred for the purchasing of expensive winter supplements and pastures are not efficiently used during summer seasons; selection for fertility and feed flow planning are complicated; effective marketing and herd performance tests cannot be done while the consolidation of routine management practices is not always possible.

With seasonal breeding, there are numerous advantages such as: the efficient use of natural pastures; less expenses done for supplements as they are less needed in winter; feed flow planning and routine management are simplified like dosing, pregnancy diagnosis, calving observation, identification, inoculation, dehorning, castration, weighing and weaning. Also, some enterprises in the farm can be coordinated; breeding and calving herds get maximum attention during this season. Due to the considerable number and uniformity of calves, performance testing and marketing are more effective (see table 2.4). The seasonal breeding is shorter than breeding that is done throughout the year, so bull requirements are high and there is a need of extra paddocks installation as bulls need to be kept separately far away from cows (Bergh, 2004).

Table 2.4: *Time of the year guidelines for a three-month summer breeding season for some regions in South Africa (Bergh, 2004).*

Region	Breeding	Calving
Eastern Highveld	November to January	August to October
Western Highveld	December to February	September to November
High rainfall Bushveld	January to February	October to December
Low rainfall Bushveld	February to April	November to January

2.12. Calving season

The ideal calving time according to Bergh (2004) is approximately six to eight weeks before adequate grazing can be expected. The state and the availability of fencing affect the implementation of controlled breeding programmes. Basically, the lack of well fenced camps affects reproductive management as farmers fail to have a structured breeding season and subsequently lead to calving that occurs during winter when the quantity and quality of grazing is poor (Mapiye, 2017). Nqeno (2008)

emphasised that, it is vital to separate bulls from cows so that the breeding can be controlled, and the time of calving is accurately predicted. The enhancement of seasonal calving in a ranch promotes accurate record keeping which includes weaning weights (Uys, 2017).

2.13. Herd structure and composition

Herd structure consists of average herd size, the gender-age distribution of animals and related calculated parameters such as cow to bull ratio. The composition of the herd is commonly assessed based on gender and age, distinguishing calves less than a year old, heifers, breeding cows, and bulls/oxen. Fifty percent of breeding cows is the target in herd of commercial sectors (Scholtz & Bester, 2010). Mating ratio in cattle farming differs according to the farming subsector. In commercial beef sector where there is a better management than other sectors, one bull is recommended to mate 30 cows while in communal areas there is no restricted breeding period, mating occurs naturally throughout the year and by any bull. This occurs because cattle in communal are roaming freely (Scholtz *et al*., 2008). Cow to bull ratio in communal areas also differs per the areas, in Eastern Cape of South Africa it is 28 to 32 cows (Mapiye *et al.,* 2009); in Okamboro, central Namibia it is 36 cows per bull; Zambia it is 35 to 39 (Perry *et al.,* 1984) Venda, South Africa it is 3 (Nthakheni, 1993); Sellale, central Ethiopia it is 9.5 (Tschopp *et al.,* 2014).

2.14. Herd entries and exits

In cattle production entries means any animals that are coming in the herd, whether they come through birth, purchase, donation or exchange and exits are through mortalities and sales. Eastern Cape communal areas purchases (12%) and births (88%) are the popular entries (Mapiye *et al.,* 2009), while the exits are through sales (45%), mortalities (30%), slaughter (15%) and thefts (10%). In the central Ethiopia Tschopp *et al.* (2014) found that, the most popular entries are births (70%), purchases (30%) and gifts (0.6%). The herd entries in the farm are determined by reproductive performance which is influenced by calving rate**.** Calving rate is defined as the number of calves born per breeding cow present in the herd.

It has been documented by Nqeno *et al.* (2011) that there are factors that are causing reproductive performances to be low in communal cattle. These causes are a delayed age at puberty and at first calving, long inter calving interval and insufficient bull numbers. Scholtz & Bester (2010) stated that, the norm in communal sector accept a calving rate of 40% whereas in commercial sector the targeting is from 55% to 95% - 99% (Mokantla *et al.,* 2004).

Due to malnutrition resulting in poor body condition of the dam and failure to conceive, in communal areas calving rates are usually low as compared to the commercial sector (Nqeno *et al.,* 2010) and the annual offtake specifically in South Africa the averages start at 7.5% to 10% and 25% respectively (RMRDT, 2008). Mapiye *et al.* (2009) found that in Eastern Cape only 4% of cattle farmers bought some cattle into their herds and no cattle had ever been exchanged and donated. Mortality rate is not affected by herd size but the larger the herd size, the higher the exit rate due to a higher offtake rate (Mapiye *et al*., 2009). High mortalities in communal areas caused by the death of calves which is mostly enhanced by drought, malnutrition and tick-borne diseases (Chatikobo *et al.,* 2001).

Calling programme for fertility and the introduction heifers with better genetics (replacement) can improve the genetic progress of the herd. But it should be noted that when the yearly records are not clear the selection programme is not easy and poor recording may lead to slower genetic progress. Primarily, the recording is done for to assess the performance of the herd for growth rate as a replacement for feed efficiency (Meissner *et al.,* 2013). Where the cattle management practices are adopted with a very low rate, the reproduction rates are also affected. These practices include culling, winter supplementary feeding, effective control of internal and external parasites and selection (Nowers *et al.,* (2013).

Mahlobo *et al*. (2016) found that female animals in the herd of cattle and goat production are the ones that form the highest form of investment, 67.4% and 69.3%, respectively and they are the ones that are not mostly culled and sold as result they constitute the highest proportion of the herd. Then the male (bulls and bucks) animals forms a very less portion of flock and herd size and they are the ones that are common sold or culled animals. According to Mahlobo *et al*. (2016) stolen cattle counts are predictors of flock decline (exits).

2.15. Livestock marketing

Emerging farmers have many options where they can market or sell their cattle, these options are called marketing channels. Private sales are the most used method, where cattle are sold to local people for slaughter for socio-cultural functions (funerals, weddings or religious celebrations) and the butchers buy them to trade for income (USAID, 2003). Musemwa *et al.* (2008) stated that infrastructure or quality of the roads, high transactional costs, and lack of information in different regions are the main factors that lead to challenges to the marketing channels**.** Other challenges related to marketing channels that face farmers are the stock lost due to theft and predation from wildlife. Throughout the continent many incidences of livestock predation have been reported (Sikhweni & Hassan, 2013). In South Africa, there are different channels used for livestock marketing and they are categorised into informal and formal channels (Soji *et al.,* 2015).

a) Formal livestock marketing channels

Commercial farmers are the main suppliers in the formal livestock marketing. They market their livestock to abattoirs when they reach market weight. These abattoirs ensure that meat inspection and quality assurance schemes comprising of carcass classification are done before meat get marketed to wholesalers, retailers, processors or butcheries, and then customers can buy from all these marketing channels. Figure 2.2 shows the formal livestock marketing channels (Soji *et al.,* 2015).

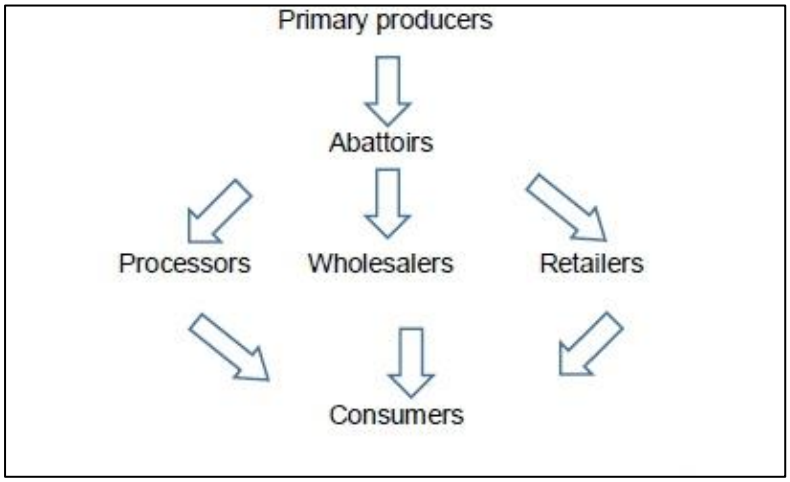

Figure 2.2: *Formal marketing channels of livestock in South Africa (Soji et al., 2015).*

b) Informal livestock marketing channels

Livestock marketing by smallholder farmers is mostly done on speculators and at auctions (Musemwa *et al.,* 2008 and Groenewald & Jooste, 2012). Young farmers that have at least secondary level education prefer to use private sales, auctions, abattoirs and speculators whereas the uneducated and old farmers sell their livestock through private sales to neighbours and relatives (Musemwa *et al.,* 2008). Only visual appraisal or live weight used to determine livestock prices. The dreadful thing about informal livestock markets is that, markets are seasonality and there is poor market information on both prices and the quality required (Groenewald & Jooste, 2012). This lead to a situation where farmers end up marketing their animals with prices that are below the market value (Groenewald & Jooste, 2012).

The off-take rate in smallholder farming is positively and negatively affected by the multiple roles of livestock. Transaction costs are in the informal marketing are low since the livestock producers doesn't need to transport their livestock to distant markets (Musemwa *et al.,* 2008). Therefore, livestock sales are done to with local buyers in the form of neighbours and relatives. However, these buyers have low purchasing power, so livestock producers are forced to sell their animals with prices that are below the actual value of the animals being sold. These farmers are lacking with lack of marketing information, so speculators end up taking them advantages by buying their animals with low prices. When farmers are financially challenged or

desperate for the cash they become being price takers and hence sell off their animals from a position of low bargaining power (Soji, 2015)

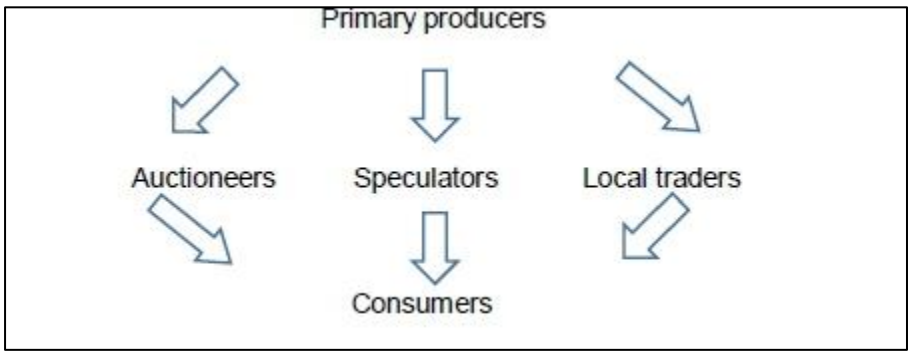

Figure 2.3: *Informal marketing channels of livestock in South Africa (Soji et al., 2015).*

2.16. Management practises in cattle farming

There are production factors that influence beef cattle productivity and the success of cattle production enterprises in emerging and communal farmers. It is essential that farmers clearly understand these factors and know how to manage them for sustainable cattle improvement and productivity. These factors are lack of information, infrastructure and marketing, poor management, poor body condition and disease in the herds. Good management is one of the ways to improve production levels in this farming (Molefi & Mbajiorgu, 2015).

Unlike in communal farming where Government assistance in encouraging some practices such as vaccination and tick control, deworming, emerging farmers are not fortunate enough to get assisted with those practices, so they must independently perform them on their own. Molefi & Mbajiorgu (2015) further stated that there is a need to implement profit-maximising programmes that can boost a shift in perspective around the culture of beef cattle farming and the management of feeding, breeding and controlling diseases. Cattle production according to Adeyeme *et al.* (2015) can also be greatly enhanced by the establishment of pest and disease control measures, more grazing land and water for agricultural purposes. Indigenous and modern knowledge combination is believed that it can improve beef cattle production in the emerging sector of South Africa.

A good understanding of the impact of climatic and rangeland management factors on beef cattle production are important for the sustainable beef cattle farming. It has been

also stated by Molefi & Mbajiorgu (2015) that where there is improved farming management practices and adoption of technological developments, the productivity of natural vegetation or planted pastures can be improved and that will have a positive impact on present and future beef cattle production and food security. Calving rate in beef cattle herds can be improved by putting in place the proper management strategies such as provision of supplementary feed during dry seasons (Molefi & Mbajiorgu, 2015). The type of the farming system used will the one determining the feeding and management plan to be implemented in the farm.

In cattle farming, according to Fordyce *et al.* (1988) there are management practises that need to be taken into consideration and they both involve the interaction between cattle and humans. These management practises are mentioned and discussed from 2.16.1 to 2.16.10.

2.16.1. Calf weaning

Weaning is the separation of calves from their parents. In calves this influences their mass, condition and conception rates of their mothers; so, it is vital to choose when and by what means to wean beef calves. The main objective of weaning is to allow a cow to regain condition so that they can be able to calve every year. Normally the right time for weaning is done when calves are seven to eight months old depending on the cow's condition and not really the age of the calf. When there is drought and poor forage supply to improve the recovery of mothers, weaning should be done when calves are six months old. When the weaning is done early (less than five months), it is advisable to feed with concentrates and feed cows that will still be suckling their calves with roughages (DC, 2000).

In both cows and calves weaning is a very stressful time which might result to a depressed performance in calves and a lot of calves even get sick and need to be treated. Stookey & Haley (2001) mentioned that there is a best method with two steps that can be used for weaning beef calves. The method is a prevention of calves from sucking while they still with their mothers, while they are still allowed to drink and graze; calves after that, they must be separated slightly and until completely. With this two-step method, weaning stress on both cows and calves is reduced as compared to

the traditional methods and it does not make any fuss when they are denied having a contact with their mothers.

2.16.2. Tick control

Ticks are a major transistor of many cattle diseases and they cause anaemia. Regular dipping of animals is the most effective method to control them. There are several dipping methods and facilities that can be used control ticks. These methods are: spray dip, immersion dipping, pour-on remedies, hand spray or tractor spray, hoof dip and draining pens. With any dipping method, there are basic requirements that one must bind with, these requirements state that a dip must: have large enough capacity; not waste dipping fluids; make animal wet thoroughly: not have a slippery surface and the cattle must not be able to turn in the dip. The most advantageous method out of these is the spray dipping because the contamination is relatively low; the storing of proteins and the possible build-up of bacteria is not possible (Jordan, 2003).

Ticks are not only damaging hides and skins; they damage important organs (udder, scrotum, and the ears) of cattle. For tick control, there are two different strategies that can be used but the choice of strategy depends on the: type of farming (dairy, extensive or feedlot); species of ticks which occur on the farm; tick borne diseases in the area and as well as the breed of animal (Hunter, 2004). These strategies involve:

a) *Intensive control*

This is mostly used in dairies, it is a frequent and continuous treatment that minimises the exposure of cattle to ticks, this strategy can be done on a weekly basis in summer and every two weeks in winter. The method also reduces a need of vaccination as animals are not exposed to the tick-borne diseases.

b) *Strategic control*

Here there is no much need of frequent dipping like the intensive control. This control aims to reduce the number of ticks and maintain sufficient numbers to expose animals to infected ticks. This way helps to immunise animals against the prevailing tick-borne diseases, there are less expenditure on dips and dipping equipment and ticks in cattle can also be reduced through the management of pastures i.e. veld burning. It has

been found that, natural pastures are more attractive to ticks than the planted pastures. Hay feeding and zero grazing conditions also have an influence in the introduction of tick and tick born disease (Hunter, 2004).

2.16.3. Cattle Identification

Cattle identification is needed for keeping of accurate production records of the herd. Animals are individually identified to keep records of the important management information on a farm. The recorded information enables the farmer to keep the parentage, birth date, production records, and health history of each animal (Neary, no date). Records should be accurate so that they can give enough information to the farmer to make individual or whole herd management decisions easily. Cattle identification allows producers to track animal growth, treatment records, and movement as well as to respond to disease outbreak when needed.

Properly identification of animals helps to prevent and eradicate diseases which might interfere with human health. There are two approaches for cattle identification (permanent and temporary). Permanent identification consists of tattoos and hot iron or freeze branding. Then ear tags; paint brands; marking crayon or paint marks and back tags can be used for temporary identification (Thelen, 2013). Whittier (2011) stated that before the identification can be done, it is important to first know if the identification needs to be done for the individual animal or as a group. The individual animal identification is needed for recording the individual animal performance then the group identification is done for ownership and group management.

2.16.4. Cattle castration

The testicles of a calf produce sperm cells and hormones that affect growth and behaviour. During castration, testicles of a male animal are removed to stop the production of male hormones. It has been used for centuries in domestic animals. All herds bulls tend to be aggressive to handlers and other cattle, they even lead to unwanted breeding and produce lower quality meat; therefore, castration is recommended as it eradicates all these problems (Bassett, 2009). As the bull become older, its carcass flavour, texture, fat composition, and overall palatability change.

Testicle removal lowers the levels of testosterone and lead to high quality beef with more consistent tenderness and marbling. In the markets, consumers turned to go for a steer beef than that of bull beef due to high muscle. The number of dark cutters decreases when the castration is done early (Goodman, 2011). Cattle castration can be done with the physical methods, whereby there is a use of elastrator bands or emasculators which is most common; but at the same it can also be done chemical and hormonal methods (Bassett, 2009).

2.16.5. Dehorning

In 2013 Cattle Standards and Guidelines Writing Group (CSGWG, 2013) stated that the horn removal in cattle improves animal welfare and safety during handling. Where the dehorning is not done to cattle, the risks of injury, damaging of hides and bruising are high as compared to polled herds more especial in the time of handling, yarding and transport. It is achieved by using dehorning knife, embryotomy wire, saws (hand and electric), guillotine shears and scoop dehorners. In Australia, the dehorning knife and scoop dehorners are mostly used in extensive beef operations. To old cattle dehorning often leads in trauma to the frontal sinuses, increases the risk of infection, too much bleeding and prolonged wound healing (CSGWG, 2013). Horn removal allows the feeding of cattle to be more convenient and easy with less interference from the dominant animals; less space required for trough; less incidents of injury to udders, flanks and eyes and to animal handlers. Dehorning also allows a larger number of dehorned animals to be trucked, housed and fed together (DAFF, 2010a).

Methods that can be used for this process according to DAFF (2010a) is the caustic stick, this one is only suitable for smallholders that have small herds. When calves are ten days old caustic soda (stick, paste) can be applied to the horn bud, after that calves need to be protected to the rain as the caustic soda can run down and cause damage to the face of the calve and cow's udder during suckling. The next method is done with the use of hot iron where the horn forming tissue at the base of the horn bud is burnt with a debudding iron heated by gas or fire; this should be done when they are three to six weeks old. Veterinarian should be asked to perform in adult cattle. In bulls, the polled trait is dominant; it may have polled offspring even though the dams have horns. Matured cattle can be dehorned where keystone instrument is used to dehorn cattle

older then hodges instrument for cattle younger than 18 months. Matured cattle can also be done with an embryotomy wire or by using a hacksaw (Hoffsis, 1995).

2.16.6. Vaccination

Vaccination programmes should start when calves are three months and older or before that, the antibodies ingested from the colostrum can interfere with the development of immunity during this period. The programme should include anthrax; quarter evil and botulism; lumpy skin disease and three-day-stiff sickness. For contagious abortion, heifers need to be inoculated at six to eight months of age (ARC, no date). Nowers (2013) found that, the adoption of vaccination and tick control is high as it is carried out as a government service unlike deworming and other practices that are poorly adopted.

In beef production herd health management plan is the most important aspect and it is important to invest in livestock disease than treating the infected animals. Cattle need to be healthy so that they can reach their performance potential. The combination of a good management; good nutrition and proper vaccination control many animal health problems. Farmers should note that vaccination programs for beef cattle vary depending on the type of operation and area, so it vital for farmers to contact their veterinarians to determine if additional vaccinations are required for the area (Powell, 2010). There are organisms (viruses, bacteria, and protozoans) that cause diseases to beef cattle, so vaccination programmes are followed to protect animals against those organisms. Animal vaccines stimulate the immune system and develop a protective response against those disease-causing organisms. Vaccines also increase ability of animal to fight off an infection if it occurs (Rodning *et al.,* 2012).

2.16.7. Pregnancy testing

Pregnancy testing is considered as last the step of the breeding season. It allows a famer to be able to determine which cows from the herd should be culled to evade the costs of wintering a cow that is not pregnant. If famers are failing to perform it on their own, they might also get the service from the local veterinarians (Pirelli *et al.,* 2000). The testing of pregnancy in beef cows plays a very important role in measuring the success of reproductive management of a cattle herd. Bekele *et al.* (2016) revealed

that, this tool is also called pregnancy diagnosis (PD) and it plays a part in fertility management; enhances the early recognition of pregnancy and treatment of the problems if possible.

The methods of PD in cow can be done through direct and indirect methods. The direct methods cover the use of trans-rectal palpation and ultrasonography, and then the indirect methods take in the measurement of endocrine hormones and pregnancy specific proteins. For correct and early PD detection, it is still useful to go for trans-rectal palpation and ultrasonography methods, as it helps in detecting problems early to achieve resynchronization of non-pregnant cows (Bekele *et al.,* 2016). In the previous years, Sousa *et al.* (2006) said that there was a PD method that was discovered called polymorphic family of placenta-expressed proteins in ruminant species.

2.16.8. Farm budgets and financial records

Normal farm record takes in every production and monetary management aspects of a beef operation. Farm records helps in evaluating the farm's performance, in planning of the farm, tax reporting, and applying for credit. Budgets in the farm are made to predict the results of the future activities provide the information for decisions making in the management of the farm and allows a farmer to anticipate potential problems and find ways to avoid them. Farm financial records are kept in separate ways; however, the used system should provide the necessary information to enable the farmers to meet their responsibilities (Pirelli *et al.,* 2000).

Records should include balance sheet, cash flow statement, and the income statement. In the past years before the computer was advent records were hand kept. Even now this method is still used in many farms, it inexpensive and easy to store the information. At the same time, it is slow and it might lead to errors and consume much time when retrieving the information. The use of computerized systems retrieval of information is easy and reduces the mathematical errors. However, computerised system consumes a lot of time as the information is entered properly and the system should meet requirements and objectives of the farming operation (Pirelli *et al.,* 2000).

2.16.9. Cattle weighing

Weighing of cattle in beef production plays a very important role; Bene (2007) stated that it is crucial to know the body measurements of the beef cattle even for dairy cattle too. The measuring of cattle body helps the farmer to be able to draw conclusions concerning proportionality and maturity, but it is also in relation to live weight. Vindis *et al.* (2010) revealed that weighing of cattle of all ages is a practice that needs to be followed by any farmer because the development of young cattle is indicated by their body mass. Animals that can be successfully fattened to high body mass in the farm are those that have adequate body frame, well-muscled top and quality body parts. This practice should be done repeatedly before any herd exit and after the herd entry to get the accurate measurements. It can be done with manual or automated electronic weighing systems.

For the live animal body mass evaluation, the manual weighing is the oldest and simplest method and it has been used for commercial farmers for many countries. Manual weighing device is not only cheap and easy to handle, it also helps in measuring the growth of animals and estimating the fodder conversions. After the manual device, the electronic weighing device has been invented, it was made differently from the manual devices, calibrated automatically and it reads the body weight autonomously as well. In each animal, it can measure the trunk, length, the chest size, the withers height and the croup height (Vindis *et al.,* 2010).

With this practice, the observation of production capacity of cattle that may affect the output of the herd is possible and it provides the most reliable information about the body mass of cattle. Spring weighing devices or modern electronic weighing devices are the devices that provide accurate data on the animal live weights when they are used. Since the manual weighing is the mostly used method, it needs two stockmen, and per bull it takes approximately three to five minutes (Brandl & Jørgensen, 1996). Pastell *et al.* (2006) reported that the automatic weighting systems have been researched intensively for pigs, sheep and poultry, but in cattle production is only used to weigh of dairy herd.

2.16.10. Veld management and livestock production

Veld management according to Trollope *et al.* (1990) involves the management of natural rangelands for specific objectives related to the different forms of land use. Veld management according to Todd *et al.* (2009) is important in livestock production because it helps in maximizing herbage production while it keeps rangeland in good for a prolonged period and it ensures a consistent forage supply for livestock. To form a good veld management programme veld assessment condition should be done (Trollope *et al.,* 1990). Due to environmental conditions, overutilization of the resource through overestimating the grazing capacity, lack of knowledge by the farmer has led South Africa to have veld that are in bad condition and dominated by unpalatable vegetation. These causes sometimes are the result of poor advice that farmers receive (Meissner *et al.,* 2013).

According to Van de Pol & Jordan (2008) there are four veld management systems that are used in cattle production. These systems are: high-production grazing controlled selective grazing, high-utilization grazing and short rotational grazing and they further explained from I.-IV.

I. High-production grazing (HPG) involves light utilization of veld. This system enhances the production of palatable species by only utilizing the grass species that are palatable which are lightly defoliated and gradually the production of unpalatable species declines. This system also improves the performance of livestock because only highly nutritious and palatable grasses are lightly utilized (Van de Pol & Jordan, 2008).
II. Controlled selective grazing (CSG) system is similar to HPG in practice because it also ensures that unpalatable species are not used at all while the palatable grass species moderately utilized. The growth of palatable species is also stimulated while unpalatable species fade off and die out (Van de Pol & Jordan, 2008).
III. High-utilization grazing system (HUG) is referred to as non-selective grazing. Every grass species that is available is utilised. This is done by compelling animals to graze every grass species available in the camp even the ones (unpalatable species) that would normally ignore. In this system,

better production and maintenance of veld condition is enhanced (Van de Pol & Jordan, 2008).

IV. Short rotational grazing (SRG) system needs a large capital input as proper fencing and water circulation are needed. This multi-camp system ensures that palatable grass species are utilized only once during a grazing period and animals are not re-grazed during the same growing period. SRG helps grasses to remain in a constantly stimulated condition more especially where there are many camps (Van de Pol & Jordan, 2008).

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CHAPTER THREE
Research Methodology

3.1. Introduction

This chapter gives a clear picture on how the study was conducted and an overview of the study area. This chapter start by explaining the study site, following the sampling procedure, data collection and analyses. The chapter ends by describing the study area, highlighting the topography and drainage, population, agricultural sector and closes with land cover.

3.2. Study area

The study was conducted in developing cattle farms that are situated at Amathole and Chris Hani districts in the Eastern Cape Province of South Africa. These districts both have eight municipalities. In both districts, six municipalities were selected since the remaining two in both districts were not having the targeted respondents. From the selected municipalities five respondents were assessed (see figure 3.1).

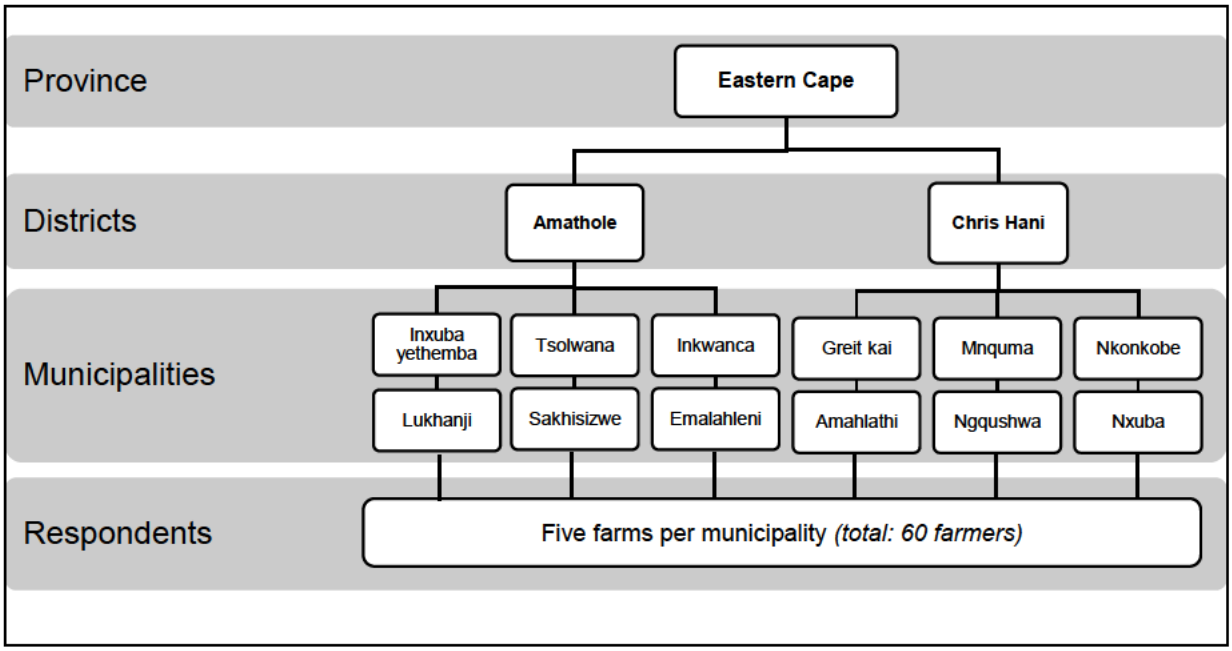

Figure 3.1: *Assessed districts and their municipalities.*

3.3. Description of the study area

3.3.1. Topography and drainage

The Eastern Cape Province extends from the Drakensberg mountains, along the border with Lesotho to the subtropical swamps of the Transkei coast. The province rises from the coastline to the escarpment where the altitude is approximately 2 500 metres above mean sea level. In this province, there are four rivers that are classified as order five rivers; they drain soils of the province and they form an important part of two of South Africa's Water Management Areas. These rivers are the Mzimvubu, Great Kei, Great Fish and Gamtoos. Apart from these rivers, there are other major rivers namely Mbashe and Sundays Rivers which are responsible for landscape evolution, on the local populations they help in ensuring the availability of water, cultivation of the soil and the management of flood disaster (ECSER, 2009).

3.3.2. Population of the Province

The Eastern Cape is the second-largest province with the area of 169 966 km^2 taking up 13.9% of the land. The population of province is more than 6.7 million people, mostly speaking isiXhosa, followed by English and Afrikaans (SAP, 2017).

3.3.3. Agricultural sector

Agriculture is well established and most of farming systems in the province can be classified commercial or subsistence. Close to Kat and Fish River Valley there are citrus growing areas, the dairy farms around Alexandria, areas produce pineapples, chicory and dairy products around Grahamstown and there are also places that produces coffee and tea at Magwa. In Mzimvubu Catchment and Qamata and Ncora have extensive irrigation schemes that are planned. Extensive farming such as game and livestock production is practised in the Eastern Cape Province, especially in the Karoo areas. In East Landon pineapple farming was the most common crop, but many producers left it (pineapple farming) and farmed with agricultural practices that they believe that are more productive (ECSER, 2009).

3.3.4. Land cover

ECSER (2009) has explained land cover as the term that describes which parts of the land retain their natural cover and which parts of the land that has been changed for housing, cultivation or forestry by human. The state of the land can be used as a measure to determine the spatial extent of land transformation.

Table 3.1: *Distribution of land cover for the Eastern Cape (ECBCP, 2004).*

Land cover	**2009 (ECBCP)**	
	Hectares	**% of EC**
Built-up land	515 731	3
Cultivated land	1 273 969	8
Degraded land	No data	
Exotic plantations	2 374 606	15
Grassland	272 257	2
Indigenous forest	6 473 363	40
Shrub land/Fynbos	135 147	1
Thicket and bush land	1 075 556	7
Mines and quarries	2 658 987	16
Mines and quarries	No data	
Wet bodies	96 752	1
Wetlands	No data	
TOTAL	**16 154 667**	

3.4. Sampling procedure

The Stratified sampling method was used for the selection in both districts. The number and availability of farmers was considered meaning municipalities with emerging farmers (farmers that own or lease land) were selected. The willingness was also considered meaning respondents that were willing to take part in the study were selected. From all the 12 municipalities, five respondents were randomly designated. All in all, 60 respondents were interviewed for the study.

3.5. Data Collection

Before the data collection process commenced, agricultural officers in all the municipalities were asked to inform the researcher when they will be meeting with emerging cattle farmers (respondents). When there were no meetings to be held with these famers, these officers were also asked to organize a meeting that will be specifically conducted for the study. Before the meeting started, respondents were informed about the study (topic, problem statement and the objectives). On the meetings that were not specifically conducted for the study, respondents were either

interviewed before or after the meeting and some were interviewed on their farms when they couldn't make it to meetings. Structured questionnaires were used for data collection where the respondents were individually interviewed. Factors that were investigated included: biographic details, land and herd particulars, animal health, animal nutrition, general management, breeding and weaning practices, replacement animals, farm structures, record keeping and economics.

3.6. Data analyses

The collected data was captured in Microsoft Office excel®, before the analysis took place the data was cleaned. The analysis was done using Statistical Analysis Software (SAS, 2011).

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CHAPTER FOUR

Results and discussion

4.1. Introduction

This chapter presents the findings of the survey carried out on emerging cattle farmers in the two selected districts i.e. Amathole and Chris Hani districts, basically it is a description of respondents and their farming environment. The biographic details of respondents are discussed and farming environment is described under land and herd description as well as farm structures available on farms.

4.2. Age, farming experience, farm size and herd size

4.2.1. Respondents' age

As illustrated in Table 4.1, the cattle farmers in Amathole and Chris Hani districts were respectively 52.6±16.11 and 57.63±13.44 years old. This indicates a lack of youth participation in farming, particularly in cattle farming. The median age for Amathole was 53 years while that of Chris Hani was 59 years. The age of farmers is regarded as a crucial factor for the success and sustainability of a farm as it indicates some farmer's variables, i.e. the level of decision-making and interest (Lubambo, 2011).

The stage in life cycle of a farmer has an impact on the decision making; it has been discovered that younger farmers are more flexible and they are always willing to participate in innovative activities compared to older farmers (Pålsson, 1996). Findings of the current study are in line with those of Musemwa *et al.* (2010) who documented that agriculture is dominated by old people and that raise concerns about the future of the agricultural industry. Musemwa *et al.* (2007) did an analysis of cattle marketing channels used by small scale farmers in the Eastern Cape Province and they discovered that age effected farmer's choice of marketing channels as young farmers were mostly using auctions while old farmers (above 60 years) refuse to sell their cattle at auctions instead they mostly make private sales (friends and relatives and speculators).

4.2.2. Farming Experience

Table 4.1 the depicts that the farming experience of cattle farmers in Amathole and Chris Hani districts were 12.27±8.72 and 11.91±7.65 years respectively. Lubambo (2011) revealed that farming skills play a key role in improving farmer's confidence in farming and decision making, and aside from training, farmers who have been into farming before got into their farms had better chances of surviving than those who had never farmed before. Experience of a farmer influences choosing marketing channels. Musemwa *et al.* (2007) found that small scale experienced farmers preferred using private sales, speculators and abattoirs. Yeamkong *et al.* (2010) in Thailand found that longer experience in dairy farmer has increased monthly milk yield and revenue.

Table 4.1: *Mean±SD of age, farming experience, farm size and herd size in the Amathole and Chris Hani districts.*

Districts	Age (years)	Farming Experience	Farm size (Ha)	Herd size
Amathole	52.6±16.11	12.27±8.72	516.03±474.74	115±91.59
Chris Hani	57.63±13.44	11.53±6.48	537.72±580.04	85.97±71.44
Mean	55.11±14.93	11.91±7.65	526.69±524.62	100.5±82.74

Sampled respondents with low levels of experience had less income as compared to those with more years of experience (table 4.2). Farmers that have been engaged into farming for many years have more chances of being successful than the newly started ones (Sikwela, 2013). On the other side Bagi (1983) pointed out that farming experience, education and frequency of contact with extension service are the indicators of managerial ability of a farmer, they also enhance farmers' ability to understand the costs and benefits of technology, interpret, and modify extension information (Ndoro *et al.,* 2014).

Table 4.2: *Sampled respondents' farming experience income from cattle sales*

Experience (Years)	Respondents Proportion (%)	Income generated from cattle sales (R)	
		Mean	Total
0-15	34 (57%)	61184.21	2092500
16-25	18 (30%)	91050.00	1638900
26-35	8 (13%)	155192.00	1210500

4.2.3. Farm sizes (ha)

The average farm size in Amathole was 516.03 hectares (ha) and in Chris Hani it was 537.72 hectares. When the population of the country increases, the pressure on the land also increase and this also impact on the farm sizes (Manyong *et al.,* 2006). However, the size of the farm determines the demand for extension services. Therefore, the bigger the farm, the more extension services are needed. Bagi and Bagi, (1989) suggested that when agricultural researches are to be conducted, the focus should firstly be on specific problems faced by large-scale farmers. In Zimbabwe, there were under utilization of the lands that were discovered on large farms and the productivity decreased exponentially with increase in farm size in all-natural regions (Sukume *et al.,* 2003).

4.2.4. Herd size (headcount)

Herd size in farms can be increased by keeping cattle for economic reasons, which can improve returns from cattle farming and food security in rural household (Mudzielwana, 2015). As illustrated in Table 4.1, the average herd size was 115 in Amathole while in Chris Hani it was 85.97. The results show that respondents in Amathole had more cattle as compared to Chris Hani. According to Spio (1997) herd size in small-scale cattle farmers is influenced by factors such as seasonal variations that lead to climatic variation and fluctuations in forage quality and quantity, forage conservation and utilization and consequently changes in cattle condition indices and populations. Livestock disease and drought reduce the size of the herd as they lead to loss of livestock. Ngqangweni and Delgado (2002) found that socio-economic factors can affect the herds sizes, these factors are: farm assets, access to finance or credit institution and household head characteristics (age, gender, marital status and educational level).

In 2003, there was a livestock survey that was conducted in all South African provinces which was the part of Food and Agricultural Organization (FAO). From the survey, the average for cattle herd size for the communal and emerging sectors was 19 while in the commercial sector it was 413 (Scholtz *et al.,* 2008). The factors that might have affected herd sizes of respondents might be feeding shortages, poor management and unsound breeding practices in line with Marufu *et al.* (2011). In 2003 on the animal production trends document, beef cattle farmers are differentiated based on the number of cattle they had, starting from small farms (less than 50 cattle) to large farms and feedlots with more than 1 000 cattle per farm (APTD, 2003).

4.2.4.1. Respondents' farming breeds

The study in figure 4.1 shows that most respondents were farming with cross breeds (n=25), followed by the Bonsmara (n=23) and Brahman breeds (n=17). Since some of the farmers were having poor fencing that might have resulted to uncontrolled breeding and subsequently to cross breeding. On the other side, the cross breeding can be done purposely. Ndebele *et al.* (2007) studied cattle breeding management practices in the Gwayi smallholder farming area of South-Western Zimbabwe, in their sample they found that the dominant breeds were Brahman (68 % of the households), Hereford (55%), Nkone (52%), Tuli (48%), Simmental (40%), Africander (10%) and their crosses (30%). Muchenje *et al.* (2007) stated that smallholder farms choose exotic breeds over indigenous breeds because they believe that they have high producing even though they are disease prone and feed demanding.

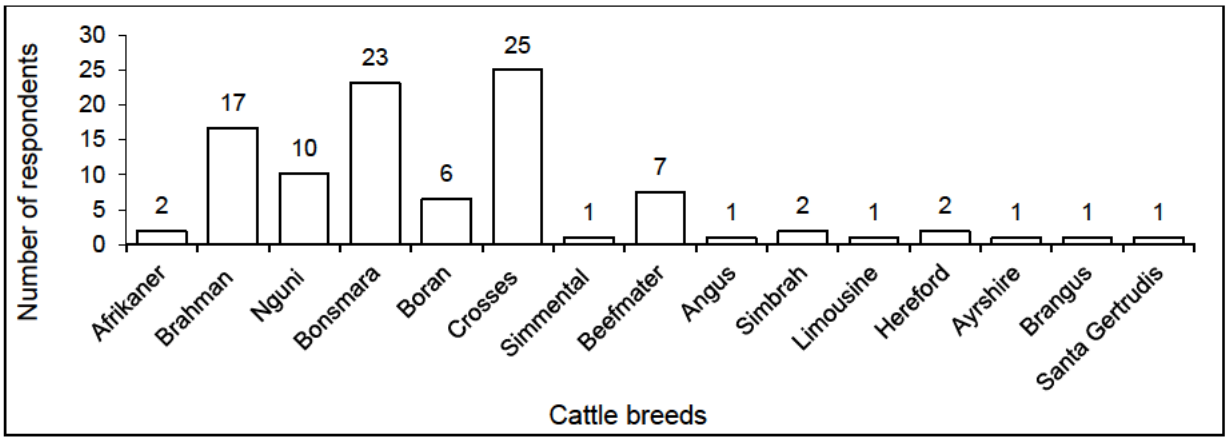

Figure 4.1: *Cattle breeds of the assessed farms.*

4.3. Educational level

Table 4.3 illustrates the level of education of the respondents in Amathole and Chris Hani districts. In Amathole there were three respondents with no education at all while in Chris Hani there were 11 respondents with no education. Fifty-three percent of the respondents had grade one to six. The results also show that three percent of the respondents had a degree in agriculture while 12% had qualifications in other disciplines. The level of education has an influence on their decision making and it is directly related to the success of a farm (Lubambo, 2011). With regards to marketing educated farmers turn to sell their herds to abattoirs while farmers with no education sell their animals to private buyers (Musemwa *et al.,* 2007). Yeamkong *et al.* (2010) in Thailand discovered that better educated dairy farmers were producing more than those farmers that were less educated. More than half of our sample (53%) were farmers with low grades of education (Grade 1-6) followed by those were uneducated at all (23%). However, this situation might be influenced by the fact that people that are involved in farming according to the results of the current study were old and they grew up during the time where education was not easily accessed. These findings were in line with those of Musemwa *et al.* (2007). In their sample, they had a lot of old farmers (above 60) who were marketing their stock to speculators and few young farmers (mean age = 49) were selling on auctions.

Table 4.3: *Educational level of respondents.*

Education	Amathole	Chris Hani	Total (%)
No Education	3	11	14 (23.3)
Grade 1-6	16	16	32 (53.4)
Grade 7-12	4	1	5 (8.3)
Agric. Degree	2	0	2 (3.3)
Other qualification	5	2	7 (11.7)
Total	**30**	**30**	**60**

4.4. Gender distribution

Figure 4.2 illustrates the gender distribution of the respondents in each of the district, and the total for the entire respondents. In this study (n=60) 12 % of the respondents were female while 88 % were males. This implies that significantly fewer women are farming with cattle as compared to men. These findings are in line with those of Lubambo (2011) who found that, women are more involved in vegetable and broiler production than with cattle and small stock. Palmer (1985) did an assessment on impacts of male out-migration on women in farming in Botswana, and discovered that female-headed households plant a smaller proportion of their land as compared to males headed households; they don't give much attention to their crops however they are more on activities that produce income than other households.

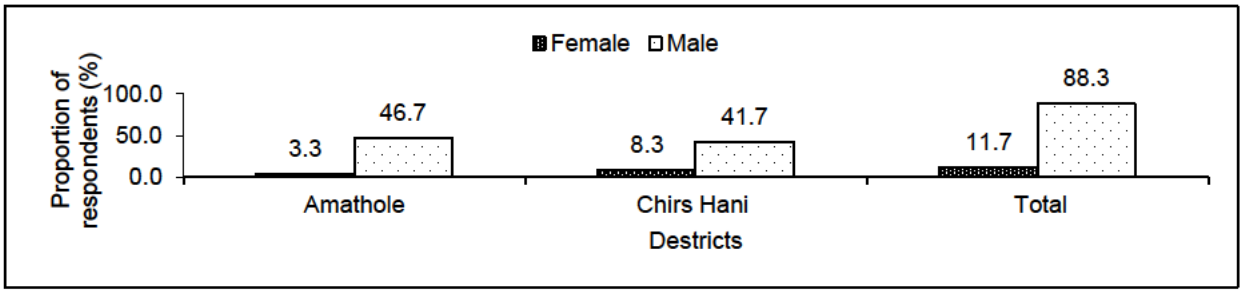

Figure 4.2: *Gender of respondents per district.*

4.5. Farming system

From Table 4.4, the total number of respondents that were practicing extensive farming system (40), accounting for 67% of the total number of respondents as opposed to 20 respondents (33%) that were practicing semi-intensive systems is presented. At district level, 17 respondents in Amathole were in extensive farming

system while 13 respondents were farming with a semi-intensive system. The most dominating cattle farming system according to Scholtz *et al.* (2008) was extensive systems accounting for about 75% of the production systems while backyard production was 18%. Van Pletzen (2009) publicized two limitations that affect stock farming on the veld which are: quantity (veld production) and nutritive value (variation in quality). These challenges reduce the production and they are still relevant in the current farming environment.

Table 4.4: *Farming system by district.*

Farming system	District		Total (%)
	Amathole	Chris Hani	
Extensive	17	23	40 (66.7)
Semi-intensive	13	7	20 (33.3)
Total	30	30	60 (100)

4.6. Farm vegetation type

Most of the farmers in Amathole raised their cattle on mixed shrubs and grasses and the same apply to the Chris Hani district. Overall 75% of farms were dominated by both shrubs and grasses. The rainfall frequency enhances the bush encroachment in grassland areas; however, the carrying capacity in these areas declines as rainfall decline. The carrying capacity is mostly dependent on tree density and the amount of grass and edible bush remaining (Tainton, 1999).

The results on table 4.5 also show the percentage of respondents who were having farms dominated by shrubs (10%) and grass (15%). These findings show that most farms were having shrubs which might be caused by under grazing and poor management. However, this allows for both grazing and browsing by livestock although it reduces the density and diversity of the grass layer, thus reducing grazing value (Euston-Brown *et al.,* 2007).

Table 4.5: *Farm vegetation type of respondents' farms.*

Vegetation type	District		Respondent Proportion
	Amathole	Chris Hani	Total (%)
Shrubs	3	3	6 (10)
Grass	4	5	9 (15)
Mixed shrubs & grasses	25	20	45 (75)
Total	**30**	**30**	**60 (100)**

4.7. Educational level and farm record keeping

Table 4.6 shows the effect of educational levels on farm record keeping. Out of 60 respondents 39 (65%) were keeping records. Many respondents (48%) had grade 1-6 followed by uneducated (27%) while two percent had an agricultural degree. Educational level didn't have an impact on record keeping. However, it is complicated to verify the drafting and using of applicable farming records.

Yeamkong *et al.* (2010) studied the effect of record keeping on monthly milk yield and revenue of dairy farms in Thailand and they found that on farms where records were kept monthly milk yield and revenues were higher than their counterparts that were not keeping records. The reasons that lead them to not keep might be as they find the process challenging. However, record keeping is a farm management aspect on its own, especially such as the recording of calving percentage, birth weight as well as the weaning weight of calves.

Table 4.6: *Farm record keeping and educational level of cattle farmers in Amathole and Chris Hani district.*

Educational level	Farm records		Total
	Keep records	No records	
No Education	10	6	16
Grade 1-6	18	11	29
Grade 7-12	4	2	6
Agric. Degree	1	1	2
Other qualification	6	1	7
Total	**39**	**21**	**60**

4.8. Farm infrastructure

Table 4.7 illustrates farm infrastructure and their condition (graded by respondents). All the respondents had fencing on their farms, but 58% had very poor fencing while 22% respondents' fencing were in a poor condition. Regarding the farm houses and buildings respondents with very good and good facilities added up to three and 12% respectively, but from our sample there were 28% of respondents with poor buildings and 30% had building in very poor condition. Most of farms in our sample had no storages (43%) and cattle handling facilities (36%). Only seven percent of farmers had good access roads, but majority of farms (72%) were having poor to very poor access roads.

The state and availability of infrastructure affected the marketing channel choices in Kamastone auction, (Musemwa *et al.,* 2007) as pens were in poor condition. In 2006, infrastructures were among the initiatives that the livestock development strategy pledged to support to promote emerging and smallholders' competitiveness and profitability (Republic of South Africa, 2006). However, farm infrastructures according to Meissner *et al*. (2013) were listed under a list of interventions that have not been materialized to small scale and communal farmers. Specifically, fencing and watering points to ensure sound rangeland management. This might be the reason why a substantial proportion of assessed farmers were having infrastructures ranging from poor to very poor. However, based on Fidzani (1993) findings, poor infrastructure does not impact livestock marketing since in most cases buyers provide their own loading and transport services.

Table 4.7: *Farm Infrastructure per district.*

Infrastructures	**Condition of infrastructures (%)**					
	Very good	Good	Moderate	Poor	Very Poor	Don't have
Fencing	3	8	8	22	58	0
Farm Houses	3	12	12	28	30	15
Storage	2	15	3	20	17	43
Handling facilities	10	15	18	18	2	36
Access road	2	5	15	37	35	7

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CHAPTER FIVE

Management practices of emerging cattle farmers in the Amathole and Chris Hani districts of the Eastern Cape Province

5.1. Introduction

In this chapter, the focus is on farm and cattle management. The focus was on famers that own land or farming on private land, since they have the potential to perform some management activities such as grazing and breeding management. Animal health and nutrition, veld and general management, breeding and weaning practices, replacement animals and record keeping will be discussed. Munyai (2012) stated that there are management skills that turned to be underestimated even though they have a significant role in farming. These skills entail the management of natural pastures, risks and conflict management.

5.2. General Management

5.2.1. Cattle herd separation according to production stage

Figure 5.1 shows the respondents that were dividing their cattle based on their stage of production (age), 32% (n=19) respondents were allowing herds to graze and stay together on farms while 68% were dividing them into the stage of production. For those farmers that were not separating their herds might be led by a challenge of poor fencing which makes it difficult to control or perform some management activities. The natural service has been stated as the easiest and most convenient method of breeding for smallholder farmers but due to a lack of facilities like proper fenced camps their breeding objective is affected (Sekwadi *et al.*, 2016).

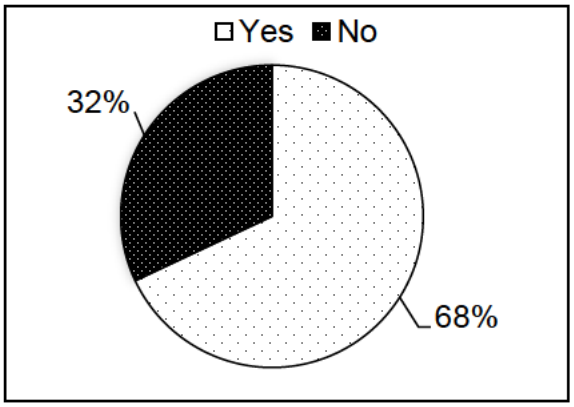

Figure 5.1: *Division of cattle herd according to production stage.*

5.2.2. Treatment of unproductive cows

Farmers had different approaches when some of their breeding cows did not calf after it was mated. Most of the farmers (48%) were culling animals (sell), whereas 27% of respondents were keeping them while one respondent (2%) indicated that he would confirm with a veterinarian before taking any decision. Nkhori (2004) pointed out that generally heifers calve when they are at age of 27 to 33 months. This author mentioned that breeding cows are normally culled when they fail to give a calf after one and a half, to two breeding seasons. Before they get excluded from the herd as cull cows they get fattened on summer grazing, and sold before the dry season.

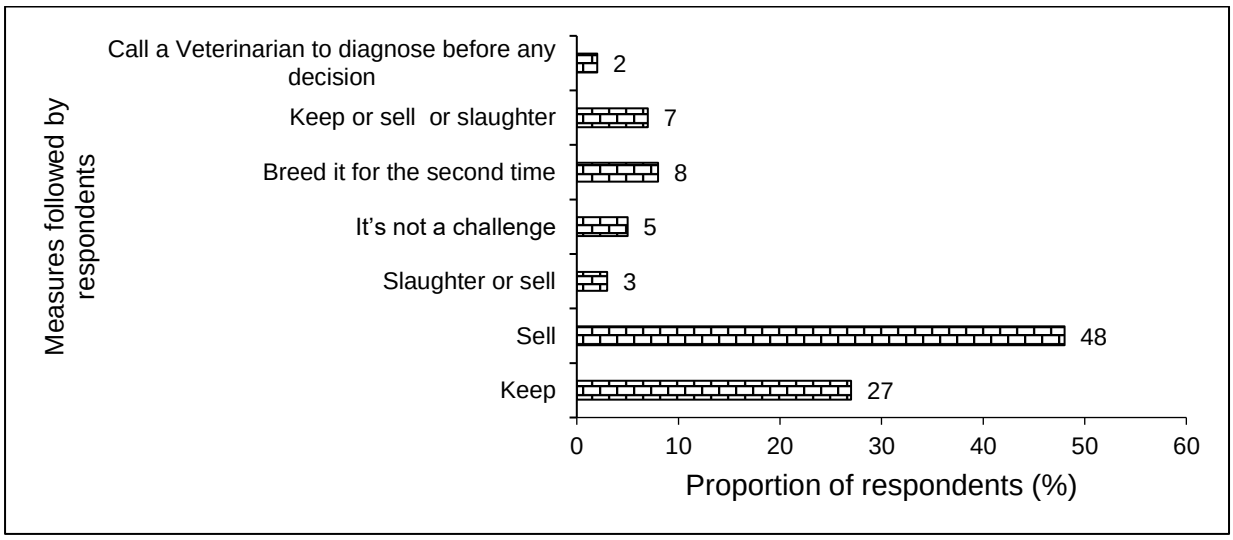

Figure 5.2: *Measures taken in unproductive cows.*

5.2.3. Routine practices in cattle management

Table 5.1 shows management practices performed by the group of the assessed farmers; seasons where they were applied and proportion of respondents. According to the findings of the current study, all the respondents were practicing these activities (table 5.1) in their farms except for deworming (33%). Only 2% respondents were not branding livestock while almost all other activities were done throughout the year except those that were deworming in summer. Even though castration was done almost in all the seasons there was a portion of farmers who confirmed that it was a winter activity. Castration decreases the number of bulls while increasing the number steers which are usable for draught power especially for small holder farmers

(Mapekula *et al.,* 2009). In bulls, it helps to open doors to the targeted stock, since the steers are usually the most targets for selling or slaughter (Musemwa *et al.,* 2008).

Table 5.1: *Cattle management activities.*

Management activities	**Proportion of respondents & seasons (%)**					
	Summer	Autumn	Winter	Spring	Throughout	Total
Castration	8	10	20	4	58	100
Dehorning	10	13	16	3	58	100
Deworming	15	9	2	7	-	33
Ear tagging	4	7	4	2	83	100
Branding	5	7	9	-	77	98
Treating sick animals	0	2	5	-	93	100
Sorting calves	0	0	8	4	88	100
Vaccinating	4	6	8	2	80	100

5.2.4. Calf weaning

This is the process of separating young calves from their mothers so that they can stop feeding them. Normally it is a stressful time for both the cows and calves. On the other side it helps cows to recover their body weights so that they can start a new cycle and get ready after postpartum (Haley *et al.,* 2005). Figure 5.3 shows the weaning weights farmers have realised. Eighty-three percent of farmers was weaning their calves then 10% of them were considering weights while most (69%) of them were weaning according to age. Some farmers believed that there is no need for that as calves wean themselves, maybe their infrastructures were poor and it was not an easy activity to perform.

As the weight of calves were estimated by respondents weaning weight is not going to be given much attention. The portion of respondents that was considering age, were weaning calves at six to eight months (27%), 4-6 months (22%), and above 8 months (22%). In this study most farmers were weaning according to age and these are in line with Mahlobo (2016) findings, and he also reported that the average weaning age for calves is 7 to 8 months. There are findings by Chimonyo *et al.* (2000) which indicated

that 6 to 8 months (early weaning) is beneficial because it prevents loss of weight of the cow and improves conception. More than 90% of the communal farmers according Ndebele *et al.* (2007) practised natural weaning while 78% of the medium-scale farmers practised systematic weaning by separation or weaning plate method.

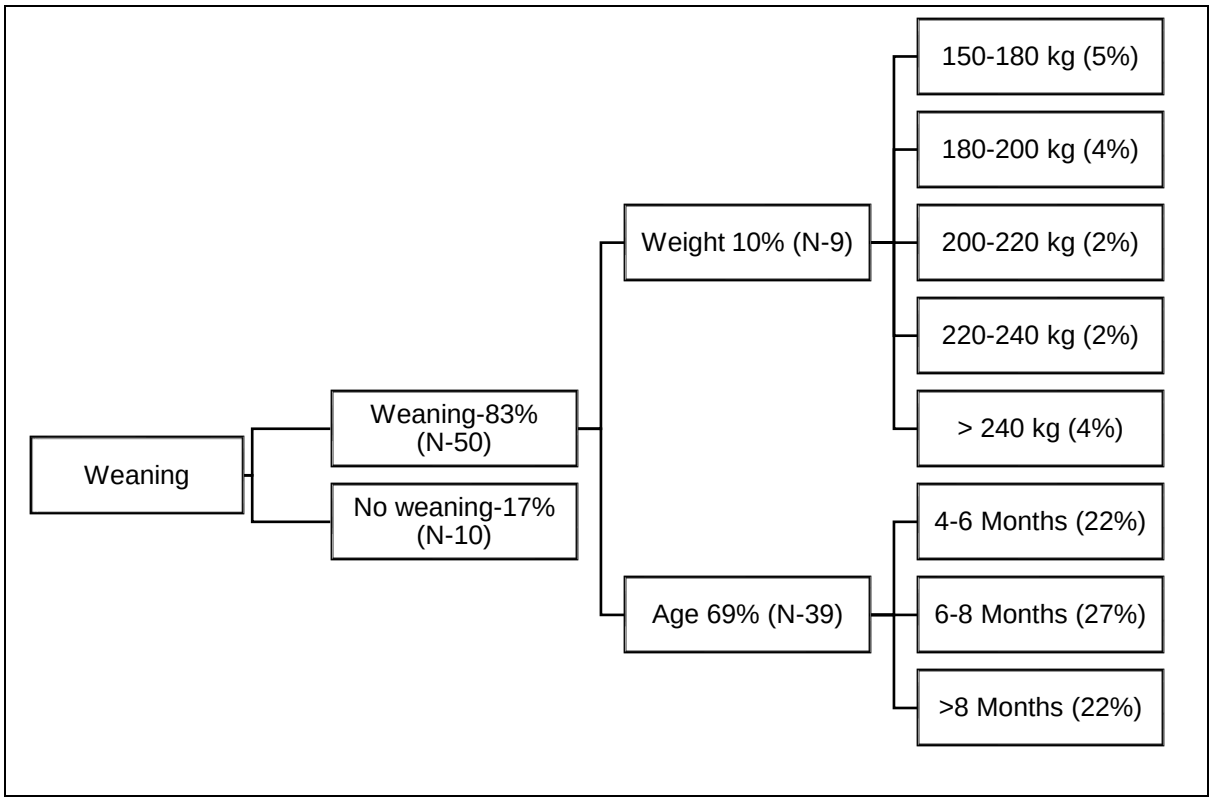

Figure 5.3: *Calf weaning practises.*

5.2.5. Animal replacement

The results shown in figure 5.4 reveal that 45% of the assessed respondents were not introducing cattle from other herds whilst 55% does. The reasons for those that were not introducing animals, might be the financial aspect or they do not see a need for that. Smallholder farmers in southern Africa frequently buy stock from commercial farms. However, it has been revealed by Bayer *et al.* (2003) that cattle that are bought should fulfil their intended function without being costly without demanding feed and veterinary care.

Some of the smallholders have a role model, commercial farmers in most cases. Sometimes these farmers do not concede the numerous functions of their animals and the need of bringing in animals that are adapted to the local conditions. In terms of

breed selection, they go for what their role model has (Bayer *et al.,* 2003). Out of 33 (55%) farmers who agreed that they buy replacement stock from other herds (figure 5.4); only 19 farmers bought cattle during the year of 2015. In the same year nine of them bought 17 bulls at an average of two per farmer. In total, 113 cattle were bought at an average of six (5.95) cattle per farmer.

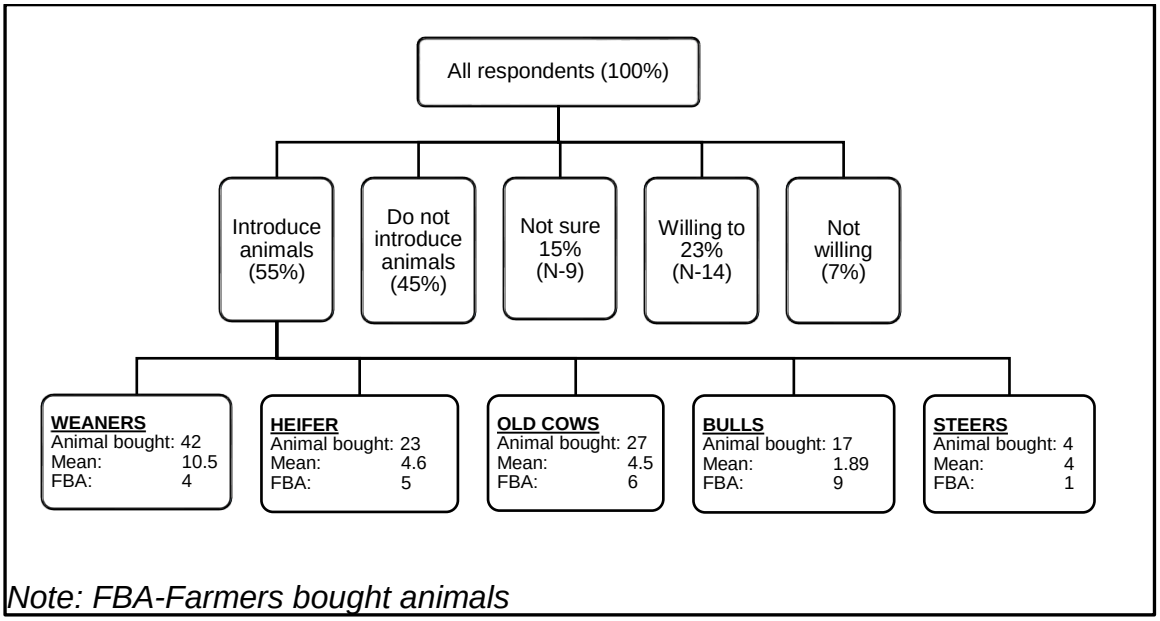

Figure 5.4: *Cattle replacement by assessed farms at the Chris Hani and Amathole districts.*

5.3. Animal health

5.3.1. Cattle Vaccination

Nowers *et al.* (2013) stated that vaccination and tick control are mostly carried out as government services unlike deworming and other practices that are poorly executed. Even in our sample 88.3% of respondents were vaccinating while 11.7% were not. There were many livestock diseases that farmers were vaccinating their cattle for but out of all diseases there were two that most respondents were vaccinating for and namely were Redwater (40%) and black quarter (42%). From the sample 30% were vaccinating for anthrax while lumpy skin and hart water was vaccinated by 22% and 20% respectively. On the other side, respondents that were just vaccinating animals without knowing the specific diseases that they were vaccinating for. To reduce the occurrence of illness in the cattle herd, the implementation of a sound vaccination

program, parasite control, and frequent herd observation is recommended. Tada (2012) stated that there are diseases that are essential to vaccinate (black quarter, brucellosis, Vibriosis and Contagious Abortion) some are occasionally vaccinated (Anthrax, Paratyphoid, Colibacillosis, Rota and Corona Viruses and Botulism) and some are optionally vaccinated (rift valley fever, lumpy skin disease and foot and mouth disease).

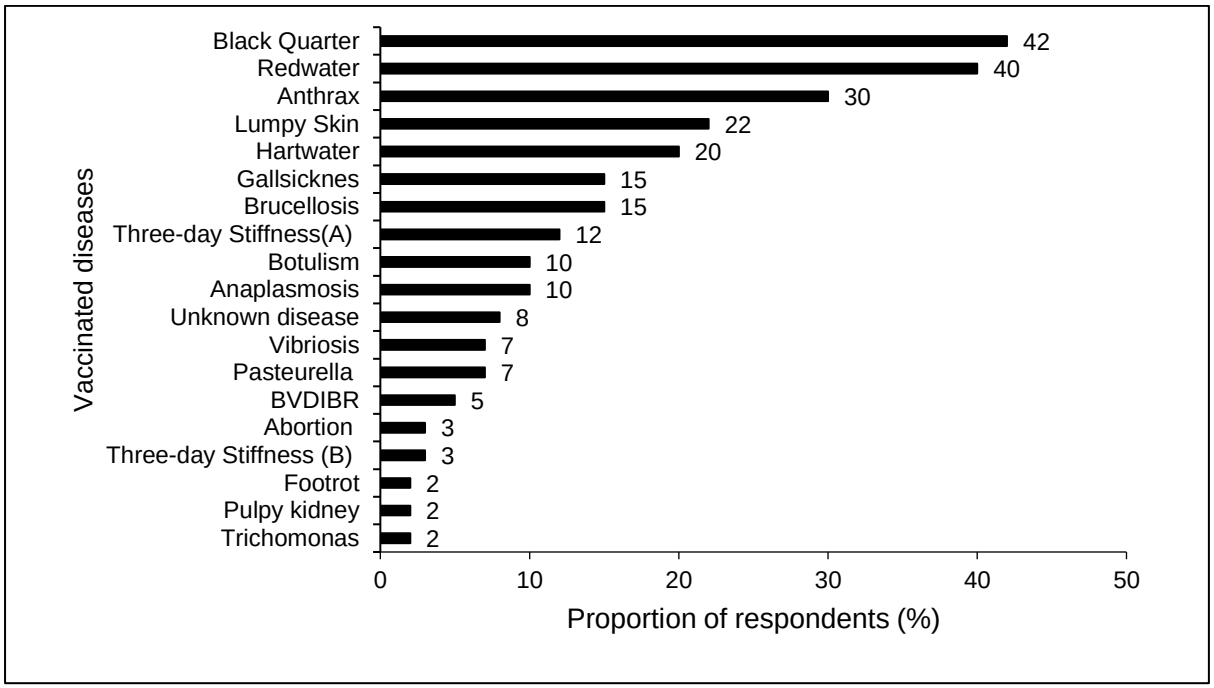

Figure 5.5: *Disease vaccinated by respondents.*

5.3.2. Parasites control

5.3.2.1. External parasites

External parasites (especially ticks) were found as a major problem that causes diseases in livestock (Anaplasmosis, Babesiosis and Ehrlichiosis), wounds that predispose to screwworm infestation and in cows they damage teat troubling farmers in their farming enterprises (Moyo & Masika, 2009). Figure 5.6 shows that 52% of respondents were using a pour on for controlling external parasites, while 33% were using the plunge dip method, while there were a few farmers using spot treatment (3%). In Moyo & Masika (2009) findings, the control methods that were used were; acaricides provided by government, however some farmers that believed that dip wash is not effective in killing the ticks. As a result, farmers ended up spraying with

conventional acaricides, household disinfectants such as Jeyes fluid (18.6%), used engine oil (10.2%), chickens (5.1%), manual removal and pouricides. There were also some farmers that were using leaf of *Aloe ferox* and the bark of *Ptaeroxylon obliquum.* La Fuente *et al.* (1998) stated that external parasite control (ticks) and the transmission of tick-borne diseases remains as a challenge for the cattle industry, especially in tropical and subtropical areas of the world. Even though traditional control methods were put in place, parasites remain to result in severe losses for the cattle farming (Moyo & Masika, 2009).

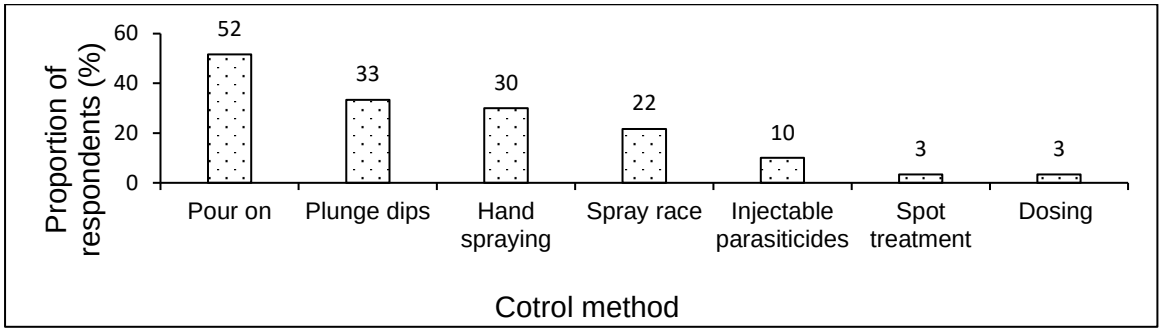

Figure 5.6: *External parasite control.*

4.8.1.1. Internal parasites

From the results of the current study there is evidence that a substantial proportion of respondents (82%) were controlling internal parasites while 18% of them was not controlling it at all (figure 5.7). These parasites include roundworms, lungworms, and liver flukes (mostly found in cattle) cause deficient performance and occasionally lead to death in young animals. In cattle's digestive system, they damage internal organs (stomach and intestine) the then subsequently affect the digestion, but by using de-wormers these parasites can be reduced. The use of faecal sampling can help with the eradication of internal parasites (Williams & Loyacano, 2001). Worldwide internal parasites are a continues problem, but grazing management strategies and biological control were proven as the effective non-chemical parasite control methods (Waller, 2006).

5.3.3. Cattle feeding prioritization

Nutrition management is the most essential element in animal production, involving supplementary feeding, grazing plan, forage storage and nutrient concentration or availability. It should be noted that nutrient requirements of an animal differ according to their type, age and their production status. The most economic and physically feasible is to give an animal what they really need (Moraes & Fadel, 2013). Table 5.2 shows measures that were followed by respondents when experiencing shortage of forage in farms. Twenty-nine (49%) of the respondents were buying forage in such instances; while eight (13%) of the respondents were feeding with farm produced forage and seven were avoiding the challenge by decreasing the herd through selling.

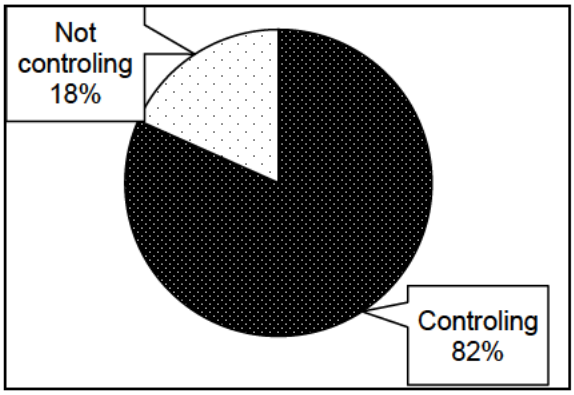

Figure 5.7: *Internal parasite control.*

Table 5.2: *Feed prioritization by assessed farmers.*

Feed prioritization	**Respondents proportion**	
	Frequency	**Percentage**
Buy feed	29	49
Feed with farm produced forage	8	13
Culling (selling)	7	11
Camp rotation	4	7
Graze animals in forests, along the road, along and inside the river	4	7
Graze in more than one camp simultaneously.	3	4
No plan	3	4
Buy feed and ask drought relief from the department of agriculture	1	2
Rent for some cattle in other farms	1	2

5.3.4. Feed conservation

According to the results (figure 5.8), only 25% of 60 respondents that were keeping forage on their farms and those that were keeping forage were keeping it in a form of hay (28.57%), silage (25.57%) and others were using both methods (42.56%). The causes for this might be the lack of equipment as this process involves movable equipment. A lack of information might be the other limiting factor to this because there are procedures that need to be followed strictly when conserving feed forage to reduce waste and produce nutritive and economic feed. This is in line with Ndoro *et al.* (2014) who found that the use of forage (e.g. grasses, silages and legumes) in livestock feeding is increasing in farmers that participate on extension programmes.

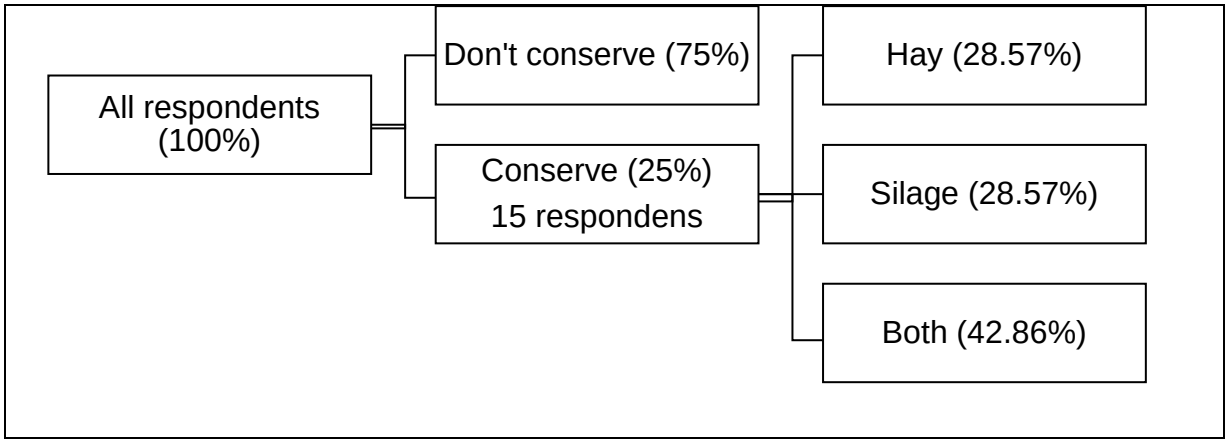

Figure 5.8: *Conservation of extra forage.*

5.3.5. Cattle supplementation (Licks)

Most of the farmers (77%) were practising lick supplementation to their animals, while 23% believed that licks are expensive, and two percent doesn't know anything about licks. Some respondents were supplementing throughout the year (13%) while most of them were only supplementing in winter (58%). Van Pletzen (2009) documented that there was a lick supplementation programme that was developed by Voermol to correct the deficiencies or imbalances in specific areas.

The programme was having three stages with the aim of ensuring the cow herd's condition and nutritional status are adequate in critical stages of the production which will subsequently enhance weaning percentage and acceptable weaning weights. There are elements that are limited on natural veld in certain seasons (phosphate and trace elements). As results in winter, veld intake in cattle decreases as digestibility,

palatability and protein content decreases. Winter supplementation (protein) prevents losses of mass in livestock while summer licks maximize growth (Van Pletzen, 2009).

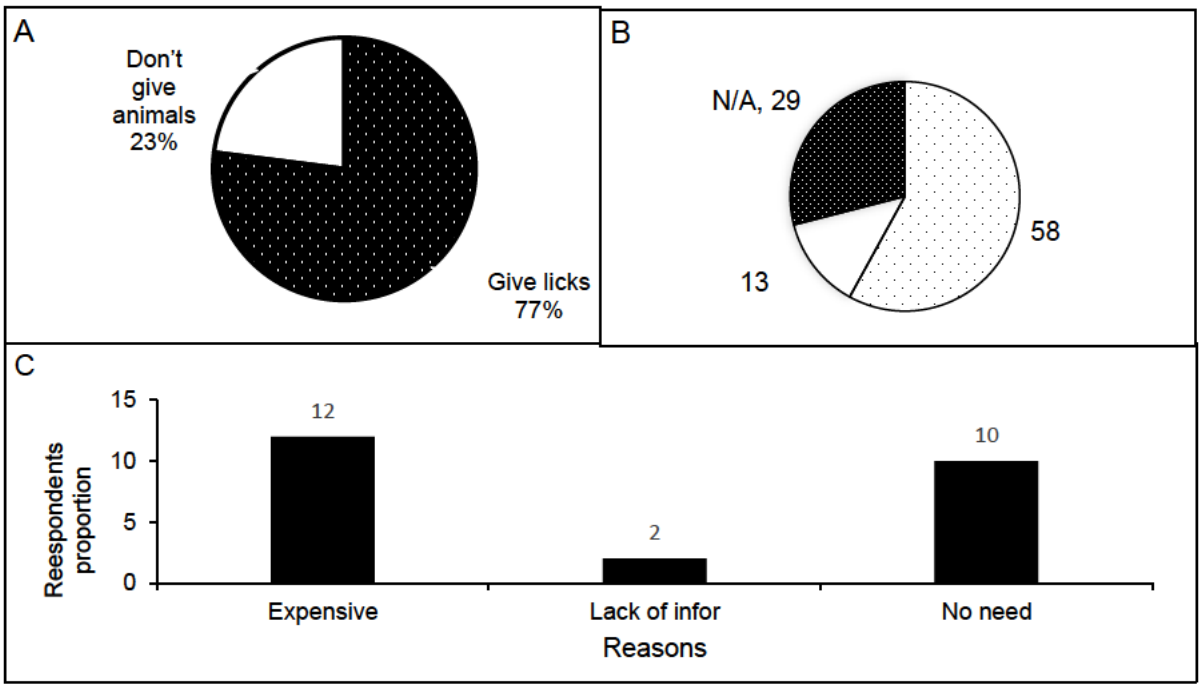

Figure 5.9: *(A) Proportion of respondents on animal supplementation, (B) Season of supplementation and (C) Reasons for supplementing.*

5.3.6. Veld management

5.3.6.1. Introduction

Veld management according to van Pletzen (2009) can deteriorate or improve rangeland, but proper management practices reduce the risk of drought and keep veld in good condition subsequently limits the sensitivity of veld to drought. Since there are distinct types of veld, there is no specific veld management system that can be applied to the entire veld. Nevertheless, there is a part of management that applies and lead to the improvement of veld production and composition and animal production in all veld types (Snyman, 2015). This is usually achieved by the application of a full rest in the growing season every second or third year which allows the building construction of grass roots reserves (Van Pletzen, 2009). Maintenance of pastures is about fence repairs, burning of secondary forest re-growth and slashing.

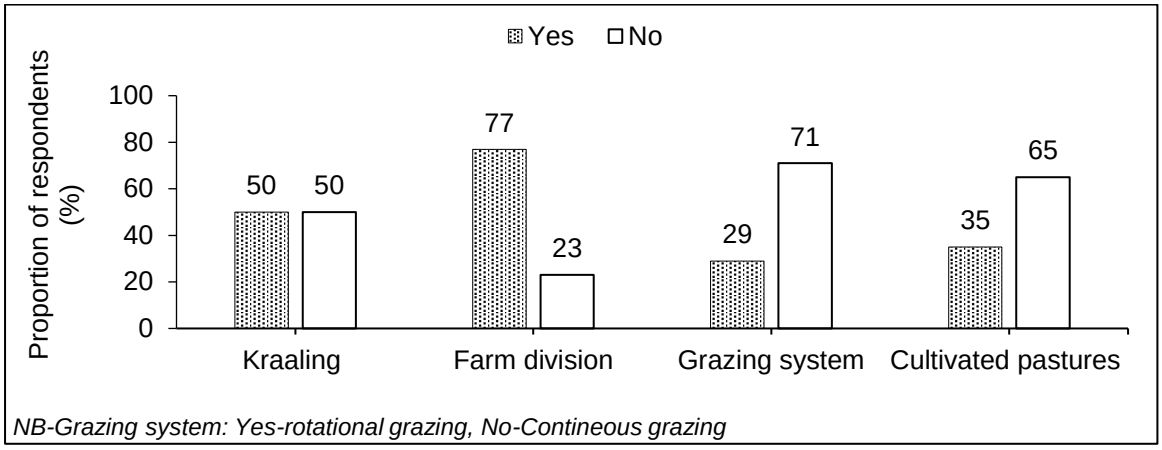

Figure 5.10: *Cattle kraaling, veld division and grazing system.*

5.3.6.2. Cattle kraaling

Figure 5.10 shows the farmers that were kraaling and those that were not kraaling their cattle at night. Half (50%) of the farmers were not while the other half was kraaling. Nthakheni (1993) highlighted that farmers are kraaling their cattle at night because they are afraid of theft, road accidents, they prevent crop damage, minimalize disease and parasite control. The average time spent looking after cattle while grazing is seven hours per day with extremes of 12 hours. However, day grazing and night kraaling are mostly practised in communal areas (Kunene & Fossey, 2006). On the other hand, cattle add some organic matter back to the field in the form of faeces (manure). Sibanda *et al.* (2017) reported that there is a rangeland practice that improves grass production which was invented by Eastern and Southern Africa. The practice involves the use of temporal kraals that are built in rangelands where cattle are temporary kept overnight for an abbreviated period for instance one week. These authors assessed this practice and concluded that it improves grass quality and biomass.

5.3.6.3. Veld division (Camps)

Figure 5.10 portrays that 46 (76.66%) from the assessed respondents had camps on their farms while 14 (23.33%) were not having camps on their farms. On farms where there was no or poor fencing, uncontrolled breeding, spread of diseases and undesirable bull to cow ratio becomes a challenge (Sekwadi *et al.,* 2016). Sholto-Douglas *et al.* (2015) highlighted that if fencing can be installed properly on the farming environment, stock theft and uncontrolled breeding can be decreased. Results from

the study shows that in those farms that are not having camps; controlled breeding cannot be easy as they cannot manage their fields and grazing. Camps (fencing) in a farming environment help in reducing labour expenses and in controlling grazing, breeding, diseases, parasites, trespassing, theft and predation but due to vandalism, theft and the absence of local by-laws and if available, poor mechanisms of enforcing these by-laws its impact undermined (Moyo *et al.*, 2008).

5.3.6.4. Grazing system

The grazing system that was used by respondents is shown on the results (figure 5.10), 71% (n=43) farmers were performing rotational grazing. This grazing improves the veld production because it allows some parts of the veld to be rested for the regrowth. It involves the division grazing land into camps whereby some of the camps are grazed and rested for a specific time depending on the regrowth rate (Tainton, 1999). This system prevents soil erosion through maintaining acceptable vegetation cover. Since it requires high work load and a lot of fencing these make it to need more finances (Tainton, 1999).

Foster (2015) listed continuous grazing as one of the harmful rangeland management practices with overgrazing for lengthy periods, too long grazing periods, repeated grazing during the same time of the year, animal breeds that are not adapted to the veld type and the long-term and injudicious provision of licks and supplementary feeding. Grazing and resting (rotational grazing) are predicted to increase grass production during the year of grazing, and prevent grassland growing out and losing quality (facilitation of grazing) (Fynn, 2012).

5.3.6.5. Cultivated pastures

Figure 5.10 show that only 35% of respondents had cultivated pastures in their farms while 65% did not have. The reason for this might be due to the high establishment cost of cultivated pastures. Those who agreed that they have cultivated pastures during drought all animals they supplement by these cultivated pastures while bulls are fed throughout the year irrespective of season. Veiga *et al.* (1996) found that when

cultivated pastures are limited herd productivity becomes low regardless of the potential of the breed.

Siegmund-Schultze *et al.* (2007) pointed out that for the establishment and maintenance of pastures labour demands high on the other hand all the established areas on the becomes easily accessed because all the obstacles such as intense bush are cleared and improved security. The establishment of irrigation on a farm increases the value of the farm on the other side, the farmer gets an opportunity to lease pastures to other farmers (Siegmund-Schultze *et al.,* 2007).

5.3.6.6. Moribund and bush encroachment management

5.3.6.6.1. Moribund

More than the half of the respondents (n=44, 74%) of the study is not taking any means of control since some were arguing that they never faced such a challenge, while other (n-14, 24%) were using burning as a tool to this encounter while three-percent named unplanned fires as the source of relief to this challenge (Table 5.3). There are many reasons why veld burning is done, according to Mahlobo (2016) fires are used to remove dry and dead plant materials; for initiating new lushes of grass; eradicating ticks; tsetse flies and other insects or pests harmful to livestock; and for harvesting forest honey. However, veld burning has destroyed plant residues that would have helped for winter grazing and enhanced the degradation of the land in South Africa. This author further found that plants and soil are not the only ones that are threatened by fires as in 2014 he found that six people, 700 sheep and cows were killed in veld fires and the estimated cost for livestock losses was approximately R3 million in the KwaZulu Natal province (Mahlobo, 2016).

5.3.6.6.2. Bush encroachment management

According to the results collected for the current study (table 5.3), many respondents (n-18, 32%) were not doing anything about this problem. There was a proportion of respondents that was not doing any control measures even though they were coming across this dilemma bush encroachment, 18% were using mechanical removal and only two farmers were applying chemicals aerial. Dalle *et al.* (2006) stated that the utilization of fire and strengthening of traditional rangeland management strategies

were recommended, because where the use of fire is prohibition, that becomes major factor that cause encroachment of woody plants (Dalle *et al.,* 2006). Kassahuna (2008) discovered that this encounter can be caused by shortage of rainfall, notably wet cycles; heavy grazing; absence of hot brush killed fires; loss of large trees and soil nutrient changes. However, it has been stated some of woody plants add value of browsing livestock to rangeland (Solomon *et al.,* 2007).

Table 5.3: *Measures to control bush encroachment and moribund.*

Control methods	**Proportion of respondents (Frequency & percentage)**	
	Bush encroachment	Moribund
No action	18 (32%)	44 (74%)
Allow surrounding households to take trees	2 (4%)	-
Spraying (Chemical)	1 (2%)	-
Mechanically remove	10 (18%)	-
Spraying and mechanically remove	3 (5%)	-
Hire aerial spraying	2 (4%)	-
Burning	3 (5%)	14 (24%)
No encroachment of undesirable plants	18 (32%)	-
Unplanned fires sometimes	-	2 (3%)

5.3.7. Livestock breeding management

Figure 5.11 shows farmers that were observing cattle when they give birth, do pregnancy test and fertility testing in breeding herds, farmers that had seasonal breeding and those that breed their own bulls and they were 78%, 15%, 12%, 47% and 62% respectively. Matiko *et al.* (2008) stated that smallholders are not practising the PD in their herds since there is a scarcity of veterinarians and these farmers doesn't know the PD importance in cattle farming.

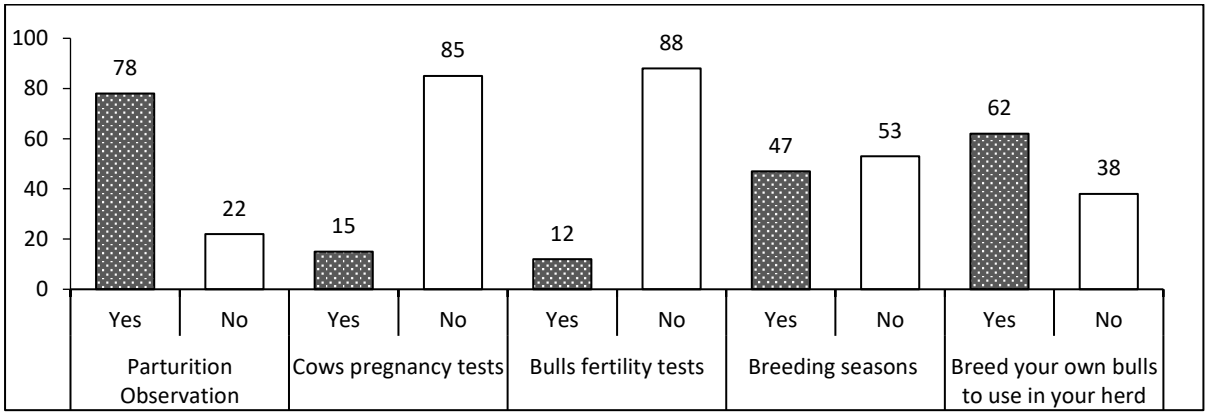

Figure 5.11: *Cattle breeding enhancement practises.*

Table 5.4 shows the total number of cows and heifers that were bred during the season of the year 2015 and their performance. In total assessed farms had 2861 breeding animals and 74% (n-1915) of them were cows than 26% (n-798) were heifers. From the total number of cows that was bred (n-1915), 1674 calves (87%) were produced and 1550 (81%) of them were weaned. In heifers, 946 animals were bred, 884 (93%) conceived however 798 (84%) calves were weaned.

The findings indicated in table 5.4 are somewhat inflated in comparison with the results of other studies. For example, in Tanzania, Matiko *et al.* (2008) observed a pregnancy rate of 44% which is low as compared to our findings and he further stated that commercial farmers should have pregnancy rates of minimum 70%. Therefore, these results are questioned.

Table 5.4: *The total and percentage of bred cows and heifers from mating till the weaning.*

Breeding cattle	**Number of cattle and percentage (in brackets)**			
	Bred	**Conception rate**	**Calving rate**	**Calves weaned**
Cows	1915 (100%)	1763 (92)	1674 (87%)	1550 (81%)
Heifers	946 (100%)	884 (93%)	850 (90%)	798 (84%)
Total	2861 (100%)	2647 (93%)	2524 (88%)	2348 (82%)

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CHAPTER SIX

The role of cattle farming in the social and economic lives of people in rural areas with reference to the efficiency in smallholder farms

6.1. Introduction

In this chapter, the focus is on roles that are played by smallholder cattle farmers in the social and economic lives of people around these ranches as well as the efficiency of the assessed farms.

6.2. Cattle farming economics, contribution, production inputs and outputs

6.2.1. Source of employment

In this study, 83% of respondents were employing people on their farms while 17% were not employing any people at all. Maybe for those respondents that were not hiring, it was because they could not afford to pay labour salaries or workers that were needed as they were getting help from their family members. In the case of cooperatives, all the members take part when there is job to be done. These results clearly show that smallholder farms take part in the process of unemployment reduction (figure 6.1(a)). As Swanepoel *et al.* (2010) documented that livestock play a vital role in providing food to urban and rural consumers. In developing countries where there are still poor citizens, livestock becomes a source of income, employment and traction.

The assessed farms employed 157 people, of which 80% were employed permanently, while 20% were temporally employed (figure 6.1(b)). Workers origination was assessed and the results show that a substantial portion of farm employed workers were from the surrounding areas (73%), there were some whom were hired from the Free State and Lesotho (17%) and some were originating within the province, but from other towns (figure 6.1(c)). In terms of monthly salaries workers were not getting the same amounts of salaries ranging from R500.00 to R3500.00 per month,

most (n=22) of the farm workers were getting salaries that range from R1000.00-1500.00, (figure 6.1(d)).

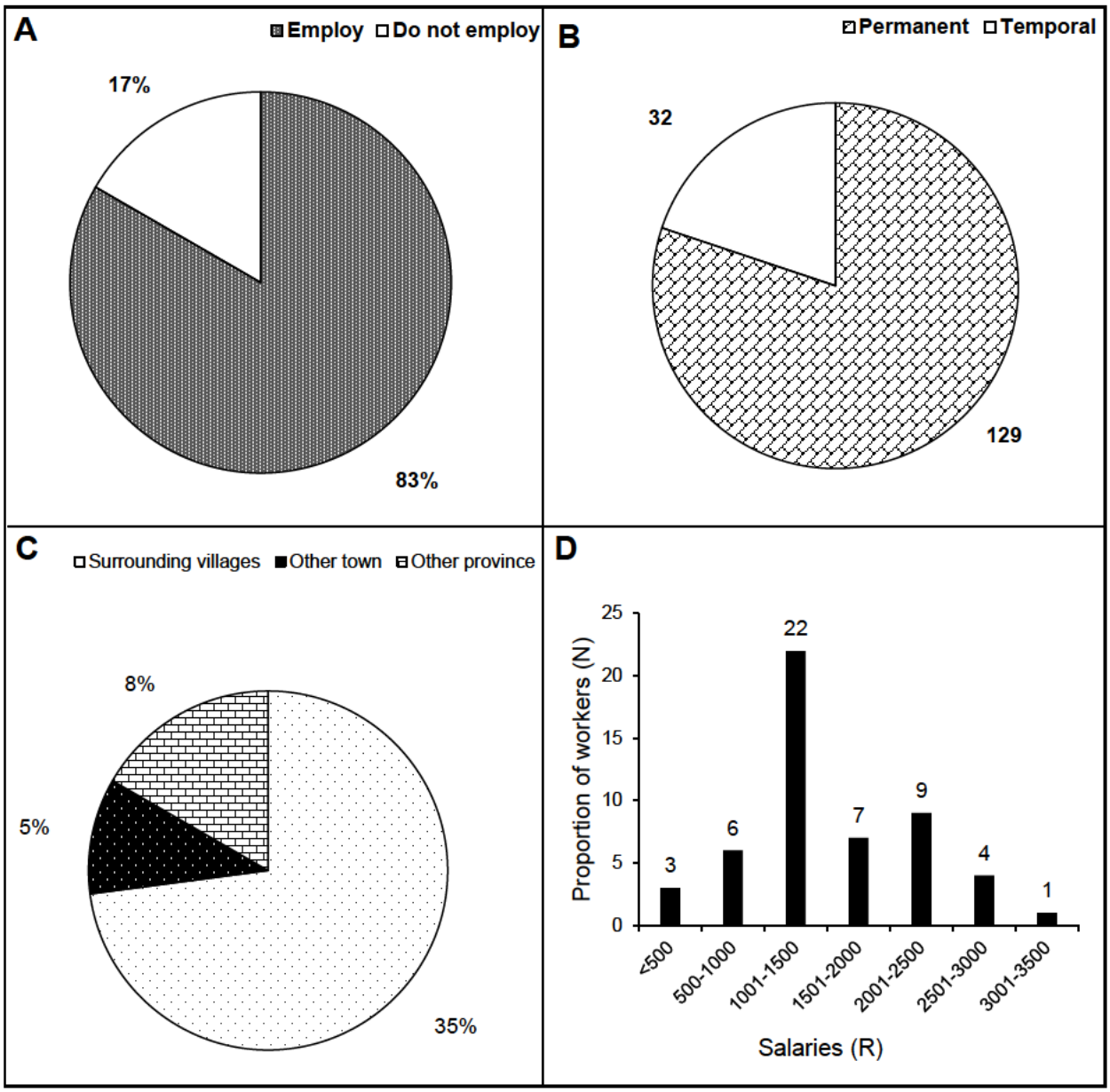

Figure 6.1: *(A)Contribution of cattle farmers in unemployment reduction (Respondents that are employing in their farms, (B) type of employment for farm workers, (C) employee's origination and (D) their monthly salary.*

6.2.2. Marketing channel

The marketing channel that was used by most farmers in the study area were private buyers (53%), auctions (30%) and speculators (20%) whilst the least used were butcheries (5%) and feedlot (5%) (figure 6.2). Musemwa *et al.* (2007) documented that

the level of education influences the choice of marketing channel. When they were analysing the marketing channels of small-scale farmers of Kamastone in village Eastern Cape, they found that farmers who were not educated were using abattoirs in other words there were no educated farmers that were using private sales. These authors also found that experienced farmers use private sales, speculators, abattoirs and both auctions and private sales.

Some animal sales are caused by pasture shortage, the need to replace a bull, or to remove a savage animal, but these were the secondary considerations (Siegmund-Schultze, *et al.,* 2007). NDA (2005) stated that due to the slow speed of payments, high chances of animals to get condemned because of their health issues and many charges involved when selling in abattoir makes abattoir to be the least used marketing channel.

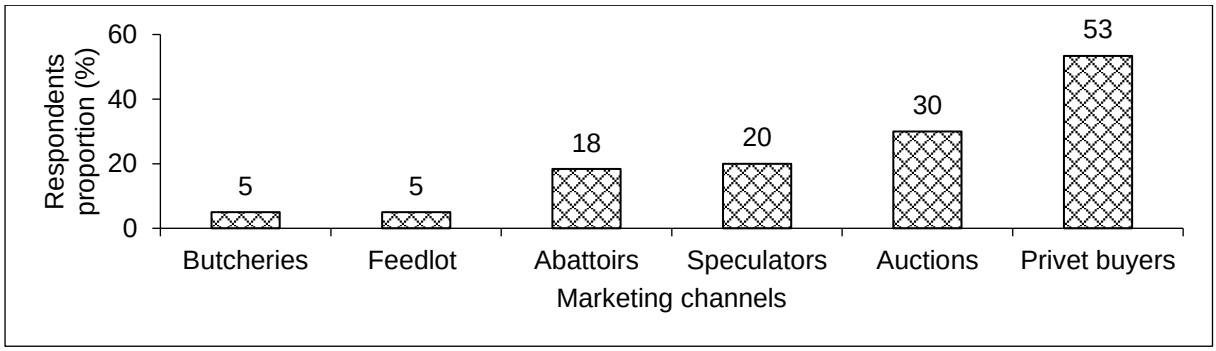

Figure 6.2: *Cattle marketing channels.*

6.2.3. Distance to marketing places

Almost all the marking places were at distance from the where respondent are situated, however this is not applicable to private buyers as they fetch animals direct from the farms at their own cost (table 6.1) even the average distance for them was 3.53 kilometres (km). According to the table 6.1, abattoirs were the least used marketing channel and they are far from farms. Nkhori (2004) highlighted that, as a farmer is far from markets the higher the transport costs become. When purchasing or selling cattle, it requires transporting or selling permits incurring additional cost when obtaining these permits from the local police station and veterinary offices (NDA, 2005). All these, limit farmers from part taking in distance marketing places. Ndoro (2015) stated that there is experiential evidence that suggested that farmers who are

situated within shorter distances to markets have a higher probability of participating in livestock markets while the ones based at a distance are hardly taking part in marketing.

Table 6.1: *Average distance from respondents farms to marketing places.*

Market place	Distance (km)	
	Mean ± SD	**Total**
Auctions	16.44±12.25	296
Speculators	5.67±15.98	68
Butcheries	39.33±22.28	118
Private buyers	3.53±11.74	113
Abattoirs	32.00±21.65	352
Feedlot	31.67±10.41	95

6.2.4. Farmers' Productivity

6.2.4.1. Farm incomes

In the current study, there were respondents (15%) that were not selling their livestock while most of them did (85%). Delgado (1999) discovered that small scale farmers have other sources of cash farming income. He also discovered that in smallholders, production is more diversified over insignificant amounts of production of 15 or more crops, on the other side poverty is seemed to be increasing and farmers are becoming more resource poor.

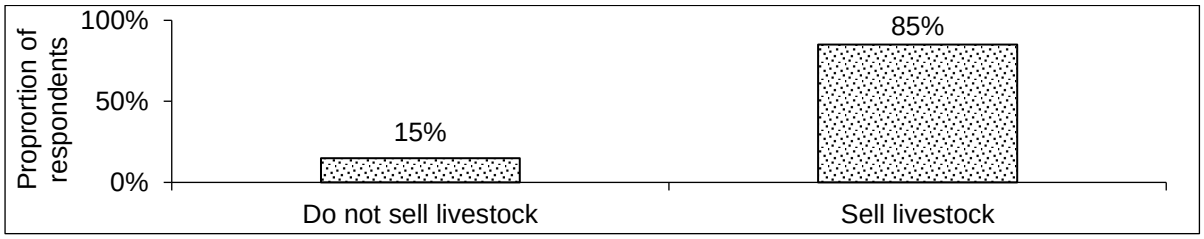

Figure 6.3: *Cattle marketing.*

From Table 6.2, it is evident that cattle production and sales contributed 43% to the annual income of farmers while all other farm sales summed up to 27.6%. There is evidence that most of the respondents in both districts were involved in other activities to support them financially however, much of the income and livelihood of the

respondents came from cattle sales. The table also displays that farmers were not only depended on cattle farming; there were incomes that were generated from non-agricultural activities such as liquor, pension, personal savings and taxi business.

According to Nagayets (2005) the income of smallholder farms is mostly received from the sale of surplus farm produce and topped up by nonfarm income. In the South African smallholders, it has been found that their farming income amount to approximately 40% while the remainder is derived from nonfarm income. Mmbengwa *et al.* (2015) mentioned that Eastern Cape was found as one of the provinces that had highest income generative capacity from livestock owned by developing farmers followed by the Northern Cape and Limpopo.

6.2.4.2. Farm expenses

Table 6.2 shows all the expenses of farmers incurred during the 2015 financial year. Fuel was the most costing item as it accounted to 28% of the total yearly expenses followed by farm workers' salaries (21.1%) and supplements (licks and feeds, 16.5%). As some of the farmers do not own the farms they were leasing and paying rent. As a result, 5.7% of the total expenses was incurred in paying the rent. Full income constraint according to Makhura (2002), states that the equivalent of total expenditure on all purchases (or equivalent) must not exceed revenues from all sales and transfers.

Table 6.2: *Statement of total income and expenses of the emerging cattle farmers in the study area for the year ended December 2015.*

Income		
Item	**Amount (R)**	**Percentage (%)**
Cattle sales	4 431 700.00	43
Other agricultural sales	2 815 500.00	27.6
Liquor industry	720 000.00	7
Personal savings	660 000.00	6.4
Government grant	630 000.00	6.1
Meat trading	480 000.00	4.7
Transport business	300 000.00	2.9
Sponsorship/donation	150 000.00	1.5
Farm structure sale	110 000.00	1.1
Pension	15 000.00	0.1
Total	**10 312 200.00**	**100**
Expenses		
Fuel	1 586 900.00	28.5
Labour hired	1 176 039.84	21.1
Licks and feeds	917 395.00	16.5
Medication	640 744.00	11.5
Repairs and maintenance	319 500.00	5.7
Rent or lease payments	263 380.00	4.7
Livestock purchased	180 200.00	3.2
Vet cost	160 300.00	2.9
Taxes (farm)	135 400.00	2.4
Hired transport	73 900.00	1.3
Ear tags	59 317.00	1.1
Tick treatment	30 980.00	0.6
Interest paid	22 450.00	0.4
Total	**5 566 505.84**	**100**
Profit	**4 745 694.16**	
Average Profit	**79 094.90**	

6.2.5. Contrasts between farm income and expenses

The average income for the respondents in Amathole was R196 953.30, while the average income from the respondents in Chris Hani was R151 536.70 (table 6.3). From our results, it can be argued that on average, cattle farmers in Amathole are making more money compared to the Chris Hani cattle farmers. However, on the expenditure side, Amothole farmers had higher expenditure of R128, 526 as compared to R63, 224.48 in Chris Hani. Adams (2002) explained the livestock income as the value of sales and exchange of livestock plus the value of sales, exchange and self-consumption of livestock products minus the expenditures related to livestock production such as feed, labour and veterinary services.

Table 6.3: *Total farming income and expenses of the assessed farmers.*

Districts	Income (Mean)	Expenses (Mean)
Amathole	R196 953.30	R128 526.00
Chris Hani	R151 536.70	R63 224.48
Total	R174 245.00	R95 875.25

6.2.6. Trend of the cattle sales in the assessed study area

Figure 6.4 shows that the pattern of the cattle farming was evaluated through enquiring the sales incurred in 2015 and the sales of the previous years (2012-2014). When the cattle sales from 2012-2014 is compared with those of 2015, cattle sales increased in 37% of the farms and declined in 20% of the farms. Cattle sales remained the same in 43% of the farms. Therefor these trends might be due the fact that South Africa has been affected by the declining farming profitability and water scarcity (drought, declining rainfall or over-demand for water), which subsequently led to the changing of land uses in many farms (Goldblatt, 2010). In emerging farms veld grazing is the main feed for livestock, therefore findings by Goldblatt (2010) reveals evidence that

overstocking is most found rangelands of Limpopo, KwaZulu-Natal and the Eastern Cape and this leads to reduced productivity, reduced soil fertility and erosion.

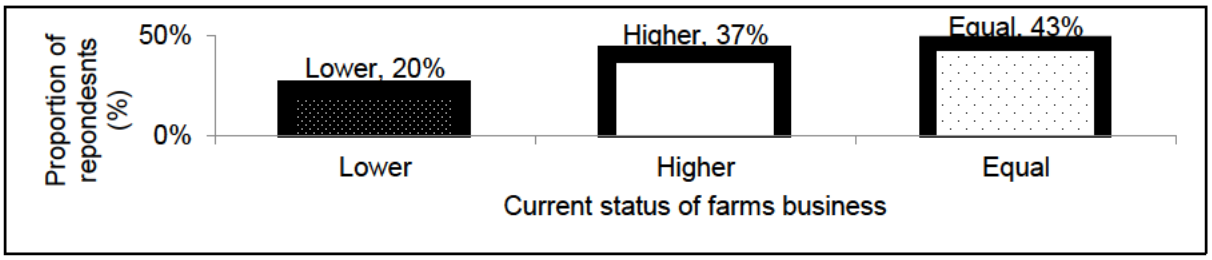

Figure 6.4: *The total of cattle sold in 2015 as compared to those of 2012-2014.*

6.2.7. Challenges faced by developing cattle farmers.

Table 6.4 shows challenges that were stated by the respondents of the study. Most farmers (80%) had a challenge of poor infrastructure followed by straying animals (40%) and stock theft (34%). Other stated challenges were poor condition of veld (23%); predation (20%), diseases and disease control (18%). In 2012, it was detailed in the Framework of Small Farmers (FSF, 2012) that South African smallholder farmers encounter many challenges that hinder their contribution to the food security relative to the commercial farmers. These challenges were listed as a lack of access to land; poor physical and institutional infrastructure; lack of access to proper roads which limit them in accessing information and transporting their inputs and produce. Unreliable markets for outputs and very poor infrastructure were also mentioned.

Table 6.4: *Identified challenges by emerging cattle farmers in Amathole and Chris Hani districts.*

Identified challenges	Proportion of respondents (%)
Poor infrastructure	80
Straying problems	40
Theft	34
Drought	30
Poor veld conditions	23
Predation	20
Diseases and disease control	18
Transport	13

6.2.8. Sources of farming advices

According to the results from the study many farmers agreed that they receive farming advices largely from the extension officers, DRDLR, agricultural magazines: 78%, 27% and 17% respectively. Ten percent was the portion of farms that was farming with ideas they got from their fellow farmers. According to Adetayo & Eunice (2013) cattle smallholder's ranches in developing countries are mainly dependent on public extension services for agricultural information. Since the potential of these farmers are still limited because it being plagued by low productivity even though the South African government is prioritizing the development of these farmers (Scholtz & Bester, 2010). Motiang & Webb (2015) studied sources of information for small-holder cattle farmers in Dr Ruth Segomotsi Mompati District Municipality in the North West Province and discovered that extension officers and animal health officers are the main source of information for small-holder cattle producers. This study shows that farmers rely on farmer's days (13%), indigenous knowledge (12%) and those farmers that were dependent on the peers (10%) for agricultural information.

Table 6.5: *Sources of farming advices.*

Identified sources of information	Proportion of respondents (%)
DAFF (Extension officers)	78
DRDLR	27
Agricultural magazines	17
Farmer's days	13
Famer's own or Indigenous knowledge	12
Fellow farmers	10

6.3. Efficiency of emerging farmers

6.3.1. The Model and Estimation

In the economic literature, the Cobb–Douglas production function was used to represent the relationship of output and two inputs, and to estimate the efficiency level of farmers. The empirical estimation of efficiency is normally done with the methodology of the Cobb-Douglas production function. The model has the advantage of allowing simultaneous estimation of the farmers as well as the determinants of technical efficiency (Battese & Coelli, 1992). The measures of technical efficiency provide an indication of the potential gains in output if inefficiencies in production were to be eliminated. Efficiency is an important economic concept and is very important in assessing a producer's (in this instance, emerging cattle farmers') performance.

The most general expression of the Cobb-Douglas production function is:

$$Y = AL^{\alpha}K^{\beta}.u$$

Where Y stands for output, L measures labour input and K measures capital input, A is the constant that represent the technology of the society that generated the observations upon which the parameters of the function were to be estimated. Parameter (A) is thought of as the combined impact of inputs that are considered to be fixed on the production function, α and β are the output elasticities of labour and capital, respectively. These values are constants determined by the available technology (Ezeh *et al.,* 2012).

For us to use Ordinary Least Squares procedure for estimating, the function is linearized using logarithm and gives the following regression specification in line with (Debertin, 2012):

$$Ln(Y) = \ln(a) + \ ln\beta_1 X_1 + \ ln\beta_2 X_2 + \cdots ln\beta_i X_i + u$$

Where: Output (Y) is the total number of cattle produced per season and it is measured in headcount. Farm size (X_1), Expenses (X_2)…
Therefore, the stochastic production frontier for cattle farmers is assumed to be of the Cobb-Douglas form:

$$\ln(y_i) = \ \alpha_0 + \sum_{j=i}^{12} \alpha_j \, . D\_Edu_{ji} + \beta_1 . \ln(Farmsize_i) + \ \beta_2 . \ln(Experience_i) + \beta_3 . \ln(Expenses_i) + \ \beta_4 \ln(Age_i) + \ \gamma_2 Transportation + \ \gamma_3 Exra\ Forage + \gamma_4 Farm\ Worker + \ \gamma_5\ Vaccination + \ \varepsilon \quad (1)$$

The error term is ε = v – u, where v is a symmetric component assumed to be distributed independently and identically as N(0,σ_v^2) that captures exogenous shocks, such as weather, supply shocks, and unobserved heterogeneity of households plus measurement error (Ezeh *et al.,* 2012). The term u is a non-negative random variable that is associated with the level of technical inefficiency of production. It is assumed to be distributed independently and identically as N (μ,σ_u^2) with truncation point at 0. Equation (1) represents a stochastic frontier production function (Aigner *et al.,* 1977).

6.3.2. Model Estimation and Discussion

More emphasis was directed to the elasticity of variables. Elasticity of production is known as the percentage change in output when that variable input is varied, in simple terms it measures the sensitivity of dependent variable to a change in independent variables (Debertin, 2012).

a) Farm Size

Table 6.6 results show farm size elasticity of 0.13; farm size was found to be positively significant at 1% level. This implies that farm size is sensitive towards the production of cattle. Smaller farms are worked more intensively, but not necessarily more profitably or efficiently and farm size, experience and technology adoption all explain

substantial differences in production efficiency and profitability (Thirtle *et al.,* 2003). The size of the farm is positively related to market participation because when farmers have more land their production will be higher (Makhura, 2002).

b) Farmer's Experience

The elasticity of farmer's experience was found to be 0.025; it was positively but not significant towards the production of cattle. The results show that farmers having more years of experience were more productive cattle farmers. More experienced farmers and those with larger farms are more likely to be granted credit (Thirtle *et al.,* 2003). Ndoro *et al.* (2014) highlighted that experience in farming enhance the ability of a farmer to understand the costs and benefits of technology, interpret, and modify extension information.

c) Expenses of production

The elasticity of expenses was 0.18; this indicates that smallholder cattle farmers in both Amathole and Chris Hani districts are under-utilizing funds on cattle farming. The expense was found to be positively significant at 5% level, implying that a 1% increase in the expenses of production will lead to 0.18% increase in cattle production. It has been revealed by Makhura (2002) that in order smallholders to generate enough income they engage themselves in non-farm activities to generate income. Since most of these farmers are situated in overcrowded, semi-arid areas in the former homelands as result they are not taking part in the mainstream agriculture. Therefore, these findings imply that more inputs may increase the production levels.

Table 6.6: *Stochastic Cobb-Douglas Production Frontier for Cattle Farmers.*

Variables	Coefficient of elasticities	Standard error
Ln Farm size (Ha)	0.1349	00531***
Ln Experience (Years)	0.0259	0.0887**
Ln Expenses (Rand)	0.1806	0.0845
Ln Age (Years)	0.4153	0.2752
ln ($\sigma^2 v$) constant	-2.7958	0.2051***
($\sigma^2 u$)		
Transportation	-0.0318	1.9991*
Extra Forage	2.5851	2.4225
Farm Worker	-3.4804	2.3659
Vaccination	-3.0196	1.8799
Constant	0-.9177	2.1127
Mean Technical Efficiency	0.71	
Log-likelihood	-2.6496	
Number of obs	60	
Chi2	15.17	
Prob > F	0.00	

***significant at 1%, **significant at 5%, * significant at 10%

6.3.3. Logistic Regression

The logistic regression analysis provides the analytical information on socio-economic factors affecting the technical and allocative efficiency of smallholder cattle farmers in Amathole and Chris Hani districts. The model was chosen because its dependent variable is binary and can only take two values, it allows one to estimate the probability of a certain event occurring (Freedman, 2009). The principal assumption on which the likelihood ratio is based, states that there are socio-economic factors affecting the efficiency of smallholder cattle farmers in Amathole and Chris Hani Districts.

The operational logit model can be written as follows:

$$Logit(p) = \ln(p/1-p) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + u$$

Where the ratio p/1-p is the odds ratio, Pi = probability that a farmer is productive, 1-Pi = probability that a farmer is not productive, Xi = various independent variables, βi = estimated parameters, and Ui = disturbance term.

Table 6.7 gives the description of the variables used in the Logistics regression and the results of the logistic regression are presented in Table 6.7. The results indicate

the chi-square value of 21.57. The estimation of the socio-economic factors affecting the efficiency resulted in the R^2 value of 0.60. The statistical model was therefore unable to explain 40% of the relationship between output and input.

Table 6.7: *Definition of variables.*

Variables	Description of variables	Units
Income	Income from farm	Rand
Age	Farmer's age	Years
Experience	Farmer's experience	Years
Farm size	Farm size	Hectares
Gender	1,if a farmer is a male, 0,otherwise	Dummy
Diversification	1,if a farmer diversify, 0,otherwise	Dummy
Extra Forage	1,if a farmer has extra forage, 0,otherwise	Dummy
Cowlick	1,if a farmer provide lick, 0,otherwise	Dummy
Farm Record	1,if a farmer keep farm record, 0,otherwise	Dummy
Farm Worker	1,if a farmer use farm worker, 0,otherwise	Dummy
Vaccination	1,if a farmer vaccinate, 0,otherwise	Dummy
Identification	1,if farmer use identification, 0,otherwise	Dummy

6.3.4. Logistic regression analysis

a) Gender of the farmer

The results in Table 6.8 show that gender of the farmer was negatively significant towards the efficiency of cattle farmers in Amathole and Chris Hani districts. The significant level was found to be 5%. The coefficient of gender was found to be -4.07 implying that 1% increase in the number of female farmers will lead to a -4.07 decrease in efficiency. However, it has been also stated by Andrew *et al.* (2003) that cattle ownership and management in the smallholder areas is dominated by men as women are confined to producing livestock species close to the homesteads (chickens and pigs). Bank & Qambata (1999) observed that female smallholders are more susceptible to challenges like feed shortages and livestock problems, lack of capital and access to institutional credit, poor technical skills and lack of access to extension services. These factors limit the participation and efficiency of women in cattle production.

b) Farming Experience

The results in table 6.8 show that experience in farming is positively significant towards the efficiency of the farmer; the significant level was found to be 5%. It is expected that the more experience the farmer is the better the chance is that such a farmer will have a good performance. Experience in farming was found to be 0.24 implying that an increase in experience by 1%, efficiency in farming will rise by 0.24%. Marandure (2015) assessed the sustainability of smallholders, where he considered their enquired farming experience. He found evidence that farming experience plays a role in farming as farmers with more experience had larger herds as compared to those with less experience and they also realised higher income from cattle sales.

Table 6.8: *Logistic regression analysis.*

Variables	Co-efficient	Standard Error	Significance
Income	1.5564	1.2574	0.216
Age	-0.0026	0.0339	0.937
Experience	0.2437**	0.1004	0.015
Farm size	0.0045***	0.0017	0.010
Gender	-4.0771**	1.8384	0.027
Diversification	-1.0857	1.3217	0.411
Extra Forage	0.2109	1.1524	0.855
Cowlick	-0.8078	1.1814	0.494
Farm Record	0.0207	0.7814	0.979
Farm Worker	4.8738***	1.6142	0.003
Vaccination	7.7351***	2.5948	0.003
Identification	-4.3986***	1.6725	0.009
Constant	-12.2002	7.1684	
-2 log Likelihood	16.49		
Chi-Square	21.57		
Pseudo R square	0.60		

**Significant at 5%, ***Significant at 1%.

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CHAPTER SEVEN

Conclusions and Recommendations

7.1. Conclusions

Cattle emerging sectors in the study is dominated by old male people that farm with many different breeds where crossbreeds, Bonsmara and Brahman being the dominating breed. In general, these famers have low levels of education. Farmers perform most management activities in their herds. With regards to animal health (diseases (88.3%), internal (82%) and external parasites (100%)) and nutrition (feed prioritization and supplementation) some farmers do take part in managing those. Kraaling, farm division, grazing system and pasture cultivation were performed as part of veld management. On average, cattle farmers had no challenge with regards to reproduction as conception and calving rates were high.

Emerging cattle farming systems is contributing towards the reduction of unemployment and the socio-economic position of communities. They use a variety of channels for marketing their produce where private buyers are being the most used channel. Distance to some of the markets is factor causing some of the farmers not marketing their stock. These cattle farmers also have other means of incomes other than from selling livestock. In their expenditures they spend a lot of money on fuel, farm workers and supplements (licks and feed). The number of cattle sold cattle amongst farmers had different patterns as there were farms who had higher (37%), equal (43%) and lower (20%) than the sales made in previous three years. However, there are challenges that were stated and discovered in in the current study. Most farmers were encountering poor infrastructures, stock theft and effect of drought. On the other hand, farmers mostly obtain farming information from DAFF, DRDLR, Agricultural magazines and farmer's days.

7.2. Recommendations

There should be a strategic plan to involve youth and educated people in cattle farming. There are improvements that need to be done in the emerging farms such as infrastructure (fencing, buildings and livestock handling facilities). Fencing helps in the enhancement of cattle management practises on farms. Concurrently that will help

them to enforce controlled and seasonal mating, proper management of the veld and provision of supplementation to cattle in need, especially in winter. Farmers should be encouraged to find means of dealing with health and nutrition problems in their herds. This should be done through engaging them in agricultural workshops or trainings specifically the ones related to animal health and nutrition. With regards to marketing, farmers should be encouraged to use the most profitable market channels. These farmers should focus on market requirements in terms of the weight, age, breed and condition of calves. Smallholders should be encouraged to build or have good relationship with their neighbouring farmers so that they can be able to combine their produce with other farms when marketing and sell in bulk as that can aid in getting better prices.

As part of supplementation, veld hey and crop residues can help in keeping the condition of the livestock, especial the breeding herd. When feed surplus is experienced feed conservation should be encouraged. To minimize the effect of drought they should be encouraged to have cultivated pastures on their farms. Farmers need training on record keeping as it is a neglected aspect in many developing smallholders. This can be done in collaboration with Agricultural Extension and the academia. The visibility of the farmer within the farm is important as it reduces the chances of vandalism and theft on the farm. The need for alternative production finances should be addressed since a radical increase in the cost of agricultural inputs occurred over the past years.

In emerging farmers of South Africa, it has been realised that they are struggling on finding financing since they do not have collateral in the form of agricultural land. Nevertheless, there are many institutions offering finance which include: Land Bank, Micro Agricultural Financial Institutions of South Africa (Mafisa), the Industrial Development Corporation (IDC), the National Empowerment Fund (NEF), and commercial banks (Coleman, 2016). Since these farmers does not perform the reproduction observations they need to be encouraged to search for the services of local veterinarians to check for diseases, pregnancy diagnoses, bull fertility and other technical aspects in animal management.

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Appendix i: *Questionnaire*

QUESTIONNAIRE FOR THE DATA COLLECTION OF RESEARCH PROJECT FOR THE COMPLETION OF MASTERS OF AGRICULTURAL MANAGEMENT

QUESTIONNAIRE NUMBER ☐

Dear Farmer,

I, Aphiwe Katikati, a Central University of Technology student, undertaking a research project to do an assessment of production practices of emerging cattle farmers in the selected districts of Eastern Cape Province, South Africa. To this end, I kindly request that you complete the following questionnaire regarding cattle farming in your place. It should take no longer than 30 minutes of your time. Your response is of the utmost importance to me, it will remain anonymous. Should you have any queries or comments regarding this survey, you are welcome to contact me telephonically at 073 002 6449 or email me at aphiwebhunganezityebi@gmail.com

NB: Please read the following instructions carefully in order to complete this questionnaire correctly;

a) To protect the farm's confidentiality, the farmer needs not to mention the name of his/her farm or of the organization where she/he manages the farm.
b) The farmers or the farm managers should provide accurate information as far as possible.
c) Mark with "X" where you have to choose and give reasons where applicable.

1. BIOGRAPHIC DETAILS	**Office use only**	
		1.
1.1 Date of the data collection: ……/……../……		
1.2. Name: ***Age:*** ☐ ***Gender***: ☐		2.
1.3 Farm name:		3.
1.4 (a) District of the farm:		4.
(b) Town of the farm:		5.
(c) Local Municipality		6.
1.5 On whose land are you farming? ***Lease*** ☐ ***Own*** ☐ ***Communal*** ☐		7.
1.6 What is your highest educational qualification obtained?		8.
1.7 Do you have any other commitment that interferes with farming? ***Yes*** ☐ ***No*** ☐		9.
1.8 If yes to question 1.7, please state		10.
1.9 Who is running the farm? ***Myself*** ☐ ***Family member*** ☐ ***Farm workers*** ☐		11.
Other ……		12.
1.10 Are you registered with any farming organization? ***Yes*** ☐ ***No*** ☐		13.
1.11 If yes to question 1.10, what are you gaining from it?		14.
1.12 If no to question 1.10, state the reason(s)		15.
1.13 How long have you been farming (years)?		16.
1.14 Is there anything that you are farming with except cattle? ***Yes*** ☐ ***No*** ☐		17.
1.15 If yes to question 1.17, please mention?		18.
1.16 What are the two most important sources of information you are using in your cattle farming? *(Mark the most important source with 1 and the second most important source with 2)*		19.
Study groups ☐ ***Agents connected to a co-op*** ☐ ***Farmer's days*** ☐		20.
Fellow farmers ☐ ***Agricultural magazines*** ☐ ***Extension officer*** ☐		21.

Internet ☐ ***DAFF*** ☐ ***Other (specify):*** 22.

..... 23.

1.17 What do you see as the three most important problems which affect the efficiency of your cattle enterprise? (Mark the most important problem 1, the second most important 2 and the third most important 3. (Maximum three)

Predation ☐ ***Straying problems*** ☐ ***Poor veld conditions*** ☐ 24.

Labour ☐ ***Animal Diseases*** ☐ ☐ 25.

Calving problems

Drought ☐ ***Theft*** ☐ ***Other, please specify*** 26.

1.18 Do you have a bakkie? ***Yes*** ☐ ***No*** ☐ 27.

2. Land Particulars

2.1 What are the soil types in your farm? ***Clay*** ☐ ***Sandy*** ☐ ***Loam*** ☐ ***Sandy loam*** ☐ 28.

2.3 Which vegetation type(s) are on your farm? 29.

Shrubs ☐ ***Grass*** ☐ ***Mixed shrubs and grasses*** ☐ 30.

2.5 What is the size of your farmland? 31.

2.6 Where do you obtain water? ***River*** ☐ ***Natural dam*** ☐ ***Borehole*** ☐ ***Buy*** ☐ 32.

2.8. Do the water source(s) supply sufficient water throughout the year? ***Yes*** ☐ ***No*** ☐ 33.

3. Herd Particulars

3.1 What cattle farming system are you practicing? 34.

Extensive beef farming ☐ ***Semi Intensive beef farming*** ☐ 35.

3.2 How many cattle do you have in your farm according to the following categories 36.

Breed	***Bulls***	***Steers***	***Heifers***	***Cows***	***Calve***	37.
						38.
						39.
TOTAL						40.

Total number of the herd 41.

4. Animal Health

4.1 Animal Vaccination

4.1.1 Do you vaccinate your cattle against diseases? ***Yes*** ☐ ***No*** ☐ 42.

4.1.2 If no to question 4.1.1, please indicate the reason(s): 43.

4.1.3 Which diseases are you vaccinating for? 44.

Anaplasmosis ☐ ***Anthrax*** ☐ ***Three-day-stiffness*** ☐ 45.

Brucellosis ☐ ***Botulism*** ☐ ***Three-day-stiffness (b)*** ☐ 46.

Lumpy Skin ☐ ***BVD, IBR*** ☐ ***Trichomonas*** ☐ 47.

Vibriosis ☐ ***Black Quarter*** ☐ ***Pasteurella*** ☐ 48.

4.2 Parasitic Control 49.

4.2.1 Do you control external parasites? ***Yes*** ☐ ***No*** ☐ 50.

4.2.2 If yes to question 4.2.1, what are you using to control the parasites 51.

Plunge dips ☐ ***Injectable parasiticides*** ☐ ***Pour on*** ☐ *52.*

Hand spraying ☐ ***Spray race*** ☐ ***Spot treatment*** ☐ *53.*

Other *54.*

4.2.3 If yes to question 4.2.1, indicate on which of the following animals: 55.

Suckling calves		***Pregnant heifers***		***Dry cows***					56.
Weaners		***Pregnant cows***		***Animals to be slaughtered***					57.
All the animals		***Heifers***		***Cows with calves***					58.
Steers		***Bulls***							59.
4.5.4 If no to question 4.2.1, indicate the reason(s) why not									60.
4.5.5 Do you control internal parasites?		***Yes***		***No***					61.
4.5.6 If yes to question 4.5.5, indicate in which of the following animals:									62.
Suckling calves		***Pregnant heifers***		***Dry cows***					63.
Weaners		***Pregnant cows***		***Animals to be slaughtered***					64.
All the animals		***Heifers***		***Cows with calves***					65.
Steers		***Bulls***		***Cattle in poor condition***					66.
4.5.7 If no to question 4.5.5, indicate the reason(s)									67.

5. ANIMAL NUTRITION

5.1 Do you experience grazing shortages?		***Yes***		***No***					68.
5.2 If yes to question 5.1, how do you priorities feeding during feed shortages?									69.
5.3 Do you conserve extra forage?		***Yes***		***No***					70.
5.4 If yes to question 5.3, how do you conserve it?		***Silage***		***Hay***		***Both***			71.
5.5 Do you give your cows supplements?		***Yes***		***No***					72.
5.6 If no to question 5.6, indicate the reason(s)									73.
5.7 Do you group your cattle into batches when you giving them supplements?	***Yes***		***No***						74.
5.8 In which season are you giving them licks?	***Winter***		***Summer***		***Both***				75.

6. CATTLE GENERAL MANAGEMENT

6.1 Which activities do you normally perform indicate season

	Summer	***Autumn***	***Winter***	***Spring***	***Throughout***		
Castration							76. 77.
Dehorning							78.
Deworming							79.
Ear tagging							80.
Branding							81.
Treating sick animals							82.
Sorting and weighing of calves							83.
Supplementation of Vitamins							84.
Vaccinating							85.

6.2 Do you keep animals that are in the same production stage separately?	***Yes***		***No***						86.
6.3 What do you do with a cow that did not calf?									87.
Keep		***Sell***		***Slaughter***		***Other***			88.
6.4 Do you observe cows and heifers giving birth?		***Yes***		***No***					89.
6.5 Do you do identification on your animals?		***Yes***		***No***					90.
6.6 If yes in question 6.5, which method(s) are you using?									91.
Hot iron branding		***Freeze branding***		***Electronic markers***					92.
Ear notching		***Ear tags***		***Tattoo***					93.

7. BREEDING MANAGEMENT

7.1 Do you have pregnancy tests done on your cows? ***Yes*** ☐ ***No*** ☐ 94.

7.2 If no to question 7.1, indicate the reason(s) 95.

7.3 Do you do fertility tests to your bulls prior to the breeding season? ***Yes*** ☐ ***No*** ☐ 96.

7.4 If no to question 7.3, indicate the reason(s) 97.

7.5 Do you perform sheath wash on bulls to test venereal diseases? ***Yes*** ☐ ***No*** ☐ 98.

7.6 If no to question 7.5, indicate the reason(s) 99.

7.7 Do you have a set breeding season? ***Yes*** ☐ ***No*** ☐ 100.

7.8 If no to question 7.7, indicate the reason(s) 101.

7.9 If yes to question 7.7, how many breeding seasons do you have? 102.

7.10 If you have a set breeding season, when does the main breeding season starts and ends 103.

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	
													104.
Starts													105.
Ends													106.

7.11 Do you breed your heifers according to? ***Age*** ☐ ***Weight*** ☐ ***Both*** ☐ 107.

7.12 If you breed your heifers according to their weight, indicate the weight (kg) 108.

7.13 If you breed your heifers according to age, indicate the age (months) 109.

7.14 On the previous breeding season, did you have heifers that were breeding for their first time? ***Yes*** ☐ ***No*** ☐ 110.

7.15 Please state the total cattle that were bred, conceived, given birth and the total number of weaned calves on the previous year *(fill on the table below)* 111.

	Breeding Animals			
	Bred	***Conceived***	***Given birth***	***Weaned calves***
Heifers				
Cows				

112. 113. 114. 115.

7.16 Did you ever face a problem of abortion in your farm? ***Yes*** ☐ ***No*** ☐ 116.

7.17 If yes to question 7.16, how many animals were affected? ***Cows*** ☐ ***Heifers*** ☐ 117.

8. WEANING IMPLICATION

8.1 Do you wean calves? ***Yes*** ☐ ***No*** ☐ 118.

8.2 If no to question 8.1, mention reason(s) 119.

8.3 Do you wean your calves according to? **Weight (kg)** ☐ **Age** ☐ 120.

8.4 At what age do you wean calves (months)? 121.

8.5 In what weight do you wean your calves? (Kg) 122.

8.6 Do you sell all your cull calves at weaning? ***Yes*** ☐ ***No*** ☐ 123.

9. REPLACEMENT OF ANIMALS

9.1 Do you buy animals from other people/farms? ***Yes*** ☐ ***No*** ☐ 124.

9.2 If yes to question 9.1, which type of animals are you buying and at what price are you buying them at? 125.

	Choose	***Price/head (R)***
Weaner calf		
Old cows		

126. 127. 128.

Bulls				129.
Steers				130.

9.3 If no to question 9.1, please state the reason(s) 131.

9.4 If no to question 9.1, are you planning to introduce any animals from other herds? 132.

No ☐ ***Yes*** ☐ ***Not sure*** ☐ 133.

9.5 If no/yes to question 9.4, please state the reason(s) 134.

9.6 How many breeding animals have you bought last year? 135.

Type of animal	Weaner calf	Old cows	Bulls	Steers	Total of sold animals		
Total							137.

10. FARM STRUCTURES

10.1 Which farm structures are available? if they are available how is their condition? 138.

Structures	**Condition**						
	Very poor	**Poor**	**Moderate**	**Good**	**Very good**		140.
Fences							141.
Roads							142.
Farm house							143.
Handling facility							144.
Storages							145.
Loading facility							146.
Dip							147.
Other:							148.
							149.
							150.

11. RECORD KEEPING AND ECONOMICS

11.1 Farm Records 151.

11.1.1 Do you keep records in your farm? ***Yes*** ☐ ***No*** ☐ 152.

11.1.2 What are your challenges with regard to record keeping? 153.

11.2 Marketing

11.2.1 Do you sell your cattle? ***Yes*** ☐ ***No*** ☐ 154.

11.2.2 If yes to question 11.2.1, where are you selling them? 155.

Auctions ☐ ***Speculators/agents*** ☐ ***Butcheries*** ☐ ***Private buyers*** ☐ ***Abattoirs*** ☐ 156.

11.2.3 What is the distance to your market? 157.

	Auctions	Speculators/agents	Butcheries	Private buyers	Abattoirs		
						158.	
km						159.	

11.2.4 How many cattle did you sell in the previous year and at what price? 160.

Type of animal	**Weaner calf**	**Old cows**	**Bulls**	**Steers**	**Total**	
Quantity						162.
Price per head						163.

11.2.5 How was the total of cattle sold in previous year as compared to the one of past three years? ***Low*** ☐ ***High*** ☐ ***Equal*** ☐ 164.

11.2.6 If the total number of sold animal was low (question 11.1.5), what do you think has resulted to that decline? 165.

11.3 Farm Workers

11.3.1 Do you have employed farm workers? ***Yes*** ☐ ***No*** ☐ 166.

11.3.2 If no to question 11.3.1, who's assisting you in the farm? 167.

11.3.4 How many farm workers employed? ***Permanent*** ☐ ***Part-time*** ☐ ***Total*** ☐ 168.

11.3.5 Where are your employees originating from? 169.

Surrounding villages ☐ ***Other towns*** ☐ ***Other provinces*** ☐ ***Total*** ☐ 170.

11.3.7 How much do you pay your workers monthly (R)? 171.

11.4 Farm Expenses and Incomes 172.

11.4.1 How did you spend your cash on the following expenses last year? 173.

Expenses	Amount	Expenses	Amount	
1. Hired transport		10. Repair		174.
2. Licks & feeds		11. Rent		175.
3. Medication		12. Taxes (farm)		176.
4. Ear tags		13. Livestock purchased		177.
5. Tick treatment		14. ***Other***		178.
6. Vet cost		15.		179.
7. Fuel		16.		180.
8. Interest paid		17.		181.
9. Labour hired		**Total**		182.

11.4.2 What are the sources of income in the farm? 183.

Cash income	***Amount (R)***	***Other income sources***	***Amount (R)***	
Livestock (Cattle)				184.
Government grants				185.
Sponsor/donation				186.

12. VELD MANAGEMENT

12.1 Do you kraal your animals? ***Yes*** ☐ ***No*** ☐ 187.

12.2 Is your farm divided in into camps, ***Yes*** ☐ ***No*** ☐ 188.

12.3 Which grazing system are you using in your farm? ***Rotational*** ☐ ***Continues*** ☐ 189.

12.4 Have you ever encountered moribund in your farm? ***Yes*** ☐ ***No*** ☐ 190.

12.5 If yes to question 12.4, how did you get rid of that challenge 191.

12.6 Have you ever encountered a challenge of the bush encroachment on the farm? 192.

Yes ☐ ***No*** ☐ 193.

12.7 If yes to question 12.6, how did you get rid of that challenge 194.

12.8 Are there any cultivated pastures in the farm for your animals? ***Yes*** ☐ ***No*** ☐ 195.

12.9 If yes to question 12.8, please mention them 196.

12.10 Which and when do you feed your animals 197.

	Weaner calf	Old cows	Bulls	Steers	
Season					198.
					199.

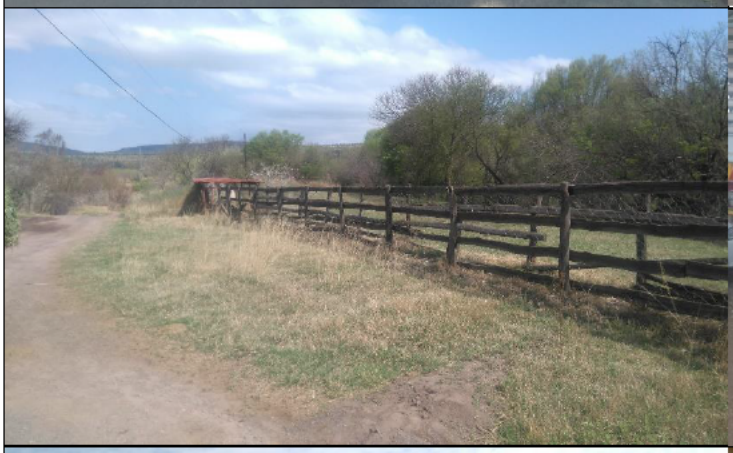
CELPHONE NUMBER**……**

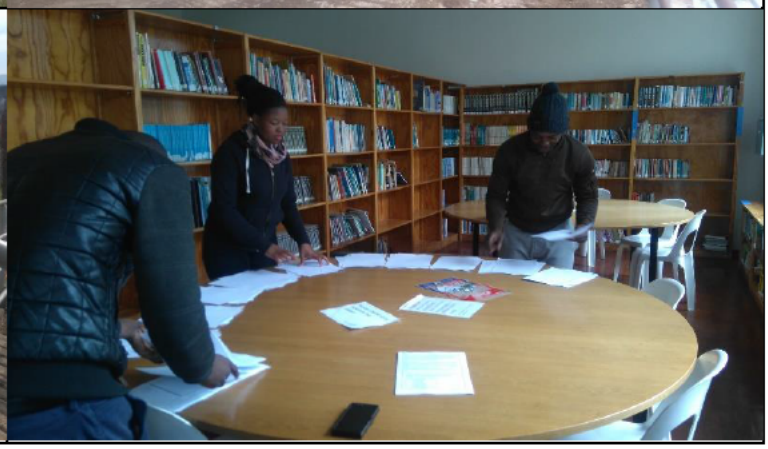
THANK YOU FOR YOUR TIME AND EFFORT FOR FILLING THIS QUESTIONNAIRE!!

Appendix ii: *Photographs taken during the data collection with the emerging farmers in Local Municipalities of Amathole and Chris Hani districts and Infrastructures of the visited farms.*







Appendix iii: *Article 1*

Production and management practices of emerging cattle farmers in the Amathole and Chris Hani districts of Eastern Cape Province

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Abstract

The study was conducted to determine cattle production and management practices of developing cattle farmers in the two selected districts (Amathole and Chris Hani) in the province of Eastern Cape. The study mainly focused on beef cattle farmers that are farming on leased or private land. From both districts 60 respondents were interviewed using structured questionnaires. A substantial proportion of the study sample had low levels of education while only 15% (n-10) had tertiary education. Cattle management activities were performed by almost all the respondents except deworming which was done by 33%. Respondents were mostly vaccinating for Black quarter (42%), Redwater (40%), Anthrax (30%) and other diseases. Assessed farmers were controlling parasites with many deferent methods where pour on (52%) was the mostly used method followed by plunge dipping (33%) and hand spray (32%). There were farmers that plant cultivated pastures (35%) and some that were also using supplements (licks) for their herds (77%). A Bush encroachment was not a problem in some farms, some farmers were not taking any actions, but 24% were using fires when reducing moribund. Breeding monitoring activities (birth observation, pregnant test and bull futility testing) were done by few respondents (78%, 15% and 12% respectively).

Keywords: Eastern Cape, cattle management, emerging farmers

Introduction

According to Sejian *et al*. (2012:20) animal production is the most vital component of world agriculture as people are mostly dependent on domestic animals for many important needs (meat, fat, milk, and other dairy products, eggs and fibres like wool or cashmere as well as for other purposes such as transport, draft power, and provision of fertilizers, especially in developing countries). According to SAI (2008:01), South Africa produces 85% of its meat requirements while the other portion (15%) is imported from other countries like Namibia, Botswana, Swaziland, Australia, New Zealand and the European Union (EU). However, Musemwa *et al*. (2008: 239) found that cattle production contributed about 25% and 30% to the national agricultural Gross Domestic Product.

The Eastern Cape; parts of Free State and KwaZulu-Natal; Limpopo and the Northern Cape is where cattle farms are mainly found. It has been documented that in South Africa almost 50 000 commercial farmers own 8.2 million cattle while 240 000 smallholders and three million subsistence farmers own 5.6 million cattle (DAFF, 2011:6), The Eastern Cape is the one of the low beef producing (6%) provinces (SABMVC, 2011:4) even though it was found to have a higher number of cattle than other provinces (DAFF, 2012).

The South African beef industry is divided into subgroups according to resource availability, method and scale of production namely, large commercial, emerging and the communal farmers (Scholtz, *et al*., 2008:2). Smallholder farms are facing limited access to land, scarcity of water and marketing channels, smaller herd size, animal diseases, theft (Montshwe, 2006:70), high transaction cost (Musemwa *et al*., 2008:241) and degradation of rangelands (GRSA, 2007:22)**.** The current study was carried out to assess the management practices of developing cattle farmers in the two selected districts of the province of Eastern Cape. Furthermore, the contribution Agricultural extension can make in the development of these farmers will also be highlighted.

Materials and Methods

The study was conducted at Amathole and Chris Hani districts in the Eastern Cape Province, South Africa. The respondents were the emerging cattle farmers who farm on private or leased land. Since both selected districts had eight municipalities each, there were two municipalities on each who had no farms and were not considered. Therefore, 12 municipalities were selected where five respondents were selected from each with a total of 60 farmers for the study. Structured questionnaires were used to collect data and respondents were individually interviewed. Factors that were investigated included details of the farmer, herd, assessment of financial and animal land management was done. The collected data was captured in Microsoft Office excel®, before the analysis took place. The analysis was done using the Stata 12.0®.

Results and Discussion

Educational level

There were 14 (23.3%) respondents with no education while six (10%) had grade 1-6. Only three (5%) farmers had degrees in agriculture. The level of education is directly related to the success of a farm and it influences their decision making (Lubambo, 2011: 30). With regards to marketing educated farmers prefer abattoirs while ones with no education prefer private buyers (Musemwa *et al.*, 2007:131). Performance based on level of education and income generated from cattle farming only is also shown. High average (23.4±33.84) number of cattle sold was found on farms with grade 1-6 however, farms with agricultural qualifications had highest average income (R109 666.70). In table 1, age and farming experience averages of respondents are shown. The age of the farmers is regarded as a crucial factor for the success and sustainability of a farm as it indicates some farmer's variables, i.e. the level of decision-making and interest (Lubambo, 2011:28). Experience in farming has been found to have an influence in choosing marketing channels (Musemwa *et al.*, 2007:01). Yeamkong *et al.* (2010:814) in Thailand found that longer experience in dairy farmer has increased monthly milk yield and revenue.

Table 1: *Educational level and performance of emerging cattle farmers in Amathole and Chris Han, Eastern Cape*

Level of education	Proportion of respondents	Number of sold animals		Animal sales animals (R)	
		Mean±SD	Total	Mean±SD	Total
No Education	14 (23%)	14.31±12.43	186	129015.4±261356.62	1677200
Grade 1-6	6 (10%)	23.4±33.84	117	90040±132098.19	450200
Grade 7-12	27 (45 %)	16.74±24.95	385	75100±101227.4	1877500
Agric. Degree	3 (5%)	16±16.52	48	109666.7±74676.52	329000
Other qualification	10 (17%)	17.29±12.39	121	86857.14±58924.18	608000

	Age (years)	Farming Experience
Mean ± SD	55.11±14.93	11.91±7.65

Cattle management activities

The entire group of farmers was practicing activities listed on table 2 on their farms except for deworming (33%). Only 2% respondents were not branding livestock while almost all other activities were done throughout the year except those that were deworming in summer. Even though castration was mostly done in all seasons (58%), some farmers were castrating in winter (20%). In bulls, castration helps in preparing them ready for market, since steers are usually the most targets for selling or slaughter.

Table2: *Cattle management activities emerging cattle farmers in Eastern Cape*

Management activities	**Proportion of respondents & seasons (%)**					
	***S**ummer*	*Autumn*	*Winter*	*Spring*	*Throughout*	Total
Castration	8	10	20	4	58	100
Dehorning	10	13	16	3	58	100
Deworming	15	9	2	7	-	33
Ear tagging	4	7	4	2	83	100
Branding	5	7	9	-	77	98
Treating sick animals	-	2	5	-	93	100
Sorting calves	-	-	8	4	88	100
Vaccinating	4	6	8	2	80	100

Animal health and nutrition

Vaccination and tick control are mostly carried out as government services unlike other poorly executed practices (deworming) (Nowers *et al.*, 2013:49). In this study 88.3% of respondents were vaccinating while 11.7% were not. Most vaccinated diseases were Black quarter (42%), Redwater (40%) and Anthrax (30%) while Trichomonas (2%), Pulpy kidney (2%) and Footrot (2%) were the least vaccinated diseases. Some respondents were just vaccinating animals without knowing the specific diseases. To reduce occurrence of illness in a cattle herd, there should be an implementation of sound vaccination program, parasite control, and frequent herd observation.

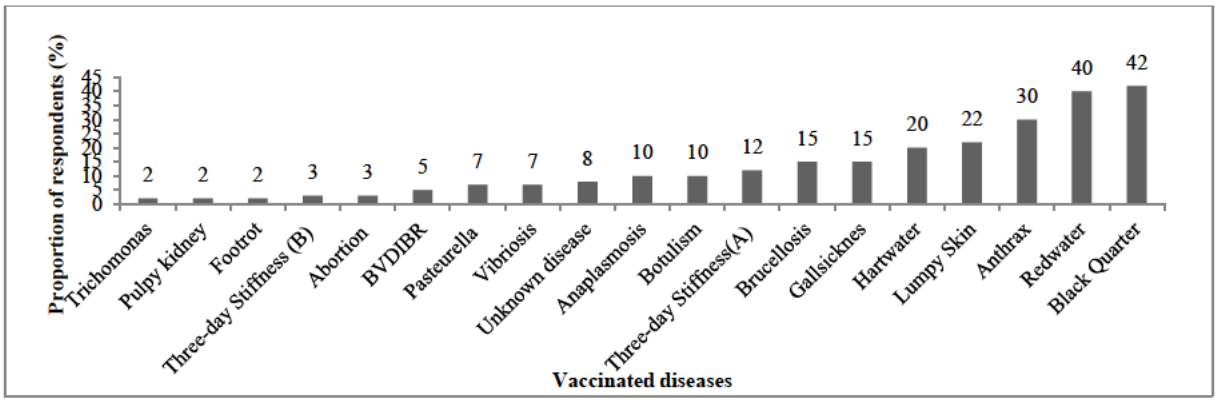

Figure 1: *Disease vaccinated by respondents*

Parasites control

The most used method was pour on (52%) followed by plunge dipping (33%); hand spraying (30%), while 16% were using spot treatment, injectable parasiticides and dosing (figure 2). La Fuente *et al*. (1998:1) stated that external parasite control (ticks) and the transmission of tick-borne diseases remains a challenge for the cattle industry, especially in tropical and subtropical areas of the world. Even though traditional control methods were put in place, parasites remain to result in severe losses for the cattle farming. It is vital to control these parasites as in livestock they cause diseases and wounds that predispose to screwworm infestation and in cows they damage teats (Moyo & Masika, 2009:01).

From the results of the current study there is evidence that a substantial proportion of respondents (82%) were controlling internal parasites while 18% of them was not controlling it at all (figure 3). Worldwide internal parasites are a continues problem but grazing management strategies and biological control were proven as the effective non-chemical parasite control methods (Waller, 2006:277). Internal parasites cause deficient performance and occasionally lead to death in young animals; they damage internal organs and subsequently affect the digestion (Williams & Loyacano, 2001:9).

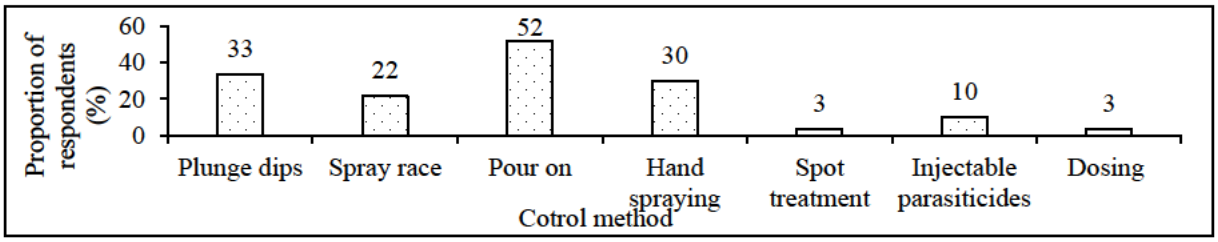

Figure 2: *External parasite control*

Cattle supplementation (Licks)

Seventy-seven percent (n-42) of 60 farms were supplementing their animals, while 23% believed that supplements are expensive and two percent doesn't know anything about licks. Some respondents were supplementing throughout the year (13%) while most of them were only supplementing in winter (58%). Van Pletzen (2009:01) documented that there is a lick supplementation programme that was developed to correct the deficiencies or imbalances in specific areas. There are limited elements on natural veld in certain seasons (phosphate and

trace elements), like in winter, veld intake in cattle decreases as digestibility, palatability and protein content decreases. Winter supplementation (protein) prevents losses of weight in livestock while summer licks maximize growth (Van Pletzen, 2009:01).

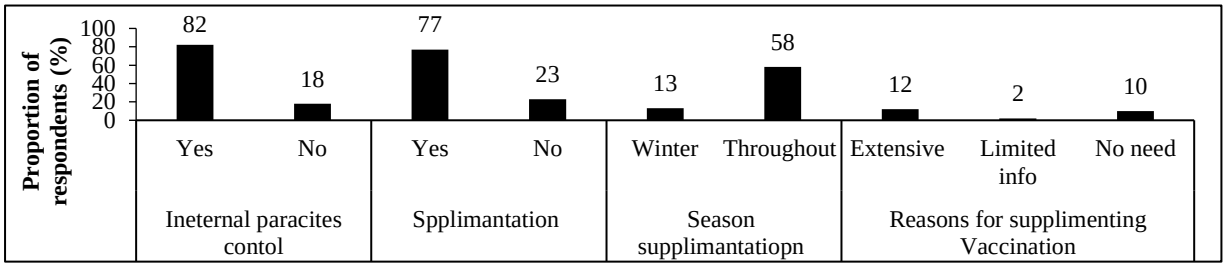

Figure 3: *Proportion of respondents on internal parasites, animal supplementation, season of supplementation and reasons for supplementing*

Veld management

Fifty percent (50%) of the farmers kraal their animals at night. Farmers are kraaling their stock since they are afraid of theft, to prevent road accidents, prevent crop damage, minimalize disease and parasite control (Nthakheni, 1993). However, day grazing and night kraaling are mostly practised in communal areas (Kunene & Fossey, 2006:01). On the other hand, cattle add some organic matter back to the field. Forty-six respondents (76.66%) had camps while 14 (23.33%) do not have any. Livestock farms that are not divided into camps are prone to uncontrolled breeding, spread of diseases and undesirable bull to cow ratio (Sekwadi *et al*., 2016:50). Camps (fencing) in a farming environment help in reducing labour expenses. The management of grazing, breeding, diseases, parasites, trespassing, theft and predation become more practical (Moyo *et al*., 2008:01).

Forty-three farmers (71%) were performing rotational grazing while 17 (29%) were following continuous grazing. Since rotational grazing requires a high work load and a lot of fencing and that these make it to require more finances (Tainton, 1999:173). Rotational grazing is predicted to increase grass production during the year of grazing, and prevent grassland growing out and losing quality (Fynn, 2012:01). Foster (2015:15) listed continuous grazing as one of the harmful rangeland management practices. There were 21 (35%) of respondents who had cultivated pastures on their farms (Figure 4). The reason for this might be due to the high establishment cost of cultivated pastures. When cultivated pastures are limited herd productivity becomes low regardless of the potential of the breed. The establishment and maintenance of pastures is expensive but it improves security and allows easy access to obstacles like intense bush, it also improves the value of the farm (Siegmund-Schultze *et al*., 2007:01).

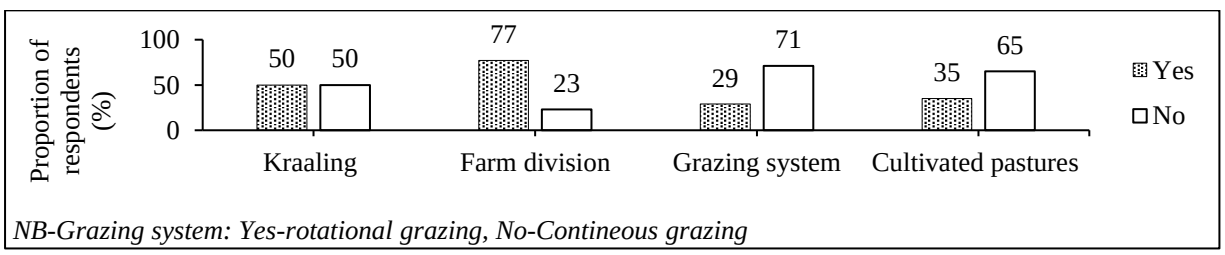

Figure 4: *Cattle kraaling, veld division and grazing system*

Moribund and bush encroachment management

More than half of the respondents (n=44, 74%) were not taking any means while others were burning (n-14, 24%) for controlling moribund (Table 3). The results of the current study are in line with those of Mahlobo (2016:20), who stated the use fire is to remove dry and dead plant materials; for initiating new lushes of grass; eradicating ticks; tsetse flies and other insects or pests harmful to livestock; and for harvesting forest honey. But veld burning has destroyed plant residues that would have helped for winter grazing and enhanced the degradation of the land in South Africa. Many respondents (n=18, 32%) were not taking control or preventative measures to limit bush encroachment while 18% were removing it mechanically (table 3). This encounter can be caused by a shortage of rainfall, notably wet cycles; heavy grazing; absence of hot brush killed fires; loss of large trees and soil nutrient changes. However, some of woody plants add value of browsing for livestock (Solomon *et al*., 2007:489).

Table 3: *Measures to control bush encroachment and moribund*

Control methods	Proportion of respondents	
	Bush encroachment	Moribund
No action	18 (32%)	44 (74%)
Allow surrounding households to take trees	2 (4%)	
Spraying (Chemical)	1 (2%)	
Mechanically remove	10 (18%)	
Spraying and mechanically remove	3 (5%)	
Hire aerial spraying	2 (4%)	
Burning	3 (5%)	14 (24%)
No encroachment of undesirable plants	18 (32%)	
Unplanned fires sometimes		2 (3%)

Livestock breeding management

The proportion from the study sample that were doing the parturition observation, pregnancy and fertility testing, season breeding and own bull breeding were 78%, 15%, 12%, 47% and 62% respectively. Matiko *et al.* (2008:897) stated that smallholders are not practising the pregnant diagnosis in their herds as there is a scarcity of veterinarians and they don't even know the PD importance in cattle farming.

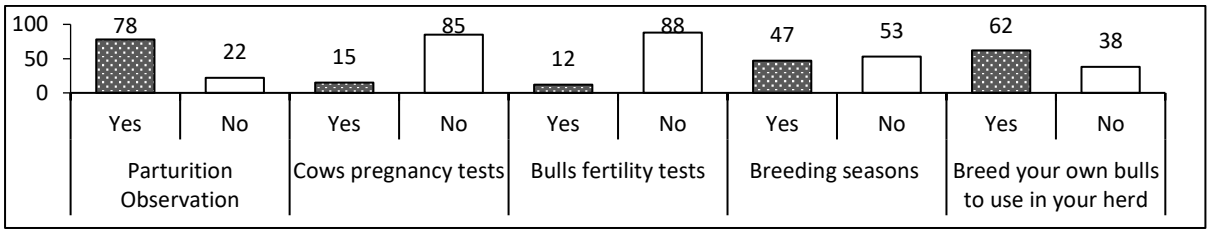

Figure 5: *Cattle breeding enhancement practises*

Livestock performance

Assessed farmers had a total of 2861 breeding stock (cows (74%) and heifers (26%). The conception, calving and weaning rate were 93% (2647), 88% (2524), and 82% 2348 respectively. On the other hand, these findings are elevated for the level of farmers as Matiko *et al.* (2008:01) observed a pregnancy rate of 44% in emerging farmers and stated that the

minimum pregnancy rates in commercial farmers should be approximately 70%. These figures are therefore lower than those of the current study. Comparable results were found by Grobler (2016:59) who found pregnancy rates ranging between 60% and 93% respectively.

Table1: *The total and percentage of bred cows and heifers from mating till the weaning*

Breeding cattle	**Number of animals bred (100%)**	**Breeding stock performance**		
		Pregnancy rate	*Calving rate*	*Weaning rate*
Cows	1915	1763 (92%)	1674 (87%)	1550 (81%)
Heifers	946	884 (93%)	850 (90%)	798 (84%)
Total	2861	2647 (93%)	2524 (88%)	2348 (82%)

Extension implication

The current study provides evidence that some of the assessed farmers were not performing some of the critical management activities on their farms. The agricultural extensionist mainly assists farmers through training in improving farming methods and techniques. Over the long term it results in improved production efficiency and income, better standard of living and lifting the social and educational standards of rural life. In the studied area special emphasis should be put on: record keeping, pregnancy and bull testing, and livestock nutrition. l It is believed that extension services in the Eastern Cape Province can be the solution to some of these management shortcomings as it can play a vital role in improving the long-term viability of these farms. It is also recommended that agriculture extension join forces with the academia as there is a growing urgency for Higher Education Institutions to become more involved and become a more vigorous partner in addressing our most pressing social and economic community problems. The belief is that this involvement and partnership can be brought about through service learning (SL), a Community and Higher Education Service Partnership where community service actions and education objectives are deliberately integrated (Bringle & Hatcher 2002:504).

Conclusion

Cattle farmers are old people particularly in the study area and most of them are not having tertiary education. Under livestock health management they vaccinate for many diseases but most respondents vaccinated for Black quarter, Redwater and Anthrax. They were controlling parasites. Some farmers were supplementing and had cultivated pastures in their farms however there is as evidence that farmers had an issue with fencing as they had camps but still doing continuous grazing in their farms. In some management practises our respondents had minimal information about them i.e. bush encroachment and moribund management.

Acknowledgements

National Research Foundation and Central University of Technology for financial assistance are acknowledged. My sincere gratitude goes to all the farmers who participated during the period of study for their precious time.

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Appendix iv: *Article 2*

Technical efficiency of emerging cattle farmers in Amathole and Chris Hani districts of Eastern Cape Province

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Abstract

The current study was carried to assess the efficiency and the role of cattle farming in the social and economic lives of people in Amathole and Chris Hani district. The data was collected from farmers (60) in 12 municipalities in Amathole and Chris Hani districts of the Eastern Cape. The efficiency of farmers was analysed using Cobb-Douglas function as it can present the relationship of outputs and inputs. Large portion of respondents do take part in unemployment reduction more especially in areas that are close to their farms. Few respondents were not selling their herds. More income was gained through the selling of cattle while more expenses were incurred on fuel. Less than half of the respondents (37%) that experienced increase in cattle sales. The size of the farm was positively related to market participation. The production expense was found to be positively significant at 5% level. Experience in farming was found to be 0.24 indicating that an increase in experience by 1%, efficiency in farming will rise by 0.24%.

Key words: Efficiency, Cattle Farmers, Cobb-Douglas, Eastern Cape

Introduction

It has been proven that most of the South African agricultural land (71%) is suitable for extensive livestock farming (ABB, 2016) therefore, the total number of cattle in the country is increasing continuously- it was about eight million in 1970 to approximately14 million in 2006 (Palmer & Ainslie, 2006). In 2010 it was indicated that nationally, the population of cattle had changed negligibly and that has led to the improvement of the rangeland conditions and the expansion of the small-scale sector (DAFF, 2010). From the total number (14 million) of national cattle, approximately 60% is owned by commercial farmers then 40% by emerging and communal farmers (ABB, 2016).

Annually the country produces approximately 823 million kilograms (kg) of beef, imports about million kg and exports 4.4 million kg. The imports are mainly from Australia and exports are mainly to Mozambique. Within South Africa there are 48.6 million people who consume 15.8 kg beef per capita per year (DAFF, 2014) and the Government of Republic South Africa in 2007 (GRSA, 2007) has realized the key role that is played by livestock production as sub–sector of agriculture and its contribution to rural livelihoods sustainability and food security. With regards to smallholders, the herd management is mostly done through the indigenous knowledge and cattle are kept in communal grazing land (ABB, 2016). The creation of higher income and employment opportunities for resource-poor African farmers is the core components of the South African agricultural policy vision through re-establishing and supporting diverse forms of successful black agriculture (Ngqangweni *et al.*, 2001).

Eastern Cape (EC) is one of the rural provinces that have many households that are keeping one to ten heads of cattle as well as pigs and goats (GSAS, 2013). Nevertheless, this province has the highest number of cattle amongst other provinces in both emerging and commercial sector (Table 1) (Meissner *et al.*, 2013). The cattle farming under this sector is frequently affected by drought, stocking density, livestock diseases, poor genetic improvement, poor or improper fencing that subsequently contribute to uncontrolled breeding, spread of disease and an undesirable bull to cow ratio (ABB, 2016). After the recent drought that occurred in the EC, there were farmers that were assisted with the supply of water, feed, boreholes and market assistance to survive the drought (Goldblatt, 2010). Montshwe (2006) discovered that most smallholder farmers consider cattle farming as an operation that provides draught power, sign of household wealth, assets of inheritance and many other socio-cultural roles. Contrary to that, they don't consider cash from cattle sales as major reason for cattle ranching. As results, their cattle stay for a prolonged period in farms and they often sell older cattle that are not in good condition (Randolph *et al.*, 2007).

Even though EC was found to have a higher number of cattle (see table 1) than other provinces (DAFF, 2012) it is the one of the low (6%) beef producing provinces (SABMVC, 2011). As approximately 40% of the beef cattle are owned by black emerging and communal farmers however it's only five percent that goes through the formal marketing channels (GRSA, 2007). Ngqangweni *et al.* (2001) emphasized that, there is a need for the research on recent livelihoods, support programmes and a regular database update of the Development of Southern Africa. To this end, there are questions about whether smallholder cattle farmers are efficient in cattle farming therefore, the objective of the study was to assess the efficiency and the role of emerging cattle farming in the socioeconomic lives of people in areas of Amathole and Chris Hani districts.

Table 1: *Estimated cattle numbers in South Africa (2010) (in thousands)*

Province	WC	NC	EC	KZN	FS	M	L	GP	NW	Total
Commercial	219	603	1531	1409	1232	868	650	321	1035	7868
Smallholders	232	208	1272	1116	911	603	433	245	713	5733

Western Cape (WC), Northern Cape (NC), Eastern Cape (EC). KwaZulu-Natal (KZN), Free Sate (FS), Mpumalanga (M), Limpopo (L), Gauteng (GP), North West (NW).
Source: Meissner *et al.*, 2013.

Methodology

The study was conducted at Amathole and Chris Hani districts, Eastern Cape Province, South Africa. The respondents were the emerging cattle farmers who farm on private or leased land. Six municipalities from each district were selected; five respondents were selected from each with a total of 60 farmers for the study. A structured questionnaire was used to collect data and respondents were individually interviewed. We use Cobb-Douglas to analyse the technical efficiency.

The most general expression of the Cobb-Douglas production function is:

$Y = AL^{\alpha}K^{\beta}.u$

Where, Y stands for output, L measures labour input and K measures capital input, A is the constant that represent the technology of the society that generated the observations upon which

the parameters of the function were to be estimated. Parameter (A) is thought of as the combined impact of inputs that are fixed on the production function, α and β are the output elasticities of labour and capital, respectively. These values are constants determined by available technology (Ezeh *et al.*, 2012).

For us to use Ordinary Least Squares procedure for estimating, the function is linearized using logarithm and gives the following regression specification in line with Debertin (2012):

$$Ln(Y) = ln(a) + ln\beta_1 X_1 + ln\beta_2 X_2 + \cdots ln\beta_i X_i + u$$

Where: Output (Y) is the total number of cattle produced per season and it is measured in headcount. Farm size (X_1), Expenses (X_2)…

Therefore, the stochastic production frontier for cattle farmers is assumed to be of the Cobb-Douglas form:

$$ln(y_i) = \alpha_0 + \sum_{j=i}^{12} \alpha_j . D\_Edu_{ji} + \beta_1 . ln(Farmsize_i) + \beta_2 . ln(Experience_i) + \beta_3 . ln(Expenses_i) + \beta_4 ln(Age_i) + \gamma_2 Transportation + \gamma_3 Exra\ Forage + \gamma_4 Farm\ Worker + \gamma_5 Vaccination + \varepsilon \quad (1)$$

The error term is ε = v – u, where v is a symmetric component assumed to be distributed independently and identically as N(0,σ_v^2) that captures exogenous shocks, such as weather, supply shocks, and unobserved heterogeneity of households plus measurement error (Ezeh *et al*, 2012). The term u is a non-negative random variable that is associated with the level of technical inefficiency of production. It is assumed to be distributed independently and identically as N (μ,σ_u^2) with truncation point at 0. Equation (1) represents a stochastic frontier production function (Aigner *et al.*, 1977).

Logistic Regression

The logistic regression analysis provides the analytical information on socio-economic factors affecting the technical and allocative efficiency of smallholder cattle farmers in the study area. The principal assumption on which the likelihood ratio is based, states that there are socio-economic factors affecting the efficiency of smallholder cattle farmers in study area.

The operational logit model can be written as follows:

$$Logit(p) = ln(p/1-p) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + u$$

Where the ratio p/1-p is the odds ratio, Pi = probability that a farmer is productive, 1-Pi = probability that a farmer is not productive, Xi = various independent variables, βi = estimated parameters, and Ui = disturbance term.

Table 1 gives the description of the variables used in the Logistics regression and the results of the logistic regression are presented in Table 2. The results indicate the chi-square value of 21.57. The estimation of the socio-economic factors affecting the efficiency resulted in the R^2 value of 0.60. The statistical model was therefore unable to explain 40% of the relationship between output and input.

Table 2: *Definition of variables.*

Variables	Description of variables	Units
Income	Income from farm	Rand
Age	Farmer's age	Years
Experience	Farmer's experience	Years
Farm size	Farm size	Hectares
Gender	1,if a farmer is a male, 0,otherwise	Dummy
Diversification	1,if a farmer diversify, 0,otherwise	Dummy
Extra Forage	1,if a farmer has extra forage, 0,otherwise	Dummy

Cowlick	1,if a farmer provide lick, 0,otherwise	Dummy
Farm Record	1,if a farmer keep farm record, 0,otherwise	Dummy
Farm Worker	1,if a farmer use farm worker, 0,otherwise	Dummy
Vaccination	1,if a farmer vaccinate, 0,otherwise	Dummy
Identification	1,if farmer use identification, 0,otherwise	Dummy

RESULTS AND DISCUSSION

Role of Emerging farming in the study

In this study, 83% of respondents were employing people on their farms while 17% were not employing any people at all. These results clearly show that smallholder farms take part in unemployment reduction (figure 1a). Livestock plays a vital role in providing food to urban and rural consumers. In developing countries where there are still poor citizens, livestock becomes a source of income, employment and traction (Swanepoel *et al.,* 2010).

The substantial portion of farm employee workers were from the surrounding areas (73%), some from Free State and Lesotho (17%) and others were other towns with the province (figure 1b). Farm workers' salaries were ranging from R500.00 to R3500.00 per month, most (n=22) of them were getting salaries that range from R1000.00-1500.00, (figure 6.1c).

Figure 1: *Contribution of smallholders in unemployment reduction and the employee's origination*

Farmers' incomes and expenses

There were respondents (15%) that were not selling their livestock while most of them did (85%) which clearly show that they are not only dependent on cattle farming. Small scale farmers have other sources of cash farming income, but poverty is seemed to be increasing in these smallholders and they are becoming more resource poor.

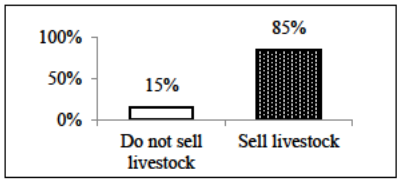

Figure 2: *Cattle marketing.*

From Table 3, it is evident that respondents were involved in other activities that support them financially but much of the income of the respondents came from cattle sales (R4 431 700.00). There were incomes that were generated from non-agricultural activities such as liquor, pension, personal savings and taxi business.

Smallholder farms mostly received income from selling the surplus of farm produce and nonfarm income. In the South African smallholders, it has been found that their farming income amount to approximately 40% while the remainder is derived from nonfarm income (Nagayets, 2005). Concurrently, Eastern Cape was found as one of the provinces that had highest income generative capacity from livestock owned by farmers followed by the Northern Cape and Limpopo (Mmbengwa *et al.,* 2015). Fuel accounted to 28% of the total yearly expenses followed by farm workers' salaries (21.1%) and supplements (licks and feeds, 16.5%). As some

of the farmers did not owned the farms they bind to pay rent and it accounted to 5.7% of the total expenses.

Table 3: *Statement of total income and expenses of the emerging cattle farmers in the study area for the year ended December 2015.*

Income			**Expenses**		
Item	**Amount (R)**	**%**	**Item**	**Amount (R)**	**%**
Cattle sales	4 431 700.00	43	Fuel	1 586 900.00	29
Other agricultural sales	2 815 500.00	28	Labour hired	1 176 039.84	21
Liquor industry	720 000.00	7	Licks and feeds	917 395.00	17
Personal savings	660 000.00	6	Medication	640 744.00	12
Government grant	630 000.00	6	Repairs & maintenance	319 500.00	6
Meat trading	480 000.00	5	Rent or lease payments	263 380.00	5
Transport business	300 000.00	3	Livestock purchased	180 200.00	3.
Sponsorship/donation	150 000.00	2	Vet cost	160 300.00	3
Farm structure sale	110 000.00	1	Taxes (farm)	135 400.00	2
Pension	15 000.00	0.1	Hired transport	73 900.00	1
			Ear tags	59 317.00	1
			Tick treatment	30 980.00	1
			Interest paid	22 450.00	0.4
Total	**10 312 200.00**	**100**	**Total**	**5 566 505.84**	**100**
Profit			**R4 745 694.16**		
Average Profit			**R79 094.90**		

Trend of the cattle sales in the assessed study area

The pattern of the cattle farming was evaluated through enquiring the sales incurred in 2015 and the sales of the previous years (2012-2014). When the cattle sales from 2012-2014 is compared with those of 2015 cattle sales increased in 37% of the farms and declined in 20% of the farms. Cattle sales remained the same in 43% of the farms (see figure 3). Therefor these trends might be due the fact that South Africa has been affected by the declining farming profitability and water scarcity, which led to the changing of land uses in many farms and overstocking (Goldblatt, 2010).

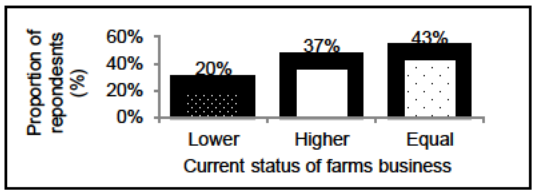

Figure 3: *The total of cattle sold in 2015 as compared to those of 2012-2014.*

Efficiency emerging farms on the assessed

Model Estimation and Discussion

More emphasis was directed to the elasticity of variables. Elasticity of production is known as the percentage change in output when that variable input is varied, in simple terms it measures the sensitivity of dependent variable to a change in independent variables (Debertin, 2012).

Farm Size

Table 3 results show farm size elasticity of 0.13; farm size was found to be positively significant at 1% level. This implies that farm size is sensitive towards the production of cattle. Smaller farms are worked more intensively, but not necessarily more profitably or efficiently and farm size, experience and technology adoption all explain substantial differences in production efficiency and profitability (Thirtle *et al.,* 2003). The size of the farm is positively

related to market participation because when farmers have more land their production will be higher (Makhura, 2002).

Farmer's Experience

The elasticity of farmer's experience was found to be 0.025; it was positively but not significant towards the production of cattle. The results show that an increase in years of experience of the farmer was the more productive they become towards cattle production. More experienced farmers and those with larger farms are more likely to be granted credit (Thirtle *et al.,* 2003) and Ndoro *et al.* (2014) highlighted that experience in farming enhance the ability of a farmer to understand the costs and benefits of technology, interpret, and modify extension information.

Expenses of production

The elasticity of expenses was 0.18; this indicates that smallholder cattle farmers in both Amathole and Chris Hani districts are under-utilizing funds in the production of cattle. The expense was found to be positively significant at 5% level, implying that a 1% increase in the expenses of production will lead to 0.18% increase in cattle production. It has been revealed by Makhura (2002) that in order smallholders to generate enough income they engage themselves in non-farm activities to generate income. Since most of these farmers are situated in overcrowded, semi-arid areas in the former homelands as result they are not taking part in the mainstream agriculture. Therefor finding means that can boost them in putting more input their farming enterprise to be able to generate high returns.

Table 4: *Stochastic Cobb-Douglas Production Frontier for Cattle Farmers.*

Variables	Coefficient of elasticities	Standard error
Ln Farm size (Ha)	0.1349	00531***
Ln Experience (Years)	0.0259	0.0887**
Ln Expenses (Rand)	0.1806	0.0845
Ln Age (Years)	0.4153	0.2752
ln (σ^2v) constant	-2.7958	0.2051***
(σ^2u)		
Transportation	-0.0318	1.9991*
Extra Forage	2.5851	2.4225
Farm Worker	-3.4804	2.3659
Vaccination	-3.0196	1.8799
Constant	0-.9177	2.1127
Mean Technical Efficiency	0.71	
Log-likelihood	-2.6496	
Number of obs	60	
Chi2	15.17	
Prob > F	0.00	

***significant at 1%, **significant at 5%, * significant at 10%

Logistic regression analysis

Gender of the farmer

The results in Table 5 show that gender of the farmer was negatively significant towards the efficiency of cattle farmers in Amathole and Chris Hani districts. The significant level was found to be 5%. The coefficient of gender was found to be -4.07 implying that 1% increase in the number of female farmers will lead to a -4.07 decrease in efficiency. However, it has been also stated by Andrew *et al.* (2003) that cattle ownership and management in the smallholder areas is dominated by men as women are confined to producing livestock species close to the homesteads (chickens and pigs). Bank & Qambata (1999) observed that female smallholders are more susceptible to challenges like feed shortages and livestock problems, lack of capital

and access to institutional credit, poor technical skills and lack of access to extension services. These factors limit the participation and efficiency of women in cattle production.

Farming Experience

The results in table 5 show that experience in farming is positively significant towards the efficiency of the farmer; the significant level was found to be 5%. It is expected that the more experience the farmer is; chances of a farmers to have good performance are high. Experience in farming was found to be 0.24 implying that an increase in experience by 1%, efficiency in farming will rise by 0.24%. Marandure (2015) assessed the sustainability of smallholders, where he their enquired farming experience. He found evidence that farming experience plays a role in farming as farmers with high experience had large herd size as compared to those with less experience and they also realised higher income from cattle sales.

Table 5: *Logistic regression analysis.*

Variables	Co-efficient	Standard Error	Significance
Income	1.5564	1.2574	0.216
Age	-0.0026	0.0339	0.937
Experience	0.2437**	0.1004	0.015
Farm size	0.0045***	0.0017	0.010
Gender	-4.0771**	1.8384	0.027
Diversification	-1.0857	1.3217	0.411
Extra Forage	0.2109	1.1524	0.855
Cowlick	-0.8078	1.1814	0.494
Farm Record	0.0207	0.7814	0.979
Farm Worker	4.8738***	1.6142	0.003
Vaccination	7.7351***	2.5948	0.003
Identification	-4.3986***	1.6725	0.009
Constant	-12.2002	7.1684	
-2 log Likelihood	16.49		
Chi-Square	21.57		
Pseudo R square	0.60		

**Significant at 5%, ***Significant at 1%.

Conclusion

This paper has demonstrated that smallholder do participate in poverty alleviation, and they do not only support people from their surrounding areas they also employ citizens from other provinces. The study also shows the progress of the assessed respondent's in term of the total number of sold cattle sold in the previous financial years as compared to those sold in last three years. And increase happened in the group of farmers that was even less than a half of the total respondents. This can be improved through proper management that can subsequently improve the condition of individual animals. Experience and production expenses were found to be co-related with the production of the respondent's farm that encourages farmers that when expenses are effectively spent as inputs, more produce can be expected.

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