THE MANAGEMENT PRACTICES OF DAIRY CATTLE AND THEIR CONTRIBUTION TO LIVELIHOODS IN MATATIELE, EASTERN CAPE

By

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DECLARATION

I, Siyabonga E Mbanjwa, do hereby declare to the University of Kwa Zulu Natal that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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ABSTRACT

The deepening economic crisis of many African countries has highlighted the importance of agricultural development as a basic condition for expanding rural incomes. A number of factors limit the contribution of livestock to household food security. These factors include resource and output management, socio-economic factors and the availability of good quality information. Effective management of livestock can play a major role in improving household livelihoods. The effectiveness of management practices largely determine success in dairy production. A number of studies in the management practices of dairy animals have focused on improving milk production. This study focuses more on the consequence of management practices of dairy animals on household livelihoods. Some 169 smallholder dairy farmers participated in a survey. Farmers were categorized into trained farmers and farmers using traditional practices in order to compare management practices. Content analysis was done to understand the challenges facing smallholder dairy farmers in their systems. Ordered Logistic Model was used to identify the determinants of the level of importance of dairy in livelihoods and General Linear Model was also used to identify determinants of management practices in smallholder dairy systems. The results indicated that among others, participation in the selling of milk is the most important factor determining the importance of dairy farming on livelihoods. Furthermore, gender of the person making decisions about milk sales was found to be the factor determining the management practices adopted in a dairy farm household. It was concluded that smallholder dairy farmers are determined and passionate about dairy farming however they lack good quality information about management. The key to success in smallholder farm decision making depends on the ability of the farmer to achieve good diagnosis, planning, implementing and monitoring and evaluation. That can only be achieved if the farmers are empowered with necessary skills required in dairy production, management and marketing.

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DEDICATION

This piece of work is dedicated to my mother (Mrs N.E Mbanjwa) and my brothers (Bhekani Mbanjwa, Vusi Mbanjwa and Msizi Mbanjwa, who were always immersed in vision about my success.

'...Humankind can only continue to exist in balance with nature. Nature does not need humans, but humans need a sound environment. For this reason, it is our duty to make a long term co-existence possible…'

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CHAPTER 1: INTRODUCTION

1.1 Background

The deepening economic crisis of many African countries has highlighted the importance of agricultural development as a basic condition for expanding rural income and off farm enterprises. In particular, this situation raises questions on whether extension services, agricultural policies, current technology are capable of creating these expansions among the household practicing dairy in South Africa. Traditionally rural households produced most of their own food, but recent studies have shown an increased dependence on market purchases by both urban and rural households, in some cases reaching 90% of the food supplies (Nandini & Kiresur, 2013).

This is a worrying factor in South Africa because food expenditures can account for as much as 60–80% of total household income for low-income households (Baipheth, 2009). Subsistence/smallholder agriculture can play an important role in reducing the vulnerability of rural and urban food-insecure households, improving livelihoods, and helping to mitigate high food price inflation (Lues *et al*., 2012). Therefore, there is a need to significantly increase the productivity of subsistence/smallholder agriculture and ensure long-term food security.

A number of projects have been implemented by Heifer International in South Africa to improve household livelihoods and therefore contribute in reducing food insecurity. These projects include Thusanang Dairy Project that was implemented in the Eastern Cape (Matatiele) in the year 2013. Eastern Cape has the highest number of livestock in South Africa yet it has the highest rates of poverty (Nesamvuni *et al*., 2012). This raises a need to evaluate the differences on livelihoods of the trained and traditional farmers residing in Matatiele, Eastern Cape.

South African dairy industry is dynamic and plays an important economic and nutrition role in the lives of many people. However, little can be said with regards to the contribution of smallholder dairy farming on livelihoods. Previous studies show that there is a lack of institutional support, research and training which would be beneficial to smallholder dairy farming environment (Uddin e*t al*., 2012). Therefore, this study was conducted to provide information about the role of small smallholder dairy cattle farming in improving rural livelihoods and to identify the problems faced by smallholder dairy farmers.

1.2 Importance of the study

Livestock make an important contribution to livelihoods in smallholder farming systems in most African countries. The contribution of livestock (including cattle, chickens, goat, sheep and horses) towards rural livelihood in the African continent includes the provision of animal protein, income and socio-cultural uses. In Sub-Saharan countries like Kenya and Rwanda, livestock keeping is the main livelihood strategy for the rural community and it also provides social and cultural values (Devereux, 2014). In Kenya, smallholder dairy farms accounted for about 75 to 90% of the national milk produced in 2013 (Onono *et al.,* 2013). Milk is among the most valuable and nutritious food for humans. It is rich in essential nutrients and its availability directly contributes to food and nutritional security and poverty reduction. In most rural areas in South Africa, people cannot afford to buy milk because of the prices reflected in the market (Garrity *et al.*, 2010). That contributes to the reasons why food insecurity remains the major problem in rural communities. Sub-Saharan Africa is reported to be in the top 10 of the countries with the highest proportion of residents living in extreme poverty (Devereux, 2014).

With regards to South Africa, this is a cliché because, about 69% of the South African land surface is suitable for grazing, and that indicate that livestock farming has got great potential (Nesamvuni *et al*., 2012). Despite access to grazing land there are a numerous factors limiting the significant contribution of livestock to smallholder farmer's household food security. These factors include availability of feed resources, social categories and type of animal species (Arriaga-Jordán & Pearson 2004). Effective management of livestock can also play a major role in improving household livelihoods. Management of livestock is defined as the ability to maintain the balance between grazing, reproductive, nutritional and health management. Success in dairy production is largely determined by the effectiveness of management practices. A number of studies in the management practices of dairy animals have focused on improving production (Tegegne *et al.,* 2013; Kawonga *et al.*, 2012; Bebe *et al*., 2003). This study focuses more on the consequence of management practices of dairy animals on household livelihoods.

1.3 Research problem

Smallholder farmers use low input production systems and productivity per cow (milk yield/cow/day) is relatively low (Gillah e*t al*., 2014). For instance, in these systems, animals are

fed on crop residues and roadside grass which are relatively low in protein and digestibility. The feeding practices are reported to reduce the productivity and animals reach puberty at a late age (often more than 24 months) and calving interval is long (often 18–24 months). Also housing is usually poor in the smallholder dairy farming systems and that has negative effects livestock health management (Onono e*t al*., 2013; Devendra & Chantalakhana, 2002). The study at hand investigates how the management constraints affect the opportunities of cattle (reproduction & milk production) to the improvement of household livelihoods in Matatiele. It is the intention of the study to gain insight and understanding on what effects do Matatiele, Eastern Cape Province smallholder dairy management practices have on the contribution of dairy on enhancing their livelihoods.

1.4 General objective

The objective of the study is to identify constraints and opportunities in the management of dairy cows (reproduction and milk production) for the improvement of household livelihoods in Matatiele.

1.5 Specific objectives

1. To assess the importance of dairy animals in household livelihoods in Matatiele.
2. To identify the dairy management practices among smallholder farmers in Matatiele.
3. To explore the challenges experienced by households in managing their dairy animals.
4. To identify factors that determine household dairy management practices.

1.6 Hypothesis

1. Dairy farming is not an important livelihood strategy for smallholder farmers in Matatiele, Eastern Cape.
2. Socio-economic status of the farmer has no effect on smallholder dairy management practices

1.7 Definition of terms

Dairy management practices, in this document, are limited to the activities farmers adopt for the daily life of their cattle. These practices vary from housing of the animals, health practices, feeding practices, choice of feeding systems for different breeds and milking practices.

Entrepreneurial skills in this document these are the skills a farmer uses to successfully look at dairy farming as a business. These skills include networking, innovation, risk taking, team working, reflection, leadership, utilising contacts, recognising and realising opportunities, ability to develop a long term business plan and business monitoring. All these skills are fundamental to developing and improving smallholder dairy farm business. A farmer who possess these skills is likely to supply milk to the community and local dairy companies, process the milk into products like sour milk, cheese, yoghurt and juice (Phelan & Sharpley 2012).

Dairy production refers to the potential of a farmer to produce enough milk of good quality. This refers to the scale of a farm, number of cattle, breeds and the type of available feeds in a farm.

1.8 Organization of the thesis

This thesis is organised into five chapters. Chapter 1 is the introduction, Chapter 2 is the literature review, which discusses the effect of management practices on the contribution of dairy on livelihoods for smallholder dairy farmers. Chapter 3 discusses the determinants of smallholder dairy practices and their challenges on livelihoods contribution. Chapter 4 evaluates the contribution of smallholder dairy farming on household livelihoods. Lastly, Chapter 5 is the summary and conclusions.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review on the livelihoods in smallholder dairy systems of rural South Africa and other rural parts of the world. The chapter begins by describing smallholder dairy farmers and the environment in which they are situated. That is followed by the description of the contribution of dairy on livelihoods development. Than the chapter describe the management practices that are usually adopted by smallholder dairy farmers in the farm. Furthermore, the chapter explores the challenges facing smallholder dairy households in relation to achieving food security.

2.2 The complexities of smallholder dairy

Smallholder farmers in most African countries face various challenges that impede their growth and ability to effectively contribute to food security relative to commercial farmers. Some of these constraints relate to the lack of access to land, poor physical and institutional infrastructure (Dlamini & Tabit 2014). Most smallholder farmers are located in rural areas and mostly in the former homelands where lack of both physical and institutional infrastructure limits their expansions. Lack of reliable markets has also been found to be one of the main constraints faced by smallholder farm¬ers. Many of these farmers receive low prices for their products by selling them at their farm gate or local markets (Van den Berg, 2013).

2.2.1 Production of milk by smallholder farmers

According to IFAD (2012), there are approximately 500 million smallholder farms worldwide. Lues *at al*. (2012) reports that, about 750 to 900 million people live on dairy farms or within dairy farming households. Production of 1 million litres of milk per year on smallholder dairy farms creates approximately 200 on-farm jobs. Throughout the world, there are more than six billion consumers of milk and milk products, the majority of them in developing countries. If smallholder milk producers continue to be in a position to compete with large-scale, capital-intensive dairy farming systems, dairy-sector development will be a powerful tool for reducing poverty and creating wealth in the developing world (Hemme e*t al*., 2010).

In most African countries, milk is produced on both small and large-scale dairy farms. The major differentiating features of these dairy sub-sectors include the holding size, the genotype of cattle raised, and the level of management. In sub-Saharan Africa, smallholder farms produce about 80 per cent of the food consumed in the continent. Smallholder farmers are quite a heterogeneous group, differing in their resource base and choice of crops and livestock, resource distribution between consumption and sales, links to markets, the relative importance of agricultural income, off-farm activities, their use of external inputs and hired labour (Mumba e*t al.*, 2011; Reardon, 1997). Generally, dairy farming in a small-scale level is generally integrated with cropping activities, using crop by-products as cattle feed and applying manure to crops (Van Schaik *et al*., 1996). The primary purpose of agricultural farming is to provide social security for the entire family. Often the farmer does not rely completely on the on-farm income, but also has a considerable off-farm income (Mapekula *et al*., 2010).

2.2.2 The dichotomy of gender in milk production

FAO (2014) reports that developing countries are increasing their shares in global dairy production and also that the profitability of milk production appears to be higher in developing than in industrialized countries. This verifies that smallholder dairy farmers in most Sub-Saharan Countries have good opportunities in dairy production. Sharma e*t al*. (2013) raised the fundamental issue of cattle management in Africa as being primarily gender-specific. For instance, their study found that only men were mainly responsible for the herd management and few women were mentioned as cattle owners. Also, the paper indicated that the dominance of male in ownership is more likely to result in an increase of beef production than of milk for sale. This is because cattle owners (mainly male) were noticed to be concerned about only the survival and growth of their animals.

On contrary, empirical evidence reported by Tegegne e*t al*. (2013) shows that woman do play a greater role than previously thought in decision making. Gender constitutes an important factor in the growing trend of widening disparities in the distribution of income and assets (Ndoro e*t al.*, 2014). Woman play a key role in smallholder dairy farming. Decisions on the amount of milk to be marketed are often determined by woman of the household and it is normally the women who control and decide on the expenditure of milk income at household level. Frequently quoted

priorities include food for the family, school fees and basic healthcare (Musalia *et al*., 2007). As opposed to previous understanding A number of studies on smallholder dairy farmers reported that female headed households typically had much smaller proportion of income than male headed households (Tebug, 2012; Reardon, 1997).

2.2.3 The competition and the market

The strengths of smallholder dairy systems include low production costs; high profit margins; low liabilities; limited liquidity risk; and relative resilience to rising feed prices (FAO, 2012). Opportunities for smallholder producers engaged in dairy production include growing demand for dairy products in developing countries; probable milk price increases; potential to increase milk yields through relatively few additional inputs; potential to increase dairy labour productivity; and employment generation in the dairy value chain (for example, absorbing family labour released by higher on-farm labour productivity). However, higher price for animal feeds lead to an exclusion of smallholder dairy from these feeds, hence low production of milk. On the other hand, higher energy prices and policies that promote bio-fuels lead to an increased use of crops for energy production and, thereby, pushing up the prices of feed and land and that also limit smallholders from accessing enough feeds and land.

The literature has indicated that there is a high informal market for milk in rural areas. This is because some consumers prefer to buy fresh milk directly from producers because the source of milk, quality and safety is known. On the other hand, Chagunda e*t al*. (2015) indicated that smallholders also sell directly to small cafes and street vendors. In this way, some transaction costs can be cut to improve profits. This contributes to the reasons why most rural households are participating in dairy farming. The high demand for value-added products such as sour milk, yoghurt and cheese is another market that needs to be explored by smallholders in order to increase profit and therefore graduate to large-scale farming. However, to go this route would require high investment, market knowledge and the necessary training (Kilelu e*t al*., 2013).

2.3 Contribution of dairy in rural livelihoods

A number of studies has indicated that smallholder dairy farming can play a vital role in livelihood development and economic growth in the developing countries (Sharma e*t al*., 2013; Baiphethi &

Jacobs, 2009). Smallholder access to markets stimulates and enhances the diversification of livelihoods for lower income farm household and thus reducing poverty. Chagunda *et al.* (2015) highlighted that in Malawi and Zambia, national governments have stimulated smallholder dairying to accelerate economic growth and poverty reduction, especially among the rural poor. In Malawi, the government has promoted the contribution of smallholder dairy to become the leader in the livestock sector. Between 2008 and 2013, the Malawi Government implemented strategies including the importation of improved exotic dairy breeds, enhanced artificial insemination (AI) services, and the promotion of local stud-breeding by farmers. Concurrently, Mumba *et al.* (2011) reported that in Zambia, the capabilities of smallholder dairy farmers were strengthened through the provision of resource persons, materials, and financial support mainly by NGOs in collaboration with the national government.

Smallholder dairy farmers are mainly in the rural community and thus are best placed to fulfil the role of nutrition security especially in countries where the logistics chains to transport food are well coordinated. Milk can improve the nutritional outcomes of household members as an important source of energy, protein, essential amino acids, and vitamins A and D which are deficient in carbohydrate-based diets (Bennett *et al*., 2006; Nicholson *et al*., 1999). Animal food products such as meat and milk are concentrated sources of high-quality protein, vitamins, minerals, and other micro nutrients vital to human health (Scoones, 2009). When children consume modest amounts of animal proteins, it alleviates poor growth, poor cognitive development, and impaired physical health. Milk is also a good source of other nutrients such as magnesium, zinc, phosphorus, and calcium which are essential for body growth (Milk SA, 2013; Kawonga e*t al*., 2012). Studies conducted in Kenya, Malawi, and Tanzania have shown that monthly consumption of milk and milk products is above 50 % of the consumed foods in households with dairy cattle than those without dairy animals (Lwelamira *et al*., 2010; Banda *et al*., 2012; Kinambuga *et al*., 2011; Bebe e*t al*., 2003).

In a study on the impact of adopting dairy technology in the coastal region of Kenya, children from households with improved dairy cattle were taller than children from households with indigenous breeds (Nicholson *et al*., 1999). Similarly, children between the ages of 2 and 5 years from households with dairy cattle and goats in rural Rwanda were found to be significantly taller than children from households that did not rear dairy animals. The assumption was that in a typical

household, the amount of milk consumed by children depends on the quantity of milk available. The ownership of dairy animals in this case has been shown to be a contributing factor towards the difference in child growth as compared to household wealth, access to land, or the mother's education (Gelan & Muriithi, 2015; FAO, 2012).

Growing smallholder dairy production improve livelihoods in various ways. It increases the production and incomes of the majority of rural and poor households who depend primarily in agriculture, reduces food prices which governs real income and poverty in urban areas, and generates multiplier effect to the rest of the economy (Wouters & Van Der Lee, 2009).

2.4 Management of dairy cattle in rural areas of Africa

Having identified the importance of dairy in livelihoods, literature indicates that dairying demands a rigid daily schedule every day of the year and a constant watch 24 hours each day (Bebe *et al*, 2003). Increasing milk yield depends on a number of management practices. Bebe *et al.* (2003) argued that increasing lactation yield of a dairy cow has been achieved more by nutrition than by genetics. The argument rests on the point that on a low quality diet, cows would not only fail to achieve their full genetic potential for milk production but also probably be more prone to problems such as infertility and metabolic disease.

In the smallholder milk-oriented farms, the management of labour is an important determinant of farm productivity. In a study by Lues e*t al*. (2012) it was indicated that smallholder management practices are informed by indigenous knowledge. The employment of a herder, whether a family member or a hired one, creates a situation whereby some prerogative of managing the milk production are transferred from the owner to the herder. The herder is remunerated in kind, cash or in kind and cash. Depending on the ownership of cattle, the herder can participate in the decision-making process for technical interventions in the herd (Tebug, 2012; Baiphethi & Jacobs 2009). Lues e*t al*. (2012) argues that the quality and quantity of milk received in smallholder systems is likely to be influenced by the milking behaviour of the operator (milking duration and techniques).

Dairy production is an important enterprise in most Sub-Saharan African countries and comprises of commercial farms and smallholder farms. The difference between commercial and smallholder

farms is mainly determined by herd size, breeds raised and management level (Borner *et al*., 2012). The reasons for keeping livestock are very diverse in communal systems. Herding of cattle is the most common method of cattle rearing in communal farming. Cattle are herded during the day and penned at night. In cases where there is limited grazing land, all the cattle from the entire village may be considered as a single interbreeding flock with no attempts of controlling mating (Bebe *et al*., 2003).

Smallholder farmers keep few animals that are mostly crossbreeds using a low input production system (Nicholson *et al*., 2004). In Malawi, farmers are organized into milk bulking groups where they collectively sell milk to processors. They receive support from government and non-governmental organizations (NGOs) such as Land O' Lakes and Small-Scale Livestock Promotion Program. The support from the institutions includes access to initial stock and improved dairy technologies. Technologies included are on feeding, housing, health and breeding. The support plays an important role as most farmers may not be able to generate sufficient initial capital on their own to profitably engage in dairy farming (Tavirimirwa *et al*., 2013).

2.4.1 Feeding dairy cows

Smallholder dairy farmers use knowledge of animal behavior to improve cow well-being and yield (Devereux, 2014). For instance, feeding and watering systems must be placed where young or inexperienced animals can find them. Accessibility of feed may be more important than the actual amount of nutrients provided. Following crop harvesting, cattle herds are let loose to feed on crop residues until the beginning of the rainy season, when the cattle have to be herded. Communal cattle are rarely supplemented with commercial feeds or improved legume fodder resulting in low intake of poor quality feed, which often limits livestock productivity (Onono *et al.*, 2013). Since feeding is restricted, cattle have little choice of feed, resulting in poor body condition and low weight gains and a higher predisposition of the animals to endoparasites during the dry season (Katsande *et al*., 2013).

The availability of high quality forage is the major constraint for smallholder dairy production in South Africa because of the soil quality and climate. This is why successful smallholder dairy farmers supplement their forage with concentrates (Lues *et al.*, 2012). The higher the quality of forage produced on the farm, the less concentrates (grain) have to be bought or produced. Forage

requirements can be met by the utilization of pastures, green chops, silage, hay or combination of any of those. Where rainfall is limited, silage or hay is produced during the rainy season to provide for the dry season. Previous studies have indicated that maize provides good quality silage in crop producing areas (Katsande *et al.*, 2013; Lues *et al.*, 2012; Nicholson *et al*., 2004). The nutritive value of plant material removed from the land as in the case of hay, green chop or silage is affected by factors such as loss of foliage, type of transportation, hay or silage production practices (for example, duration of wind drying, fineness and compaction of silage material, weather condition) and feeding facilities. Dry matter yield increases with plant age while nutritive value decreases (Devereux, 2014).

Few roughages support milk production as well as young green cultivated pastures. Considering the nutritive value and production costs, green pasture is one of the most economical feed for dairy cattle. Effective utilization of pasture is a certain way of minimising feeding costs in a dairy herd (Nicholson *et al*., 2004). Pastures include veld, cultivated dry land pasture and cultivated irrigated pasture. In veld types, pasture management practices and suitable species for cultivated pastures vary from area to area and require the advice of a pasture specialist to ensure optimal utilization.

Veld, especially sour and mixed veld has a limited value of milk production. However, it can be utilized by lactating cows in early summer (Bergamaschi *et al*., 2015). The nutritive value of veld declines to such an extent after the middle of January in most areas of southern Africa, that high level of milk production cannot be sustained. Climate is a major determinant of pasture plantation. Frost will be detrimental to blue buffalo grass, Columbus grass (*Sorghum alum)*, babala (*Pennisetum typhoides)* and fodder sorghums, while whipping lovegrass (*Eragrostis curvula*), tall fescue, smat finger grass (D*igitaria eriantha)*, Italian rygrass (*lolium multiflorum)* and clover grass mixture will not be affected (Grant & Albright, 2014).

Pasture should be grazed in a pre-boot or boot stage. Depending on age and species, green pasture can support production up to 18 kg/cow/day without additional concentrate feeding. Higher production requires concentrate feeding of only 200-300 g/kg milk (Webster, 1993). Pasture can be utilized by means of continuous, rotational or strip grazing. Continuous means that cattle remain on one pasture throughout the grazing season. Rotationally grazed pasture is divided into several sections and adequate time allowed for re-growth between grazing periods. Strip grazing is

normally controlled by fencing and fresh pasture is provided continuously. Rotational and strip grazing are preferred for dairy cows. Green pastures are palatable and cows graze 8 -10 hours per day, taking about 3600 bites and eating as much as 12 kg dry matter. Consumption increases up to 14.5 kg dry matter when cows graze day and night (Miller, 2012). When cows eat in groups, they eat more than when they are fed separately. Also they are likely to be less fearful, hence, more contented, healthier and more productive. The common practice of feeding and milking cows in groups thus has a sound psychological basis (Stone *et al*., 2015).

Tegegne *et al.* (2013) reported that feed marketing is not well organized and informal marketing is the dominant system in Ethiopia. The major feed resources marketed include grass hay, crop residues, green grass, while marketing of Napier and Rhodes grass was also practised in some parts of Ethiopia. Apart from basal diets, urban and peri-urban dairy production system markets agro-industrial by-products as well. The dominant feeding system in rural and peri-urban dairying system is grazing of private or communal pasture lands, while stall feeding dominates in landless urban dairy production system.

2.4.2 Housing management

Espinoza-Ortega *et al.* (2007) articulated that the reasons for proper housing for a dairy cow is to protect animals from sun burn, rain, hot and cold winds of the inclement weather; to provide clean and comfortable shelter and to protect animals from wild animals and theft. Concurrently, Herrero *et al* (2009) indicated that advantages of adequate housing as increased production of milk; better utilization of labour; production of higher quality milk and milk products; better health of animals; decrease in mortality rate of claves; proper disease control; better care and supervision of animals; Better productive and reproductive efficiency of animals and proper and controlled feeding of animals also occurred.

In smallholder/subsistence farming, proper housing of dairy animals is a major problem (Devereux, 2014). Inadequate roofing and poor drainage can result in accumulation of slurry during the rainy season, which is difficult to clean given the many tasks farmers need to perform particularly in the rainy season when crop production is of prime importance. Hence, accumulation of slurry is inevitable and is observed in most dairy farms. Accumulation of slurry would be detrimental to the animals and provide a medium for pathogens as well as high chances of milk

contamination. The use of iron sheet roofs also needs to be critically evaluated because they conduct heat and could be associated with heat stress mainly in the hot-dry and hot-wet seasons.

Biradar *et al.* (2013) indicated that the smallholder housing systems restrict the cows from freely expressing their normal behavior and enjoying free movement. The restricting sizes of the animal units in these farms are normally due to the small pieces of land owned and the financial constraints by these smallholder farmers, which makes it difficult for them to build cattle housing units with recommended dimensions. The restriction of movement is likely to predispose the cows to lameness.

2.4.3 Health management practices

Dairy cow health is a challenge among smallholder farmers. Disease control is limited by not treating sick animals or waiting too long before diseases are reported. Absence of detailed record keeping and disease surveillance makes it difficult to quantify the actual prevalence and severity of diseases affecting dairy animals. Miller (2012) reported malnutrition and poor animal husbandry as the major predisposing factors to poor animal health among smallholder farms. The combination of health and nutrition challenge in dairy production implies further suppression of animal productivity in terms of milk yield and fertility.

In the study by Chaminuka *et al.* (2014) on Livelihood Roles of Cattle conducted in Limpopo Province, South Africa, it was found that cattle were dipped once a week starting from five in the morning at a central point in the village, or between two villages. It was also articulated that children brought the cattle to the dip tank before going to school. A few elderly women of pension age also performed this task for some households, particularly those where their children were working in the city.

Dairy cattle are susceptible to mastitis (an infection of the udder), which is spread by slurry on the floor of housing units that are not kept clean. Therefore, poor housing conditions lead directly to poor health outcomes. Furthermore, if outdoor pens or kraals do not have roofs, such that animals are exposed to heavy rains during the rainy season which turns the ground into mud and can cause diseases such as foot rot (Kashfi *et al*., 2012). Health risks is mostly caused by inappropriate flooring or by housing different species together which might result in some animals being injured.

The number of trained veterinarians is inadequate and formal veterinary services are inaccessible to most smallholder livestock keepers in African countries. Irregular veterinary and extension services account for the high disease incidence in some areas. The inadequate number of veterinary personnel justify the poor health conditions of cattle in smallholder dairy systems. However, an alternative to formal veterinary services and informal ethno-veterinary practices was developed in the 1990s, called "community-based animal health workers" (CAHWs). CAHWs have demonstrated positive impacts on livelihoods and on livestock health in several African countries (Devereux, 2014).

2.4.4 Financial management

Financial management is considered to deal mainly with how farmers acquire finances and how those finances are managed. Financial management determines the capital structure of the farm and guide in making the decision of whether to borrow or use own equity. A number of studies has emphasized the importance of financial management in smallholder farming and determining the relationships between profitability and leverage, and also the importance of book keeping practices (Gebreegziabher & Tadesse, 2014).

The level of education plays a major role in determining the finances in smallholder dairy enterprise. Kibirige & Obi (2015) indicated that the use of ratios to explain the financial position is required for a sustainable business. These ratios include debt to asset ratio, operating margin, equity to asset ratio, operating expense ratios, depreciation ratios among others to measure the financial position of the farm. Financial records provide information on the performance of a business. The use of these records enables the farmer to analyse the liquidity, profitability, repayment capacity, and efficiency in use of assets and capital (Van Schaik *et al.,* 1996). Dennis (2010) reported a significant negative relationship between debt-to-asset ratio and age of respondents. That is, as age increased the debt-to-asset ratio decreased.

According to Tegegne *et al*. (2013), income alone is not an adequate measure of farmer's financial well-being, they suggested the use of debt-to-asset ratio to indicate financial condition. Furthermore, they found that farmers with fewer years of experience had a higher debt-to-asset ratio than those families with longer tenures. Furthermore, their study indicated dairy households with more educated husbands had higher debt loads than other families.

Gebreegziabher & Tadesse (2014) found that young, married, and well-educated families made a formal budget more often than other families. However, approximately 25% of their sample made written budget plans. According to Van Schaik *et al.* (1996), smallholder farmers reported that there is considerable merging of farm and family financial management. Furthermore, it was noticed that smallholder farmers who use the recommended financial management practices and separate farm and family expenses for fuel, insurance, and repairs have a lower debt-to-asset ratio. Therefore, a statement could be made that families who separate all farm and family expenses would be less likely to be financially stressed.

2.5 The market chain for smallholder dairy

Smallholder farmers sell their milk through different strategies including short channels and longer channels (Uddin e*t al*., 2012). Marketing channels can be categorized into four types: direct selling; selling through intermediaries; dual distribution; and reverse channels. Accordingly, Ulrich *et al*. (2012), reported that more than 90% of smallholder dairy farmers sold their milk through more than one channel. The two most popular channels of marketing were through middlemen and local buyers, Specifically, 52% of the farmers mainly sold their milk to middlemen while 43% mainly sold it to local buyers. Local buyers are neighbours and other people who live near the farmers especially in market centers where they have rented houses and they buy milk for direct consumption. To the contrary, Dennis (2010) found that direct milk marketing to consumers is the most popular channel of fresh milk in small scale farming.

Saadullah (2001) articulated that smallholder dairy farmers market their milk in different institutions including schools and churches. However, Jaffee *et al*. (2011) indicated that in Kenya, only 1% of the farmers were marketing their milk to institutions. Furthermore, farmers were found to be reluctant in marketing their milk through cooperatives and farmer groups. This is because the amount marketed is very small due to lack of surplus in production. Tegegne *et al*. (2013) indicated that although both formal and informal milk marketing systems do exist, the latter is the dominant across all the smallholder production systems.

However, smallholder farmers can have a comparative advantage over large-scale competitors with respect to the transaction costs of accessing and supervising family labor and access to local knowledge (Kinambuga *et al*., 2011). Furthermore, the transaction costs associated with most non-

labor transactions including input supplies, finance and capital, and certification are typically greater for smallholders.

In most African countries, smallholder dairy farmers take milk to the nearest urban centres, some were found to cover long distances to reach markets that offered higher retail prices (Kinambuga *et al*., 2011). For example, in Kenya traders travelled over 100 km on public transport to deliver milk where retail prices almost double those in their nearest areas. The traders mostly use bicycles or public transport to move around farms to collect milk and the same means to deliver the milk to markets, including restaurants and individual households. They handle daily between 60 – 250 litres each and sell to hotels, restaurants and individual customers. The net market margins mainly reflect returns to labour given the low operating costs and almost negligible capital costs. They are generally lower compared to stallholder dairy traders in Tanzania where they range from 18 – 32 %, reflecting high supply of milk in Kenya compared to Tanzania.

Tembo *et al*. (2014) reported that in Zambia some traders boil than cool the milk before sale. This is done mainly to lengthen shelf life because of the distance and time that the milk takes to reach the consumers. Many milk bars and kiosks were found in all urban centres, some of which are operated by dairy coops. They mostly sell raw milk that they buy directly from farmers which they transport to their premises using public transport, bicycles or pick-up trucks. Some milk bars process the milk into yoghurt or ferment it to make sour milk. The main players in the milk market are the processing companies, brokers and milk bars (Bennett *et al*., 2006). Smallholder farmers always sell raw milk directly to consumers or to the processors. The major constraint facing smallholder farmers is that they do not have proper means to process their milk. This indicates another opportunity for smallholder dairy farmers to maximise their profit in the industry.

The South African dairy industry is dominated by five major milk buyers and almost 50% of the dairy market is controlled by only two buyers (Chaminuka *et al*., 2014). These milk buyers are only involved in the secondary industry and not in the primary industry. Among them, the three major players include Nestle, Parmalat & Clover. On the other hand, the Kenyan dairy sector is dominated by small scale producers. About 89 percent of milk in South Africa is marketed through formal channels, and almost all the fresh milk sold is pasteurized (Banda *et al*., 2012). In Kenya, only about 30 percent of the milk is marketed through the formal channels. There are also various

differences in the dairy sectors of the two countries. The average daily milk production in Kenya is 8-10 litres per cow, whereas in South Africa, in 2007 the national average milk production per cow was 4 590 kg, approximately 12.7 litres in daily production (Ulrich *et al*., 2012). The South African dairy industry is more capital intensive, highly specialised and with fewer producers who manage larger dairy operations.

Market access has been identified as one of the factors influencing the performance of small-scale farmers in developing countries (Tegegne *et al*., 2013). Smallholder access to markets is recognized as a vital opportunity to enhance and diversify the livelihoods of lower-income farm households and reduce rural poverty. However, there is a debate on extent to which emerging standards pose barriers rather than catalysts for smallholder production. There is considerable concern that the opportunities provided by high value agricultural food markets will go unrealized by smallholders because of either their technical inability to meet emerging regulatory and private standards or the high compliance and certification costs involved (Ridder *et al*., 2015). That is, whatever productivity or production cost advantages small-scale farmers might have would be outweighed by the burgeoning transaction costs associated with facilitating, monitoring, and certifying smallholder compliance with standards.

2.6 Challenges facing smallholder dairy farmers

Rural-urban migration in South Africa has led to increased demand for milk as a food and income source. To satisfy the demand, the relatively low productivity of smallholder dairy cows has to be improved through alleviation of the various constraints that affect the smallholder farmers. A number of studies have reported less utilization of new technologies, lack of training and finance, low milk prices, feed shortage, poor farm management, low productive and reproductive performance and high disease prevalence as the main constraints to smallholder dairy farmers (DAFF, 2012; Banda *et al.,* 2011; Chinogaramombe e*t al*., 2008). Tebug (2012) also identified poor record keeping, poor artificial insemination services and production environment as constraints to smallholder dairy development.

In a study by Banda *et al.* (2011) in Malawi, smallholder dairy challenges were categorized into breeding, feeding, health and marketing. In their study, 44.6% of the people reported that challenges in animal breeding were mainly the unavailability of AI services and scarcity of good

quality semen and 42.6% were stressed by diseases. Also, 56.8% indicated low milk prices and 39.2% reported poor markets as the major challenges in milk marketing. According to Tembo *et al*. (2014) in Zambia, shortage of land, improved animals and access to artificial insemination were constraints limiting dairy production. Other constraints included lack of extension services, diseases, lack of credit service and market problem.

Furthermore, the majority of smallholder farmers are characterized by illiteracy, outdated technologies, low returns, high seasonal labour fluctuations and women playing a vital role in production (Van den Berg, 2013). Lack of human capital has also been found to be a serious constraint for smallholder farmers. Being illiterate with poor technological skills, can be serious obstacles in accessing useful and formal institutions that disseminate technological knowledge. The majority of smallholder farmers are not capacitated with financial and marketing skills and are unable to meet the quality standards set by the markets. Lack of production knowledge leads to lower quality in production (Baiphethi & Jacobs, 2009).

Low resource endowment is another challenge facing smallholder dairy farmers in South Africa (Chinogaramombe *et al*., 2008). Smallholder dairy farmers produce low quantities of milk that are of poor quality. This is because they have limited land, capital and access to water. Similarly, Tebug (2012) indicated that lack of human capital is a serious constraint for smallholder dairy farmers. The majority are often illiterate with poor technological skills which can be serious obstacles in accessing useful formal institutions that disseminate technological knowledge. The majority of smallholder farmers are not capacitated with financial and marketing skills and are unable to meet the quality standards set by fresh produce markets and food processors (Bennett *et al*., 2006).

Smallholder dairy farmers mostly keep indigenous and crossbred cattle in their systems (Milk SA, 2013; Kibirige & Obi, 2015). These cattle are well adapted to the local feed resources, local housing facilities and scavenging systems. They have low nutritional requirements, heat tolerance, larger rumen volumes and possibly a more efficient digestion of low quality feed. Most importantly, their performance is also good in terms of feed efficiency. However, the major disadvantages of the local cattle in dairy include low productivity, failure to let milk down without presence of the calf and late maturation (DAFF, 2012).

Smallholder dairy households face problems with the availability of feeds (Tebug, 2012). Feed shortage especially during the dry season limits milk production. This is as a result of high feed costs. Banda *et al*. (2011) reported that approximately 50% of the total costs in smallholder dairy households is from feeds. On the other hand, smallholder dairy farmers face low milk price due to an unorganized market network, low local demand and lack of facilities for milk preservation. Alternative feeding systems like the introduction of urea molasses mineral blocks and farm formulated concentrates, utilising locally available feed resources as substitutes to costly concentrates available in the market may be helpful in reducing the feeding cost.

Gebreegziabher & Tadesse (2014) reported that in Ethiopia, smallholder dairy production is severely hampered by various factors related to drought, diseases, limited feeding, poor market, limited credit, limitations of land for sustainable dairy development, problems related to waste disposal, shortage of supply of genetically superior dairy animals, poor extension services, labor problems, limited infrastructure and veterinary services. On the other side, Tegegne *et al.* (2013) indicated that the primary constraints under milk marketing and consumption included poorly understood structure and performance of the informal private sector, lack of reliable information on demand patterns, including product differentiation and changes in dairy consumption habit with urbanization, limited market information on input (e.g. feeds) and output markets. Lastly, concerns over public health hazards of marketed raw milk associated with increased informal marketing particularly brucellosis, zoonotic tuberculosis and low standards of milk hygiene.

Banda *et al.* (2012) articulated that the challenge to increase productivity in smallholder dairy production systems include under-nutrition and seasonal fluctuations in quantity and quality of feed resources and low rate of adoption of available technologies to address them. Concurrently Pursley *et al.* (1997) indicated that natural grazing can hardly sustain milk production and in regions with developing dairy industry, milk production is largely affected by seasonal variations. Supplementary feeding can be justified economically only where a steady market is within reach.

Lastly, some challenges arise from policy and institutional aspects (Espinoza-Ortega *et al*., 2007). These challenges include poor infrastructure particularly roads to allow improved access to output markets, poor rural water supply, mismanagement in farm families due to slow changes in the policy environment and the enactment of regulations to back up policy changes and poor linkages

between input and output markets by farmers organisations. Furthermore, since deregulation of the marketing/ control boards in South Africa (1997), the number of smallholder dairy producers have declined (Milk SA, 2015). Due to economies of scale, processors have amended their procurement patterns after deregulation and started buying less from smaller milk producers. That has reduced the contribution and the effectiveness of smallholder dairy in the economy.

A number of initiatives have been taken to eradicate these challenges faced by smallholders. The improvement of marketing channels could play an important role in improving the marketing, profitability and also the household livelihoods. According to Gelan & Muriithi (2015) the development of the supply chain is one of the important instrument in supporting the smallholder dairy farmers to achieve significant profitability. In Kenya, a number of smallholder dairy projects have also been working on improving the channels through which milk is distributed. This includes both formal and informal channels. It has also been established that about 80% of the milk sold in Kenya goes through the informal channels (Gebreegziabher & Tadesse, 2014).

2.7 Summary

This chapter has indicated that smallholder dairy farming in sub-Saharan Africa occur within diverse biophysical and socio-economic environments. Rural families develop different livelihood strategies driven by opportunities and constraints encountered in such environments. Markets and local cultures determine different land use patterns and agricultural management practices across regions. Within villages, households differ in resource endowment, production orientation and objectives, ethnicity, education, past experience and management skills. Household development is thus not only necessary to target agricultural innovations, but also to address how the specific objectives and endowments of different household types affect resource allocation. There is poor planning in family farming as the family is mainly ruled by emotions and equality, whereas business is economic and profit directed.

CHAPTER 3: THE EFFECT OF SOCIO-ECONOMIC FACTORS ON SMALLHOLDER DAIRY MANAGEMENT PRACTICES

3.1 Abstract

Proper management of dairy cattle has a definite impact on the quality and quantity of milk. Research has indicated that subsistence/smallholder dairy farming has relatively produced low quality and quantity of milk. This research was done to identify the constraints and the factors that drive the adoption of poor management practices in smallholder dairy systems. The analysis was based on 169 smallholder dairy farmers located in Matatiele, Eastern Cape Province of South Africa.Principal Component Analysis were used to derive a composite variable for management practices. General Linear Model was used to identify determinants of management practices in smallholder dairy systems and Content Analysis was done to understand the challenges facing smallholder dairy farmers in their systems. Empirical results indicates that factors such as number of people employed in a household, frequency of cattle illness, gender of the decision maker and the kind of labour employed in a farm were statistically significant in determining the adoption of management practices. Moreover, stocktheft, feed shortage, lack of infrastructure and lack of entrapreneural skills are the main constraints faced by smallholder dairies in Matatiele. The study concludes that poor management practices and lack of entrepreneural skills limits the success of smallholder dairy farmers. Therefore the study recommends an emphasis in education about agricultural practices and implementation of agricultural training centres in rural areas.

Keywords: dairy cattle, management practices, Principal Component Analysis, General Linear Model, Content Analysis, education and entrepreneural skills.

3.2 Introduction

Smallholder agriculture can play an important role in livelihoods creation amongst the rural poor. There is a need to significantly increase the productivity of subsistence/smallholder agriculture to ensure long-term food security. Smallholder agriculture is defined in various ways depending on the context, country and even ecological zone. For insance, Baiphethi & Jacobs (2009) defined smallholders based on their limited resource endowment relative to other farmers in the sector. DAFF (2012) refered to smallholder farmers as those farmers owning small plots of land on which they grow subsistence crops. Whereas, Swai e*t al*. (2010) defined smallholders as farmers with 10

or fewer cattle of all ages and sex. This paper focuses on the latter definition, in smallholder dairy systems, mixed crop-livestock production is carried out primarily to maximize the returns from the limited resources and to contribute in the benefits obtained from livestock which include draught power, meat, milk, and manure. Milk and other milk products from dairy plays an important role in providing food and income (Hemme e*t al*., 2010).

Generally, proper management of the animals has a definite impact on the quality and quantity of milk. However, research has indicated that subsistence/smallholder farming has produced relatively low quality and quantity of milk. Management is the most fundamental aspect in smallholder dairy systems and when good management practices are in place, production efficiency could be improved and livelihoods be enhanced. There are numerous management practices which could influence milk production as a whole, the most common being milking, feeding, housing and health practices. Lues e*t al*. (2012) reported that management practices are inter-linked, failure of one practice has consequences on the other practices: for instance, management of the herd and milking shed can contribute to healthy milk with a low bacterial count. There are numerous management practices which could influence milk production as a whole. The most common being milking, feeding, housing and health practices.

Research shows that an increase in household milk production translates into more income and contribute to poverty alleviation (Kilelu e*t al*., 2013; Lues e*t al*., 2012; Hemme e*t al*., 2010). However, development of smallholder milk producer requires a deep understanding on how and why they adopt their management practices. Household Economy Approach (HEA) identifies the type of information one needs in order to understand and get access to food and income. According to HEA acquiring baseline information is the first and main step into the solution.

Baseline information in the development of smallholder dairy in South Africa includes all the realities facing these farmers in production and marketing. Some of the realities include understanding the diversity of smallholder dairy farmers as they are from low, middle and top class families with most of these farmers being mainly from poor backgrounds (Lues e*t al*., 2012). Smallholder dairy farmers' production systems are characterized by outdated technologies, low returns, high seasonal labour fluctuations and women playing a vital role in production. Smallholder farmers differ in individual characteristics, farm size, resource distribution between

food and cash crops, livestock and off-farm activities, their use of external inputs and hired labour, the proportion of food (milk) sold and household expenditure patterns.

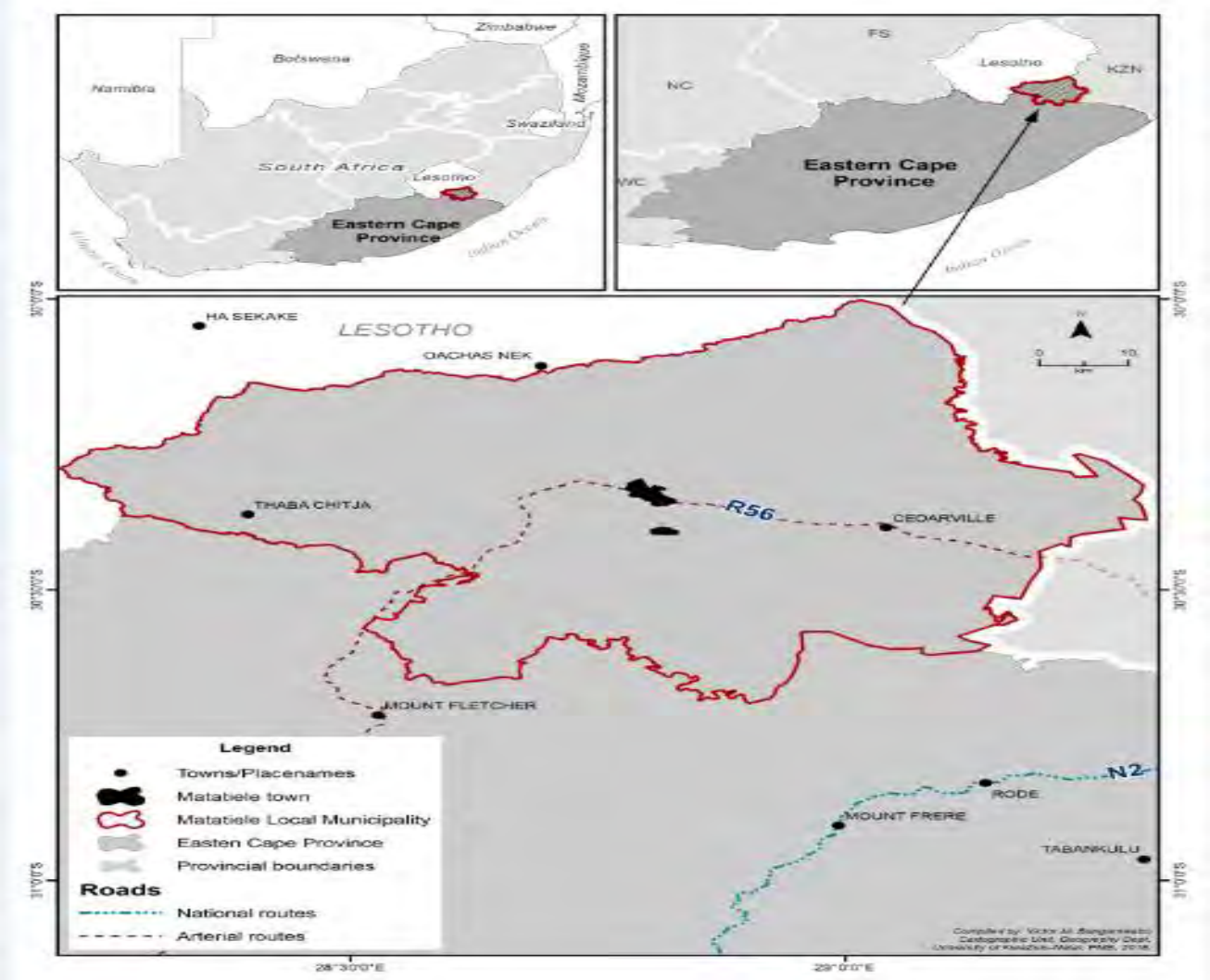
On the other hand, identifying the major issues affecting dairy contribution to the improvement of poor household livelihoods require proper strategic planning to overcome the challenges faced by smallholder dairy farmers. Some of the challenges facing smallholder dairy in South Africa includes the, shortages of quality feeds and fodder, poor management practices, limited access to veterinary care, disorganised marketing systems, lack of institutional support and also research and training (Van den Berg, 2013).

Development of smallholder dairy farmers in South Africa can play a major role in the transformation of agriculture in South Africa. Therefore this paper contributes in transformation by identifying the constraints and the factors that drive the implementation of poor management practices in smallholder dairy systems that lead to the difference between smallholders and commercial farmers in terms of productivity and marketing. It is a view of this paper that the upliftment of rural households could play a major role in reducing inequalities in South Africa.

3.3 Research methodology

3.3.1 Study area

Primary data for this study was collected from villages around Matatiele region under the municipality Matatiele Local Municipality (MLM). MLM is situated within the jurisdiction of the Alfred Nzo District Municipality in the Eastern Cape Province of South Africa. According to census 2011, MLM covers an area of 4352 km^2 and constitutes 58% of the Alfred Nzo District. The majority of the population is African at 98.1%, while Coloured, Indian/Asian and White population groups constitute 0.9%, 0.3% and 0.7% respectively. The majority of the population is mostly residing in rural villages. The total household size was estimated at 49 527 households in 2011.



Source:UKZN-PMB Geography Department

Figure 3.1: Location of Matatiele in South Africa

3.3.2 Background of the study area

Matatiele is characterised by high unemployment rate and low income levels (Eastern Cape Department of Economic Development, Environmental affairs and Tourism, 2014). These however are characteristics witnessed in the rest of the country. An average household size of four was reported by Census 2011, this means a minimum of R2658.00 per month was required for a typical household to survive at 2011 prices. In reference to this, about 25 358 (51%) households in Matatiele Local Municipality were living below this average. This has resulted in large number of people with high dependency on social assistance in the form of grants, approximately 59000 (28.9%) people were the beneficiaries of social grants in 2011. The percentage of households

living in poverty was at 22.4% according to Multidisciplinary Poverty Index census 2011. In terms of the Eastern Cape economy, UKhahlamba and Alfred Nzo District Municipalities are the smallest economies in the province; each contributed approximately 5% of the province's GDP (Eastern Cape Department of Economic Development, Environmental affairs and Tourism, 2014).

Matatiele is a summer rainfall region and is characterised by 'sourveld' grazing conditions. Temperatures varies from 7 to 10°C in the cold-dry season (April–June) and between 18 and 24°C in the hot-dry season (August–October) with an annual precipitation of about 710 mm occurring mainly between October and March. Because of high summer rainfall and relatively high altitude, sourveld becomes relatively unpalatable to livestock in autumn and winter. This has important implications for the type of farming systems the region can support. In the case of milk production, a seasonal fluctuation in rainfall and temperature in Matatiele can give rise to greater seasonal variability in milk production (Kibirige & Obi, 2015). Milk production in Matatiele has traditionally been pasture based with varying rates of supplementation of purchased feeds. About 71% of the population within the municipality were younger than 35 years of age in 2011. This is not surprising given that the whole province (Eastern Cape) has a relatively young population with 70% of the population under the age of 34 years (Van den Berg, 2013). High youthful population indicates the existance of future opportunities for smallholder development.

Eastern Cape is the second most youthful province in the country behind Limpopo Province (Eastern Cape Department of Economic Development, Environmental affairs and Tourism, 2014). About 52.9% of the population had some primary education while only 7.6 % managed to complete at least primary school. Only 0.4% of the population have attained some form of higher education (Dlamini & Tabit, 2014). Poor access to higher education could be attributed to poor financial backgrounds, and poor infrastructure in most schools. This limits the inflow of skilled labour required for the development of smallholder dairy farms in the province. On the other side, the province has five universities, three technikons and 20 technical colleges (Kibirige & Obi, 2015). This indicates that Eastern Cape has the potential to equip youth with the necessary skills for the development of its economy, especially through agriculture.

Vulnerability to food insecurity is widespread in the Eastern Cape, particularly among households in Alfred Nzo district municipality (86%) followed by Chris Hani district municipality (83%) and

O.R Tambo district municipality (81%) (Dlamini & Tabit, 2014). The Eastern Cape has one of the highest levels of food insecurity in South Africa (Van den Berg, 2013). According to the (Eastern Cape Department of Economic Development, Environmental affairs and Tourism, 2014)about 78% of the households in the province were classified as food insecure. This was much higher than national average of 64% in 2011. High prevalence of food insecurity in the province indicates the need for research on new strategies to deal with the problem.

3.3.3 Selection of the study area

The study area was purposefully chosen based on the heifer project that was implemented in the households located at Matatiele. The project began in January 2013 and it intended to assist 600 families at Matatiele to become smallholder dairy producers. One hundred and fifty families received a dairy calf (Jersey) each. A total of 101 adult females were part of the households in the project and 179 males. The households had to manage the calf until it reproduced. According to Heifer International website, milking began with an average production up to 59 litres per day per cow which is a total of 8 850 litres in a day. This makes a monthly average of 265 500 litres for all households. Vegetable seedlings were distributed to project families and they planted their gardens. These vegetables were meant to be used as cow feed. Therefore this research was conducted in this area to understand the management practices that can lead to an improved contribution of dairy into household livelihoods.

3.3.4 Sampling procedure

A stratified random sampling was adopted in this study. Households were categorized into three groups. These groups were informed by whether or not the household is a recipient in the heifer project from Heifer International. Initially, 150 households received one heifer each in the year 2013/2014. However, only 42% (62) household found still owning at least one cow in 2015. Therefore each group was set to include 50 households. This means that the second group had 50 recipients who were no longer owning a cow. The third group constituted of 50 non-recipient households who were traditional dairy farmers. This means that the expected total sample size of this study was to be 150 smallholder dairy farmers.

However, due to some complications in the field, heifer recipients who were no longer owning the cows were not easy to find and some were not eager to participate in the interviews. This is because some of them were no longer part of the project and the project administrators were not able to locate the households. Another reason included the fact that some of them were ashamed since they failed to apply the skills they received from the training before they were given the heifers. Therefore only 13 of that group were willing to respond. Moreover, 48 recipients who were still part of the project were interviewed. Lastly, 121 of smallholder dairy farmers using traditional practices responded. The actual total sample size was 169 smallholder dairy farmers.

3.3.5 Data collection procedures

In various studies, a range of data collection methods are used to achieve the research objectives and to ensure that the data collected is accurate. In this study, semi-structured questionnaire and focus group discussion were used to obtain required data to achieve the study objectives. The questionnaire was used to collect the quantitative data. Data were collected over a period of two weeks in September 2015 with the assistance of five enumerators fluent in isiXhosa and se-Sotho. The enumerators were trained on data collection methods and the contents of the questionnaire before performing the survey.

The questionnaire was pre-tested on three smallholder dairy farmers to test questions for each group. Two of these farmers were heifer recipients. In that two, one of them was no longer owning the cow. The third respondent was a traditional smallholder dairy farmer. From the responses obtained from the questionnaire, questions that were not clear or ambiguous were modified appropriately. Possible response options that were not captured in the closed-ended questions were added to reduce the number of responses falling into the category ‘other’. Pre-testing was used to improve the reliability and validity of the questionnaire. The actual data collection process began after the changes from pretesting.

The questionnaire was designed to capture data on socioeconomic factors including age, gender, level of education attained, family size, farmland ownership and income from dairy farming, income from non-farm activities and other household activities. Also, the questionnaire covered issues on livelihoods, livelihood assets, livelihood strategies, dairy income expenditure; assets

ownership; perceived benefits and constraints to dairy farming and contribution of dairy on livelihoods.

Focus group discussions were conducted to acquire data on the challenges facing smallholder dairy farmers. The participants were randomly selected from a group of farmers. The group sizes varied between 7-11 participants who voluntarily agreed to form part of the discussions. Moreover, farmers' perceptions of own wealth (poor, well-off, rich) and future prospects with respect to their dairy activities were recorded. A facilitator with experience conducting interviews, who spoke the local language, facilitated the discussions. The discussions were recorded for analysis purposes. The data collected was later transcribed into themes, concepts, discussions and quotes (content analysis).

3.3.6 Data analysis

The section discribes the analytical method, tools and the reasons for adopting this analysis. The quantitative data was analysed using Statistical Package for Social Sciences (SPSS version 23) and STATA (version 13). SPSS was used in obtaining descriptive statistics and cross tabulations and Principal Components. STATA was used to run General Linear Model. Descriptive statistics and cross tabulations were used to analyse demographics and socio-economic characteristics of the households sampled. Qualitative data (focus group discussions) were analysed using Content analysis.

3.3.7 Principal Component Analysis

Principal Component Analysis (PCA) is a statistical, multivariate technique that linearly transforms a group of correlated variables into a relatively smaller group of uncorrelated variables that capture most of the information in the original group of variables. Mathematically, PCA creates uncorrelated components from an initial set of *n* variables, where each component is a linear weighted combination of all the initial variables (Gujarati & Porter, 2009). Thus, PCA takes a set of variables, X_1 through to X_n and computes linear combinations of them that represent *m* dimensions or principal components (PCs):

$$PC_1 = a_{11}X_1 + a_{12}X_2 + \ldots + a_{1n}X_n$$

$PC_m = a_{m1} X_1 + a_{m2}X_2 + ... + a_{mn}X_n$

Categorical Principal Components Analysis (CATPCA) presents a more general approach, which enables to deal with some limitation of traditional PCA. This type of PCA enables dealing with nominal and ordinal variables, and furthermore, it can discover nonlinear relationships between variables. CATPCA were used in this paper to create a composite variable for management practices. Management practices were captured through questionnaires. A number of studies have adopted this method before (Gebremedhin 2009; Mumba e*t al.*, 2011).These practices include proper housing of the animals, health practices, previous training about the management of dairy cows, feeding practices, choice of feeding systems for different breeds and milking practices. The first principal component accounted for the most variation and it was used as a composite variable for management practices. This composite variable for management practices was used as a response variable in GLM.

3.3.8 General linear Model (GLM)

GLM was run to identify the factors determining management practices of smallholder dairy farmers in Matatiele. This method was chosen based on the nature of the dependent variable and the independent variables. The model can be specified as:

$$\boldsymbol{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \mu_i}$$

Where:

Y, represent the smallholder dairy management practices in Matatiele. $\boldsymbol{\beta_o}$, is the constant term in the model. $\boldsymbol{\beta_i}$, is a vector of variable coefficient for i =1…k where k is the number of independent variables. $\mathbf{X_i}$, is a vector of variable for i =1…k, $\boldsymbol{\mu_i}$ is the error term.

Dependent variable

Optimization of management practices is one of the limitations in smallholder dairy farming which need to be considered. Smallholder farmers operate in complex systems where they have to allocate their scarce resources across many different enterprises (Gillah e*t al*., 2014). They are rarely able to manage any single enterprise in the "optimal" manner prescribed by researchers. Rather, they make compromises in the management of individual enterprises in order to reduce

risk or meet household needs. This raises a need for researchers to work with smallholder farmers to identify the complexities around decision-making regarding management practices on the farm. This is needed to suggest ways to improve productivity and profitability in smallholder dairy systems. The dependent variable for this model is a composite of management practices for smallholder dairy farmers in Matatiele. This was a continuous variable that captured the highest variation of management practices in the principal components analysis.

Independent variable descriptions

EMPLOYMENT TOTAL: The total number of people employed is directly linked with income received and availability of labour in a household. As the number of people employed increases, family labour decreases and that impacts the management practices in dairy farming households. Concurrently, total number of the employed in a household determines the amount of income received in a household. The variable was expected to have a positive effect on the management practices.

EXPERIENCE: Experiences in smallholder dairy farming have a direct effect in the performance of the farmer. According to Njoko (2014) in the study about willingness to pay for water, found that farmers with high experience knew well about the functioning of the irrigation scheme. This means that farmers with low experience might not be familiar with some of the challenges in the business which might lead to adoption of improper management practices. Furthermore, Tebug (2012), highlighted that farmers who possess great experience were found to own larger herds and adopt good management practices in their farm. Therefore, the effect of experience was captured through this variable and a positive effect was expected.

INCOME: The amount of income earned by smallholders is a key determining factor for the day to day decision making. However, determining the income of a smallholder farmer is very complex. This is because smallholder farmers derive their income in a variety of sources (Chagunda e*t al*., 2015). The amount of income earned in a household translate to the dairy management practices that will be adopted in a particular household. For instance the quality and quantity of milk from the cow depend on the feed which the cows feed on. Animal science literature has shown that feeding a dairy cow is more expensive than feeding a beef animal.

Therefore this variable determines the effect of income in the adoption of dairy management practices in smallholder systems and it was expected to have positive effect in the model.

FREQUENCY OF CATTLE ILLNESS: The number of times cattle are treated for diseases demands the farmer does proper planning about cost, time and labour. This means that almost all the management practices are affected by the health status of the cattle. The respondants were asked how frequent are the cattle ill and the options were: often, sometimes, seldom and not ill at all. The variable was expected to have negative effect on the management practices.

HHH_ED: Household heads who in most African countries appears to be predominantly male often act as key decision makers in the household. Household head's highest level of education were categorised as follows: no formal education; attained any level of primary education; or, attained any form of secondary or higher education. According to Leus e*t al*. (2012) households with highly educated household heads tended to be properly managed. Therefore, this variable tests the effect of household head's education level on dairy management practices of smallholders. The variable was expected to have a positive effect in the response variable.

MILK SALES DECISION: One of the complexities of smallholder farmers is that farming business is not separated from the household daily activities. This means that decision making is made by anyone available at home in a particular time. In this study, decision making about milk sales was distinguished by gender of the person responsible for decision making in a particular household. The respondents were asked if the person responsible for decision making regarding dairy is male or female or both. This variable is expected to have both positive and negative relationship with management practices. The negative relationship arises from the fact that males are reluctant to sell the milk since they do not spend much time at home, which reduces their ability to understand the benefits of petty cash for e household daily needs (Mapekula *at al*., 2010).

HEIFER: A project under Heifer International organization trained people in Matatiele about dairy cow management and successful farmers were given the heifers to raise and begin dairy farming. However, some smallholder dairy farmers in the community did not participate in the project. Therefore this variable identifies heifer recipients among traditional smallholder dairy farmers. Farmers who received their dairy cattle from Heifer International are expected to have better management practices. The variable is a dummy which takes one if the respondent received their

cow (s) from the project and zero otherwise. The variable is expected to have a positive effect on smallholder dairy management practices.

LABOUR: Smallholder farmers are identified as farmers that rely exclusively on family labour. However, due to the increasing monetization of the economy, decreasing family size, increasing rural-to-urban migration, and increasing schooling of children, smallholder farmers have become dependent upon hired labour. This variable identifies the variation on paid and unpaid labour in smallholder dairy management practices. The categories of this variable were 1= family labour, 2 = unskilled community labour, 3 = skilled labour. The variable was expected to have both positive and negative relationship with management practices. For example, unskilled community labour might not perfom all the duties because of the perceptions they may have about their salary and that would negatively impact on the management practices.

3.4 Results and discussions

3.4.1 Socio-economic factors

A number of studies have acknowledged that household head is the one making decisions in a household (Kibirige & Obi, 2015; Grobler *et al*., 2008; Somda e*t al*., 2004). Therefore, it is important to describe the household head in order to understand the factors underlying household decision making. In this study, three types of smallholder dairy farmers were recognized. These were trained farmers, farmers using traditional practices and the farmers who were trained but no longer owning dairy cow. The results revealed that 63.9% of the households were headed by males and 36.1% were headed by females. In agreement, Mapekula *et al*. (2010); Grobler *et al*. (2008) indicated that the majority of rural households are headed by males. The dominance of male decision making threatens women's voice in smallholder dairy systems. Furthermore, 31.3% of the male household heads were trained farmers and 68.8% were using traditional practices. In the female headed households, 36.8% were trained farmers and 63.2% were using traditional practices. High percentage of farmers using traditional practices indicated insufficient training, which translate to lack of innovative skills and ideas. In the male headed households, 3.7% were of the age below 25 years, 13.1% were aged between 26 years and 46 years and 83.3% of the male household head were 47 years and above. For females, 1.6% were aged less than 25 years, 19.7% were between 26 and 46 years and 78.7% were at the age above 46 years. Low percentage of youth

confirm the findings of previous research (Dlamini & Tabit, 2014); Devereux. 2014), which found that in rural South Africa and other African countries, agriculture is dominated by elderly people.

The respondents were asked to rank their livelihood strategies based on the contribution to their daily needs. The results indicated that 31. 4% ranked social grants as their number one livelihood strategy, 27.8% ranked growing crops and sales as their number one livelihood strategy, 20.2% ranked employment as their best livelihood strategy, only 12.5% ranked dairy as their number one livelihood strategy, 7.2% indicated that they depend on self-employment and 0.6% ranked remittances as their best livelihood strategy. Furthermore, among those who ranked dairy as their main livelihood strategy, nine percent were traditional farmers and 3.5% were trained farmers. A relatively high percentage of traditional farmers ranking dairy as the main livelihood strategy might be due to the number of cows they have and the value of the animals to their livelihoods. Lastly, the results indicate that large numbers of people are dependent on social grants, this indicates the role played by government interventions on rural livelihoods. Table 1 shows the socio-economic status in both trained farmers and farmers using traditional practices. The chi-square was used to test if there was any statistical difference between farmers using traditional practices and trained farmers in a specific factor.

Based on Table 1, the results show that elderly in both trained farmers and farmers using traditional practices were dominating smallholder dairy farming. This is according to what was found in the research by Uddin *et al*. (2012). Even though the results indicate that most farmers were married in both groups; however, more farmers were single under trained farmers. This highlights the maturity level of the household head's decision making. Above 90% of the farmers in both groups were literate. This indicates great chances for skill development programs and better opportunities with new technology. The assumption is that education helps the household head to make informed decisions, improve capacity to produce and to earn more income hence the higher the education for dairy farming household, the higher the contribution of dairy in a household *(ceteris paribus*). The family size of the household in smallholder systems reflects the amount of labour available to perform farm activities. Therefore, lower percentages in both groups for household size above five members indicate that there might be not enough labour to work in the farm as farming intensifies. The high unemployment indicate that most dairy farming households were restricted from economic power to implement their ideas and strategies about the development of

the farms. These findings are according to what was found in research by Uddin *et al*. (2012); Kinambuga *et al*. (2011).

Table 1: Comparison of the socio-economic status among trained smallholder dairy farmers and smallholder dairy farmers using traditional practices.

Variable	Trained farmers (%)	Farmers with no training (%)	Pearson Square P-value
Household Head age			0.665^{ns}
<25 years	2.1	3.3	
≥26to<45 years	21.3	13.2	
≥46 years	76.6	83.5	
Marital status			0.309^{ns}
Single	12.9	11.6	
Married	77.4	66.1	
Widowed	9.7	22.3	
H-head education level			0.096*
Illiterate	2.1	7.4	
Primary	43.8	37.2	
Secondary	50	40.5	
Tertiary	4.2	14.9	
H-H Employment			0.156^{ns}
Full time	8.3	8.3	
Part time	10.4	7.4	
Unemployed	60.4	69.4	
Self-employed	20	14.9	
Income per month			0.229^{ns}
≤ R1000	14.6	13.2	
R1000>or< R2000	33.2	24	
>R 2000	52.1	62.8	
Milk sales			0.000***
Selling	77.1	27.3	
Not selling	22.9	72.7	
Family size			0.103^{ns}
≤5 members	37.5	18.2	
≥ 6 members	62.5	81.8	
Note: '***' Significant at 1 %; '**' Significant at 5%; '*' Significant at 10% & 'ns'not significant			

3.4.2 General Linear Model (GLM) Results

The results show that the model was significant in identifying the determinants of management practices in smallholder dairy (Prob >chi^2 = 0.001). Furthermore, among 16 parameters that were included in the analysis, only six were found to have a statistically significant effect in explaining the variation of the management practices in smallholder dairy farming. These 16 parameters included household total income, recipients and non- recipients (traditional smallholder dairy farmers), kind of labour employed, frequency of the illness of the cow, total number of people employed in a household, experience in dairy farming, gender of the household milk sales decision maker, household head education level and the interaction heifer recipients/ non recipients with education level of the household head.

Table 2: The determinants of management practices

VARIABLES	COEFFICIENT	STD ERROR	P-VALUE
Employment total	-0.1311	0.0757	0.083*
Experience	0.0022	0.0080	0.784^{ns}
Income			
R 0-1000	-0.3834	0.3186	0.229^{ns}
R1001-2000	-0.3192	0.2272	0.160^{ns}
Illness Frequence			
Often	-0.5953	0.3424	0.082*
Sometimes	0.4566	0.1990	0.022**
Seldom	-0.5226	0.5343	0.328^{ns}
Education Level			
Illiterate	-0.2806	0.4135	0.497^{ns}
Primary	-0.2166	0.2057	0.292^{ns}
Secondary	-0.1673	0.2873	0.560^{ns}
Decision maker			
Male	0.8476	0.2421	0.000***
Female	1.0085	0.2784	0.000***
Both	0.3307	0.2998	0.270^{ns}
Heifer			
Yes	0 .1968	0.2432	0.418^{ns}
Kind of labour			
Skilled	1.4803	0.5447	0.007***
Family member	0.1576	0.2031	0.438^{ns}
Constant	-0.4185	0.2826	0.139^{ns}
Log likelihood =-125.51; Prob > chi^2 =0.0000			
Note: '***' = Significant at 1 %; '**' = significant at 5%; '*'= significant at 10%; 'ns' = not significant			

The analysis indicate that total number of people employed in a dairy farm household has a statistical significance in explaining the management practices adopted in the farm (P-value < 0.083). According to the results of this paper, when one member of the dairy farm household becomes employed, the perfomance in management practices is reduced by 13.1%. this is supported with the literature on smallholders which indicates that smallholders use family members as their labour. This is one of the strategies that is used in smallholder system to cut the cost of labour in order to maximise the little profit received on the farm. However, Gebreegziabher & Tadesse, (2014) indicated that the use of family labour is not sustainable for the long term development of smallholder farmers since family members prioritise other wage-paying jobs.

The results indicate that the frequency in which the animals becomes ill had significant impact in controlling the management practices of smallholder dairy farmers in Matatiele. Furthermore, the analysis indicated when the cattle often become ill then the management practices are affected negetively (P – value <0.082). Whereas, when the cattle are not frequently (sometimes) getting ill, than management practices are affected positively (P-value <0.022). Furthermore,the results show that management practices are reduced by 59.5% for farmers who indicate their cattle often get ill. Whilest the management practices improve by 45.6% for the farmers who indicated their animals were sometimes affected by disease as compared to the farmers who had never experienced any illness from their cattle. This means that the less frequently the animals get ill, the better are the management practices and the opposite is true for more frequent illness. Gillah e*t al*. (2014), reported that the health of the cow becomes more significant in determining management practices when the verterinary services are not easily accessible. Concurrently, farmers indicated during focus group discusssions that there is only one veterinarian in town and it is expensive for them to go to town for advice or one medication, so they end up relying on their traditional medications.

Smallholder dairy farmers usually use family labour in farm activities. This is done to reduce the cost of labour since family labour is not expensive. However, the results in this paper show that hiring skilled labour had a positive significant effect on the management practices compared with hiring random community member (P-value < 0.001). The model estimates that management practices would increase by 148.0% when replacing unproffesional community labour with professionally trained labour. Furthermore, recent research has indicated a sharp decline in labour supply for agricultural production in most African countries. This attributes to a host of factors

such as rural-urban migration, increased enrolment in school, increased employment opportunities accompanying industrialization, urbanization, as well as increased off farm employment (Bassey e*t al*., 2014). The high numbers of youth dropping out of school before finishing matric should be dealt with accordingly to reduce the pool of less educated labour in rural areas. Also, agricultural subjects should be emphasized in rural schools to increase the number of youth with a proper understanding of the agricultural opportunities in the economy.

The decision making on management practices indicated that male and female decision making about milk sales had a positive statistically significant influence on the management practices when compared with those who were not selling the milk (P-value <0.000). Even though male and female decision making about selling the milk positively affect management practices, male decision making was found to improve management practices by 84.7% whereas, female decision making was found to improve management practices by 100.8% compared to the farmers who were not selling at all. In smallholder systems, decisions about the farm directly impact on the household and decisions about the family. The more a farmer is aware of the decision-making processes that affect farm and household, the more sustainable the enterprise will be and the more likely it will be profitable and sustainable. The higher impact from female decision making on dairy management practices suggest that female contribution in smallholder development projects could be a winning strategy to achieve development. Sharma e*t al*. (2013) indicated that women's active involvement in decision making is essential for rapid economic development.

3.5 Focus group discussion analysis

Table 3 presents the themes gathered from the focus group discussions that were conducted with the farmers in Matatiele. Farmers were asked to talk about their difficulties in dairy farming and their response were recorded, transcribed and summarised.

Table 3: Challenges facing smallholder dairy farmers in Matatiele

Theme	Concepts	Discussion	Quotes
Concerns about the stocktheft	High unemployment Poverty Jealousy	Participants indicated that there are lots of unemployed people in their area, as a result they suspect that these people try to make their living by stealing their livestock and sell it to the nearest villages. Others stated that the people who do not have livestock in the area are the ones who steal the livestock. They steal the livestock and exchange it in the other villages so that they will be able to enjoy the benefit received by livestock keepers.	' the unemployed man are problematic' 'if I could catch him, I can kill him by hands' ' some people don't want to see other people living their lives peacefully'
Concerns about shortage of feeds in winter	Costs Drought Veld-fire (grass)	Participants indicated that in recent years they experience shortage of feeds due to drought conditions and that diminishes the cattle conditions, hence productivity of the cows. Others indicated that burning the grass really reduces the feeds in winter because they rely on grass and crop residue for animal feed since they can not afford to buy feeds regularly.	'Feeds are too expensive in town' 'Children are the ones who set the fire in our fields' 'In summer we don't have a problem'
Lack of infrastructure	Cattle panels Capital Dairy company	Most old mans agreed that when they grew up in the same place (Matatiele), they use to take their cows to the panels and that used to help them to control mating and calving period. Uncontrolled mating leads to the failure to produce enough quantities of milk as demanded by the market.	'we don't have milk processing company close to us' 'we used to have panels' 'help from government'

Inadequate intrapreneural skills	Socio-cultural value Inadequate value adding skills	Some of the farmers stated that selling milk to their neighbours is unhuman. They further indicated that it is a principle in the area that if the neighbor does not have a cow and the other neighbours has many cows than the neighbor with many cows should give one or two cows to the other neighbor so that the neighbor will be able to get milk and use the cows for other purposes like draught power. Some of the farmers said making business about food is something for the people in urban areas.	'I don't calculate whether I make profit or not' 'I don't know how to process the milk except making maas'

The analysis of the focus group discussions on the challenges facing smallholder dairy farmers in Matatiele indicated some of the key reasons why smallholder farmers are not successful in South Africa. The issues about stock theft has serious negative effects not only holding back the progress of the farmer but it also exacerbate hatred and killings among the citizens. Farmers weekly (Mashala., 2013) reported that during the 2011/2012 financial year, estimated R430 million was paid by the government to compensate farmers for stock theft. This value does not include smallholder farmers since they don't have insurance for their livestock and their security system is very weak and that makes them more vulnerable to the matter.

As mentioned in Table 3, the selling of milk to the neighbours was not seen as 'ubuntu', therefore if smallholder farmers have to generate livelhoods from their livestock, their mindset has to be changed. Moreover, the shortage of feeds in smallholder dairy cattle is one of the challenges that leads to the reduction of economic life of the cow. Low cattle productivity is one of the factors that worsen the gap between smallholder dairy and commercial dairy farmers. According to Ngongoni *at al.* (2006) the development and use of genotypes such as crossbreds (*Nguni x Jersey or any other exotic*) has been shown to give the benefits of both increased production and tolerance to climatic and nutritional stresses. Indigenous cows are most readily available in greater numbers than the exotic cows, and they are well adapted to disease and nutritional constraints. However, indigenous cows produce low quantities of milk. Also, lack of information in smallholder dairy farmers is mainly driven by the lack of infrastructure like poor roads and no internet access.

Economic theory indicates that government responsibility is to create a conducive environment for the public to participate in economic projects that are demanded by the economy of the country. One of the duties for the government in developing smallholder farmers in South Africa includes providing infrastructure. Smallholder farmers in Matatiele indicated that their cattle panels are no longer fenced which exacerbate stock theft and uncontrolled mating. Farmers also indicated that they used to have a dairy company where they sold excess milk.

3.6 Conclusions and recommendations

Smallholder dairy farming has a huge potential to reduce household food insecurity and increasing the significance of agriculture in South African economy. The results indicated that proffesionally

trained labour in smallholder dairy systems is required to improved management practices. Therefore, acquiring highly trained and productive labour would recquire rural children to be encouraged to study farming practices in high schools and tertiary institutions so that they will increase participation and introduce innovative strategies that are required to facilitate dairy development, hence sustainable livelihoods.

The results reflected the significant role of decision making especially for woman in affording proper management practices. This highlights a need to enhance woman participation in decision making processes. Many scholars have indicated that decision making in a farm is central to management and it is a challenge. This is because often demands of food security are detrimental to smallholder profitability and it can happen that the sole focus on producing for the market can negatively affect food balances and other food security factors. However, the key to success in smallholder farm decision making depends on the ability of the farmer to understand the key aspects of decision making which include diagnosis, planning, implementing and monitoring and evaluation. Past research has indicated that these decision making aspects are sequential and following them will put farmers in greater command of the resources and processes that influence their food security and their income generation.

Focus group analysis indicated four main challenges that were found to be hindrants for smallholder dairy in Matatiele. These include stock theft, lack of entrepreural skills, feed shortage and poor infrastructure. Stock theft and poor infrasructure are the issues that call for government interventions to create a condusive environment for smallholder dairy farmers. In terms of lack of entrapreneural skills and feed shortages, these calls for human capital development. In reference to this, past research has indicated that smallholder dairy farmers relies on the knowledge and labour of farmers; understanding of their livestock; the conditions they require and their ability to use inputs and farming methods effectively. Overcoming these challenges would lead to improved and diversified livelihoods. It will also create a regular income and employment opportunities and is likely to reduce rural-urban migration by offering opportunities in rural areas, especially to rural women.

Dairy farming requires provision of basic infrastructure and agricultural skill development centres for the improvement of management practices of the smallholder farmers. Training more

veterinary and animal production personnel would be of valuable importance for the sustainability of dairy and livestock as a whole in smallholder systems. The government should provide capital to the cooperative that will specialize in buying the milk from the farmers and sell it to the dairy companies in the Eastern Cape.

CHAPTER 4: THE CONTRIBUTION OF SMALLHOLDER DAIRY FARMING TO HOUSEHOLD LIVELIHOODS

4.1 Abstract

Smallholder dairy farming can play an important role in providing for household livelihood requirements. However, the reality of the situation indicates that most smallholder dairy farmers in South Africa are poor, vulnerable to food and nutrition insecurity and also marginalized from the economy. This research was done to identify the factors determining the contribution of dairy on livelihoods. The research was conducted with 169 smallholder dairy farmers in Matatiele, Eastern Cape Province of South Africa. Ordinal Logistic model was used to determine the factors that explain the importance of dairy in a smallholder milk producing household. Empirical results indicated that factors such as number of cattle owned, education level of the household head, household disposable income, cattle ownership and milk sales were statistically significant in determining the importance of dairy on livelihoods. The results also indicated that very few farmers perceive dairy as their main livelihood strategy because they do not sell the milk. Hence the study concludes that selling the milk is the main driver of the importance of dairy on livelihoods. The study recommends training of smallholder dairy farmers particularly on entrepreneurial skills so that more farmers would sell the milk and realise the importance of dairy in their livelihoods.

Keywords: Smallholder dairy farming, household livelihoods, marginalized from economy, Ordinal Logistic Model, entrepreneurial skills.

4.2 Introduction

The contribution of milk production on household livelihoods can be direct and indirect (Bennett *et al*., 2006). Direct contribution includes nutritional benefits (proteins, calcium and Vitamin A) provided to household members especially children. Milk and other dairy products are highly recommended for the communities where there is high prevalence of immune deficient (HIV/AIDS) diseases and also for the stabilization of osteoporosis in old aged people (Milk SA, 2013; Tamminga, 1992). Indirect benefits include income received from the sales of milk and employment opportunities generated in both production and marketing. Smallholder milk production also has a direct contribution to the intensification of the production systems for

instance, by better use of crop residues and other by-products, and increased availability of manure for crop production.

However, Bennett *et al*. (2006) pointed out that these benefits are hardly realized at household level because large retailers and larger dairy industries around the world are promoting the use of new technology in manufacturing practices or highly expensive agricultural practices such as the use of milking machines which are increasingly raising the standards but making it difficult for smallholder producers to participate. The failure of smallholder milk producers to compete with international dairy products hampers efforts to increase trade both intra-regionally and internationally on such commodities, preventing many farmers from realizing an opportunity to improve their economic well-being.

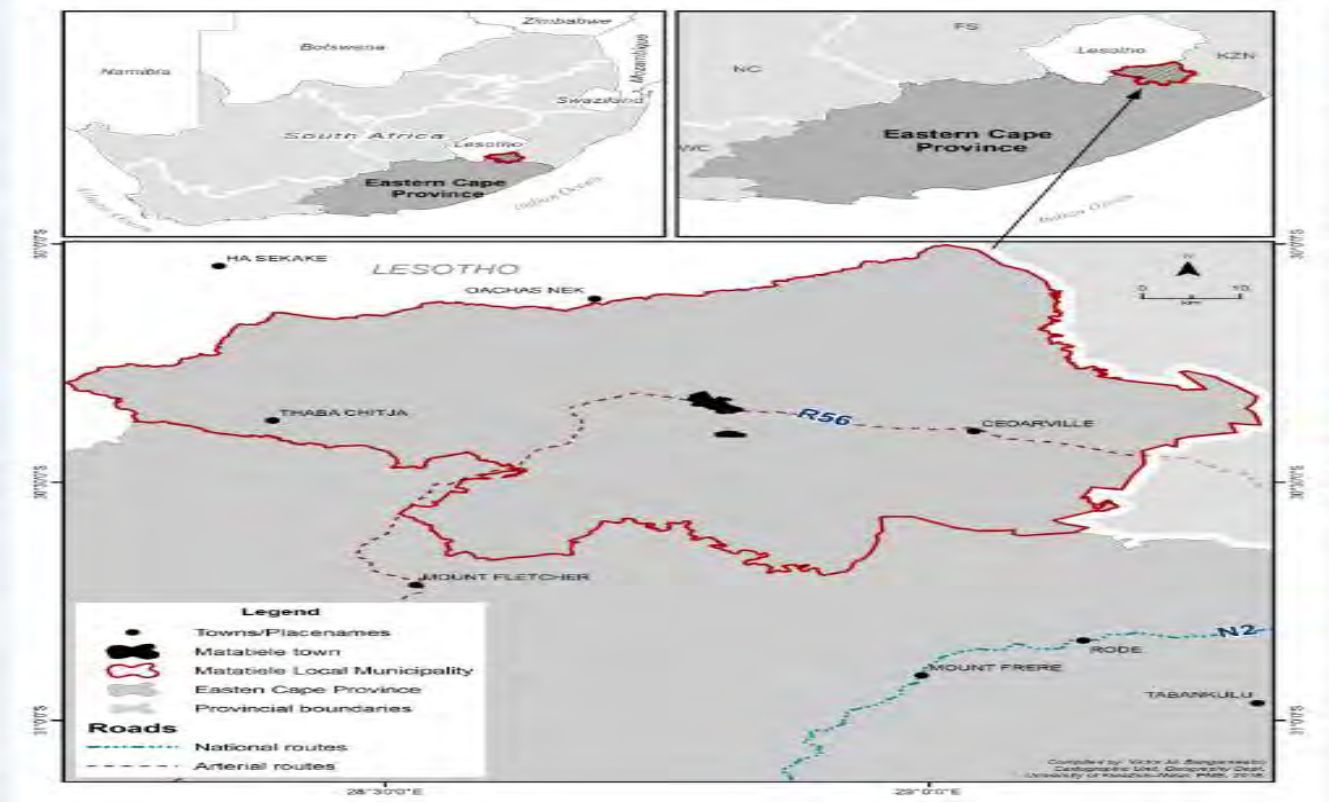
The development of smallholder dairy products can be achieved by first assessing its importance and the contribution to household livelihoods, that can be achieved by understanding the contribution of smallholder milk to a country's total milk production. However, quantified assessment of the contribution of smallholder dairy farmers into milk production remains unknown because of poor record keeping. Rural low income households in South Africa and most Sub-Saharan countries depend on farming for living (Gelan & Muriithi, 2015). Therefore, smallholder agricultural development programs need to improve dealing with challenges and constraints related to persistent food insecurity, food price volatility, food safety and sustainability concerns in rural areas. Dairy development improves and diversifies livelihoods and is likely to reduce rural to urban migration (Wouters & Van Der Lee, 2009).

A number of studies have indicated that smallholder dairy can contribute to livelihoods through income generation, provision of employment and reduction of food and nutrition insecurity (Gelan & Muriithi, 2015; Kibirige & Obi, 2015; Ndoro e*t al*., 2014). However, the reality of the situation indicates that most smallholder dairy farmers in South Africa are poor, vulnerable to food and nutrition insecurity, marginalized from the economy. This research was conducted to identify the factors determining the importance of dairy farming on livelihoods. This is important for the implementation of rural agricultural development policies and projects.

4.3 Research methodology

4.3.1 Study area

Primary data for this study was collected in the villages in Matatiele Local Municipality (MLM). MLM is situated within the jurisdiction of the Alfred Nzo District Municipality in the Eastern Cape Province of South Africa. According to census 2011, MLM covers an area of 4352 km^2 and constitutes 58% of the Alfred Nzo District area. The Total population was 203,843 in 2011. The majority of the population is African at 98.1%, while Coloured, Indian/Asian and White population groups constitute 0.9%, 0.3% and 0.7%, respectively. The majority of the population is mostly residing in rural villages. The total number of household was estimated at 49 527 households in 2011.



Source: UKZN-PMB Geography Department

Figure 4.1: The location of Matatiele in South Africa

4.3.2 Background of the study area

Vulnerability to food insecurity is widespread in the Eastern Cape, particularly among households in Alfred Nzo district municipality (86%) followed by Chris Hani district municipality (83%) and O.R Tambo district municipality (81%). The Eastern Cape has one of the highest levels of food insecurity in South Africa (Dlamini & Tabit, 2014; Van den Berg, 2013). According to the Eastern Cape socio-economic review and outlook (2014), about 78% of the households in the province were classified as food insecure. This was much higher than national average of 64% in 2011.

StatsSA (2011) reported a high unemployment rate (38, 7%) and low income levels in Matatiele. These however are characteristics witnessed in the rest of the country. An average household size of four was reported by StatsSA (2011). Furthermore, Sender (2016) reported that for a typical household in the Eastern Cape (five members) to survive in 2011 prices, a minimum of R2658.00 per month was required. In reference to this, about 25 358 (51%) households in Matatiele Local Municipality were living below this average. This has resulted in large number of people with high dependency on social assistance in the form of grants, approximately 59000 (28.9%) people were beneficiaries of social grants in 2011 (Sender, 2016).

Matatiele is a summer rainfall region and is characterised by 'sourveld' grazing conditions. Temperature varies from 7 to 10 degrees Celsius in the cold-dry season (April–June) and between 18 and 24 degrees Celsius in the hot-dry season (August–October) with an annual precipitation of about 710 mm occurring mainly between October and March. This indicate good environmental conditions for dairy farming as suggested by FAO (2012). Because of high summer rainfall and relatively high altitude, sourveld becomes relatively unpalatable to livestock in autumn and winter. In the case of milk production, a seasonal fluctuation in rainfall and temperature in Matatiele give rise to greater seasonal variability in milk production (Kibirige & Obi, 2015). Milk production in Matatiele has traditionally been pasture based with varying rates of supplementation of purchased feeds.

4.3.3 Selection of the study area

The study area was chosen based on the Heifer Project that was implemented in Matatiele. The project began in January 2013 and it intended to assist 600 families at Matatiele to become

smallholder dairy producers. However, 150 families initially received one dairy calf (Jersey) per family. The recipients had to manage the dairy calf until it reproduces and pass the first calf to other members of the project. Vegetable seedlings were distributed to recipients to provide feeds. Therefore, this research was conducted in this area so that comparisons on dairy management practices, benefits and challenges will be made amongst the Heifer Project recipients and traditional farmers in the area.

4.3.4 Sampling procedure

Stratified random sampling was adopted in this study. Households were categorized into three groups. These groups were informed by whether or not the household is a recipient in the project from Heifer International. Initially, 150 households received one heifer each in the year 2013/2014. However, only 42% (62) household were found still owning at least one cow in 2015. This means that the second group had 50 recipients who were no longer owning a cow. The third group constituted of 50 non-recipients' households who were smallholder dairy farmers using traditional practices. This means that the sample size of this study was expected to be 150 smallholder dairy farmers.

However, due to some complications in the field, heifer recipients whom were no longer owning the cows were not found to participate in the interviews. This is because some of them were no longer part of the project and the project administrators were not able to locate their households. Another reason included the fact that some of them were ashamed since they failed to apply the skills they received from the training before they were given the heifers. Therefore, only 13 farmers of that group were willing to respond. Furthermore, 48 recipients who were still part of the project were interviewed. Lastly, 121 of smallholder dairy farmers using traditional practices responded. The actual total sample size was 169 smallholder dairy farmers.

4.3.5 Data collection procedures

In various studies, a range of data collection methods are used to achieve the research objectives and to ensure that the data collected is accurate. In this study, semi-structured questionnaire and focus group discussions were used to obtain the required data to achieve the objectives. The questionnaire was used to collect the quantitative data. Data were collected over a period of two

weeks in September 2015 with the assistance of three enumerators fluent in Xhosa and Sotho. The enumerators were trained on data collection methods and the contents of the questionnaire before performing the survey.

The questionnaire was pre-tested on three smallholder dairy farmers. Two of these farmers were heifer recipients. Among those two, one of them was no longer owning the dairy cow. The third respondent was a traditional smallholder dairy farmer. From the responses obtained from the questionnaire, questions that were not clear or ambiguous were modified appropriately. Possible response options that were not captured in the closed questions were added to reduce the number of responses falling into the category 'other'. Pre-testing improved the reliability and validity of the questionnaire. The actual data collection process began after the changes from the pre-testing.

The questionnaire was designed to capture data on socioeconomic factors including age, gender, level of education attained, family size, farmland ownership and income from dairy farming, income from non-farm activities and other household activities. Also, the questionnaire covered issues on livelihoods, livelihood assets, livelihood strategies, dairy income expenditure; asset ownership; perceived benefits and constraints to dairy farming and contribution of dairy on livelihoods.

4.3.6 Data analysis

The quantitative data was analysed using Statistical Package for Social Sciences (SPSS version 23) and STATA (version 13). SPSS was applied in the analysis in order to perform descriptive statistics and cross tabulations. STATA was used to run Ordinal Logistic model. Descriptive statistics and cross tabulations were used to analyse demographics and socio-economic characteristics of the households sampled. Ordinal Logistic model was used to determine the factors that explain the importance of dairy in a smallholder milk producing household. The model was chosen based on the nature of the dependent variable used to fulfill the requirements of the objective. Respondents were asked to rank dairy as a livelihood strategy among other livelihood strategies that were applicable to each respondents.

Table 4 indicate the categories included in the rankings that were used in the ordered logit model as the dependent variable. Only 13.0% of the respondents ranked dairy as their number one

livelihood strategy. Rank number two indicates that 24.3% of the respondents had two livelihood strategies and they ranked dairy as the second livelihood strategy. In this study, ranking number five was chosen as the reference category. According to Gujarati and Porter (2009), the reference category is usually the one that makes most sense and which is of most interest to the researcher. The category for those who were not receiving any benefit from milk production was a category of interest. Choosing this as the reference category allowed comparison with those households who did not benefit from milk production (for example some of the respondents indicated that they were not consuming the milk from the cow but they give it to their dogs or give it to neighbours) and those who were benefiting.

Table 4: Dairy rankings as a livelihood strategy in a household

Rank	**Description**	**Percentage**
1 = not applicable (reference)	Dairy is not a livelihood strategy	13.6
2 = least important	Three or lower of three or more strategies	46.2
3 = important	Two of four to five strategies	3.0
4 = very important	Number one livelihood strategy	13.0
5 = extremely important	Two of three or fewer strategies	24.3

Source: Survey data (September 2015)

The model in general form is as follows:

$$Y = \beta_O + \beta_1 X_1 + \ldots + \beta_n X_n + U_t$$

Where;

Y = dependent variable that represent rankings on the perception about the importance of dairy on household livelihood strategies. β_o is a constant, $\beta_{1....}$ β_n = are coefficients to be estimated, X_1…… X_n are explanatory variables describing i^{th} household and U_t is an error term.

Table 5: Description of variables

Variable	Description of the variable	Expected sign
Dependent variable		
Dairy ranking	Dairy was ranked amongst other livelihood strategies to identify the dependence on dairy by households.	
Independent variables		
Experience	Amount of time a farmer has spent in dairying	+
Milk quantity	The amount of milk obtained per day in the household	+
Cattle quantity	The number of cows owned in a household	+
Total employment	Number of people who provide their labour somewhere else rather than in household farming.	+/-
Education	Household head education level: Illiterate =1; Primary =2; Secondary =3; Tertiary education = 4	+/-
Income	Income available for household needs per month: Less than R 1000 =1; between R 1000 &R 2000 =2; Above R 2000 = 3	+/-
Ownership	The gender of the person owning the animals in a household: Male alone =1; Female alone =2; Both male & female = 3	+/-
Sales	The amount of milk sold in a household per day: Sales within one to five litres =1; Six to ten litres =2; 11 to 15 litres =3; Above 15 litres =4; not selling = 5	+

Table 5 describes the variables that determine the decision about the perceived importance of dairy. The number of people employed is expected to have a negative effect on the importance of dairy in a household. This is because employment reduces the quantity of labour available for dairying and also reduces household dependence on dairy (Mapekula e*t al*., 2010). The amount of milk a household receives from the cows determines how much benefit a household can get from dairy (Chagunda *et al*., 2015). The quantity of milk depends on the number of dairy cows kept in the household. Therefore, it is expected that both quantity of milk and the number of dairy cows

have positive effects on the importance of dairy in a household. Furthermore, some of the farmers were selling excess milk, especially if they had more than one lactating dairy cow. Van Schaik (1996) highlighted that farmers who sell more milk tend to enjoy the benefit from economies of scale. Hence, a positive relationship between milk sales and the perceived importance of dairy on livelihoods. Another factor that contributes to the importance of dairy on household livelihoods is experience in dairy farming. Experience is expected to have a positive effect on the importance of dairy on livelihoods. Income received in a household could come from different sources including farm income and off-farm income. However, a number of studies indicated that households with high level of income tend to be less dependent on farming (Borner *et al* 2012; Uddin *et al*., 2012; Musalia *et al*. 2007). According to Somda *et al*. (2004) households with their livestock owned by males benefit more from their animals compared from their counterparts (households with female owned livestock). Lastly, it was expected that education level of the household head will have a positive effect on the importance of dairy on livelihoods.

4.4 Empirical results and discussion

4.4.1 Socio-economic status and demographics

A number of studies have acknowledged that the household head is the one making decisions in a household (Kibirige & Obi, 2015; Grobler *et al*., 2008; Somda e*t al*., 2004). Therefore, it is important to describe the household head in order to understand the factors underlying household decision making. In this study, three types of smallholder dairy farmers were recognized. These were trained farmers, farmers using traditional practices and the farmers who were trained but no longer owning dairy cow. The results revealed that 63.9% of the households were headed by male and (36.1%) were headed by female. In concordant, Mapekula *et al*. (2010); Grobler *et al*. (2008) indicated that the majority of rural households are headed by males. Furthermore, 31.3% of the male household head were trained farmers and 68.8% were traditional farmers. In the female headed households, 36.8% were trained farmers and 63.2% were traditional farmers. In the male headed households, 3.7% were at the age below 25 years, 13.1% were aged between 26 years and 46 years and 83.3% of the male household head were 47 and above. For females, 1.6% were aged less than 25 years, 19.7% were between 26 and 46 years and 78.7% were at the age above 46 years.

The respondents were asked to rank their livelihood strategies based on the contribution to their daily needs. The results indicated that 31.4% ranked social grants as their number one livelihood strategy, 27.8% ranked growing crops and sales as their number one livelihood strategy, 20.2% ranked employment as their best livelihood strategy, only 12.5% ranked dairy as their number one livelihood strategy, 7.2% indicated that they depended on self-employment and 0.6% ranked remittances as their best livelihood strategy. Furthermore, among those who ranked dairy as their main livelihood strategy, nine percent were farmers using traditional practices and 3.5% were trained farmers. A relatively high percentage of farmers using traditional practices ranking dairy as the main livelihood strategy might be due to the number of cows they have and the value of the animals to their livelihoods. Large number of people dependent on social grants indicates the role played by government interventions on rural livelihoods. Table 6 shows the socio-economic status in both trained farmers and farmers using traditional practices.

Based on Table 6, the results show that elderly in both trained farmers and farmers using traditional practices were dominating smallholder dairy farming. This is according with what was found in the research by Uddin *et al*. (2012). The dominance of elderly people in rural areas arise from the ownership of cattle in a household. Devereux., (2014) found that only 10,3% of the participants in the age less than 35 years owned cattle. Even though the results indicate that most farmers were married in both groups however, more farmers were single under trained farmers. This highlight the maturity level of the household head's decision making. Above 90% of the farmers in both groups were literate. This indicate great chances for skill development programs. The assumption is that education helps the household head to make informed decisions, improve capacity to produce and to earn more income hence the higher the education for dairy farming household, the higher the contribution of dairy in a household (ceteris paribus).

The family size of the household in smallholder systems indicates the amount of labour available to perform farm activities. Therefore, lower percentages in both groups for household size above five members indicate that there might be not enough labour to work in the farm as farming intensifies. The high unemployment (60.4% trained and 69.4% farmers using traditional practices) indicate that most dairy farming households were restricted from economic power to implement their ideas and strategies about the development of the farms. These findings are according with what was found in the research by Uddin *et al*. (2012); Kinambuga *et al*. (2011) who indicated

lack of capital with high unemployment as the significant factor that limits the growth of smallholder dairy farming.

Table 6: Socio-economic status among trained smallholder dairy farmers and farmers using traditional practices

Variable	Trained farmers (%)	Farmers with no training (%)	Pearson Square P-value
Household Head age			
<25 years	2.1	3.3	0.665^{ns}
≥26to<45 years	21.3	13.2	
≥46 years	76.6	83.5	
Marital status			0.309^{ns}
Single	12.9	11.6	
Married	77.4	66.1	
Widowed	9.7	22.3	
H-head education level			0.096*
Illiterate	2.1	7.4	
Primary	43.8	37.2	
Secondary	50	40.5	
Tertiary	4.2	14.9	
H-H Employment			0.156^{ns}
Full time	8.3	8.3	
Part time	10.4	7.4	
Unemployed	60.4	69.4	
Self-employed	20	14.9	
Income			0.229^{ns}
≤ R1000	14.6	13.2	
R1000>or< R2000	33.2	24	
>R 2000	52.1	62.8	
Milk sales			0.000***
Selling	77.1	27.3	
Not selling	22.9	72.7	
Family size			0.103^{ns}
≤5 members	37.5	18.2	
≥ 6 members	62.5	81.8	
Note: '***' Significant at 1 %; '**' Significant at 5%; '*' Significant at 10% & '^{ns}' not significant			

4.4.2 Ordered logit model results

Table 7 indicate the results of the ordered logistic regression model, where the dependent variable is an ordinal variable depicting the perception on the importance of dairy in rural livelihoods.

Table 7: Determinants of the importance of dairy on livelihoods

VARIABLE	COEFFICIENT	STD ERROR	Odds Ratio	% change	P-VALUE
Experience	0.00832	0.01424	1.00836	0.836	0.559^{ns}
Milk quantity	-0.03994	0.05204	0.96084	-3.91	0.443^{ns}
Cattle owned	0.04845	0.02778	1.04965	4.965	0.081*
Total employment	0.02185	0.17844	1.02209	2.209	0.983^{ns}
Education					
Illiterate	-0.01743	0.88327	0.98271	-1.728	0.004***
primary	0.87094	0.59031	2.38917	138.917	0.140^{ns}
secondary	0.54846	0.53845	1.73059	73.059	0.308^{ns}
Income					
< R 1000	1.28502	0.60535	3.61474	261.474	0.034**
R1001 & R 2000	0.16002	0.42905	1.17353	17.353	0.709^{ns}
Ownership					
Single male	-1.08987	0.62176	0.33625	-66.374	0.080**
Single female	-1.79044	0.68084	0.16688	-83.311	0.009***
Sales					
1-5 litres	1.51066	0.49674	4.52974	352.974	0.002***
6- 10 litres	2.17487	0.71725	8.80110	780.110	0.002***
11 – 15 litres	4.14349	0.01730	58.0705	5707.055	0.000***
Above	4.78286	0.00823	101.167	10016.71	0.000***
Prob > chi2 =0.000; Log likelihood = -146.99223; Pseudo R^2 = 0.1907					
Note: '*' = Significant at 10 %; '**'= significant at 5%; '***' = significant at 1%; 'ns' = not significant					

The results show that the model was statistically significant in explaining the importance of dairy as a livelihood strategy in the households in Matatiele. Nigelkerke R^2 indicates that about 20% of the variation in the importance of dairy was explained by the parameters that were included in the model. Among the 15 estimates included in the model, nine had a statistically significant impact (at 10%) in explaining the importance of dairy on livelihoods. These estimates include the number

of people employed in a household, quantity of milk obtained per day, experience in dairy measured by number of years involved in dairy farming, the amount of milk sold per day, amount of disposable income received per month, cattle ownership categorised by gender, and the education level of the household head.

Cattle quantity was statistically significant in determining the level of the importance of dairy on livelihoods. According to Table 7, for a unit increase in the cattle owned, the odds for the level of importance of dairy on livelihoods increase by 5%. This indicates a positive effect of the number of dairy animals on the contribution of dairy on livelihoods as expected. These results confirm results by Somda e*t al*. (2004), who indicated that an increase of milk production will generate more income and contribute to poverty alleviation.

Illiteracy was found to have a negative influence on the importance of dairy on household livelihoods. The results indicate that moving from having a tertiary education to illiteracy reduces the level of the importance of dairy on livelihoods by 1.76 %. This indicates that an improvement in the literacy level would make farmers realise the benefit of dairy on livelihoods. Education improves access to information about dairy management and marketing which are major constraints in smallholder systems. Furthermore, Marenya & Barrett (2007) found that farmers with no or low education were not doing well in farming and concluded that education is a major key in developing smallholder farmers.

In terms of household disposable income, the results show that income range of less than R 1000 was statistically significant in explaining the importance of dairy on livelihoods. Table 7 depicts that moving from disposable income above R2000 to disposable income less than R1000 improved the odds of the level of dairy importance on livelihood by 261.4744%. This means that farmers earning income of less than R1000 are largely dependent on dairy farming. This indicates that farmers look at dairy farming as an inferior practice. As the income increases, farmers substitute dairy farming with other livelihood strategies. A number of studies have indicated that even though smallholders are practicing agriculture but they see it as more of a coping strategy rather than a strategy that could develop their livelihoods (Van Den Berg, 2013; Wouters & van der Lee, 2009; Wubeneh &Ehui, 2006). This emphasizes the need for government interventions like subsidizing

the education of the children from low income families and provision of free training programs for low income families in order to improve the confidence of these farmers in dairy production.

The results show that both single male and single female ownership had a statistically significant impact in determining the level of the importance of dairy on livelihoods. Moving from single male ownership of dairy animals to married couple ownership reduced the odds of importance of dairy on livelihoods by 66. 4%. Whereas the movement from female ownership of dairy animals to married couple reduced the odds of dairy being important by 83.3%. A relatively high percentage of reduction of the importance of dairy from single woman ownership highlights that female ownership of dairy animals is more beneficial on household livelihoods. This is in accordance with the finding by Thamaga-Chitja e*t al*. (2010) who indicated that in rural areas, woman spends much of their time doing household duties and they tend to have a better understanding of household requirements, management and development. In contrary, Uddin e*t al*. (2012) found that gender of the person owning cattle was not statistically significant in determining the contribution of dairy in household livelihoods.

Lastly, moving from not selling to selling the milk of less than five litres, six to ten litres,11 to 15 litres and above 15 litres per day generally increased the odds of dairy being the important source of livelihood by 353%, 780.1%, 5707.1% and 10016.7% respectively. These results indicate that the level of the importance of dairy on livelihoods increases as the amount of milk sold from a farm household increases. This means that smallholder dairy farmers should develop and adopt strategies that generate and improve milk sales in order to realise the importance of dairy on livelihoods. On the other hand, Van Den Berg, (2013) indicated that the chances for smallholders to consistently sell their production are limited by a number of factors and these factors decrease as the quantity of production to sold increases. These factors in smallholder dairy systems include poor record keeping, low amount of milk and poor quality milk produced, unidentified marketing strategies, market availability and accessibility (Arriaga-Jordan & Pearson 2004). Furthermore, the socio-economic status of the farmers in this study reflected high unemployment rates which indicate low purchasing power and that might exacerbate the difficulties in selling milk.

4.5 Conclusions and recommendations

The generalization in the literature that smallholder dairy farming is becoming increasingly important because of its potential to substantially contribute to sustainable household livelihoods through economic well-being, household food security, and nutritional stability needs to be re-evaluated. This is because the findings of this research indicated that very few (12%) smallholder dairy farmers perceive dairy farming as their most important livelihood strategy. A probability analysis was undertaken in this paper. The results indicated that there are very low chances for smallholders in Matatiele to satisfy most of their needs through dairy. This may be due to the fact that majority (71.4%) of the households sampled did not have suitable cattle-breeds for milk production such as Jersey. However, even among those with dairy breeds, very few (31.8%) were selling the milk. This has led to the conclusion that training on management practices is not enough to create a competitive smallholder dairy farmer, farmers need to be well equipped with entrepreneurial skills in order to successfully benefit from the enterprise. Furthermore, since smallholders are striving to commercialize their business on dairy, it is recommended that they should be capacitated with skills that will give them comparative advantage on their counterparts (commercial farmers) in order for them to dominate the dairy industry in South Africa.

The dominance of elderly people on household milk production in Matatiele indicated that future performance of the industry will have limited prospects. Truncated participation of youths threatens the future of dairy and this may worsen the situation of food insecurity and unemployment which might lead to increased poverty levels in the face of increasing population and limited resources. In the light of increasing the number of people who recognise dairy as the best livelihood strategy, initiatives should be taken to increase the benefits received from dairy in smallholder farming. Therefore, this research recognises a need to train smallholder farmers particularly about record keeping. This is because poor record keeping prevents profit determination which is required for quantifying the contribution of dairy on livelihoods and enterprise development. Further research would be needed to extend this static analysis in order to capture the long-term strategies adopted by smallholder dairy farmers.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATION

This study was conducted to assess the role of smallholder dairy management practices in the contribution of dairy on livelihoods. In this study, management practices of smallholder dairy farmers were evaluated with an aim of identifying their contribution on farmers livelihoods in light of improving food security status in rural households. The specific objectives were to identify factors determining household dairy management practices, to identify the challenges experienced by households in managing dairy animals and to assess the importance of dairy animals on livelihoods in Matatiele. The study used descriptive statistics, chi-square tests, general linear model, ordered logistic regression and content analysis to achieve these objecives. Furthermore, the study indicated that factors such as the number of people employed in a household, frequency of the illness of a dairy cow, the person who makes decisions about the management of dairy and the kind of labour that is employed in a household determined the management practices in smallholder dairy farming.

Smallholder dairy farmers recorded having diverse livelihood strategies where only 12% perceived dairy farming as the most important livelihood strategy. The comparison between trained farmers and those using traditional practices indicated no significant difference in terms of age, marital status, employment, income and household size. However, level of education and sales of milk indicated a statistically significant difference among these farmers. In the farmers using traditional practices, 7.4% were illiterate whereas only 2.1% of the trained farmers were illiterate. In terms of milk sales, 27.3% of the farmers using traditional practices were selling the milk while 77.1% of the trained farmers were selling. The marketing of milk in the informal market suggests that farmers receive small amounts and as a result they end up using the revenue for household expenses and that contributes to the constraints faced by smallholder dairy development.

Moreover, the number of cattle owned, education level of the household head, disposable income in a household, cattle ownership and the amount of milk sold in a household determine the importance of dairy on livelihoods. The main challenges that were identified by the farmers include stock theft, shortage of feeds in winter, lack of infrastructure and lack of information about dairy farming.

The study concludes that lack of good quality education and training on agricultural practices in smallholder dairy farming are the most critical factors to be considered for the deveolpment of smallholder dairy farmers. Poor contribution of dairy on livelihoods is attributed to the lack of information on how to use the available resources for the benefits of household livelihoods. Illiteracy especially in farmers that use traditional practices restrict the potential benefits of education about agricultural practices to the farmers. The dominance of elderly people in smallholder dairying also worsens the contribution of dairy on livelihoods. On the other side, this study indicated that selling milk is the main driver of the importance of dairy on livelihoods. Therefore, there is a need for agricultural training centres in rural areas.

5.1 Policy recommendations

- There is a need to make smallholder dairy farmers aware about the importance of the benefits of good management practices in the farm.
- Record keeping is an abstract concept to most of the farmers especially farmers that use traditional practices, since they see it as just a waste of time. As record keeping is an integral part of good management, it is imperative that the farmers be helped to appreciate the essential and practical nature of record keeping in dairying. This, from a business perspective would enable them to easily account for invested resources, production levels and revenue received.
- Farmers need to be equipped with entrepreneurial skills in order to successfully benefit from the enterprise. Furthermore, assuming that smallholder dairy farmers are striving to commercialize their business, it is recommended that they should be capacitated with skills that will give them comparative advantage over their counterparts (commercial farmers) in order for them to fully participate in South African dairy industry.
- Further research is required to extend this static analysis in order to capture the long-term strategies adopted by smallholder dairy farmers.

5.2 Study limitations

Very few trained farmers who no longer owned the cattle participated in the survey. On the other hand, too many farmers using traditional practices participated. These imbalances restricted the critical comparison of the three groups of farmers mentioned in the research methodology. Farmers

were not able to estimate the costs incured for the management of their cattle which than restricted quantifying the contribution of dairy to livelihoods. Therefore, it is recommended that farmers should be taught to keep records.

5.3 Suggested areas of further research

A number of studiess on smallholder dairy development have bigger sample sizes, larger sample size allow more variation and improve the accuracy of the research. Therefore this study could be improved by increasing the sample size. Further research should consider comparing management practices in both summer and winter in order to get a broad understanding of management practices and contribution of of dairy on smallholder livelihoods.

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APPENDICES

Appendix A: Questionnaire

Introduction

Smallholder Dairy Evaluation Questionnaire

I would like to invite you to participate in this research. If you decide to take part in this interview please note the following:

- Your participation is completely voluntary.
- All the identifying information that you provide will remain confidential.
- You have the right to withdraw from the interview at any point without any penalty.
- There is no risk of physical and legal harm in this study.
- You are free not to answer any questions that make you uncomfortable. If you feel that some of the questions asked cause you tension and anxiety or any stress, you will be provided with a referral to see a counselor from the University of Kwa-Zulu Natal (Pietermaritzburg).

Participation agreement

I..... have been given an opportunity to ask questions about the research and they have been answered to my satisfaction. I agree to be interviewed.

Signature of the participant.....

Date.....

Identification

1. Province _____Sub location _____village_____

2. Name of enumerator _____

3. Date _____

Background information

4. Head of household:

Name _____

Gender

1 Male ☐ 2 Female ☐

Age_____

Employment status

1 Full time employed ☐ 2 Part time employed ☐ 3 Unemployed ☐

5. Household structure excluding household head

	< 17 years	Youth (18- 35)	Adult (36- 65)	Old age 65 >
Male				
Female				
Total				

6. Employment status excluding household head (please indicate the number of people in a corresponding space)

	< 17 years	Youth (18- 35)	Adult (36- 65)	Old age 65 >
Employed				
Unemployed				
Total				

7. Please indicate the number of people who receive any type of grants in this household

	< 17 years	Youth (18- 35)	Adult (36- 65)	Old age 65 >
Male				
Female				
Total				

8. Household total monthly income including grants (tick)

1	R 0- 1000	
2	R 1001- 2000	
3	R 2001 - 3000	
4	R 3001 – and above	

Livestock management

9. Do you own any livestock in this household?

1 Yes ☐ 2 No ☐

If "Yes" please proceed to question number 18 below

<u>If you do not own dairy cow</u>:

10. Why do you no longer own a dairy cow?

1. The animal died
2. I sold the animal
3. I slaughtered and ate the meat
4. It was taken away by Heifer

11. If the animal died, please specify the age your animal died _____

	What was the cause?	Tick
1	It was affected by the disease	
2	I didn't have enough feeds	
3	I didn't manage to build proper housing for the cow	
4	Any other (specify)	
5		

12. Would you still like to own a dairy cow? 1 Yes ☐ 2 No ☐

13. Did you receive the training on the management of dairy animals? 1 Yes ☐ 2 No ☐

14. If "yes" Please indicate your status about the training

1. I managed to apply the training skills effectively in my cow
2. It was difficult to apply what was taught in my dairy cow
3. I didn't get enough support to enable me to apply the training skills

15. What are the major constraints that prevent you from being a dairy farmer?

		Tick
1	Lack of capital	
2	Inadequate amount of owned land	
3	Lack of knowledge about dairy	
4	Climatic conditions are not favourable	
5	Lack of support	

16. Did you have the market to sell your milk? Yes ☐ No ☐

17. If "No" what was you major constraint?

		Tick
1	The price was too low, I didn't make a profit	
2	There were many of us who were selling milk in the area	

3	People didn't prefer my milk over my competitors	

Please proceed to question number 40

If you have dairy animals:

18. Please indicate the type of livestock that you own in the list below

Livestock list	**Number owned**	**Number sold in the previous year**
Dairy cows		
Goats		
Chicken		
Any other (specify)		

19. Where did you get your dairy animals?

1. From Heifer Project
2. From the department of agriculture
3. I bought it from my own pocket

20. What type of breed (s) are your dairy animals? Tick

1	Indigenous (Nguni)	
2	Crossbreeds	
3	Exotic (Jersey, Ayshire)	

21. For how many years have you owned dairy animals? _____

How many you started with?	How many do you have now?

22. Please indicate the type of feeding system you use for your dairy animals

		Tick
1	Zero grazing only (e.g. cut and carry)	
2	Pasture only	
3	Pasture and zero grazing	

23. Why are you using the above mentioned feeding system?

1. I don't have the knowledge about other feeding systems
2. I don't have resources required for other feeding systems
3. Both of the above
4. I am satisfied with the conditions of my animals in the current feeding system

24. For how long have you been using the feeding system selected in (q) number 22 above?

1. 1 year and less
2. 2 years
3. 3 years
4. 4 years and above

25. Are there any supplements given to the animals before or after grazing? Yes ☐ No ☐

26. How do you feed your dairy animals in winter when the grass is dry in the fields?

1. I feed them the same way as in summer
2. I buy commercial feeds as supplements
3. I give them crop residues

27. Who is responsible for sending and bringing back the animals for grazing?

1. Any member of the household available that time of the day
2. Only children
3. Employed boy from neighborhood

28. Is there a sheltered house for dairy animals in this household? 1 Yes ☐ 2 No ☐

29. Have you ever experienced any sickness in any of your animals in the past 2 years?

1 Yes ☐ 2 No ☐

30. If "Yes", please choose in the categories below based on the symptoms observed?

1. Internal disease
2. External disease
3. Both

31. How have you dealt with the diseases mentioned in the question above? (Tick)

1	I consulted the officials from the department for help	
2	I got the medicine in the veterinary pharmacy	
3	I asked the nearest farmers for assistance	
4	Other (specify)	
5		

Household livelihoods

32. What benefits are you receiving from dairy animals? (Tick here)

1	Easy access to milk for consumption	
2	Sell milk for income	
3	Provide security e.g. for traditional ceremonies	
4	provide nutrients to the fields (manure)	
5	wealth status	

33. Do you milk any of your dairy cows? 1 Yes ☐ 2 No ☐

34. If "No" why?

1. The cows are not able to produce enough for human consumption and the calves
2. We don't eat unpasteurised milk
3. There is no market to sell the milk

35. How much milk do you get from one animal per day? _____

36. What do you use the milk for?

1. Provide for home consumption
2. Sell it to the community/ milk processing companies
3. Both own consumption and selling

37. Do you have a market for your produce (crops, animals or milk)? 1 Yes ☐ 2 No ☐

38. If "yes" in the above question...who are you selling to?

1.	Door to door household visits	
2.	Churches and schools	
3.	Other farmers for processing	
4.	Other	

(Specify) _____

39. How much income do you receive from milk sales? _____

40. What are the activities that you do for living (livelihood strategies)? (Tick)

		1 yes	2 No	Rank
1	Rely on the benefit from dairy farming			
2	Grow crops and sell them			

3	Temporally employed locally			
4	Running my own business not related to agriculture			

41. How many meals per week depend on milk in this household?

1. None
2. 1
3. 2
4. 3
5. 4 and above

42. Please indicate the type of crops that you grow in your fields or garden during the year?

Crop	**Tick**	**No of hectares**
Vegetables (spinach, cabbage)		
Maize		
potatoes		
Oats		
Wheat		

43. Please indicate and rank your income expenditure

*1…highest and 5 …least

	activity	**tick**	**Rank**
1	Food, health and clothes		
2	Provide for educational needs of the children		
3	Dairy farming		
4	Crop production and management		
5	No income received		

44. Can you please select the assets you own in this household?

	Assets	**Yes**	**No**	**Quantity/ size**

1	Do you have dairy cow (s)			
2	Do you feel that you own enough agricultural land			
3	Do you have any rental agricultural land			
4	Do you have access to water			
5	Do you own the fridge			
6	Do you have electricity			
7	Do you have a salt lick for your animals			
8	Do you have a car or tractor			
9	Do you have radio, television or access to news paper			

45. Do you know any agricultural extension officer in this area? Yes ☐ No ☐

Appendix B: Focus Group Questions

Focus group guide questions

1. What motivated you to be a farmer?
    - Purpose of farming
    - How did you begin?
2. Describe your farming system
    - Farm size
    - Labour & availability
    - Gender dynamics
3. Elaborate on your farming experiences with regards to dairy farming
    - SWOT analysis (rank challenges according to importance)
    - Access to Resources and Support services (Resource mapping & Venn diagram)
    - Power issues and relationships (gender)
4. How do you generate income from your farming?
    - Streams of income
5. How do you spend the money generated from your farming?
    - Main use of money
6. In your own opinion do you think dairy farming has a potential in this area?
    - What could make it grow?
    - How do you think it could improve your livelihoods?