

**FACTORS INFLUENCING MILK PRODUCTION AMONG
SMALL SCALE DAIRY FARMERS IN MIRANGINE IN
NYANDARUA COUNTY AND MAUCHE IN NAKURU
COUNTY, KENYA**

BY

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DECLARATION

This research project report is my original work and has not been presented for examination in any other university for the award of an academic certificate.

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DEDICATION

This research project is dedicated to my beloved wife Winnie for her moral and financial support, self-sacrifice and determination to ensure my success. Also to my children Jeremy and Teggy, not forgetting High Hope academy students and deliverance church Theta Samuels and ambassadors to you all I say, this is the way. Finally I dedicate my work to my dear parent Mr. and Mrs. Francis Kamau for their invaluable support during my research period.

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ABBREVIATIONS AND ACRONYMS

AFC	Agricultural finance cooperation
AI	Artificial insemination
COMESA	Common market for eastern and south Africa
DFID	Department for international development
EADD	East Africa dairy development
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GOK	Government of Kenya
ICT	Information and communication technology
IFAD	International funds for agriculture development
ILRI	International Livestock Research Institute
KARI	Kenya Agricultural Research Institute
KDB	Kenya Dairy Board
KDP	Kenya dairy project
KDSCP	Kenya dairy sector competitiveness programme
MDG	Millennium Development Goals
MOLD	Ministry of livestock Development
NKCC	New Kenya Cooperative Creameries
SDCP	Smallholder dairy commercialization programme
SHG	Self-help group.
SRA	Strategy for Revitalization of Agriculture
SSMV	Small Scale Milk Vendors
UHT	Ultra heat treatment
USAID	United States Agency for international development

ABSTRACT

Dairy farming remains the economic backbone of livestock farmers in high potential areas like Mirangine and Mauche. However, in such areas, milk production has been quite low. This is an indication that there are constraints which results in low milk production. For potential milk yields to be realized, all production constraints and their individual effects on milk production must be identified. The purpose of this study was to comparatively analyze the factors influencing milk production in Mirangine division in Nyandarua County and Mauche division in Nakuru County through a qualitative analysis of milk production, and the performance of the dairy enterprises at the farm level. The specific objectives of the study were: 1. To identify the how marketing factors influence milk production in Mirangine and Mauche division among small scale dairy farmers; 2. To establish how farmers awareness on dairy farming affects milk production in Mirangine and Mauche division; 3. To identify how demographic characteristic of small-scale dairy farmers influence milk production in Mirangine and Mauche division; 4. To establish how cattle breeds variability affects milk production in Mirangine and Mauche division. A structured questionnaire was used to collect data from 352 small scale farms in Mirangine and Mauche regions of Kenya and key informants were also interviewed. With the use of SPSS version 20, data from the survey was analyzed and presented using descriptive statistics. The results from the study showed that there is a difference between average productions of the two regions with farmers in Mirangine producing more than farmers in Mauche. Majority of farmers from Mauche sold their milk locally to shops and hotels while majority of farmers from Mirangine sold their milk to middlemen. More than half of the farmers in Mauche do not receive training on dairy farming while majority of farmers in Mirangine receive training on dairy production with the government and the private sector providing most of the training. Majority of farmers in Mauche had most of their cattle in the foundation of breeding while their counterparts in Mirangine had most of their cattle at the appendix stage. This study recommends that the government should: promote commercial dairy farming, and more so promote the stocking of quality dairy breeds through easily accessible financial arrangements; strive to help the farmers improve their breeds by registering them and offering semen through the government veterinary doctors and extension officers.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The dairy industry is a major employer in the world and it is growing further as the demand for milk is increasing with the growth in population to over the 7 billion mark. The total milk production in the world has increased by 32% whereas per capita world milk production has declined by 9%. This indicates that the world milk production has not kept pace with the increase in world population. Kenya's dairy industry is a dynamic and plays an important economic and nutrition role in the lives of many people ranging from farmers to milk hawkers, processors, and consumers. Kenya has one of the largest dairy industries in sub-Saharan Africa. Though the last livestock census was conducted in 1966, the current official cattle population statistics come from the ministry of Livestock and development, through its field reports compiled by extension officers. The official statistics place the number of milking cattle at 3.8 million (Government of Kenya, 2008). A survey conducted by Smallholder Dairy project (SDP) asserts that there are approximately 6.7 million dairy cattle in Kenya (SDP, 2005). The Food Agricultural Organization (FAO) on the other hand estimates a figure of 5.5 million milking animals (Techno serve, 2008). In Africa, Kenya is the only country, after South Africa that produces enough milk for both domestic consumption and export. Sudan on the other hand is the largest producer of milk in the common market for Eastern and Southern Africa (COMESA), but it does not produce enough to satisfy both domestic and export markets.

The dairy industry is the single largest agricultural subsector in Kenya, larger even than tea (Muriuki *et al.*, 2004). It contributes 14 percent of agricultural GDP and 3.5 percent of total GDP (Government of Kenya, 2008). The industry has grown tremendously since its liberalization in 1992. Liberalization led to a rapid growth of the informal milk trade that mainly consists of small scale operators dealing in marketing of raw milk. At that time, there was an emergence of new institutional arrangements in milk collection,

processing and marketing, which included hawkers, brokers' self-help groups, neighbors and business establishments like hotels (Karanja, 2003). The informal markets controls an estimated 70 percent of the total milk marketed in Kenya (KDB, 2009; Government of Kenya, 2006). This sector is important and is driven by among other factors the traditional preferences for fresh raw milk and its relatively lower cost. However, this has not been established in Mirangine and Mauche regions of Kenya. Raw milk markets offers both higher prices to producers and lower prices to consumers but with several challenges relating to quality control and standards, and the associated health and safety concerns.

The informal milk market has in the past faced several challenges. This was because prior to policy change in 2004, informal vendors, including mobile milk traders and bar vendors, and milk transporters, were not recognized under the old dairy policy. As a result, they were frequently harassed as powerful dairy market players sought to protect their interests and increase market share. There were also concerns over food safety and quality of milk sold by the informal sector players. The dairy policy at the time focused on promoting value addition and increasing the market share of pasteurization milk while attempting to address potential public health risks of consuming raw milk. However, since 2004, there has been a major change in policy and practice towards the informal milk market (Leksmono, et al., 2006). The dairy policy now clearly acknowledges the role of small scale milk vendors (SSMVs) and contains specific measures to support them. These include: development of low-cost appropriate technologies, training on safe milk handling, provision of incentives for improved milk collection and handling systems, and establishment of supportive certification system. While the Dairy Policy is still in progress, awaiting approval by parliament, there has been a proactive engagement by the Kenya Dairy Board in training and certification of SSMVs, in order to safeguard public health and assure quality of the raw milk (Leksmono, et al., 2006).

Nakuru County had many districts; Njoro being one of them is composed of Four Divisions. These are Njoro Division, Mauche Division, Laare Division and Mau Narok Division.

Mauche division is along the Mau Narok Route and was initially part of Teret and Likia forest before settlement. It has an area of 166 square km and human population of 25,800 people (2009 GOK). The area has been prone to clashes in the past between the different communities but has now settled down as a productive area with a high potential for dairy farming. The division has a total of 8925 cattle producing 7.5 million litres annually (District livestock production annual report 2012). These administrative units: districts and divisions though not currently existent in the current constitution, will be used for the purposes of this study.

The climate being at the foot of the Mau is very favorable for dairy farmers if well exploited. Only Njoro Farmers' Cooperative is doing well in the District, currently collecting over 3,000 litres daily, and delivering to the Brookside owned cooler in Njoro town. Tuungane Dairy Farmers Cooperative in Mauche started well about two years ago, delivering to Brookside, then to Buzeki and later to Happy Cow. Towards the end of 2011, it went down due to mismanagement. Farmers lost faith in it and currently, are doing less than 1,000 a day even with the cooler from happy cow (Kenya dairy board annual report 2011).

Mirangine division covers an area of 97sq km and an estimated population of 30,000 people according to 2009 population census. Mirangine division which is under study has a total of 8460 cattle and produces more than 50% of the total milk of the Mirangine district (i.e. 11.5 million litres annually). Like the Mauche division Mirangine division is surrounded by Ndoduri forest Bahati forest and a lot of hills some of which are within the slopes of Aberdare ranges. The main processors within the division are Brookside and KCC. The two divisions of Mirangine and Mauche are homogeneous in many ways; climate, cattle population, human population among others. The study intended to comparatively analyze the factors that bring difference in milk production which has a margin of around 4 million litres annually between the two divisions (KDB, DLPO annual report 2012).

1.2 Statement of the Problem

Dairy farming remains a major concern in rural households especially in Mirangine and Mauche divisions in Kenya. From the annual reports from ministry of livestock 2010 and 2012, it is seen that the small scale dairy farmers in Mirangine have a better production rate better than farmers in Mauche; for the farmers in these two regions to break even in their dairy farming they require a production of 18Litres of milk per cow per day. This means that the farmers in Mauche may be incurring opportunity cost in the form of the large amounts of potential revenue they may be missing as compared to farmers in Mirangine; taking into consideration that, farmers in Mirangine may not be operating at optimum production capacity.

1.3 Purpose of the study

The purpose of this study was to analyze factors influencing milk production among small scale dairy farmers in Mirangine division of Nyandarua County and Mauche division of Nakuru County.

1.4 Research objectives of the Study

The study was guided by the four objectives as stated below

1. To identify how demographic characteristic of small-scale dairy farmers influence milk production in Mirangine and Mauche division.
2. To identify how marketing factors influence milk production in Mirangine and Mauche division among small scale farmers.
3. To establish how farmers awareness on dairy farming affects milk production in Mirangine and Mauche division.
4. To establish how cattle breeds variability affects milk production in Mirangine and Mauche division among small scale farmers.

1.5 Research Questions

1. To what level does demographic characteristic of small-scale dairy farmers affects the milk production in Mauche and Mirangine divisions?
2. In what ways does marketing factors of milk affects its production in Mauche and Mirangine divisions?
3. To what extent does the farmers' awareness on dairy farming affect the production of milk in Mauche and Mirangine divisions?
4. In what ways does dairy cattle breed variability affect production of milk in Mauche and Mirangine divisions?

1.6 Significance of the Study

Among the major millennium development goals of the Kenyan government is poverty reduction and food security. Dairy farming stand a better platform as compared with other sectors of agriculture in this nation as far as marketing of the product is concerned.

Kenya's dairy industry is one of the most impressive in the developing world.

The country has the most competitive processing sector in the region with an excess capacity and the Smallholder dairy farmers are well-placed to produce for this capacity if the conditions are right (Karanja, 2003). However there are regional imbalances with respect to dairy development. According to the Ministry of Livestock and Fisheries Development report (2003), Rift-Valley provinces produced 50% of the country's 3.196 billion litres of milk with Nakuru district contributing 8.6% of the milk output in Rift valley. If all region of this country would produces the same with dairy farmers taking dairy farming with the seriousness that it deserve, then unemployment will reduced among many youth who are complaining daily of lack jobs, improve livelihood among dairy farmers and boosting our economy as a country as well as reducing poverty among many. The study was exploring and encouraging dairy farmers in Mauche and in the nation at large to adopt good practices in order to strike a balance among many region of this nation as far as milk production is concerned. The study recommended ways of improving the road network. The existing road network needs to be improved and

expanded to reduce cost of dairy production and hence increase marketed milk. A lot of emphasis in improvements and expansions of the road network should be directed towards upgrading of the feeder roads which link the farms to the milk collections centers. Upgrading of the feeder roads which are impassable during the rain season will significantly increase the collection and marketing of milk from farm. The informal sector, controlling about 65% of the milk marketed dealt mainly with raw milk which was commonly used to make tea, coffee or as food snack and therefore did not require any processing. The higher preference by consumers for raw milk as compared to processed milk, provides an opportunity for the informal sector and hence the small holder dairy production system to be competitive. The formal sector which is involved in milk processing, value –addition, increasing shelf-life, and packaging to ensure safety of milk and dairy products is mainly in the hands of public and private processors. The sector has the capacity to increase milk intake, processing and packaging to cope with large volumes of milk during wet seasons.

1.7 Delimitations of the Study

The study was done in two divisions, Mauche division of Njoro district Nakuru County, and Mirangine division of Mirangine district Nyandarua county Kenya with an estimated population of 2000 small-scale dairy farmers each. The research boundaries were the administrative locations of the Divisions. These two divisions are homogeneous in many ways for example number of cattle, population per household, climate etc but with a huge difference in milk production. The small scale dairy farmers dominate in the two divisions and those who sell their surplus milk will be sampled for the study in the two division. Structured questionnaires and key informant interviews were used to collect data. According to Cooper and Emory (2008), the questionnaire is conveniently used because it is cheaper and quicker to administer, it is above researcher's effect and variability, and is highly convenient for the respondents as they could fill them during free times or when workloads are manageable. On the other hand interviews were used when questioning a group of respondent saving time and resource for the study because the two area of study were far apart.

Dairy farming refers to the rearing of animals: goats, cows and camels. This study was focusing on the comparative analysis between the two divisions as far as cow milk production is concerned. All other factors were held constant and only market of milk, demographic characteristics of the farmers, dairy cattle breed variability and awareness of farmers on dairy farming was studied as factors affecting the production of milk among small-scale farmers in the two divisions under the study because of time limit.

1.8 Limitations of the Study

There was language barrier in some areas of Mauche; in such areas the researcher was using research assistants who were fluent in the residents' language and were coming from the area to interpret the key and major issues related to the study. Suspicion and mistrust particularly with personal details got in the way of data collection and the respondent were shying away from giving the information required by the researcher but this was solved by assuring the respondent that the information they were giving was treated with respect, professionalism and confidentiality. Another limitation was non-respondents, uncooperative and unfriendly respondents, but this was reduced by motivating the respondents and by following up on the questionnaires.

1.9 Assumptions of the Study

The following were the assumptions of the study: factors like nutrition of the animals, infrastructure, Technology, land size among others were assumed to be constant and only breed of dairy cattle, market of milk, demographic characteristics and Awareness level of farmers in dairy farming were taken to be the only factors that influences production of milk by small-scale farmers in the two divisions under the study.

Responses received from respondents, were assumed to be true, honest and transparent.

The sample unit under focus was a true representation of the population, and that the responses collected back from them provided the necessary data for a conclusive and informed outcome.

1.10 Definition of Significant Terms

Dairy Sector-This term has been used here to refer to the smallholder cattle milk producers and specifically those from Mauche Division Nakuru county and Mirangine division Nyandarua county.

Smallholder Dairy Farmer – These are farmers keeping dairy cows with a herd of less than five cattle. In this research therefore farmers with a herd of less than five cattle irrespective of the breeds were considered to be smallholder farmers.

Productivity -the term will refer to the income farmers get from their dairy farming.

Practices-these are routine activities geared toward dairy farming.

Awareness-having knowledge on dairy farming in order to increase milk production.(having known how among dairy farmers).

Demographic characteristics-these are social factors of the dairy farmers e.g. age, marital status ,sex among others that in one way or the other affect

Break Even -This is the minimum price the businessperson must receive to cover all costs of production of milk.

Breed variability -This refers to the different breeds of cattle as owned by the farmers; farmers own different breeds of dairy cattle e.g. Friesian, Guernsey, Ayrshire etc.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter contains a literature review on the world dairy industry, Kenya dairy sector, milk production in Kenya, Marketing factors, awareness of dairy farmers, Demographic characteristics, Breed variability, theoretical framework, conceptual framework and knowledge gap.

2.2. The world dairy industry

Over the last 24 years, total milk production in the world has increased by 32% whereas per capita world milk production has declined by 9%. This indicates that the world milk production has not kept pace with the increase in world population. Nonetheless, as opposed to the trend towards intensification of milk production in developed countries, production growth in developing countries is a large part due to increasing numbers of milk animals and dairy farms and only a small part due to productivity gains (Knips, 2009). India is the world largest producer of dairy products in the world while the world largest exporter of dairy products is New Zealand (Knips, 2009).

Milk production grew steadily in East Africa in the 1980s and 1990s. The pace of growth has since accelerated following recent high rates of income growths and urbanization, though the exact figures are not easy to verify. According to Ngigi (2004), milk production increased during the 1990s at an annual rate of 4.1% in Kenya and 2.6% in Uganda, (Uganda Investment 2002) suggests that the figure was higher in Uganda, with production having risen from 365 million litres in 1991 to 900 million litres in 2000. One reason for such high growth is high domestic consumption. Milk consumption in Kenya is 145 litres per person per year, which is among the highest rates in developing world (SDP), spurring an estimated 4 billion litres of production in 2003 (Export Processing Zones Authority 2005). Although only about 35% of milk produced is marketed, at a retail price of US\$0.75 or more per litre, The Kenyan dairy industry is estimated to generate \$2 billion litres per year (Strategic Business Partners 2008). Much of the market

demand is met by smallholder dairy farmers, typically with 1-3 cows on farms measuring 0.5-1.5 hectares. According to the International Livestock Research Institute (ILRI), by 2006 there were approximately 1.8 million small holder farmers in Kenya (SDP).

2.3 Dairy Sector in Kenya

The Kenya dairy farming sub-sector is one of the most vibrant in East Africa and it has the highest milk per capita availability and consumption (Ngigi, 2004). Kenyans including people from Mirangine and Mauche are amongst the highest milk consumers in the developing world, consuming an estimated 145 litres per person per year, more than five times milk consumption in other East African countries (SDP, 2005). The smallholder dairy sub-sector is a crucial one as it accounts for 80% of the total number of cattle in the country and it also contributes 70% of the total milk output (IFAD, 2006). Most of the dairy farming is done on the Kenyan highlands which are over 1000 m above sea level. These areas are highly populated as compared to the lowland and the population provides market for the milk produced, which is complementary. Over and above the population that provides markets the highlands have the favorable agro-ecology for dairy farming (Staal, et al, 1997). The small scale dairy farming enterprise has been found out to be very profitable. This is because of the good milk prices. Despite the withdrawal of some government subsidies like the artificial insemination the business continues to thrive. The good market prices resulted from the liberalization of the dairy sector (Ngigi, 2003).

Dairy production in Kenya is divided into small scale and large scale with the small scale farming being the most popular as it constitutes 70-80% of the total dairy subsector (Ngigi, 2003; Karanja 2004; IFAD, 2006). The smallholder group is also divided into four sub-groups which are resource poor, small scale intensive, part time dairy farmers and crop oriented dairy farmers (IFAD, 2006). These groups have different characteristics which make them have different constraints. Their production is done by a number of systems, which include intensive and extensive grazing. Intensive grazing (also known as zero grazing) is used where there are small land sizes and therefore farmers feed their animals in stalls with very minimal movement. There are those who practice extensive production where mostly the animals graze and they are not stall fed.

The third method is where the farmers have a hybrid system such that the animals are fed in the stalls and also are allowed to graze on their own. These systems are normally referred to as free, semi-zero and zero grazing representing increasing intensification (Bebe et al., 2003a).

Many small scale farmers practice intensive dairy farming where they do stall feeding and a combination of stall feeding and grazing. This is because of their small land sizes usually less than 5 acres (Bebe et al., 2003a). Because of intensification most of the farmers prefer to keep the large mature breeds (Bebe et al., 2003b) as they believe they are more productive as compared to others. In terms of output the smallholder open grazing is realized to have less output than the zero grazing itself (Karanja 2003). This can be attributed to the use of concentrate and supplements in the zero grazing system and intensive feeding programs. The production systems are influenced by the agro climatic characteristics of the area, land productivity potential and prevalence of animal diseases. In contrast, according to Stotz (1983) there are 4 milk production systems practiced by the Kenya small holders: Open grazing (a) with zebu cattle where cattle are herded on own or other people's farms or on communal lands. (b) With upgraded cows which involves the use of cultivated pastures with some minerals and concentrates; semi-zero grazing. Cows are identified by pure exotic or highly up-graded dairy cows. Cows are grazed on open fields for most of the day and supplemented with concentrates and fodder or hay; zero grazing. Has the highest milk yield. Feeds are brought to the cows kept in stalls. The system is labor intensive, requires heavy initial capital investment but maximizes the use of land resource

The widespread adoption of dairy cattle in the country was stimulated by several interacting factors such as: the conducive policy and institutional environments provided by successive Government; the presence of significant dairy populations (owned by settler farmers); a sub-tropical geography suitable for dairy cattle; and smallholder communities who kept cattle and who had milk as an important part of their diet (Thorpe et al., 2000).

Kenya is self-sufficient in milk in milk production versus demand. In 2005, the country produced approximately 3.5 billion litres of milk, against a consumption of about 3

billion litres. the Kenya dairy policy change of 2004, which incorporated small-scale milk producers and traders into the milk value chain and liberalized informal milk markets, has led to an increase in the amount of marketed milk, number of licensed milk vendors and a boost in demand for milk, leading to benefit for Kenyan milk producers, vendors and consumers. As a result of this policy change, milk production was targeted to increase to increase to 4.2 and 5 billion litres by 2010 and 2014, respectively (Kenya Dairy Board, 2006). The dairy processing industry in Kenya comprises of large, medium and small scale processors.

Milk production is usually influenced by a variety of factors, in this study we will look into the following four factors namely: Marketing structure; level of awareness of farmers, demographic characteristics and breed variety.

2.3.1 Marketing factors and milk production.

Marketing is defined as the set of human activities directed at facilitating and consummating exchanges. All business activities facilitating the exchange are included in marketing (Philip kotler, 2003).Marketing involves all activities involved in the production, flow of goods and services from point of production to consumers. Marketing includes all activities of exchange conducted by producers and middlemen in commerce for the purpose of satisfying consumer demand.

The Kenyan dairy industry has grown tremendously since its liberalization in 1992. Liberalization led to a rapid growth of the informal milk trade that mainly consists of small scale operators dealing in marketing of raw milk. At that time, there was an emergence of new institutional arrangements in milk collection, processing and marketing, which included hawkers, brokers, self-help groups, neighbors and business establishments like hotels (Karanja, 2003). The informal markets controls an estimated 70 percent of the total milk marketed in Kenya (KDB, 2009; Government of Kenya, 2006). Until the 1990s, the Kenya Creameries Corporation (KCC) processed all the milk in Kenya, but its monopoly slowly decreased between 1993 and 1996 (Olok-Asobasi and Sserunjogi, 2001). Many private processors have joined the dairy business since 1992, and have increased greatly since 1999. According to the industry statistics by the Kenya

Dairy Board, in 2010, there were an estimated 27 processors, 64 mini dairies, 78 cottage and 1138 milk bars.

After the liberalization of the milk industry, there were concerns over food safety and quality of milk sold by the informal sector players. The dairy policy at the time focused on promoting value addition and increasing the market share of pasteurization milk while attempting to address potential public health risks of consuming raw milk. However, since 2004, there has been a major change in policy and practice towards the informal milk market (Leksmono, et al., 2006). The dairy policy now clearly acknowledges the role of small scale milk vendors (SSMVs) and contains specific measures to support them. These include: development of low-cost appropriate technologies, training on safe milk handling, provision of incentives for improved milk collection and handling systems, and establishment of supportive certification system. While the Dairy Policy is still in progress, awaiting approval by parliament, there has been a proactive engagement by the Kenya Dairy Board in training and certification of SSMVs, in order to safeguard public health and assure quality of the raw milk (Leksmono, et al., 2006).

A study of the milk marketing system in Kenya has shown that there are at least 8 different marketing channels as shown below:

Table 2.1 Milk marketing system in Kenya

Milk Marketing Channels	Number of intermediaries
Producer-consumer	0
Producer-milk hawker-consumer	1
Producer-processor-consumer	1
Producer-processor-retailer-consumer	2
Producer-dairy co-operative -processor-retailer consumer	3
Producer-milk transporter-processor- retailer-consumer	3
Producer-milk trader-processor-retailer-consumer	3
Producer-dairy coop-milk transporter-processor- retailer-consumer	4

The Kenyan dairy market suffered when KCC collapsed but since the revival of KCC and further emergence of numerous small scale processors, milk marketing is not as challenging as it was at the time KCC was collapsed. The milk is either sold raw directly to consumers or to the processors. The main players in the milk market are the processing companies, brokers and milk bars (Muriuki, *et al*, 2003). The major constraint facing smallholder farmers is that they do not have proper means of delivering their milk to the process or sand also poor road infrastructure (Muriuki, *etal*, 2003). This affects marketing of farmers' milk given the perishable nature of milk.

There are conscious efforts to improve farmer groups which have been deemed to help farmers to be able to bear the transaction costs involved in marketing (Kirsten and Vink, 2005). This effort to help farmers over come the transaction costs is thus a very key factor to assist farmers to be able to sell their milk more profitably, which in their absence can result to market failure of the smallholder dairy sub-sector. The supply chain of milk and its products is also an important factor influencing marketing and consequently profitability of milk and its products. The development of the supply chain is of importance as it will be instrumental in supporting the smallholder dairy farmers to achieve significant profitability. The smallholder dairy project has also been working on improving the channels in which milk is distributed. This includes the formal and informal channels. It has also been established that about 80% of the milk sold in Kenya

goes through the informal channels (Karanja, 2004). Therefore the improvement of these marketing channels will also play an important role in improving the marketing and also the profitability of farmers. Most of the informal milk marketing channels suffer from transaction arrangement problems. The most pronounced being the standard of measurement where the lack of standard of measurement has been known to be a major contributor to market failure to many of the commodity markets in Africa (Kristen and Vink, 2005).

2.4 Level of awareness on dairy farming and milk production

Awareness is described as having knowledge or cognizance; aware of the difference between two or more versions (The free dictionary). Over the last decade, milk productivity growth has been positive. The increase in productivity may be attributed to a number of factors such as improved animal husbandry practices and veterinary care, better quality feeds, and adoption of more intensive grazing systems and improved cow breeds (Wambugu S. et al. 2011). Farmer awareness is promoted by presence of extension officers in Kenya. Dairy producers aim to increase productivity at the lowest possible cost. Farmers seek to ensure that the safety and quality of their raw milk will satisfy the highest expectations of the food industry and consumers. In addition, on-farm practices should ensure that milk is produced by healthy cattle under sustainable economic, social and environmental conditions. This can be achieved by observing the best practices in the industry. Good dairy farming practices entail the following as stated by FAO (2009): Animal health; Milking hygiene; Nutrition (feed and water); Animal welfare; Environment and Socio-economic management. Farmers should take into consideration applying these principles & practices to the whole farm system within a philosophy of continuous improvement, starting with the livestock in scope (SAI).

Farmer awareness is particularly important in production; Dairy goat farming has been hit hard by lack of training for farmers and this is likely to reduce milk production, a Dairy Goat Association of Kenya official has said. Nyeri branch assistant officer Moses Karuga said few farmers know the benefits of goat farming and the shortage of agricultural extension officers has slowed down the promising sector. “Lack of awareness is discouraging many, leading them to invest in other farming activities,” says Mr. Kiruga,

whose association brings together farmers who own Kenya Alpine goats also known as German Alpine goats, which are known for producing high quality milk. According to 2011 livestock statistics, in central Kenya there were 117,402 dairy goats compared to 491,300 meat goats. (<http://www.businessdailyafrica.com/Shortage-of-extension-services-hurts-goat-milk-production/-/1248928/1659712/-/wx4rcg/-/index.html>). This supports the idea that farmer awareness has a significant effect on the farmers' choice of economic venture and their performance in that particular venture.

Farmers should use good quality forage and improved pasture which may provide sufficient nutrients for maintenance and production of approximately 5.0 kg/d of milk (Trail and Gregory 1981). Concentrates are fed to supply energy and protein for increased milk production. In addition to the limited availability, the high cost of concentrates and the declining milk to concentrate price ratio makes it difficult to feed adequate concentrates regularly resulting in low productivity. The declining milk price to concentrate price ratio from 1985 through 1993 caused the decline in viability of dairying. It has been shown that unless the milk to concentrate price ratio is greater than one, the economics of feeding concentrates may be doubtful (Walshe et al 1991). The declining milk price to concentrate price ratio may be used as a guide to choose feeds and the optimum quantity of concentrate to be fed in a given situation.

Farmers should have knowledge of these practices and how to apply them so as to be deemed aware therefore being aware entails knowing this potential production changing practices and whether they apply them or not is another issue. Awareness of the market dynamics by the farmer will also affect the amount of milk that reaches the market.

2.5 Demographic characteristics of farmers and milk production

According to Wikipedia, Demographics are the quantifiable statistics of a given population. Demographics are also used to identify the study of quantifiable subsets within a given population which characterize that population at a specific point in time. Commonly examined demographics include gender, age, ethnicity, knowledge of languages, disabilities, mobility, home ownership, employment status, and even location. Demographic profiling is essentially an exercise in making generalizations

about groups of people. As with all such generalizations many individuals within these groups will not conform to the profile - demographic information is aggregate and probabilistic information about groups, not about specific individuals (<http://en.wikipedia.org/wiki/Demographics>). With this definition in the background, price of milk that dairy farmers receive will always be affected by the population and by extension the location they are, it is expected that that dairy farms will move to areas with higher milk prices. Studies by Wheat (1973), Morgan (1967, Calzonetti and walker (1991) suggest that the chief location factors of include demand for products which is an off shoot of marketing of the product; cost of factors of production such as labour and raw materials. Transportation (proximity) to markets, land, and infrastructure; a minimum level of development is required to attract any investment by the population to a given location, or entice the population to indulge in a certain economic activity and influence the level of success that they are bound to experience. Kenyans consume an estimated 145 litres per person per year, more than five times milk consumption in other East African countries (SDP, 2005). Among all developing countries, only Mongolians and Mauritians consume more milk per dollar earned than do Kenyans (ILRI, 2007), therefore a populated area may provide a good market and boost production; though the population may have other non-economic issues that affect their choice of economic activity and the level of dedication the put into the activity of choice. In rural Kenya, the management of land under a traditional system with no title deed to land amplifies the problem brought about by the population and results in overstocking and overgrazing leading to limited herbage production throughout the year. This is exacerbated by the fact that grazing is communal, without proper management and control over livestock numbers. Farm sizes are generally small and used first and foremost for food crop production in order to ensure household food security. As a result, there is limited cultivation of fodder for animals. Land tenure is not conducive to long-term investments and improvements required to increase dairy production. Given the scarcity of communal grazing land and difficulties with its access and management, it appears unlikely that the households can overcome their shortage of feed by greater reliance on communal feed supplies.

Across the years, a higher percentage of male-headed households kept improved cows compared to their female counterparts. On the other hand, more female-headed households kept local animals, indicating that they had less access to improved dairy breeds and perhaps dairy technologies in general. Baltenweck and Staal (2000), who found that female-headed households were more likely to have less access to information on new dairy technologies,. Overall, the percentage of households keeping improved animals increased over the years.

Table2. Percentage of households keeping cows by gender between year (2000-2010)

Gender of household head	Percentage of households keeping cows							
	2000		2004		2007		2010	
	local	improved	local	improved	local	improved	local	improved
Male	28.1	50.0	27.9	57.9	31.4	56.6	28.9	56.8
Female	39.0	34.9	34.9	42.9	34.5	39.3	31.6	40.6
Sample	29.4	48.2	29.3	54.8	32.1	52.6	29.7	52.4

(Wambugu S. et al. 2011)

Large-scale farms are normally located farther away from towns or communities and from public waterways than are small-scale farms. Also, small-scale farms tend to be located closer to market outlets compared to large-scale farms. This is an advantage especially for perishable products such as milk, where distance to market outlet is vital.

2.6 Breed Variability and milk production

The dairy herd is mainly confined within the high potential areas and is composed of Friesian, Ayrshire, Guernsey, and Jersey as pure breeds and their crosses which make up over 50% of the total herd (Muriuki, 2001). In the low potential areas, milk production is mainly from indigenous zebu and sahiwal breeds, while in the arid areas, camels and goats are the most important producers of milk. 84% of the Kenyan marketed milk comes from cattle, 12% from camel and 4% from goats. The dairy cattle population has grown tremendously from about 0.8m in 1960 to about 4m in 2005 The dairy herd is mainly confined within the high potential areas and is composed of Friesian, Ayrshire, Guernsey,

and Jersey as pure breeds and their crosses which make up over 50% of the total herd (Muriuki, 2001).

Between June 2009 and May 2010, milk productivity was highest in the High Potential maize Zone (297 litres/cow), followed by Central Highlands (233 litres/cow), while Western and Eastern Lowlands had the lowest milk productivity at 67 and 91 litres/cow, respectively (Wambugu S. et al. 2011). This can be partly attributed to the types of breeds kept in those areas.

Table 2.3 Average number of cows kept by households by type and agro-regional zone

Agro-regional zones		Improved cows				Local cows			
		2000	2004	2007	2010	2000	2004	2007	2010
Coastal	Lowlands	0.1	0.7	0.2	0.2	3.2	9.6	4.7	4.0
Eastern	Lowlands	1.0	1.2	1.1	0.8	2.5	1.7	1.9	1.7
Western	Lowlands	0.2	0.1	0.0	0.1	4.6	4.7	3.5	4.1
Western Transitional		1.3	1.0	1.0	1.3	3.7	2.8	2.8	1.6
High Potential Maize Zone		6.8	6.0	6.0	5.4	3.2	1.6	2.1	2.2
Western	Highlands	2.1	1.8	1.8	1.5	1.2	1.0	0.8	1.1
Central	Highlands	3.3	2.5	2.4	2.2	0.1	0.0	0.0	0.0
Marginal Rain Shadow		4.2	3.7	4.1	3.1	1.8	1.0	1.1	1.8
Average		3.2	2.7	2.6	2.4	2.5	2.2	1.9	1.9

(Wambugu S. et al. 2011)

The country's dairy cattle are estimated at 3.5 million head. Dairy cattle are mainly kept in medium to high rainfall areas. The key top dairy breeds are Ayrshire, Friesian, Guernsey and Jersey. Dairy production is one of the most leading enterprises in the livestock sub-sector and forms an important livelihood to most small scale farmers. In 2008, the total milk production is estimated at 2.6 billion liters out of which more than 70% is produced by pure bred *Bos Taurus* breeds and their crosses (KDDP, 2001). The main *B. Taurus* breeds kept include Holstein Friesian, Ayrshire, Jersey and Guernsey. The ever increasing human population and concurrent urbanization will require efforts be geared towards increasing milk production to offset any resultant deficits. Improved milk production can be achieved through appropriate breed improvement programmes. Precise and accurate knowledge of genetic and phenotypic parameters are critical in planning and

developing appropriate breed improvement strategies (Kahi *et al.*, 2004). Such breeding programmes should be undergoing regular appraisal to identify optimum efficiency and predicts possible rates of improvements. Thus, bifurcation of the phenotypic trend into genetic and environmental trends will enable the assessment of the effectiveness of the selection programme and management conditions over time (Musani and Meyer, 1997; Ojango and Pollot, 2001). This will also help in designing more appropriate genetic improvement and management strategies aimed at increasing milk production. However, estimate of genetic and phenotypic trends for various cattle breeds on small, medium and large scale farms are scarce in literature. More so, no information is available on the phenotypic characteristics of the cattle breeds kept in both Mirangine and Mauche.

Since feed, feeding systems and management are real constraints to intensification, the development and use of genotypes such as crossbreds (*Bos Taurus* x *Bos indicus*) has been shown to give the benefits of both increased production and tolerance to climatic and nutritional stresses (McDowell 1989). There is evidence that indigenous cattle are more resistant than *Bos Taurus* to ticks and tick-borne diseases (Baker & Rege 1984). In addition, they probably use feed more efficiently at low feeding levels and have the ability to select high quality diets when grazing course tropical pastures (McDowell 1989). The use of improved animals (Friesian, Jersey, Guernsey and Ayrshire) requires high management, large amounts of concentrates/cow and low forage to concentrate ratio of the magnitude 40:60 (McDowell 1989). These requirements are lacking in the smallholder sector and therefore use of improved pure exotic dairy cows should not be encouraged. The problem of exotic cows in the environment with feed and management constraints was reported in Friesian cows, which produced 1736-2540 kg/lactation (Mostageer et al 1987). All these factors add to one deciding factor that a farmer considers when choosing a breed to keep and thus affecting their milk productivity.

2.7 Theoretical Framework

Human behavior is seen as a result of the interplay of diverse forces that create a set of circumstances through the dynamic interaction of man and his environment (Albrecht et al. 1987 in; Hoffmann, 2005; Ndah, 2008). According to the psychological Field theory of Kurt LEWIN, the interaction of situational forces with the perceived environment can

be described as a field of forces, a system in tension or a psychological field. Human behavior can be described as follows: A person in his subjectively perceived environment feels something is worth striving for like adoption of Agricultural best practices. They then mobilize their personal powers to achieve this goal of adoption of the best practices in dairy farming. When something negative or undesirable occurs like a case of low production or poor quality, the person activates his personal powers in the same way to avoid the negative situation. Ways of reaching targets and avoiding negative situations can be blocked or impeded by barriers or inhibiting forces like lack of awareness, risk or uncertainty about outcome, insufficient capital, cultural practices, lack of opportunities for scaling up of Dairy farming innovation.

Inhibiting forces-forces negatively influencing behavioral change initiating the best practices in dairy farming e.g. lack of subsidies like artificial insemination, limited liquidity for labour hiring, buying concentrates, lack of machinery, and limited knowledge driving forces-forces conducive to positive target improved e.g. financial assistance, technical advice, training, provision of inputs, financial assistance, linkage with market outlets. Adoption of best farming practices is thus seen as resulting from the psychological field of inhibiting and driving forces hence these forces are present in a state of equilibrium or dis- equilibrium with varying degrees of tension between them. Once such forces are identified in the farmers decision making process, the chances of diffusion can be estimated and consequences for promotion programs can be concluded (Kriesemer and Grötz 2008).

According to Rogers (2003),the determinants of adoption are: perceived attributes of the technology; comparative advantage; the degree to which an innovation is perceived better than the idea it supersedes; complexity - the degree to which a practice is perceived as relatively difficult to understand and to adopt negatively related to its rate of adoption; trial ability -degree to which an innovation like modern dairy practices may be experimented at a limited basis; compatibility-degree to which sustainable practice is perceived as consistent with the existing values, past experience and needs of potential adopters.

Rogers (2003), posited that the type of innovation decision process through which an individual passes from; knowledge to attitude and finally to adopting (individual or collective, optional or authority). With the communication channels being either interpersonal or by mass media, originating from specific or diverse source social system: norms, network interconnectedness socio-cultural practices and norms that can inhibit or drive adoption. Efforts of promotion agent past and present efforts made to promote of dairy farming the government, agricultural organizations and NGOs, ant national and international level.

In many rural areas milk production is still carried out with simple tools by traditional methods, using practices based on trial and error. The production of food is slightly increased. There is little question that changes must be done in milk production methods, and new technologies are increasingly being viewed as the vehicle for solving agricultural problems. While the solutions seem to b simple, in practice it is not. Even where new technologies exist they may be inappropriate for particular agricultural settings, they cannot be transferred easily, or they collide with traditional cultural practices and preferences.

Developing agriculture by means of substituting new for existing technologies involves behavioral change on the part of the farmer. The amount of change involved will depend of the technologies and practices being promoted and the extent to which farmers current behavior is inconsistent with them (Sofranko, 1984). Strategies for bringing about change have generally focused on altering the environment in which milk production is carried out, or in the direct transformation of farmers themselves (Rogers, 1969).

2.8 The conceptual framework

The Conceptual framework is an illustration of the relationships between the variables identified for the study. It shows the relationship between the independent and the dependent variables. For this particular study, the productivity of small-scale dairy farmers in Mauche and Mirangine divisions is the dependent variable while the independent variables are the factors that in one way or the other affect productivity of these farmers in the two divisions. These factors are market of the milk, Demographic

factors, genetics and the awareness of dairy farmers. These factors, either in isolation or a combination will cause or influence farmers milk production in the two divisions under study. The moderating variable for this study will be the cultural issues affecting the milk production for example the rearing system adopted by the people living in the two division. The intervening variable will be Government policy that affects milk production and dairy farming at large.

Independent Variables

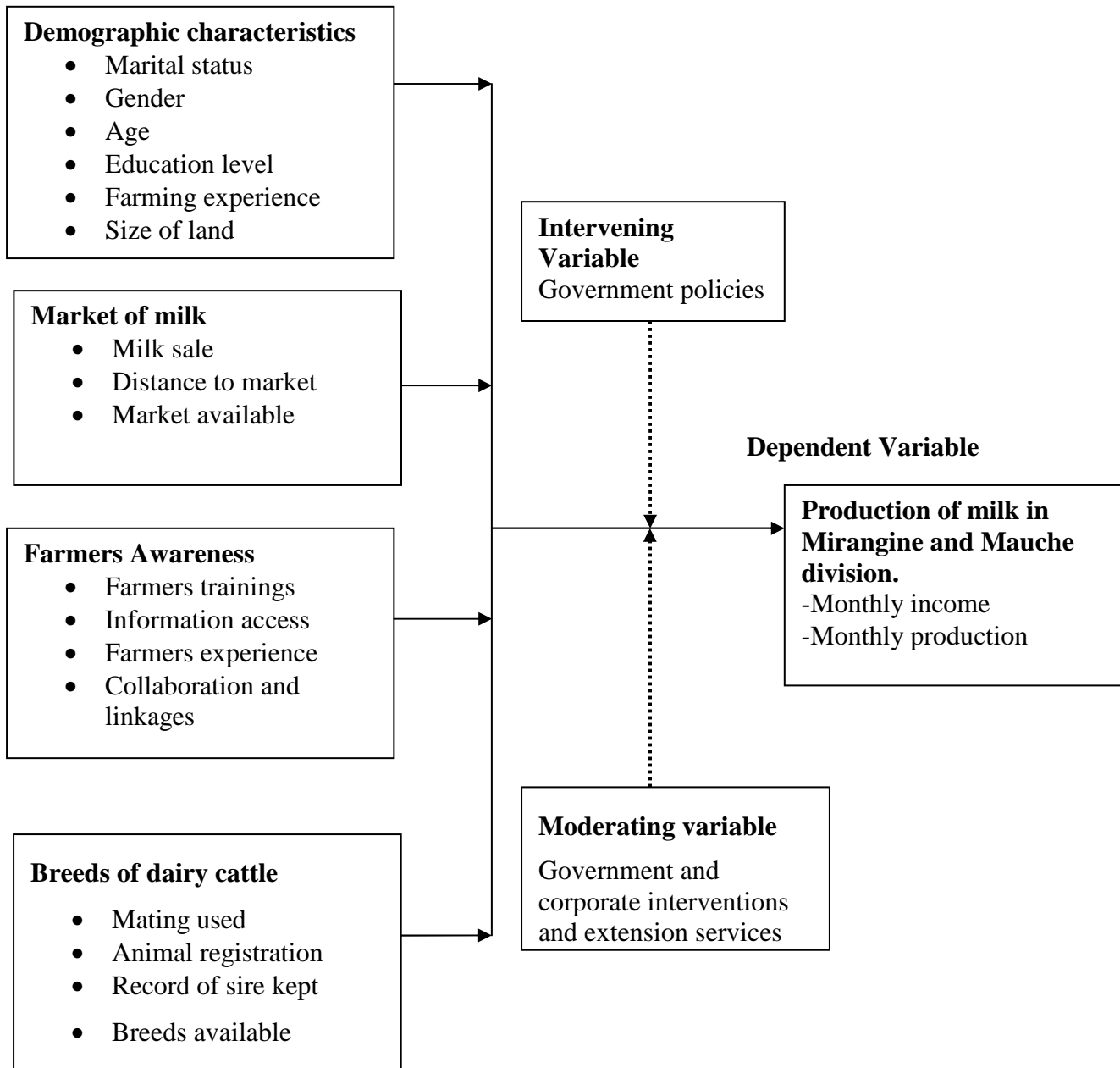


Figure 1 conceptual framework.

2.9 Summary of Literature Review

What can we conclude from the literature reviewed above? What is the level of certainty for each of those conclusions? In order to answer these questions, it is important to appreciate that a recollection of all the literature reviewed strongly substantiates the good of milk production that cannot be wished away in today's world. It is conclusive to say that from the literature review, bearing in mind the perceived gross benefits and gross costs, there are net benefits realized from the adoption of both large scale and small scale dairy farming.

It is however, surprising and a matter of greater concern on the reluctant and even sluggish pace that the some dairy farmers have not adopted towards high milk production. Bearing in mind the fundamental principles in Theory of dairy farming, consumer behavior, the key assumption is that the consumer is rational and seeks to maximize utilities (Benefits realized from the consumption of a given commodity). On the other end of the continuum, the theory of the firms indicates that firms seek to maximize benefits and minimize costs. In the wake of these fundamental construes, dairy farming in particularly in developing nations like Kenya seem to be defying the odds and acting in a manner that would in dairy farming termed as "irrational".

It is in the purview of these inconsistencies that the basis for undertaking this study was established. The gap in knowledge was a lack of comprehension of the real issues that curtail enhanced adoption of dairy farming in developing nations like Kenya. To furnish such knowledge, this study poses the question: What are the factors affecting the adoption of dairy farming especially in Mirangine and Mauche amongst the farmers.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter identifies the research design of the study. It further highlights the target population, Sampling procedures and the methods of data collection. Also included are the measures undertaken to ensure the validity of data collected, and its reliability in this study. A summarized table at the end of this chapter is provided to highlight the operational variables and show how they are scaled.

3.2. Research design

This is the framework that assisted the researcher to structure the collection of data, analysis and the interpretation of data. The study will adopt a qualitative case study research design. According to Yin (2003) a case study design should be considered when: (a) the focus of the study is to answer “how” and “why” questions; (b) you cannot manipulate the behavior of those involved in the study; (c) you want to cover contextual conditions because you believe they are relevant to the phenomenon under study; or (d) the boundaries are not clear between the phenomenon and context. This approach has the potential to deal with simple through complex situations. It enables the researcher to answer “how” and “why” type questions, while taking into consideration how a phenomenon is influenced by the context within which it is situated. A case study is an excellent opportunity to gain tremendous insight into a case. It is argued that a case study provides a more realistic response than a purely statistical survey and it enables the researcher to gather data from a variety of sources and bring together the data to illuminate the case. This study will use primary data which will be gotten by conducting a household survey. The survey strategy is appropriate when the researcher wishes to use the findings to infer on the whole population. Survey allows the collection of large amount of data from sizeable population in a highly economical way.

3.3 Target population

The target population was the small scale dairy farmers in Mirangine and Mauche divisions which were estimated to be 4000 farmers according to 2012 annual reports from Ministry of Livestock development. The focus was analysis of the questionnaire which was used to guide the interviewer of the sampled respondents. A part from this 5 key informant; 4 ministry of livestock officials and 1officials from Kenya dairy board were included to make a total of 4005.

3.4 Sample size and sampling techniques

The technique used was purposive, and stratified random sampling in the selection of the study sample. A purposive sampling procedure involves the hand-picking of subjects on the basis of certain specific characteristics. This sampling procedure best fitted the 5 key informant respondents. To ensure representation among small-scale dairy farmers in Mauche division and Mirangine division, stratification of the target population was done where each division was treated as a stratum and random sampling was done to collect data.

The sample size was calculated using the Krejcie and Morgan Table as shown in Appendix IV where a sample $S=351$ was found as appropriate when the estimated target group was estimated population $N=4005$. Two key respondents were sampled from each region and one from Kenya dairy board to bring the total sampled population to 356.

3.5 Data Collection Methods

Data was collected by the use of questionnaires and interview schedules. A written questionnaire is a data collection tool in which written questions are presented that are to be answered by the respondents in written form. These written Questionnaires were administered to respondents via hand-delivery and collected later. Questionnaires, incorporating both open-ended and closed-ended questions items were used to gather the necessary data to conduct this study. According to Cooper and Emory (2008), the questionnaire is conveniently used because it is cheaper and quicker to administer, it is

above researcher's effect and variability, and is highly convenient for the respondents as they could fill them during free times or when workloads are manageable.

An interview is a data collection technique that involves oral questioning of the respondents, either individually or as a group (Chaleunvong, 2009). While the structured questionnaires were largely administered to the small scale farmers, in depth interviews using semi structured questionnaires were preferred for the ministry officials, processors, traders and officials from the Kenya dairy board, as they are deemed more knowledgeable and experienced. Responses to the questions posed during the interview were recorded as well as crossed from a checklist.

3.5.1 Pilot Testing of the instrument

Ten questionnaires were administered in Mau Narok division which neighbors Mauche and another ten were administered in Ngorika division which neighbors Mirangine division. The respondent were selected randomly, at least a week before the main study. They were asked to respond to the questions as the researcher observed whether each question measured what it is supposed to measure, how long it took to interview one respondent, whether response choices were appropriate, whether the tool collected the information needed among other things. Necessary adjustments were made to the tool. To facilitate this, the researcher sought permission from local leaders, for example, the chief and assistant County Commissioner.

3.5.2 Validity of the instrument

Validity is the accuracy and meaningfulness of inferences, which are based on the research results; it is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study (Mugenda & Mugenda, 2003).

The following measures were taken to ensure validity:

1. Survey questions were made based on literature review to ensure validity.
2. Questionnaires were pre-tested on a pilot survey and amendments made to make them more clear to respondents.

3. Data was conducted within four days so as to avoid the possibility of the occurrence of major events in the dairy industry that may have affected affect the opinion and attitude of a section of the respondents in the course of the study.

3.5.3 Reliability of the instrument

Joppe (2000) defines reliability as the extent to which results are consistent over time and an accurate representation of the total population under study. If the results of a study can be reproduced under a similar methodology, then the instrument is considered to be reliable.

This study espoused the test retest reliability approach as a measure of consistency. Reliability was tested using the Cronbach's alpha that was calculated from questionnaires from a pilot study that was conducted in the two regions so to assess the survey tool before the study; the questionnaire had an alpha of 0.76 which was found to be greater than 0.7 thus it was considered acceptable. The questions that were vague were restructured to make them more understandable to the farmers.

3.6 Data Collection Procedure

An assistant researcher was trained in order to standardize the data collection exercise. A full list of respondents to be interviewed was first prepared. The local administration office was informed of the research and an introductory letter sought from them, permission was also sought from the national council of science and technology so as to make of the study conform to the set standards. The physical location of the respondents was established for ease of delivery of the questionnaire. For illiterate respondents, a guided interview was done. With the help of the assistant researcher, all questionnaires were edited, verified and collected for analysis.

3.7 Data Analysis Technique

Both qualitative and quantitative methods were used to analyze the data. Qualitative analysis was used to analyze the perception data that was collected from the ministry officials, milk processors and officials of Kenya Dairy Board, raw data collected from the field was organized, clustered, interpreted and conclusions made from it. Where notes

were taken, they were organized to manageable forms to enable summarized interpretations to be made. The final conclusions were arrived at after careful verification of the data collected and interpreted.

Quantitatively, data from the structured questionnaires was edited and processed. It was then coded to enable categorization into groups and entered into SPSS. Descriptive statistics was then used for the frequencies and percentages as per the results obtained. Difference between sample means tested using the t-test.

3.8 Ethical Consideration

Ethical measures are principles the researcher should bind herself to in conducting the research before data collection (Macmillan and Schumacher, 1993). Initial approval was secured from the University of Nairobi. A research permit was sought from the NCST. The respondents were assured that the information given was for the purpose of this research and was to be treated with utmost confidentiality.

3.9 Operationalization of Variables

The Operationalization of a variables means manipulating both the independent and dependent variables in such a way that they end up having a few levels thus becoming measurable.

Table 3.1 Operational definition of variables

OBJECTIVE	TYPE OF VARIABLE	INDICATOR	MEASURE	MEASURING SCALE	TYPE OF ANALYSIS TOOL
To Identify the relationship between market of milk and production in Mirangine and Mauche division.	<p>Dependent</p> <p>Production of milk by small-scale farmers in Mirangine and Mauche division</p> <p>Independent</p> <p><i>Market of milk.</i></p>	<p>Monthly production</p> <p>Monthly income</p> <p>Milk sale</p> <p>markets available</p> <p>Distance to market</p>	<p>frequency</p> <p>amount of milk</p> <p>amount of income</p> <p>Price per litre</p> <p>List of markets</p> <p>No. km covered</p>	<p>ratio</p> <p>ratio</p> <p>ratio</p> <p>ratio</p> <p>ratio</p>	<p>mean</p> <p>mean</p> <p>mean</p> <p>mean</p> <p>Mean</p>
To establish how farmers awareness contributes to the Dairy production in Mirangine and Mauche division.	<p>Independent</p> <p><i>farmers awareness</i></p>	<p>Farmers Trainings.</p> <p>Dairy farming experience</p> <p>Information access.</p> <p>Collaboration and linkages.</p>	<p>Number</p> <p>No of years</p> <p>List of source</p> <p>No of tours</p>	<p>ratio</p> <p>ratio</p> <p>ratio</p> <p>ratio</p>	<p>mean</p> <p>Mean</p> <p>mean</p> <p>mean</p>
To asses whether there is a relationship between demographic characteristic and Dairy production in Mirangine and Mauche division.	<p>Independent</p> <p><i>Demographic characteristics</i></p>	<p>Gender involvements in production</p> <p>Marital status</p> <p>Age</p>	<p>Type</p> <p>type</p> <p>Number.</p>	<p>Nominal</p> <p>Nominal</p> <p>ratio</p>	<p>mean</p> <p>-</p> <p>mean</p>
To establish how dairy cattle breeds variability affects the production of milk in Mirangine and Mauche division.	<p>Independent</p> <p><i>Cattle breed variability</i></p>	<p>Mating used</p> <p>Animals registration</p> <p>Record of sire</p> <p>Breeds availability</p>	<p>type</p> <p>Numbers</p> <p>Numbers</p> <p>number</p>	<p>nominal</p> <p>ratio</p> <p>ratio</p> <p>ratio</p>	<p>-</p> <p>mean</p> <p>mean</p> <p>mean</p>

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents and discusses findings of the study which have been discussed under thematic areas and subsections in line with the objectives of the study. Much of data in this study is quantitative and therefore quantitative methods of analysis are used where by descriptive statistics have been used to analyze the quantitative data. Specifically, frequencies distribution tables are used to summarize and present data in relation to the study objectives.

4.2 Questionnaire Response rate

Questionnaires were administered to two groups of respondents, the first group involving the small scale dairy farmers from Mauche division and the second group of farmers from Mirangine division. The study targeted 4005 respondents as computed in the chapter three of the study. The sample size was split into two to cover each region thus a total of 352 questionnaires were distributed: 176 to each region. Of the 352 questionnaires distributed, only 348 of the responses were deemed fit for analysis as the other four were partially filled, this gave a response rate of 99.15%. The four extension officers from ministry of livestock two from each region of study and one official from Kenya dairy board were all interviewed by the researcher hence a 100% response rate. This was possible due to the fact that the questionnaire was administered by research assistants and risk of non-return was eliminated because as soon as the questionnaire was well filled out was recovered.

4.3 Relationship between demographic characteristics of farmer and milk production

The demographic characteristics of the respondents are presented in this section of this study. These are social factors that potentially influence milk production and include gender, age, and experience in dairy farming, education level of farmers, training, and types of breed selected among others.

4.3.1 Milk production

Table 4.1 shows daily milk production by respondents' farms in the two different regions. It is evident that most farmers in Mauche (44.3%) produce less than 5 litres daily and about 39.1% produce between 5 and 10 litres per day. This means to about 83.4% of the respondents producing less than 10 litres per day. In Mirangine most respondents (32%) produced between 5 and 10 litres with 87 (about 58%) of respondents producing over 10litres, and 20.9% of the respondents producing over 20 litres. Only about 10% of respondents in Mirangine produce below 5 litres per day.

Table 4.1 Milk production per day by region

Milk Production per day	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
below 5litres	77	44.3	17	9.9
5-10litres	68	39.1	55	32.0
10 -15litres	18	10.3	38	22.1
15-20litres	7	4.0	26	15.1
over 20litres	4	2.3	36	20.9
Total	174	100	172	100

From Table 4.1 it can be said that on average farmers in Mirangine division produce relatively more milk per day than the farmers in Mauche. This trend is maintained in the average daily milk sale as shown in Table 4.5 in Mirangine as supported by all other demographic characteristics of farmers produces more milk than Mauche .A lot need to be adopted by Mauche farmers and other farmers from other parts of the nation to make sure production of milk goes up like that of Mirangine. The question of production per

region between Mauche and Mirangine was fully ascertained by an officer from Kenya dairy board during an interview as captured below;

There is big difference in terms of milk production in Mirangine and Mauche divisions. From our records as Kenya dairy board we have registered more milk traders from Mirangine division who trade their milk using motorbike to town of Nakuru. This is an indication that there is more of product from the area. A part from traders the processors are many in this area of Mirangine and all of them collect a considerable amount of milk. This is not the case with Mauche.

4.3.2 Distribution of farmers by gender

A personal attribute of the farmer's analysis in the study was their gender. During the data collection exercise, farmers were asked to state their gender. The Table 4.1 shows that male respondents make up more than half the population in both the regions with Mirangine having 133 males (76.2%) as compared to 41 females (23.8%). Respondents from Mauche comprised of 105 males (60.3%) and 69 females (39.7%).

Table 4.2 Gender of the Respondent by region

Gender of the Respondent	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Male	105	60.3	131	76.2
Female	69	39.7	41	23.8
Total	174	100	172	100

This shows that there is more male involvement in dairy production in Mirangine than in Mauche; this may be brought about by the reason that farmers in Mirangine view dairy farming as a commercial activity more than in Mauche thus more men are involved trying to control resources in the household. This has an effect on the difference in overall production of the two regions as more men are involved in farm business decision making in Mirangine than in Mauche.

4.3.3 Marital Status of the Respondents

In the study, respondents were asked to state their marital status. Of the participants who responded to the question, 96.0% from Mirangine were married consisting of 164 and about 93.0% from Mauche were married consisting of 161 persons. Respondents from both regions had more or less the same marital rate. Marital status could contribute to difference in production between the married and unmarried respondents in that, a household with a married couple tends to have more labour capital for dairy farming, which is mostly a labour intensive activity when practiced in small scale in Kenya.

4.3.4 Education Level of the Respondents

As shown in Table 4.2, 68.4% of the respondents from Mauche had attained education from primary level and below while Mirangine had about 48% of the respondents falling in the same category. About 52.1% of the respondents from Mirangine listed secondary education and above while Mauche had slightly over 31.6% who had attained secondary education as their highest qualification. This shows that farmers in Mirangine are generally more learned than their Mauche counterparts.

This could be a possible contributor to the difference in dairy productivity as learned people tend to be innovative and they may be in a better position to implement best practices in the industry while people who are not learned may not be capable to understand or implement the best practices without the strict assistance of experts or extension officers. This may be more pronounced in the mixing of concentrates and administering of medicine. Education is also important when it comes to pricing and marketing of the produce.

Table 4.3: Education level of respondents by region

Education Level of the respondent	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Primary Level And Below	119	68.4	82	48.0
Secondary	47	27.0	74	43.3
Post-Secondary	8	4.6	15	8.8
Total	174	100	171	100

The result from the Table 4.2 clearly shows that the level of education in Mauche is generally low. According to Karanja (2003) such limited education levels are likely to negate the adoption of new and improved dairy production practices by farmers leading to low milk production. Education generally increases a person awareness of his/her environment and ability to acquire and process information about his/her environment and to detect changes in it. Education also enhances the farmers' ability to identify alternatives and compare costs Mbwesa (2004). This study supported the proposition by Bhole et al (2006) that people with low levels of education had difficulty finding a paid job and therefore sees no other possibility than engage in farming.

This fact was ascertained by one of the extension officer from ministry of livestock Mauche division whose argument is captured below;

In Mauche division the illiteracy level is very high and its contributed much by issue of early marriage and once that happen it affects dairy farming especially milk production due to poor adoption of skills once the farmers are trained by extension officers.

4.3.5 Experience in dairy farming

The survey item sought to know the period the respondents had been in dairy production. The underlying assumption for this item was that the more experienced a dairy farmer was, the more he/she applied best farm practices and consequently improved production. Intervals representing the number of years as a dairy farmer were used as a measure of experience.

Table 4.4: Experience in farming by region

Experience of the respondent in dairy farming	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
1 -5 years	51	29.3	23	21.4
5 - 10 years	56	32.2	38	27.2
10- 15 Years	31	17.8	32	18.3
Over 15years	36	20.7	78	33.0
Total	174	100	171	100

As illustrated in Table 4.3, Majority of respondents from Mirangine had over 15 years' experience in dairy farming at 78 (33%), 5-10 years had the next highest percentage of respondents with respondents having between 1-5 years having the least representation at 21.4%. In Mauche most of respondents (32.2%) had between 5-10 years' experience with 1-5 years being the second most represented and 10-15 years the least. This implies that farmers in Mirangine are more experienced than their counterparts in Mauche. The emphasis of experience in any undertaking cannot be over-emphasized; in the dairy sector experience is especially important for improving of the breed and feeding. Any farming has its own challenge and the more the farmer has experience the more he/she is in a better position to overcome challenges and this gives out explanation why the milk production in Mirangine is far much high than in Mauche

4.3.6 Age distribution of farmer by region

Most of respondents in Mirangine were above 50 years of age. Table 4.6 below shows 131 persons were more than 36 years of age in Mirangine despite Kenya boasting of a young population with youth majority. In Mauche, most of respondents were between the ages of 26 and 35 years of age with a 15 respondents being 25 years and below.

Table 4.5 Age category of the respondents by region

Age Category of the Respondent	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Below 18years	1	0.6	0	0.0
18 -25years	15	8.7	8	4.7
26 -35years	54	31.2	33	19.2
36 -45years	48	27.7	36	20.9
46 -50years	20	11.6	32	18.6
Above 50years	35	20.2	63	36.6
Total	173	100	172	100

As shown in the Table 4.4 above, farmers in Mirangine are generally older than those in Mauche. This may be attributed to the fact that Mauche is a more recent settlement scheme than Mirangine. The glaring age difference also contributes to the level of experience in dairy farming as shown in Table 4.3. An elderly population though less productive is more settled and experienced in whatever the economic endeavors they undertake. Age may also be an impediment when it comes to innovation as younger people are deemed more innovative. According to government of Kenya, 2012 the average age of a farmer is 60 years. Very few youth people who involve themselves in dairy farming and those who does like case of Mauche they don't give dairy farming the seriousness it deserves. Therefore youth should be encouraged to enter into dairy farming through milk value chain, value addition and any other stage of milk value chain and eventually they will engage in production after realizing the benefits.

4.3.7 Size of land under dairy farming

As shown in Table 4.6, majority of sample employed less than 1 acre in dairy farming in both regions, the two regions had about the same number of farmers employing 1-2 acres and the frequency reduced as the acreage employed increased with only a few respondents employing more than 6 acres.

Table 4.6: size of land that is used for dairy farming

Size of land under dairy production	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Under 1 acre	82	47.1	79	45.9
1 -2 acres	66	37.9	59	34.3
2 -4acres	16	9.2	18	10.5
4 -6acres	8	4.6	10	5.8
above 6acres	2	1.1	6	3.5
Total	174	100	172	100

The survey item did not bring out much difference between the farmers in the two regions as they had a similar distribution amongst the different size categories. The high percentage employing less than 1 acre in both regions may be attributed to high population densities and zero grazing farming system which is practiced in the regions. Size of the land may be the same but what is put in the land for the dairy farming brings the difference between the two regions. Its was noted that the land in Mauche set aside for cattle, the rearing method applied was the extensive grazing while in Mirangine the land set aside for cattle farmers has planted pasture and cut carry method was mostly used. The land usage affects production more than the land size.

4.4 Relationship between milk marketing structure and milk production by region

Marketing is defined as the performance of all business activities that are involved in the flow of milk and services from the point of initial production until they are in the hands of ultimate consumer. To investigate the milk marketing structure, respondents were asked to answer a few questions regarding the price, form of milk used and distance from nearest market. The results were presented in a series of frequency distribution tables.

4.4.1 Selling prices of milk/ litre by region

In well-functioning marketing systems, farmers are free to market their products through the outlets of their choice. The decision to market their milk through particular outlets is a function of production cost, transport cost, risk cost and promptness of payment among other factors.

Table 4.7: Selling price of milk/liter by region

		Mauche		Mirangine	
Selling Price of a litre of milk	Frequency	Percentage	Frequency	Percentage	
20-30 Ksh	151	86.8	171	98.3	
30-40 Ksh	23	13.2	3	1.7	
Total	174	100	174	100	

Table 4.7 above has summarized the frequency of milk price ranges in the two regions. About 171 respondents in Mirangine representing approximately 98% said that they sell milk at price of between 20 and 30 shillings. 151 respondents from Mauche (about 87%) named a price of between 20 and 30 with the rest of respondents from the two regions naming 30-40. The milk prices were seen to be relatively equal in both regions though more farmers in Mauche reported to be getting a higher price for their produce than in Mirangine, this can be attributed to the milk marketing scheme where farmers who sell to consumers directly fetch higher prices than those who sell to middlemen which was the case as shown in Table 4.7. Also the supply demand forces have attributed the difference in prices between the two regions where in Mirangine due to production been high the price is a bit lower than Mauche. However milk like any other commodity follows rules of supply and demand where during dry season prices go up as supply is low. On the other hand during rainy season the prices go down due to increased production from farmers.

4.4.2 Milk marketing channel

It is interesting to note that the channels most used by respondents in the two regions are: middlemen in Mirangine and local shops/hotels in Mauche and the least used is dairy

cooperative with not a single respondent using it in Mirangine while only one respondent using this channel in Mauche.

Table 4.8: Milk marketing channel

Milk marketing channel/ option used	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Sell to neighbors	63	36.2	7	4.0
Local Shops/ Hotels	66	37.9	13	7.5
Middlemen	39	22.4	13	64.9
Direct to processors	5	2.9	41	23.6
Dairy cooperative	1	0.6	0	0.0
Total	174	100	174	100

The results show that may be the reputation of cooperative is not friendly for both divisions. In terms of trust and management of dairy cooperatives and promptness of payment clearly show farmers prefer local shops and hotels in Mauche and middlemen in Mirangine. Reduced cost of transportation is another positive attributes favoring middlemen in Mirangine. Middlemen will collect milk from door step using motor bike which is an advantage to the farmer than cooperative who must charge some cost due to transport. The marketing channel farmers decide to use to market their milk either boost the morale or kills the morale of farmer affecting production of milk eventually.

4.4.3 Form of milk sold at farm

The majority of farmers sell their milk in raw form as shown in the in Table 4.9 below, only a few farmers sell milk in sour form. This may be due to the fact that they are small scale and they lack processing and preservation equipment at their farms and also the simple fact that they sell their milk to middle men who take it as soon as it is produced and go to sell it to another party. Farmers tend to prefer selling milk in raw form to middlemen and retailers due to prompt payment from the middlemen as opposed to delayed payment systems employed by cooperatives and milk processors.

Table 4.9: Form of milk sold at farm

Form of milk sold at the farm	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Raw	168	96.6	172	98.9
Fermented milk	6	3.4	2	1.1
Total	174	100	174	100

The aspect of value addition if embraced by the dairy farmers increases the returns of dairy farming but the resource to do the value addition is the challenge to small scale farmers.

Skills to do the value addition is another major challenge that prevent the process adoption and farmers are left with only one option, selling raw milk which does not fetch more profit when compared with fermented milk.

4.4.4 Distance to nearest market

Most of respondents (about 45%) in Mauche live less than a kilometer from the closest milk market with about 35% living between 1 and 2 kilometers from the milk market. Majority (about 65%) of the respondents in Mirangine live within a kilometer from the milk market with the remaining proportion distributed almost uniformly between, 1-2 km, 3-5km and over 5 km (see Table 4.10). It is shown that farmers in Mirangine at an average of 1kilometer live closer to the milk markets than farmers in Mauche who live an average of 1-2 kilometers from the market.

Table 4.10: Distance to nearest market

Distance of the nearest market in km where milk is sold	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Less than 1km	79	45.4	115	66.1
1km-2km	64	36.8	21	12.1
3km-5km	11	6.3	23	13.2
over 5km	20	11.5	15	8.6
Total	174	100	174	100

The closer the farmer is to the nearest market the easier it is to make quick sale especially during rainy seasons. This increases production and lower the transport cost hence encouraging more farmers to do dairy farming hence boost milk production. Most of the roads in the two region of study are weather roads and during rainy season are impassable. This affects the milk marketing and production.

4.4.5 Average daily sale of milk in litre as grouped by region

As shown in Table 4.11 above, more than half of the respondents from Mauche (58.6%) made a daily sale of less than 5 litres followed by those who sold between 5 and 10 litres that comprised about 30.5%. None of the respondents from Mauche sold over 20 litres of milk. Most of the respondents from Mirangine sold between 5 and 10 litres, 21.6% (37 respondents) indicated that they sold between 10 and 15 litres. 6.4% of the respondents reported that they sold more than 20 litres of milk on the daily.

Table 4.11: Average daily sale of milk in litre as grouped by region

Average sale of milk per day	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Below 5 litres	102	58.6	20	11.7
5 litres -10 litres	53	30.5	84	49.1
10 litres- 15litres	14	8.0	37	21.6
15litres- 20litres	5	2.9	19	11.1
Above 20litres	0	0.0	11	6.4
Total	174	100	171	100

From the Table it is evident that on average, farmers in Mirangine sell more milk than farmers in Mauche, this can be explained by the proximity to the market and the milk marketing channels which Mirangine seems to be better off as compared to Mauche. The more production of milk from these two regions the more the sale of milk because consumption may be almost equal. What remains upon domestic use finds it way to markets and because Mirangine has more production of milk as compared to Mauche then a lot of milk is sold.

This fact is ascertained by an extension officer from Mirangine whose argument is captured below;

In Mirangine division most of farmer sells all of the morning milk and mostly the evening milk is left for consumption purpose unless it's more than the demand of each household. Farmers have problem when preserving evening milk which they mostly sell to kiosks and hotels. This increases the chances of low milk sale per day and calls for facilities like coolers which are used for chilling milk and preserve it for sale especially evening milk.

4.5 Farmer's awareness and milk production

Farmers' awareness was measured by a number of factors, these include: whether or not they got training on dairy production, their main source of dairy information and the number of farmers they networked with.

4.5.1 Institution offering training on dairy production

Summary of institutions that trained farmers on dairy farming is illustrated in Table 4.12 below. About 53% of respondents from Mauche and 45% from Mirangine chose none. Government of Kenya was chosen by about 40% from Mauche and less than 30% from Mirangine. As it is shown 20% from Mirangine got training from the private sector while only about 4% from Mauche did the same. Less than 5% from each region did get training from NGOs. Generally more farmers in Mirangine got some form of training as compared to farmers in Mauche where a majority had not gotten any form of training from any organization. Most of the farmers in the two regions who had gotten some form of training on dairy farming were trained by the government. A significant number of farmers (23.1%) from Mirangine got their training from the private sector which is an indicator of the strong private sector presence in Mirangine as compared to Mauche which had 3.4% of the farmers trained by the private sector.

Table 4.12: Institution offering training on dairy production

Institution offering training on dairy production	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
NGO	5	2.9	7	4.0
Government of Kenya	68	39.1	49	28.3
Private Sector	6	3.4	40	23.1
None	95	54.6	77	44.5
Total	174	100	173	100

From the study capacity building on farmer is an indication of increasing awareness among small scale dairy farmers and the trainings has an effect on milk production. New ideas on dairy farming receive better implementation when farmers are trained by

extension staffs from either government or private sector. Result of the study reveals that a lot of farmers are on their own with no training services from either government or private sector. Where private sector and NGOS are seen the change in production is evident this one contributing factor on the reason why Mirangine has more milk production than Mauche. Milk production depends to some extent on farmers' awareness which is increased through capacity building among dairy farmers.

4.5.2 Source of dairy information on farm

Table 4.13 illustrates respondents' source of dairy information in five given categories plus "none" option. About 40% of farmers from both Mauche and Mirangine stated media that is approximately 70 respondents from each region. Approximately 36% percent of respondents from Mauche and 20% from Mirangine chose other farmers. About 18% persons from Mirangine chose "all of the above" while 5% from Mauche chose the same. Approximately another 16% from Mirangine and 14% from Mauche said they attended workshop and about 6% from Mauche and 4% chose leaders and farmers' representatives. Almost 2% of farmers from Mauche chose none.

Table 4.13: Source of dairy information on farm

Source of Dairy information on your Farm	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Other Farmers	62	35.8	35	20.6
Leaders and farmers representative	11	6.4	7	4.1
Media	68	39.3	69	40.6
Workshops	23	13.3	29	17.1
all of the above	8	4.6	30	17.6
None	1	0.6	0	0.0
Total	174	100	173	100

The study most farmers in the two regions get important dairy information from the media; this can be explained by the low literacy levels in the two regions as shown in Table 4.4 where most of the farmers cannot seek information from other sources like journals thus they turn to the media and vernacular radio stations for important information.

4.5.3 Rating of services offered by government officers on Dairy Production by region

Respondents were asked to rate services they got from government officers on dairy production using a four point scale from 1-poor through to 4-very satisfactory. Most of farmers from Mauche (46.4%) and about 31.8% from Mirangine said it was poor. An average score of the rating was computed and Mauche a mean rating of 1.85 which was fair as Mirangine had a mean rating 2.08 which translated to fair.

Table 4.14: Rating of services offered by government officers on Dairy Production by region

Rating of services offered by government officers on Dairy Production	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Poor	78	46.4	54	31.8
Fair	39	23.2	49	28.8
Good	50	29.8	67	39.4
Very Satisfactory	1	0.6	0	0.0
Total	168	100	173	100

Result from the study reveals that for more production to be realized in this two regions government services are needed. Services like disease control and animal nutrition among others are key factors to consider when doing dairy farming and these services are offered by government cost of production of farmer goes down and this in one way or the other boost milk production. An extension officer from Mirangine ascertained this during an interview whose argument were highlighted below;

In Mirangine division the biggest challenge is the issue of staff to farmer ratio and this hinders our services to farmers because we can't be able to reach all dairy farmers as we could have wished .Our government should employ more staff to reduce the ratio to a level where services could be felt in the whole division by our dairy farmers. Also the resource to reach out the farmer are also little, for example no a single vehicle to go to the field. The vehicles available are of poor conditions and fueling them also is a problem. A lot need to be put in place to make our service as Government workers available to all farmers in Mirangine.

4.5.4 Number of farmers networking with each other.

Respondents were asked the number of farmers they networked with on matters of dairy farming and were supposed to respond in four given categories plus “none”. About 83% of respondents from Mirangine chose more than three with about 10% choosing three and 5% and 3% choosing two and none respectively. About 37% of the respondents from Mauche chose more than three, about 16% of the respondents chose three, about 18% chose two, about 8% chose one and 23% chose none as illustrated in Table 4.15 below.

Table 4.15: Number of farmers networking with each other

Number of farmers networking with	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
None	42	24.4	4	2.3
One	17	9.9	0	0.0
Two	32	18.6	7	4.1
Three	22	12.8	18	10.5
More than three	59	34.3	143	83.1
Total	172	100	173	100

As shown in Table 4.15, majority (83.1%) of the respondents constituting of 143 respondents from Mirangine said that they networked with more than three farmers while almost a quarter of the respondents from Mauche said they do not network. This may be explained by the population density of the two regions where farmers in a sparsely

populated region may find the distance between farms inhibiting. Sacco, cooperatives, training sessions by the government and the private sector may be an avenue for networking where Mauche farmers when selling their milk in retail may not encounter.

The more the farmers network with other farmers the better for them since the interaction becomes an avenue for sharing challenges in dairy and experience as well as sharing ideas. Lesson learnt in dairy farming exchange hands and this brings improvement and increases production of milk (Muriuki et al, 2003)

4.6 Breed variability and milk production

Milk production of a cow is governed by the inherited genetic characteristic of a cow. Different breeds of cows have been shown to produce different quantities of milk when they are compared under the same environment (McDonald et al, 1998). In this study breed commonly found in the two region, average production of respondent's cattle, mating type used and breeding stage has been looked at and how they affect milk production in the two regions of study.

4.6.1 Breed of Cattle commonly found on farm by region

The availability and quality of breeding stock plays a key role in increasing the milk productivity of the livestock sector. Farmers were asked to state the common breed in their farms and this aimed at measuring the most common breeds in the regions and the breeding stage.

Table 4.16 Breed of Cattle commonly found on farm by region

Breed of Cattle commonly found on Farm	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Friesian	35	20.1	75	43.1
Ayrshire	13	7.5	63	36.2
Gunsey	0	0.0	3	1.7
Jersey	3	1.7	3	1.7
Crosses	123	70.7	30	17.2
Total	174	100	174	100

Farmers were asked what the most common breed on their farm is and an option of five breeds was given, where one of the options was “crosses”. As shown in Table 4.21, 123 (70.7) farmers in Mauche chose crosses, 35 (20.1%) chose Friesian, 13 (7.5%) chose Ayrshire and 3(1.7%) chose Gunsey. On the other hand, 75% of the farmers in Mirangine chose Friesian, 63 (36.2%) chose Ayrshire, 30 (17.2%) chose crosses. Gunsey and Jersey were chosen by 3(1.7%) each. As seen in Table 4.16, crossbreeds accounted for about 70.7 percent of the respondents’ cattle in Mauche. This is consistent with Muriuki & Thorpe (2004) who established that crossbreed cows are the most popular in Rift Valley province which includes Mauche division. Majority of the respondents from Mirangine claimed to have Friesian and Ayrshire cattle, these differences tend to add to the disparity in the production rates of the regions as pure breeds have a higher yield than crosses.

The study is similar to that of Ngigi (2004) in the study of smallholder dairy in Kenya. The researcher identified improved breeds as an important driver for change in milk production. According to researcher widespread introduction of highly productive breeds of dairy cows has been major source of increased productivity in dairy sector. Therefore Mirangine farmers have more improved cows hence more milk production per cow per day as also shown in Table 4.17 below.

4.6.2 Average production per day of respondents’ cattle

Majority of the respondent, over 80% from Mauche and about 60% from Mirangine expressed that their cattle produced below 10 liters a day. About 30% from Mirangine and 10% from Mauche said their cattle produce an average of 10-15 liters with less than 5% from the regions producing an average of 15-20 liters a day. About 7% of respondents from Mirangine and less than 5% from Mauche produced an average of more than 20 litres. The two regions had about equal sample population and from Table 4.17, deductions can be made that Mirangine has a relatively higher production rate per cow than Mauche.

Table 4.17 Average production per day of respondents' cattle

Mauche			Mirangine	
Average sale of milk per day	Frequency	Percentage	Frequency	Percentage
Below 10 litres	145	83.3	103	59.2
10 litres- 15litres	21	12.1	53	30.5
15litres- 20litres	5	2.9	6	3.4
Above 20litres	3	1.7	12	6.9
Total	174	100	171	100

4.6.3 Breeding stage of animals

Respondents were asked to choose the breeding stage at which their animals fall; four categories were given including: Foundation, Intermediate, Appendix and Pedigree. Table 4.18 provides a summary of the results that were obtained: Majority (about 63%) of the respondents from Mauche had their cattle at foundation stage while most of the respondents from Mirangine claimed their cattle were at appendix stage of breeding. This is a testament of the farmers experience and commitment to the industry and consequently influences milk production.

Table 4.18 Breeding stage of animals

Mauche			Mirangine	
Breeding stage of cattle	Frequency	Percentage	Frequency	Percentage
Foundation	109	62.6	59	33.9
Intermediate	56	32.2	45	25.9
Appendix	9	5.2	66	37.9
Pedigree	0	0.0	4	2.3
Total	174	100	174	100

The study shows clearly that Mirangine dairy farmers have been breeding their cattle well from one stage of breeding to the next. The breeding is continuous with good representation of all the stages of breeding. This is not the case with Mauche where

representation is poorly distributed. This is a clear indication that breeding is not properly done in Mauche. This agrees with Table 4.16 and 4.17 above. The more the foundation stages are in a region the poor the production of milk in that particular region. The researcher identifies Mirangine division to be ahead of Mauche in production as breeding aspect is concerned.

4.6.4 Type of Mating Used region

Table 4.19 illustrates the type of mating that the respondents use for their animals. Natural mating was the most common type in Mauche where 133 or 76.4% of the respondents used it. 22.4% of the respondents used Artificial Insemination (A.I) and 1.1% had not yet used any type. In Mirangine 125 of the respondents or 72.3% used A.I, another 48 (27.7%) used Natural mating. This explains the common types of the breeds found in the regions as natural mating mostly results in crosses as artificial insemination is the best method for improving the breeds.

Table 4.19: Type of Mating Used region

Type of Mating Used	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Natural Mating	133	76.4	48	27.7
A.I	39	22.4	125	72.3
Not Yet	2	1.1	0	0.0
Total	174	100	173	100

According to results of the study majority of farmers from Mauche use natural mating which is very hard to keep records of the sire used in a breeding programme. It clearly shows and agrees with the above Table 4.17 that in Mauche there is poor breeding and milk production is affected negatively by this fact. On the other hand majority of farmers in Mirangine uses AI as a tool of breeding and this improves and upgrades their cattle and eventually they realize good breeds with good milk production.

4.6.5 Challenges on farm by region

Farmers were asked to state the most common challenge on breed and production on their farm. Table 4.20: Illustrates a summary of the responses with resistant diseases at 34.9%

being the most common in Mauche while repeat on estrus was the most common in Mirangine with 25.6% direct mention in the responses. The study shows that Mauche farmers have a challenge on with disease resistant which is managerial issue which can contribute reduction in production of milk in this region. The issues of disease resistant is also to some extent a challenge in Mirangine but good control leads to good milk production in this region.

Proper disease control should be encouraged to maintain good milk production Wambugu (2001).

Table 4.20: Challenges on farm by region

Most common challenge on farm	Mauche		Mirangine	
	Frequency	Percentage	Frequency	Percentage
Diseases Resistant	60	34.9	19	11.3
repeat on estrus	49	28.5	43	25.6
Dystocia	2	1.2	6	3.6
Adaptability	3	1.7	17	10.1
silent heat	33	19.2	19	11.3
all the above	3	1.7	2	1.2
None	18	10.5	52	31.0
Other	4	2.3	10	6.0
Total	174	100	168	100

According to study the majority of the farmer experience challenges related to breeds with Mirangine highlighting repeat of estrus and this can be as result of poor timing during insemination. This is a challenge which could be eliminated with increased management of dairy cattle herd. This challenge also affects Mauche farmers as such due to use of natural mating in their breeding where bulls could be associated with some breeding diseases.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSION, CONCLUSION AND RECOMMENDATIONS OF FINDINGS

5.1 Introduction

This research study sought to establish the factors attributable to the difference in milk production (output levels) between small scale dairy farmers in Mirangine and Mauche divisions, both in the vicinity of Nakuru County. This chapter therefore contains a summary of the findings, discusses these findings and furnishes conclusions based on the objectives of the research study. The chapter also contains some recommendations for consideration based on the study findings. The tail end section deliberates on the contributions of the study to the general body of knowledge.

5.2 Summary of the Findings

The first objective of the study was to identify how demographic characteristic of small-scale dairy farmers affects milk production in Mirangine and Mauche division and it was found that more male dominated sector, with an average of about 67.25% male against 32.75% female respondents. Mirangine, however, had a larger number of females engaged in dairy farming than Mauche division. This result agrees with Wambugu (2010) who found out that males are more involved in dairying farming of improved breeds than their female counterpart. A larger portion of the respondents also affirmed to being married, Mirangine stood at a whopping 96.0% while Mauche were at 93.0%. It was perhaps the transition rates from one level of education to the other that started setting the two divisions apart. For instance, Mirangine registered a primary to secondary school transition rate of about 94.0% whereas Mauche barely managed a 59.0% rate.

A majority of the dairy farmers in Mirangine were past their youthful years, with most respondents cited at above fifty years. This would however prove to be a blessing in disguise for the division as 65.0% of farmers here had ten or more years' worth of experience in dairy farming. More than half of these farmers produced ten or more litres

of milk on a daily basis, with a further 39.53% producing between 5 – 10 litres daily. On the other hand, Mauche boasts of a much youthful populace with the majority falling below 45 years of age. Most dairy farmers here fell in the age bracket of 26 – 30 years, and this came at a steep price as much as 60.0% of respondents having an experience in dairy farming of less than ten years. Perhaps attributable to the relatively low experience levels in dairy farming, about 81.0% of respondents in this division had a daily output of ten or less litres of milk with a mere 6.32% being able to produce over 20 litres a day.

Both divisions registered low acreage of land under dairy farming. About 80.0% and 84.0% of respondents in Mirangine and Mauche respectively had committed below two acres of land to dairy farming. However, Mirangine division had an almost 6.0% lead as far as two or more acres of land are committed to dairy farming, and the same is even more pronounced for over six acreages.

The second objective of the study was to identify how marketing structure of milk affects its production in Mirangine and Mauche division among small scale farmers. The study found out that most of the milk output in Mirangine is sold almost entirely at the rates of Kshs 20 – 30 a litre. Only 1.7% of farmers sold the same at between Kshs 30 – 40. In comparison, about 13.2% of dairy farmers in Mauche sold their milk output at the relatively expensive Kshs 30 – 40 a litre. This can be partly explained by the fact that almost 78.0% of Mauche dairy farmers sell their milk to neighbors and/ or local shops. Here, less than 11% sold ten or more litres daily as opposed to the more than 38% of Mirangine farmers who sells a similar amount of milk daily. In Mirangine, dairy farming has taken a commercialized approach as majority of the farmers either sell milk to middlemen (63.0%) or directly to the processing plants (23.0%). This is further strengthened by 65.0% of dairy farmers here living in a radius of less than a kilometer from the nearest market as opposed to 44.0% in Mauche the same. All this put together has an effect on overall production since good marketing structure like that of Mirangine encourages more production among the small scale farmers.

The third objective of the study was to establish how small scale dairy farmers awareness on dairy farming affects the milk production in Mirangine and Mauche division. The study found out that (56%.) farmers in Mirangine division showed the most aggression

in seeking out dairy farming related information from many other sources other than from their counterpart farmers. These farmers quest for extensive information on dairy farming was also highlighted by their expansive peer to peer networks as a majority of them were cited as having networked with more than three peers on dairy farming related matters. On the other hand,(44.0%) dairy farmers in Mauche division sourced most of their dairy farming related information from the media as well as other farmers. As would be pointed out later, an increased awareness level in dairy farming by local farmers directly affects the output levels in milk production.

The fourth and the last objective of the study were to establish how cattle breeds variability affects the milk production in Mirangine and Mauche division among small scale farmers. The study found that Mirangine farmers aggressively pursued the adoption of quality dairy breeds such as Friesian (45.0%), Ayrshire (36.2%) and about 1.7% stocked the Gunsey breeds. The milk output levels of these breeds was also boasted to a larger extent by their fairly advanced breeding stages with about 40.0% of breeds rated as Appendix or Pedigrees. This was not the case for Mauche the bulk dairy farmers in Mauche division (at about 70.7%) relied on cross breeds of dairy cattle most of which were as a result of in-breeding thus significantly dampening the potential for their milk production capacity.

5.3 Discussion of Findings

This section briefly cross-examines the findings of this study in light of its previously stated objectives. These objectives were to examine the demographic characteristic of small-scale dairy farmers, the marketing factors of milk production, the farmers' levels of awareness on dairy farming and variability of cattle breeds, and how these four elements respectively influenced milk production in the two divisions

5.3.1 Influences of Demographic Characteristic on Milk Production

From the findings, there is a stark difference between the age structures and years of schooling, whereas male dominance seemed to cut across the sector in both divisions and a majority of the respondents were similarly married. The study concurs with Wambugu (2011) who argued that majority of farmers keeping dairy cows that are improved per

household are male headed. Dairy farmers in Mirangine division were fairly past their youthful age and had received more years of schooling based on their high transition rates as compared to dairy farmers in Mauche. The study also concurred with Baltenweek and Staal (2000) who strongly says that whereas the youthful population is generally believed to harbor the most production potential in any economy, in certain sectors such as dairy farming the contrary is true. The study totally agrees with walker (1991) who says that dairy farming is a science that calls for patience, character and practical experiences in order to fully reap of the fruits therein. The greatest undoing of a youthful populace involved in dairy farming in Mauche division would be attributable to their haste, relative inexperience in dairy farming and fairly fewer years of schooling as compared to the more elderly dairy farmers in Mirangine division.

Most farmers in both regions had committed small parcels of land to dairy farming with the majority at below two acres. However, as far as committing two or more acres of land, Mirangine was solidly ahead probably as attesting to the more exposure and well-seasoning those dairy farmers had acquired over the years in running/ managing dairy farms.

5.3.2 Influences of Marketing factors on Milk Production

From the study, dairy farmers in Mirangine division were more commercially oriented as their fairly developed market structures promoted commercialization and spurred competition amongst these farmers. This drove most farmers to pay more attention into their dairy farming; it might as well have informed the concentration of a majority of them in a radius of less than a kilometer to the nearest dairy markets.

In Mauche most of the dairy farmers too lived less than two kilometers away from their nearest markets, their fair distribution inside that radius appeared to be more of default than design. There lacked that convincing concentration around markets to point to their commercial orientation as far as dairy farming is concerned. To the contrary, findings of this study pointed out to a more subsistence based dairy farming in this division as would be indicated by the larger portion of respondents, about seventy eight percent, who affirmed to selling their daily dairy produce to either their neighbors and/or local shops.

The study concurs to Echessah (1994) who argues that any efforts to improve dairy cattle milk production should be accompanied by improvements in the milk marketing systems in order to ensure that there are sufficient outlets to cater for the increased outputs of dairy products and the marketing systems provides the right incentives to producers in order that they provide the goods and services that are required by consumers at acceptable prices. The study also concurs with a similar study undertaken by Ruigu,(1978) who reviewed the opportunities and problems in smallholder milk production marketing in Kenya and found out that the price the farmers are paid is an important incentive for sustained and increased milk output. The researcher can therefore strongly conclude that the price of milk determine the production level of small scale farmers.

5.3.3 Influences of Levels of Awareness on Dairy Farming on milk production

Though a significant number of dairy farmers in both areas had not received any training on dairy farming, standing at about 53% and 45% for Mirangine and Mauche divisions respectively, Mirangine division however showed the most inclination in receiving training from private institutions and NGOs whereas dairy farmers in Mauche leaned towards the Government of Kenya for the same. Farmers in Mirangine division also showed the most aggression in seeking out dairy farming related information from many other sources other than from their counterpart farmers. These farmers quest for extensive information on dairy farming was also highlighted by their expansive peer to peer networks as a majority of them were cited as having networked with more than three peers on dairy farming related matters.

On the other hand, dairy farmers in Mauche division sourced most of their dairy farming related information from the media as well as other farmers. As would be pointed out later, an increased awareness level in dairy farming by local farmers directly affects the output levels in milk production, breeding and proper utilization of land acreages. The relatively higher milk output in Mirangine division, with more than 50% producing ten or more litres per day, and fairly uniform milk pricing would attest to a growing level of awareness of these dairy farmers about their production capacities and market structures. The study concurs with Muriuki (2003) that the more the farmers network with other

farmers the better for them since the interaction becomes an avenue for sharing challenges in dairy and experience as well as sharing ideas. Also the study agrees with Walshe (1991) who urges that the lesson learnt in dairy farming exchange hands and this brings improvement and increases production of milk.

5.3.4 Influences of Variability of Breeds on Milk Production

From the study, the variability of cattle breeds stocked by different farmers in both divisions was the most pronounced of the four elements being interrogated for their possible contributions to the gapping difference in milk production between Mirangine and Mauche divisions. Mirangine farmers aggressively pursued the adoption of quality dairy breeds and milk output levels of these breeds was also boasted significantly by their fairly advanced breeding stages with about 40% of breeds rated as Appendix or Pedigrees. These farmers were also seen to be more proactive as far as breeding and mating is concerned – about 72.3% of respondents here cited artificial insemination as their preferred ‘mating’ procedure as it ensured certainty of conception and good quality of breeds (it did minimized in-breeding). This is consistent with Muriuki & Thorpe (2004) who established that crossbreed cows are the most popular in Rift Valley province which includes Mauche division. Majority of the respondents from Mirangine claimed to have Friesian and Ayrshire cattle, these differences tend to add to the disparity in the production rates of the regions as pure breeds have a higher yield than crosses.

The study is similar to that of Ngigi (2004) in the study of smallholder dairy in Kenya. The researcher identified improved breeds as an important driver for change in milk production. According to researcher widespread introduction of highly productive breeds of dairy cows has been major source of increased productivity in dairy sector

5.4 Conclusions of the study

Whereas major strides have been made, there is still a lot of room for improvement as far as the dairy sector goes. The concept of dairy farming, and commercialized agriculture as a whole, is yet to be fully sold to the youthful populace in Kenya. The levels of Government support in terms of trainings and other capacity building exercises, provision of extension services and raising awareness levels in dairy farming as far as breeding,

disease control and management and other best practices go was deemed to be wanting. As much as 60.6% and 69.6% of respondents in Mirangine and Mauche divisions respectively rated the services received from Government officers as below par, either rating it as poor or fair. Only an accumulated average of about 34% rated the same services as good enough.

Though mechanization is possible, it has been established from this study that dairy farming particularly in Kenya is a largely labour intensive undertaking that calls for a certain level of attention and commitment from the farmers. It has also been established that whereas the age factor, levels of education and awareness and practical experience in dairy farming were pertinent to improved dairy farming, the variability of good quality dairy breeds was seen to be the single largest determinant of milk production capacities. This was evidenced by the large difference in quality of dairy breeds stocked by dairy farmers in Mirangine vis a viz those Mauche.

The demographic characteristics of the respondents in light of their age, education, awareness levels and even marital status provided meaningful insight into the nature of dairy farming in Kenya. The dairy farming sector in Kenya is yet to realize significant input from the youthful, post-secondary educated generations in Kenya. A majority of dairy farmers are however married thus promptly positioning them as beneficiaries of otherwise cheap labour from their spouses, children or even grandchildren.

5.5 Recommendations of the study

Having looked at the theoretical framework, the conceptual framework, alongside the literature review, the study findings and the conclusions made, a series of recommendations are pointed out:-

1. That the Government of Kenya, through the relevant Ministry and State Departments, join hands with key stakeholders in the private sector to undertake a nationwide campaign to promote commercial dairy farming, and more so promote the stocking of quality dairy breeds through easily accessible financial arrangements. Proper utilization of land to ensure its maximum utility is realized, among other dairy farming best practices, should be inculcated to the farmers as

well as would be dairy farmers in order to ensure there is a sustained consistency in the improvement of milk production

2. Though cognizant of the fact that this study targeted small scale dairy farmers, the fragmentation of land witnessed was alarming as it did prohibit proper utilization of the land resource which is the backbone of any meaningful agricultural activities. This practice also stifled the efforts, and regressed the milestones achieved, in transforming agriculture from subsistence levels to a commercially lucrative engagement that would see the MDGs on poverty alleviation, improved health through proper nutrition and even improved environmental sustainability addressed
3. The government should strive to help the farmers improve their breeds by registering them and offering semen through the government veterinary doctors and extension officers at a considerable cost. This will ensure change of breeds and up grading of the cattle farmers have and eventually bring a change in milk production among small scale farmers.
4. Further there is need to employ more livestock extension officers as a measure of improving extension effectiveness. This is the only way the extension officers can be able to have more individual visits to the farmers. There is need also to adopt information and communication technologies in extension services.
5. Efforts should be made to reach more female farmers through developing gender sensitive extension packages and extension approaches that are gender friendly. This is to try and encourage more female to take frontline in dairy farming and increase the current production in dairy sector.

5.6 Suggestions for Further Research

Out of this research, the following areas were found to have deficiencies of information and further research on these areas might be of value.

1. Determine the policy interventions required in revitalizing, sustaining and making competitive the dairy cooperative sector in Nakuru County and nationally, within a liberalized regional and global market economy.

2. Assess the contribution of informal milk marketing groups to the dairy sector and their implications on the formal dairy cooperatives in Nakuru County.
3. The contribution of the dairy sub sector on the quality of life for the dairy farmers in the post liberalization period. Case of Mauche in Nakuru County.
4. A comparative analysis of large scale dairy farmers' production in Mirangine division in Nyandarua County and Mauche division in Nakuru County.

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APPENDICES

APPENDIX I: Letter of transmittal of data collection instruments

James G. Kamau

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NAKURU

TEL 0723929266

TO WHOM IT MAY CONCERN

Dear Sir/Madam

**RE;FACTORS INFLUENCING MILK PRODUCTION AMONG SMALL-SCALE
DAIRY FARMERS IN MIRANGINE DIVISION IN NYANDARUA COUNTY
AND MAUCHE DIVISION IN NAKURU COUNTY**

I am a postgraduate student in the University of Nairobi, pursuing a Masters degree in Project Planning and Management. I am conducting a research on Factors influencing milk production among small-scale farmers of small-scale dairy farmers' milk in Mirangine and Mauche division. You have been selected to help in this study. I do humbly request you to allow me to interview you. The information being sought is meant for research purposes only and will not be used against anyone. The researcher will ensure that a feedback reaches all those who participated.

Findings will greatly inform all stakeholders involved and will be a major breakthrough in the revival and sustainability of Dairy sector in the country. Your responses will also be treated with confidence. No names of individuals or farms will be needed.

Thank you in advance.

Yours sincerely,

JAMES KAMAU

L50/71686/2011

APPENDIX II: Dairy farmers' questionnaire

Introduction

This questionnaire is on assessment of a comparative study of small-scale dairy farmers' milk production in Mirangine in division Nyandarua County and Mauche division in Nakuru County. The exercise is in line with research study requirement in partial fulfillment of a master in arts in project planning and management degree at the University of Nairobi. The data collected will be used for said purpose only. The identity will be held with strictest confidence. Below are some questions to assist in comparing the milk production in the two divisions mentioned above? The questionnaire contains four sections. Kindly respond to all questions in all four sections by indicating by a ticking the space provided or by explaining your opinion briefly on the space provided

SECTION A: Influences of demographic characteristic on milk Production

1. Gender of the farmer

Male () female ()

2. What is your marital status?

Married () Single ()

3. What is your education level?

Primary level and below () secondary () post secondary ()

4. What is your experience in dairy farming?

1-5yrs () 5-10yrs () 10-15yrs () over 15yrs ()

5. Indicate your age category

Below 18yrs () 18-25yrs () 26-35yrs () 36-45yrs () 46-50yrs ()
above 50yrs ()

6. What is your milk production per day?

Below 5lts () 5-10lts () 10-15lts () 15-20lts () above 20lts ()

7. Indicate the size of your land under dairy production

Under 1 acre () 1-2 acres () 2-4 acres () 4-6 acres () above 6 acres ()

SECTION B: Influences Milk Marketing factors on Production

8. Indicate the selling price of a litre of milk in your farm

20-30 ksh () 30-40ksh () 40-50ksh ()

9. Which milk marketing channel /option do you use to market you milk

Sales to neighbor () Local shops/hotels () Middlemen () processors ()
Dairy cooperative ()

10. Which form of milk do you sell at your farm?

Raw () fermented milk () chilled ()

11. How far is the nearest market where your sell your milk?

Less than 1km () 1km-2km () 2km-3km () 3km-5km () above 5km ()

12. What is your average sale of milk per day?

Below 5litres () 5liter-10litre () 10liters-15litres () 15litres-20litres ()
Above 20litres ()

SECTION C: Influences of farmers' awareness on milk production

13. Who offer training on dairy production in this region?

NGO () GOK () private sector () none ()

14. What is the source of the dairy information on your farm? Tick appropriately.

From other farmers and friends () Leaders and farmers representative ()

Media (Radio, T.V, Newspaper etc) () Workshops, Seminars, and meetings ()

Internet services () All of the above. ()

15. How can you rate services offered by government officers on dairy production on your farm?

Poor () fair () good () very satisfactory ()

16. How many farmers do you network with on matters of dairy production within you area or from far?

none () one () two () three () more than three ()

17. Which gender is involved more on dairy production in your area?

Male () female () both ()

SECTION D: Influences of breed variability on milk production

18. Which breed of cattle is commonly found in your farm?

Friesian () Ayrshire () Gunsey () Jersey () crosses ()

19. What is the average production per day of your cattle?

Below 10liters () 10litres-15litres () 15litres-20litres () above 20 liters ()

20. At what level do rate you animals in breeding stages

Foundation intermediate appendix pedigree

21. Which type of mating do you use?

Natural mating

A.I

22. Tick appropriately the common challenge on breed and production in your farm

Diseases resistant () repeat on estrus () dystocia () adaptability () silent heat () All of the above () none () any other.....

In your own opinion how can dairy production be improved in this region?

.....
.....
.....
.....
.....
.....

APPENDIX III: Key informants interview

Good morning/afternoon, Thanks for taking the time to talk with us, my name is Kamau James Gitau; I am currently undertaking a Masters Degree in Project Planning and Management at the University of Nairobi. In fulfillment of my dissertation I am researching on ‘small scale dairy farmers production in Mirangine in Nyandarua county and Mauche in Nakuru county’. I am studying the difference in milk production between these two divisions. I will be recording the session because I don’t want to miss any of your comments. People often say very helpful things in these interviews and we can’t write fast enough to get them all down. I won’t use any names in the reports. You may be assured of complete confidentiality. May I ask you a few questions...?

1. According to your own opinion are there policies that need to be put in place to boost the production and marketing of milk from small scale farmers? Please mention.
2. Between the informal and formal market of milk which is most common in the two area under study and how do they affect the production of milk by small scale farmers?
3. What affects the small scale dairy farmers in the two divisions as far as milk marketing is concerned?
4. In your own opinion does the government do enough to assist the small scale farmers in terms of extension services and trainings in order to increase milk production?
5. In your own opinion do small scale farmers in these regions implement modern ways of dairy farming in order to improve milk production?

6. In your own view what is the age category of the dairy farmers in these two regions?
7. What would you comment on education level of most dairy farmers relative to milk production in the two mentioned divisions ?
8. According to your own opinion are the two divisions homogeneous in terms of dairy farming?
9. Who are the major stakeholders in dairy farming sector in these two regions? How do they assist small scale farmers to increase awareness on dairy farming?
10. In your own observation is there dairy cattle breed variation in Mauche and Mirangine? Does the variability affect the production of milk among the small scale dairy farmers in these two regions?
11. Where do you see dairy farming in these two regions five years from now?
12. Anything I missed or any comments?

Thank you for your time!

APPENDIX IV: Sampling table

Krejcie and Morgan sampling table

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

(Krejcie R. V et al. 1970).

Where: "N" is population size, S" is sample size.

APPENDIX V: Letter of authorization

REPUBLIC OF KENYA



NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

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Website: www.ncst.go.ke

Our Ref: **NCST/RCD/10/013/26**

Date: **24th May 2013**

James Gitau Kamau
University of Nairobi
P.O Box 30197-00100
Nairobi.

RE: RESEARCH AUTHORIZATION

Following your application dated **17th May, 2013** for authority to carry out research on "*A comparative study of small scale dairy farmers production in Mirangine in Nyandarua County and Mauche in Nakuru County, Kenya.*" I am pleased to inform you that you have been authorized to undertake research in **Selected Districts** for a period ending **31st July, 2013.**

You are advised to report to **the District Commissioners, District Education Officers and District Agricultural Officers of Selected Districts** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


DR. M. K. RUGUTT, PhD, HSC.
DEPUTY COUNCIL SECRETARY

Copy to:
The District Commissioner
The District Education Officer

"The National Council for Science and Technology is Committed to the Promotion of Science and Technology for National Development".