THE RELATIONSHIP BETWEEN AGRICULTURAL FINANCING AND PRODUCTIVITY OF DAIRY FARMING IN CENTRAL KENYA

BY:

KIRAGU BERNICE MWIHAKI

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DECLARATION

Student's Declaration

This research project is my original work and has not been submitted to any other University or institution of higher learning for any academic award.

Signed…… Date ……..

Kiragu Bernice Mwihaki

D63/68630/2013

Supervisor's Declaration

This research project has been submitted for examination with my approval as the University Supervisor.

Signed…….. Date ……

Mr. Mwachiti M. Ngome

Lecturer, Department of Finance and Accounting

School of Business, University of Nairobi

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May the Almighty God bless you all greatly!

DEDICATION

This research project is dedicated to my Husband Edward, Brother Wachira and Mentor Mercy Kiogora who have unwaveringly supported me during the time I developed this paper, and to my entire family for their support throughout the course. To my niece Jacqueline I encourage her to work hard and she will accomplish her educational dreams.

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ACRONYMS

COMESA	Common Markets for East and South Africa
EAC	East African Community
GDP	Gross Domestic Product
GoK	Government of Kenya
KDB	Kenya Dairy Board
KNBS	Kenya National Bureau of Statistics
MOLAD	Ministry of Livestock and Development
NGOs	Non-Governmental Organizations
SACCO	Savings and Credit Cooperative Societies
USAID	United States Agency for International Development

ABSTRACT

Agriculture in Kenya among the small holders is still traditional and subsistence in nature, agricultural finance is needed to create the supporting infrastructure for adoption of new technology. Massive investment is needed to carry out major and minor agricultural activities such as, rural electrification, purchase of livestock feeds, installation of fertilizer and pesticide plants, execution of agricultural promotional programmes and poverty alleviation programmes in the country.

Previous descriptive studies have suggested that more intensive dairy production in East Africa can have positive impacts on the opportunities and welfare of smallholder farmers, with consequent effects on agricultural development. This study sought to establish if there is a relationship between Agricultural Financing and Productivity of Dairy farming in Central Kenya.

The study adopted secondary data. A census survey was undertaken hence there was no need for sampling. Time series data for the period 1981-2013 was obtained. Data was collected from the Kenya Dairy Board, MOLAD, Department of Cooperatives and Marketing, Kenya National Bureau of Statistics and County Offices. Regression model was developed to quantify the impact of credit, number of dairy cattle and number of cooperatives on milk yield. The Statistical Package for Social Sciences (SPSS) Version 20 computer package was used for data analysis.

From the study it was established there is a positive relationship between Agricultural Financing and Productivity of Dairy farming in Central Kenya. This is because financing facilitates acquisition of input resources for improved productivity such as additional dairy cattle, animal feeds, and improved technology and extension services.

The study recommends that various stakeholders should strive to carry out researches on other forms of financing which are also key to the productivity of dairy farming. These forms include grants, personal savings and supplier's credit. This will enable them to know which form of financing is more impactful and hence be increased. A study of the entire nation is also recommended since the dynamics of every region are different. The study also recommends an extensive survey be undertaken on the population of dairy cattle and harmonized for reliability of data. Data on Milk Yield also needs to be harmonized to include also amounts consumed and sold to informal traders as opposed to current statistics that only relate to milk produced and sold to registered traders. This data will be key in establish areas of intervention in the milk industry.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Agriculture has contributed significantly to Kenya's development process. It contributes employment and foreign exchange, food and raw materials, markets for the growing economy, and capital for investment in other sectors. Overall, agriculture contributes 25% of Kenya's Gross Domestic Product (GDP). Small –scale farms popularly referred to as smallholdings, are particularly important because they are estimated to employ 60% of the labour force (GoK 2002), produce about 70% of marketed output (GoK, Republic of Kenya Statistical Abstract, 2005), and produce their own food.

Agricultural output is low in developing countries especially in Kenya due to small holdings, traditional methods of farming, poor irrigation facilities, low or misuse of modern farm technology etc. (Zuberi, 1989). This results in small income and no saving or small saving. Therefore, it needs of time that credit agencies come up to help them in applying and undertaking the improved farm practices. Credit is an important instrument that enables farmers to acquire commands over the use of working capital, fixed capital and consumption goods (Siddiqi, 2004). Credit plays an important role in increasing agricultural productivity. Timely availability of credit enables farmers to purchase the required inputs and machinery for carrying out farm operations (Munir, 2009).

The dairy industry is the single largest agricultural sub-sector in Kenya, larger even than tea (Muriuki, 2004). It contributes 14 percent of agricultural GDP and 3.5 percent of total GDP

(GoK, Sessional Paper of the National Livestock Policy, 2008). The industry has grown tremendously since its liberalization in1992. Liberalization led to a rapid growth of the informal milk trade that mainly consists of small-scale operators dealing in marketing of raw milk (Karanja A. , 2003). The informal milk market 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.

Greater commercialization of the dairy sub-sector and an increase in smallholder incomes will come from improved technologies that will make the existing resources more productive, as well as policies and actions that will deal with the seasonal intra-year variations in production which include creation of a strategic milk reserve, investment in processing of long life dairy products and investment in infrastructure such as roads and electricity.

1.1.1 Agricultural Financing

Murray (1953) defined Agricultural Finance as "an economic study of borrowing funds by farmers, the organization and operation of farm lending agencies and of society's interest in credit for agriculture."Tandon and Dhondyal (1962) defined Agricultural Finance "as a branch of agricultural economics, which deals with financial resources related to individual farm units."Agricultural financing is the financing of agriculture-related activities, from production to market. It refers to financial services ranging from short-, medium- and long-term loans, to leasing, to crop and livestock insurance, covering the entire agricultural value chain - input supply, production and distribution, wholesaling, processing and marketing. Whereas financing may take various forms, our main concentration in this study is financing through borrowed funds, that is, credit.

1.1.2 Productivity

The concept of productivity is a relative term and sometimes it is considered to be an overall efficiency and effectiveness of productive units or as a ratio of output to the corresponding inputs used. Though various definitions are apparently conflicting to each other but their different interpretations have common characteristics i.e. productivity is someone's ability to produce more economically and efficiently (Mohammad, 1992).

In this study, agricultural productivity could be defined as ratio of output to inputs in relation to number of cattle, animal feeds, labour and technology (tractor, milking machines and ox-plough) employed in agriculture. It will also be defined as the increase in output as a result of interventions adopted to remove constraints in accessibility of required inputs.

1.1.3 Agricultural Financing and Productivity of Dairy Farming

There are few agricultural credit institutions, the main one being the Agricultural Finance Corporation (AFC), which is not the most popular. Other sources of credit include commercial banks, whose credit is usually unsuitable for farming, and micro-finance institutions, which are more popular with small and medium enterprises (SMEs), including smallholder dairy farmers. Smallholder farmers', who are the dominant players in dairy farming, low use of credit is less due to the unavailability of credit than to the conditions and cost of credit, collateral requirements and inadequate grace periods, among other factors. Other relevant institutions are NGOs and church-based organizations which have become very active in dairy development in East Africa. Development partner institutions are also relevant in dairy development, as sources of innovations and funds (H.G. Muriuki, 2011)

Unfortunately, smallholder farmers often face serious financial constraints to scaling up production. In Kenya, land ownership is poorly documented, so farmers can't use their land as collateral to secure loans. Banks are reluctant to lend money to rural farmers and small business owners who have limited assets and virtually no financial history. This lack of access to commercial finance prevents many farmers and entrepreneurs from growing their businesses (FAO, 2011)

1.1.4 Dairy Farming in Central Kenya

Dairy farming is a class of agriculture for long-term production of milk, which is processed (either on the farm or at a dairy plant, either of which may be called a dairy) for eventual sale of a dairy product. There are many players in the dairy sector: those offering services and inputs; industry facilitators and development partners; and the users of services/inputs. Smallholder dairy farmers dominate the industry at the production level.

Central Kenya covers an area of 13,191 km² and is located to north of Nairobi and west of Mt. Kenya. The region had 4,383,743 inhabitants according to the 2009 census. Central Kenya region, comprising of 5 counties and 35 administrative regions (sub-counties), is classified as a milk surplus area compared to the other eight regions in the country. It is estimated that there are over600,000 smallholder dairy farmers in the region and the sector is a source of livelihood for 1.2million households and this mirrors the trend in COMESA and EAC countries where 80 percent of produced milk comes from small-scale farm holdings. Current estimates indicate that the value of dairy produce in the region is close to 30billion and this can easily be doubled if stability in the industry is maintained (GOK, 2010).

1.2 Research Problem

In many parts of Sub-Saharan Africa, smallholder farmers are being compelled by policy and markets to diversify from traditional export crops whose outlook for growth remains uncertain. Alternative agricultural activities are needed which offer higher returns to land and labour, offer the expectation of future growth, and are suitable for adoption by the resource-poor smallholder farmers who continue to dominate African production (Staal S, 1997). Market-oriented dairy production may fill this need for some smallholder producers, particularly in light of expected rapid growth in milk consumption in the developing world over the next two decades (Delgado et al., 1999).

Previous descriptive studies have suggested that more intensive dairy production in East Africa can have positive impacts on the opportunities and welfare of smallholder farmers, with consequent effects on agricultural development (Launonon, 1985)(Leegwater, 1991). There are several potential avenues for impact. In a number of regions, there is good potential for increased demand and higher real prices for milk and dairy products. Intensification of dairy production can thus result in increased incomes for smallholders. Cash receipts from milk and dairy product sales typically are distributed more evenly throughout the course of a year than income from crop sales. Because dairy production tends to be labour intensive, it can increase the intensity of household labour use and generate hired employment. This may stimulate the demand for labour, providing benefits to unskilled laborers and distributing the gains from dairy production more broadly and progressively.

Agriculture in Kenya among the small holders is still traditional and subsistence in nature, agricultural finance is needed to create the supporting infrastructure for adoption of new

technology. Massive investment is needed to carry out major and minor agricultural activities such as, rural electrification, purchase of livestock feeds, installation of fertilizer and pesticide plants, execution of agricultural promotional programmes and poverty alleviation programmes in the country.

Agriculture is considered a risky business. Drought, heavy rain, pests and diseases, unreliable input supplies, lack of storage and cooling facilities, bumpy roads, fluctuating prices, seasonality of many crops: all make the financial outcome of farming unpredictable(Fries, 2004), so most banks are reluctant to finance crops and livestock. They have few staff or branches in the countryside, and distances are large, pushing up transaction costs. Millions of micro-entrepreneurs – farmers, processors, traders, transporters, input suppliers – run their businesses in difficult circumstances. There is enormous entrepreneurial potential among these farmers and traders.

Literature in Kenya and in other developing countries is abound with discussions of factors considered to be important in determining agricultural productivity. These include quantifiable factors such as technical change, relative factor product prices, input use, education, agricultural research and extension, market access and availability of credit. Other factors include weather, farm production policies, landownership patterns, inadequate involvement of beneficiaries indecision-making, insecurity and the legal and regulatory environment. Many development programs and projects in Kenya have attempted to remove constraints associated with these factors by introducing facilities to provide credit, information, farm inputs, infrastructure, education, marketing networks, etc. The removal of these constraints, it is believed, can result in increased productivity at farm level and also an increase in farm incomes. According to the Kenya Poverty Reduction Strategy Paper (KPRSP), declining agricultural productivity has led to food shortages,

underemployment, and low incomes from cash crops and poor nutritional status which further reduces labour productivity (Kenya R. o., 2001).

In this study we shall concentrate on one of the interventions employed to improve agricultural productivity; agricultural financing/credit. Many studies have concentrated on the supply side of agricultural credit with less consideration on the demand side. This study will therefore be distinguished from the earlier ones since the focus will be on the demand side. The question therefore is whether there a relationship between agricultural financing and productivity of dairy farming.

1.3 Research Objective

The main objective of this study is to establish the relationship between Agricultural Financing and productivity of Dairy Farming in Central Kenya.

1.4 Value of the Study

Agricultural financing provoke many areas in which study can be carried out, but this study focuses on understanding whether financing has contributed to the level of productivity of dairy farming which contribute majorly to the GDP of this country. The study will provide a base and platform for further study concerns since Agricultural financing with a focus on the demand side has not been adequately studied.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter will consider previous studies done by various scholars that are related to the topic of the study. It will first discuss the various theories that will aid in meeting the objectives of the study. This is then followed by empirical studies relating to the same.

2.2 Theoretical Literature Review

The aim of this section is to highlight relevant theories relating to financing and agricultural productivity, review the theoretical approaches used in literature to measure agricultural productivity and its determinants more rigorously and set precise relationships for estimation.

2.2.1 The trade-off theory of capital structure

The trade-off theory considers a fusion of factors that jointly determine the firm optimal capital structure. Holding the firm's assets and investment plans constant, a firm optimizes its debt ratio by considering the trade-off between the costs and benefits of borrowing (DeAngelo and Masulis, 1980; Myers, 1984). In the core of the theory are tax advantages of borrowing (interest tax shields) that are balanced against the costs of financial distress (Myers, 2003). Costs of financial distress encompass costs of bankruptcy or financial embarrassment. The firm is assumed to substitute debt for equity, or vice versa, until the value of the firm is maximized. Factors of financial distress discussed in the literature on trade-off theory include firm profitability, earnings volatility, and asset specificity. In the context of agriculture, it would be incorrect to disregard other production risks such as weather shocks. Expected bankruptcy costs, among other costs of financial distress,

arise when firm profitability declines (earnings volatility and other risks increase); the thread of these costs pushes these firms toward lower leverage targets (Fama and French,2002).

The relevance of this theory to my study is the fact that dairy farmers require credit to improve their productivity. They will assess the benefits associated with obtaining credit to purchase resource inputs such as animal feeds and high yielding cattle breeds and the cost of the credit.

2.2.2 Pecking order theory

The pecking order theory was developed by Myers (1984) in his article "The capital structure puzzle", in reaction to the fact that the, previously mentioned, trade-off theory did not explain the financing behaviour actually conducted in companies. Instead Myers (1984, p. 567) proposed an alternative view on financing choices. He said that companies follow a pecking order when deciding on the type of financing they choose. When financing an investment, companies prefer internally generated funds to external funds and they prefer debt to equity issues (Myers, 1984, p. 581). The explanation Myers (1984, pp. 582-585) use is based on information asymmetry and is as follows. Investors have no detailed information about an investment a firm is about to make so if the firm issues stock to finance the investment, the investors will not pay full price for the stock because of the risk he faces due to the information asymmetry. This means that if a firm wants to do an investment of 10M with NPV 12M they might need to issue stocks for 12 M to get the 10M needed for the investment. This scenario would mean that the company would not do the investment since the total NPV is zero. The only scenario where a company would issue stock, under these assumptions would be when the stocks are overvalued (Myers& Majluf, 1984, p. 195). This also means that there exists an equilibrium level between issuing shares and debt. Investors are aware of this type of corporate behaviour nowadays and stock issues are generally met with

suspicion from the market. This forces a company who need external funds to take on debt instead, thus forcing the company to adopt a pecking order, even though this situation is a bit stylized (Myers, 1984, p. 585)

This theory is relevant to this study since the dairy farmers' choice of credit rather than other forms of financing is dependent of various factors. Their preference for cooperative societies over other formal financial institutions for obtaining credit is based on their assessment of their financing needs.

2.2.3 Productivity Growth

Productivity growth has been shown to be a major source of growth of aggregate output (Solow, 1957) and of agricultural output (Hayami, 1985). Hayami and Ruttan (1985) have shown that agricultural output can grow in two main ways: an increase in use of resources of land, labour, capital and intermediate inputs or through advances in techniques of production through which greater output is achieved through a constant or declining resource base. The latter, also referred to as productivity, occurs without a corresponding change in output, occasioning a rise in the ratio of total outputs to inputs. Seen in this way, productivity can be defined simply as a measure of the increase in output that is not accounted for by the growth of production inputs. Under certain assumptions of efficiency, productivity growth and technical change are synonymous (Grosskopf, 1993).

Today, many developing countries are shifting from subsistence farming to the promotion of new export-oriented corps. However, the shift from subsistence agriculture to commercial agriculture, to production for the world market, has led to the division of tasks and specializations in agriculture. In adopting the different farm innovations, farmers need financial resources. The structural changes in agriculture have increased the demand for farm loans. The increase in loan demand is due to the much greater returns to investment obtainable from the new, more productive

farm technologies. It has been proven that easy access to credit facilitates the adaptation and use of new farm technologies and hence increases agricultural production.

However, increasing loans to farmers requires the transformation of rural credit system from limited informal, traditional, local savings and lending arrangements to an integrated formal, national savings and credit system(Stevens, 1988).

Since the value of the products of livestock keeping is greater than the value, or "opportunity cost" of the plant material they consume, the introduction of animals or poultry to any land use system must cause intensification of production. In all continents, intensity of production has increased through growth in livestock numbers, especially rapid in the case of chickens. In their study of "Crop-Livestock Interactions in Sub-Saharan Africa", (McIntire J., 1992) hypothesize that "the evolution of interactions follows an inverted U form as population density increases: integration is very weak at the beginning, increases and then decreases." This describes a process of change from grassland based systems to mixed farming systems, as human population density increases, followed at a later stage after further population growth by a switch to greater specialization in crop production or landless livestock systems.

Dairy production systems in Kenya however can largely be classified as large- or small-scale. Small-scale producers (the smallholders) dominate dairy production owning over 80 percent of the 3.3 million dairy cattle, producing 56 percent of the total milk production and contributing 80 percent of the marketed milk (Omore, 1997). In a study by the Smallholder Dairy (R&D) Project (SDP) (Omore A., 1999), covering most of the milk producing regions in the country, majority of those surveyed were smallholders and 73 percent of these had dairy cattle. These findings confirmed the importance of dairy in Kenya's agricultural sector and the country's economy. The

study also confirmed that dairy production is conducted on small farms with crossbred herds, which range in size from one to three head, and that production is based on close integration of livestock and crops. Dairying is a multi-purpose cattle system providing milk, manure and a capital asset to the farmer.

Development of smallholder dairy production systems in the Kenya highlands has been marked by declining farm size, upgrading to dairy breeds and an increasing reliance on purchased feeds, both concentrates and forage (Staal S, 1997). In areas such as Kiambu County, purchased fodder has become very important in dairying. The area planted with fodder for sale is equal to the area planted with maize, the staple food crop.

The country has a potential to even widen its lead in milk production. Milk production has in the past increased through increase in cattle population. Production level per dairy cow per day is estimated at 4 to 8 litres (Staal S.J, 2001) on average. Future increase in total milk production need not continue to depend on enlarged dairy herd. About half of the over 3 million head are mature cows, annual total milk production can be increased by about 500 million litres over the current level by increasing the daily production per cow by only one litre a day above the current level. Through improved feeding, adoption of improved production technologies such as use of planted fodder, purchased concentrates and minerals, higher total milk productivity per unit land and per cow can be achieved. According to Bebe (BebeB.O., 2003), milk production can be increased through keeping more cows (14-47 percent), upgrading the local Zebus (8-47 percent), producing more feeds (24-38 percent) and through other measures such as extension, advice, purchase of more feeds and improved disease control.

The theoretical literature has amply discussed strategies to alleviate agricultural financing shortages in developing countries. Promoting rural finance in terms of institutional arrangements and provision of an enabling environment for the survival of such institutions have become part of financial management strategy for the alleviation of poverty in the rural setting of an economy. On the matter, we have the traditional agricultural credit projects approach and the new views on rural financial markets (Adams, 1984).

Farmers' organizations such as dairy co-operative societies have contributed significantly to the development of the smallholder dairy through milk marketing and provision of other services at relatively low costs (Owango M., 1998). The performance of many co-operatives however declined in the 1990s due to liberalization of the dairy industry and the resulting competition, political interference and mismanagement. Dairy farmers' contribution to the management of the co-operative societies is minimal and limited to election of the committee members. Due to the perception of helplessness in the management of their dairy societies and the mismanagement common to these societies, some degree of mistrust has developed in the past and the farmers have tended to move towards formation of self-help groups (SHG) which are smaller and where members have more influence on their activities. Self-help groups, although more popular than cooperative societies, have inherent problem due to their inability to borrow arising from their legal status. Co-operatives, dairy co-operatives included, have been undergoing a turbulent period trying to adjust to the liberalization of the economy. According to the National Development Plan (2002 – 2008) and the Economic Survey (2002) there were over 9,000 co-operative societies that had been registered in 1999 out of which, 46 percent (about 4,200) were agricultural. About 330 Dairy Societies have been registered (CBS, 2002). Most of the co-operatives are dormant. Even with the active societies, only about 50 percent of members are active (Omore A. Muriuki H.,

1999). Despite the problems in the co-operative societies, they are better placed for the collective interest of the dairy sector development (Omiti J., 2000) if their governance problems are resolved.

From experience, it has been found that developing a sustainable farm credit system is not an easy task. It is even more difficult to develop and implement such systems in developing countries, where they are confronted with several complex issues. Some of these issues are internal to rural financing (Christen, 1995) and others are external issues, as their solutions depend on sectoral and macroeconomic policy and institutional framework (Jayarajah, 1995). In an effort to create sustainable rural financing programs, innovative financial services are necessary for the development of the financial market.

According to (Stevens and Jabara, 2000) improvements in rural credit enable economic development in at least five ways. First, the rural financial markets provided by banks enable a greater mobility and flexibility in exchanges in rural areas. Farmers are able to make payments from distant locations without having to meet in person. Second, rural savings and loans enable improved resource allocation. This occurs when they mobilize excess cash from farmers with few, low-return investment opportunities and lend it to the farmers with higher-return investment prospects. Third, loans allow farmers to better manage the inherent risks associated to the nature of the agricultural production (high variation in weather conditions and prices). Fourth, loans enable farmers to take on large investments. And fifth, loans ameliorate life-cycle problems, in which the young need to acquire farm and household assets--often by borrowing from community members whom have accumulated savings (Adams, 1984)(Stevens, 1988).

Kenya's strength in dairy arise from its possession of a dairy herd of over 3 million dairy cattle, which is over 85 percent of the dairy cattle population in Eastern Africa and over 70 percent of dairy cattle in Eastern and Southern Africa (Thorpe W., 2000 (b)). Weakness can however arise from the small scale of milk output, 10kg per farm per day(BebeB.O., 2003), which can result in low bargaining power and limited ability to capture scale economy in the market (Muriuki H.G., 2002), the poor rural infrastructures, reliance on rainfall for production and the poor milk markets. Kenya has great opportunities deriving from its developed smallholder dairy production system. This creates tremendous opportunity for marketing of the dairy germ plasm and products to the region.

2.3 Empirical Studies

The studies reviewed in this section suggest many important hypotheses relating agricultural productivity to its determinants. This section discusses some important results and conclusions from some of the studies. The discussion is organized according to the key explanatory factors found to affect agricultural productivity.

2.3.1 Factors affecting Agricultural Productivity

Resource inputs particularly capital and labour are the first factors on which empirical analysis of productivity have always focused. This is based on the production function analysis which stipulates capital and labour as primary factors of production. (Ekborm, 1998), using survey data, finds a positive and significant correlation between labour input per farm and productivity. Although only statistically significant at the10% level of significance, the study also finds that household capital, proxied by the value of domestic animals, capital availability, and non-agricultural farm incomes are positively related to agricultural productivity. Increasing labour and

capital availability is therefore seen in this context as being important for productivity increases in the country.

Advocates of the old supply-leading agricultural credit viewed credit as an integral component of input packages designed for Green Revolution crop varieties. Actually establishing a causal link between credit and agricultural development, however, has proven difficult. For example, one comprehensive study looked at the investment decisions of government, financial institutions, and farmers and the effects on agricultural investments and output in India (Binswanger, 1993). The study covered the 1960s and1970s, a period when India aggressively expanded its financial system into rural areas. The authors concluded that the availability of credit was more important than subsidized interest rates, and the expansion of banking had a larger impact on output through expanding fertilizer use than through increased investments. Bank expansion was greatly aided by government road investments and reduced transaction costs for banks and farmers.

The role of financial capital as a factor of production to facilitate economic growth and development as well as the need to appropriately channel credit to rural areas for economic development of the poor rural farmers cannot be over emphasized. Credit (capital) is viewed as more than just another resource such as labour, land, equipment and raw materials (Rhaji, 2008). (Shepherd W. , 2002) opined that credit determines access to all of the resources on which farmers depend. Consequently, provision of appropriate macroeconomic policies and enabling institutional finance for agricultural development is capable of facilitating agricultural development with a view to enhancing the contribution of the sector in the generation of employment, income and foreign exchange (Olomola, 1997).

Advocates of the old supply-leading agricultural credit viewed credit as an integral component of input packages designed for Green Revolution crop varieties. Actually establishing a causal link between credit and agricultural development, however, has proven difficult. For example, one comprehensive study looked at the investment decisions of government, financial institutions, and farmers and the effects on agricultural investments and output in India (Binswanger, Khandker and Rosenzweig 1993). The study covered the 1960s and1970s, a period when India aggressively expanded its financial system into rural areas. The authors concluded that the availability of credit was more important than subsidized interest rates, and the expansion of banking had a larger impact on output through expanding fertilizer use than through increased investments. Bank expansion was greatly aided by government road investments and reduced transaction costs for banks and farmers.

The use of improved seeds/planting materials on agricultural productivity were also documented in studies of (Adewuyi, 2002), (Idjesa, 2007), (Ogundele, 2003), Ogundele and Okoruwa (2006), and Tella (2006) in the humid forest, moist savannah and dry savannah agro-ecological zones of Nigeria. Findings of (Idjesa, 2007), (Ogundele, 2003), and Ogundele and Okoruwa (2006) using the stochastic frontier model revealed that the use of improved seed had a positive impact on the technical efficiencies of crop farmers. This finding was consistent with Nkonya et al (2005), who also showed that purchased seeds had a positive impact on a farmer's productivity in Uganda. Tella (2006), however, showed that improved planting materials when not utilized in the recommended proportion could reduce a farmer's productivity. However, the positive contribution to efficiency of farmers having access to improved planting materials could be reversed if the costs were relatively high and out of the reach of farmers. (Adewuyi, 2002) using the linear

programming and Tobit models observed that the high cost and inadequate supply of input (plant material inclusive) negatively affected productivity.

The effect of farm size on farm productivity is inconclusive. (Lau, 1971) using the profit function equation found that small farms attained higher productivity levels than larger farms in India. (Sahidu.S.S, 1974) adopted the Lau-Yotopolous model to sample India wheat farms and came up with a contrary conclusion showing large and small farms exhibiting equal levels of productivity. (Khan, 1979) using the Lau-Yotopoulous model in Pakistan observed, however, that large farms were more efficient than small farms. Using a normalized profit function and stochastic frontier function, (Ajibefun, 2002) and (JN, 1988) showed that large farm size enhanced productivity among farmers in the dry savannah and humid forest agro-ecological zones of Nigeria.

Farm size is one of the factors that has been hypothesized as a determinant of agricultural productivity. (Ekborm, 1998) and (Odhiambo, 1998) explicitly include farm size as one of the factors determining agricultural productivity. (Ekborm, 1998) finds a negative but statistically significant relationship between farm size and agricultural productivity. This implies that smaller farms are more productive than larger farms. According to the author, this finding is plausible because smaller farms are often forced to intensify production to sustain household welfare. Larger farms on the other hand can afford the "luxury" of extensification. The study by (Odhiambo, 1998) further indicates that the negative relationship between productivity and farm size operates largely through labour resource inputs where smaller farmers tend to use more labour per unit of land than the larger ones. Several other studies have also reported farm size to be related to technology adoption which in turn increases productivity. For instance, (Barker, 1978) demonstrated that large

farmers had higher rate for hybrid usage and were therefore more productive than the smaller ones. In some cases, smallholders lag behind in adoption but later catch up as has been the case with hybrid maize in Kenya (Hassan, 1997). Some studies have, however shown productivity not to vary with farm size ;(Karanja D. T., 199) show scale to have no effect on hybrid and fertilizer as well as productivity. These results show that the effect of land size on productivity remains largely an empirical question.

Access to extension services has been identified as key to farm productivity in a series of studies. (Obwona, 2000), using the translog production function, demonstrated that access to extension services by tobacco farmers improved their productivity in Uganda. In contrast, (Bravo-Ureta, 1991)using the stochastic efficiency decomposition model based on Kopp and Diewert's deterministic methodology, concluded that extension services did not markedly affect productivity of farmers in New England. However, the studies of (Adewuyi, 2002), (Ajani, 2000), (P.S., 2000) and (Awotide, 2004) all reported that extension services enhanced farmers' productivity in the humid forest and dry savannah agro-ecological zones of Nigeria.

A number of empirical studies in Kenya have considered extension services as an important determinant of agricultural productivity. A case in point is the study by (Evenson, 1998), which sought to analyze the impact of extension on agricultural productivity. The main finding of the study was that extension services have a discernible impact on productivity. The impact, according to the study, was at the highest top end of the distribution of yields residuals, "suggesting that productivity gains from agricultural extension may be enhancing unobserved productive attributes of farmers such as managerial abilities" (Evenson, 1998). The implication of this finding is that other factors such as farm management abilities and experience affect the effectiveness of

extension as a determinant of agricultural productivity. Other studies that have demonstrated the importance of extension for enhancing productivity are those by (Odhiambo, 1998), (Ekborm, 1998) and (Nyoro J. a., 1999).Although the importance of extension services in enhancing agricultural productivity are widely acknowledged, the extension system in Kenya has virtually collapsed.

2.3.2 Determinants of Productivity of Dairy Farming

Milk is produced primarily from cattle (the main source of marketed milk in Kenya), camels and goats, which contribute 84, 12 and 4%, respectively (MoARD, 2000). The major types of cattle kept for milk production are the improved exotic breeds and their crosses (collectively called 'dairy cattle') and the indigenous (zebu) cattle, which provide milk for communities in the drier parts of the country. The improved dairy cattle contribute about 60% and the zebu cattle about 25% of the total national milk output. Market-oriented dairy farming in Kenya, where exotic cattle are dominant, is concentrated in the crop–dairy systems of the high potential areas where feed supply and disease control are much better than in the arid and semi-arid lands (ASALs) of the country (Omore A. Muriuki H., 1999).

Several factors, which include the presence of significant dairy cattle populations, the importance of milk in the diets of most Kenyan communities, a suitable climate for dairy cattle and a conducive policy and institutional environment, have been contributing factors to the success of dairy production by smallholders (Conelly 1998; Thorpe et al. 2000).

Through national extension programmes, there has been much effort to improve dairy husbandry practices. Investments have also been made in training at university, diploma and certificate levels.

Donor agencies have contributed greatly in enhancing the efficiency of extension services. Notable among these efforts was the National Dairy Development Project (NDDP) in the 1980s, funded by the Dutch government. However, during the general liberalization programmes of the 1990s, public resources for extension services, including livestock, were generally reduced. Recent research shows that, although most farmers report continued availability of government extension, many do not use those extension services, possibly reflecting lack of access.

Increased commercialization of agriculture has been an integral part of increasing incomes and improving living standards of rural areas of many developing countries (Strasberg et al 1999). Commercialization, it is argued, can positively influence productivity through specialization (better resource allocation) and intensification (increased use of inputs).In developing countries where infrastructure is usually poor, physical access to markets is crucial as this has a direct bearing on farmers' production costs and the prices they receive.

On-farm consumption (non-marketed milk) accounts for about 40% of milk and the remaining 60% is marketed through various channels (Figure 2). Less than 15% of marketed milk flows through milk processors (Thorpe et al. 2000). The balance of marketed milk is sold as raw milk. Non-processed milk marketing channels include: direct milk sales to consumers by farm households (58%); and milk collected by dairy co-operative societies, self-help groups and individual milk traders who also sell either directly to consumers or to processors. Differences in milk marketing channels exist between and within the country's various regions

Agricultural co-operatives are agricultural-producer-owned coops whose primary purpose is increase member producers' production and incomes by helping better link with finance,

agricultural inputs, information, and output markets (*Agricultural Cooperatives Sector Development Strategy* 2012-2016, 2012). Cooperative development in many countries has shown that farmers who are effectively organized can benefit from aggregated links to markets and services, from accessing centralized services that can help them achieve higher yields and higher incomes, and from speaking with a collective voice to advocate for their needs. At a global level, countries with the highest share of cooperatives in marketed outputs (e.g., Taiwan, Korea, the Netherlands, France, etc.) also have high average yields for staple crops like rice and wheat, as well as substantial cash crop exports.

According to the National Development Plan (2002 – 2008) and the Economic Survey (2002) there were over 9,000 co-operative societies that had been registered in 1999 out of which, 46 percent (about 4,200) were agricultural. About 330 Dairy Societies have been registered (CBS, 2002). Most of the co-operatives are dormant. Even with the active societies, only about 50 percent of members are active (Omore A. Muriuki H., 1999). Despite the problems in the co-operative societies, they are better placed for the collective interest of the dairy sector development (Omiti J., 2000) if their governance problems are resolved. A case in point is The Githunguri coffee and dairy agricultural cooperatives are making lives of many Kenyans flourish. Currently the cooperative has grown tremendously to 17,000 registered members, annual turnover of Ksh 3 billion and an average of 170,000 litres of milk per day. Today Fresha has revolutionized the Dairy industry in Kenya (www.fresha.co.ke).

2.3.3 Effect of Agricultural Financing on Productivity

FAO studies of trader working capital confirm the thesis that traders finance their operations from a combination of sources. The study found that trade can survive in the absence of adequate

institutional or other financing, but its growth is slowed. Drawing lessons microfinance institutions, certain countries have begun to respond to the demands of agricultural traders. They now offer financing with flexible amounts, lines of credit, alternative forms of collateral, other financial products and above all, offices located near the traders (Quirós, 2007),(Gálvez, (2006a); Shepherd A. , 2004).

The experiences of the agricultural value chain finance model in Myanmar show that financing is an important issue for the development of agricultural value chains. The private sector providers sell the inputs to farmers on credit, yet this supplier credit rarely stands alone since these companies themselves lack sufficient funding. They need financing which is hard to obtain. In order to recover sales revenue quickly, their preference is cash sales rather than selling inputs to farmers with deferred payment. Consequently, in Myanmar, the agro-input retailers offer deferred payment sales at a high interest cost which results in an inflated price for farmers. The farmers do benefit from at least having access to sales on credit, but it is expensive. Given that financing is a hindrance for both farmers and their agro-input suppliers, more finance is required in the value chain. More financing is needed farther up the value chain but, currently, the very limited capacity of the banks in rural areas and the fragmented nature of the value chains makes this financing unavailable (Myint, 2007).

A study was designed to analyze the impact of short term credit scheme of Zarai Tarraqiati Bank Limited on farm production. According to the study by (NaushadKhan, Inayatullah Jan, Mujib Rehman, Anwar Mehmood and Akhtar Ali) carried out in four villages of district Karak in 2005-06. The main findings of the study suggest that short term agricultural credit by Zarai Tarraqiati Bank has positive effects on wheat, gram and livestock production. Based on the encouraging

response of the farmers towards credit programme and timely repayment by the farmers, it is recommended that for increasing production per unit area in the area, ZTBL should expand the short term credit programme and increase the credit limits so that large number of farmers could benefit from the credit programme of the bank.

(Akinseinde, 2006),using data envelopment and To bit model, showed that having access to credit facilities contributed positively to a household's production efficiency in the humid forest agro-ecological zone of Nigeria. Similarly, (Obwona, 2000), using the trans log production function, showed that access to credit contributed positively towards the improvement of efficiency among tobacco farmers in Uganda. The unavailability of financial resources to farmers in the developing countries is one of the major constraints to increase farm production.

The use of credit as an independent variable in the agricultural production function in empirical studies has been challenged. However, (Sial, 2011) have posited that improved seeds and other inputs like tractors, fertilizer and biocides that may be purchased using credit money play an important role in agricultural production and these can be directly influenced by the availability of credit. The inclusion of credit as an explanatory variable in the production function is usually challenged on the grounds that it does not affect the output directly; rather it has an indirect effect on output through easing the financial constraints of the producers in purchasing inputs (Carter, 1989). (Carter, 1989) argues that credit affects product in the agricultural sector in three ways. First, it encourages efficient resource allocation by overcoming constraints to purchase inputs and use them optimally – "...this sort of effect would shift the farmer along a given production surface to a more intensive and more remunerative input combination". Secondly, if the credit is used to buy a new package of technology, say high-yielding seed and other unaffordable expensive inputs,

it would help farmers to move not only closer to the production frontier but also shift the entire input-output surface. In this regard it embodies technological change and a tendency to increase technical efficiency of the farmers. Finally, credit can also increase the use intensity of fixed inputs like land (Kumar, 2013), family labor, and management, persuaded by the "nutrition-productivity link of credit" – that raises family consumption and productivity. Carter's reasoning implies that agricultural credit not only improves management efficiency but also affects the resource allocation and profitability.

(Dantwala, 1989) estimated demand and supply of credit and its role in poverty alleviation in India. He emphasized on supply of credit and to increase technical assistance to farmers to increase agricultural productivity. Developing countries improved their agricultural output by introducing modern agricultural technology such as chemical fertilizers, recommended seeds, tractors and modern irrigation facilities etc. But modern agricultural technology was capital intensive and hence increased demand for credit (Jonson, 1969).

(Nosiru, 2010) proved in his research article on the topic ―Micro credits and Agricultural Productivity in Ogun State, Nigeria that micro credit enabled farmers to buy the inputs they needed to increase their agricultural productivity. However, the sum of credit obtained by the farmers in the study area did not contribute positively to level of output. This was as a result of non-judicious utilization, or distraction of credits obtained to other uses apart from the intended farm enterprises. (Siddiqi, 2004) reported that flow of credit to farmers had increased demand for inputs to increase crop production. The elasticity of amount of credit, No of tractors, irrigation, use of chemical fertilizer and pesticides etc. with respect to dependent variable agricultural income on per cultivated as well as per cropped acre basis indicated that credit (production credit) and tube wells

impacted positively and significantly at 95 percent confidence level. Number of tractors and use of fertilizers also contributed positively but insignificantly. It was because of inappropriate use of fertilizer and tractors.

Promoting an efficient, sustainable and widely accessible rural financial system remains a major development challenge in most sub-Sahara African countries. With about 73% of Africa's population living in the rural areas and experiencing a high incidence of rural poverty, improved rural finance is crucial in achieving pro-poor growth and poverty reduction goals. However, the development of rural financial systems is hampered by the high cost of delivering the services to small, widely dispersed customers; as well as a difficult financial terrain – characterized by high covariant risks, missing markets for risk management instruments and lack of suitable collateral (Onumah, 2003).

2.3.4 Agricultural Financing in Kenya

An often-mentioned impediment to agricultural productivity in Kenya especially among small-scale farmers is the lack of credit. It might be argued on the basis of the above findings that increased access to credit can positively influence productivity by increasing the farm's capital base. More directly, access to credit enables farmers to purchase farm materials such as fertilizers, access extension services, improved technology, improved seeds and herbicides that are important for enhancing productivity.

Lack of working capital and low liquidity limit the farmer's ability to purchase productivity enhancing inputs like seeds, fertilizers and pesticide. In spite of the relatively high adoption rates of inputs like fertilizers, the quantities used are low and therefore, hybrid variety crops that are

dependent on fertilizers may not attain their potential production (Nyoro J. , 2002). The average production efficiency levels are higher among producers who have access to formal credit, (Awudu, 2000). Access to credit resulted to higher technical efficiency in maize production in Kenya, (Kibaara, 2005).

Kenya has not developed a comprehensive rural financial services strategy. The rural financial sector is governed by the Banking Act, Building Society Act and the Post Bank Act, Deposit Taking Micro Finance Bill 2005 and the SACCO Societies Regulatory bill, 2004 .Through the Economic Recovery Strategy for Wealth and Employment Creation (ERSWC) the government has identified poor access to farm credit and financial services as a contributing factor to the decline in agricultural productivity. The Strategy for Revitalizing Agriculture (SRA) proposes to encourage an orderly development of microfinance institutions through the enactment of facilitative legislation, encourage commercial banks to set up operations in the rural areas by providing appropriate incentives, encourage banks to lend to agriculture by reviewing and repealing legal provisions that have undermined banks lending to the sector, recapitalize and streamline the management of Agricultural Finance Corporation so that it can perform its function of providing affordable credit to farmers (Republic of Kenya, 2004). As a follow up on SRA, the Agricultural Sector Co-ordination Unit (ASCU) has fast tracked the rural financial services by establishing a thematic group on inputs and rural financial services with an overall objective of developing an Integrated Farm Input Strategy.

2.4 Conclusions

The studies have highlighted there exists a relationship between agricultural financing and productivity of farms but none has clearly shown this relationship with dairy farming in Central Kenya. This forms a gap of study and hence the basis of this study on the relationship between agricultural finance and productivity of dairy farming in Central Kenya.

CHAPTER THREE

STUDY METHODOLOGY

3.1 Introduction

This chapter brings out the study design and methodology. This chapter covers the research design plan for the project, the population of the study and sampling design, data collection procedure used, data analysis techniques used and data validity and reliability.

3.2 Research Design

The study was a census survey that involved collection of data over a time period of 33 years. Qualitative study was also used. Qualitative study includes designs, techniques and measures that do not produce discrete numerical data (Mugenda and Mugenda, 2003). The study considered this scientific method because it is time saving, cheaper method of studying the organization and coming up with more accurate and in-depth findings.

3.3 Population of the Study

Population is a well-defined or set of people, services, elements, events, group of things or households that are being investigated .Target population in statistics is the specific population about which information is preferred. The target population should have some observable characteristics, to which the study intends to generalize the results of the study (Mugenda and Mugenda, 2003).

The targeted population for this study was Dairy Farmers in Central Kenya. Central Kenya covers an area of 13,191 km² and is located to north of Nairobi and west of Mt. Kenya. The region had 4,383,743inhabitants according to the 2009 census. The region's headquarters are in Nyeri. Since

2007, Central Kenya was divided into 5 Counties namely Nyeri, Kiambu, Nyandarua, Kirinyaga and Murang'a counties and 35 sub-counties. According to land productivity potential, it is a high potential area with an annual rainfall of more than 750 mm. It is estimated that there are over 600,000 smallholder dairy farmers in the region and the sector is a source of livelihood for 1.2million households and this mirrors the trend in COMESA and EAC countries where 80 percent of produced milk comes from small-scale farm holdings. Current estimates indicate that the value of dairy produce in the region is close to 30billion and this can easily be doubled if stability in the industry is maintained (GOK, 2010).This study focused on Dairy Farming in Central Kenya.

3.4 Data Collection

The study adopted secondary data. A census survey was undertaken hence there was no need for sampling. Time series data for the period 1981-2013 was obtained. Data was collected from the Kenya Dairy Board, MOLAD, Department of Cooperatives and Marketing, Kenya National Bureau of Statistics and County Offices.

Data relating to dairy cattle population yield was obtained from the KDB, MOLAD, and KNBS. Data relating to volume of milk was obtained from the KDB, MOLAD and KNBS. Data relating to credit was obtained mainly from KNBS. Data relating to trends in development of Cooperatives was obtained from the KDB, Ministry of Industrialization, County Offices and KNBS. Other data sources were websites of development partners involved in Agricultural Financing and Dairy Farming Development in Central Kenya.

3.5 Data Analysis Technique

The data collected was edited, coded and tabulated into manageable summaries. Regression model was developed to quantify the impact of credit, number of dairy cattle and number of cooperatives on milk yield.

The regression model used is:

$$Ý = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + é$$

Where: Ý= milk yield (measured in litres)

β_o= constant.

$\beta_1\beta_2\beta_3$ =regression coefficients

X_1= Credit.

X_2= number of dairy cattle.

X_3= number of dairy cooperatives.

é= error term.

The hypothesis of the study:

H0: Agricultural Financing has a relationship with productivity

H1: Agricultural Financing has no relationship with productivity

The Equation:

i. Dependent Variable = Milk Yield (measured in litres)

ii. Independent Variable = Credit

iii. Control Variables=Number of dairy cattle and Number of Dairy Cooperatives

Conventionally, productivity is measured by an index of output divided by inputs.(Hayami, 1985) have shown that agricultural output can grow in two main ways: an increase in use of resources of land, labour, capital and intermediate inputs or through advances in techniques of production through which greater output is achieved through a constant or declining resource base.

Milk Yield was considered as the measure of Productivity since it is the most common output in Dairy Farming. To produce the milk various inputs are required primary being the dairy cattle, feeds, extension services and labour. Farmers are usually limited in accessing these inputs and one of the major interventions to facilitate access to these inputs is financing through Credit. One of the major providers of credit to the dairy farmers is the cooperative societies.

The study was tested at 95% confidence level and 5% significant level. For a significance number found to lie outside the constructed confidence interval, the null hypothesis was rejected.

3.6 Data validity and Reliability

Validity determines whether the study truly measures that which it was intended to measure or how truthful the study results are (Golafashani, 2003); while reliability is a "purpose of explaining" in quantitative approach and "generating understanding" in qualitative approach to study (Stenbacka, 2001).

Appropriate and reliable data for measuring and analyzing agricultural productivity has been lacking. In order to obtain data validity and reliability, data was obtained from multiple sources for variability and analysis and a multi-pronged approach in data collection was used where possible.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

The Statistical Package for Social Sciences (SPSS) Version 20 computer package was used for data analysis. The raw data obtained from the Kenya National Bureau of Statistics library and website on their Statistical Abstracts, Population Census and Economic Surveys for the various years was entered into a data matrix with two dimensions. The data was cross-checked with figures from the Ministry of Livestock and Development, the Department of Cooperative Department, the Kenya Dairy Board and various reports by various development partners. The number of years under consideration was 1981 – 2013.

The varied analyses, frequencies and correlations between the variables were then executed using the analyze option on the software to give an assortment of output which are presented in the subsequent subheadings below.

4.2 Data Presentation

Appendix II is a Table on data collected on various variables that is Milk Yield (in Litres), Credit Amount (Kshs), Number of Dairy Cattle and Number of Cooperatives data series for the period 1981 to 2013.

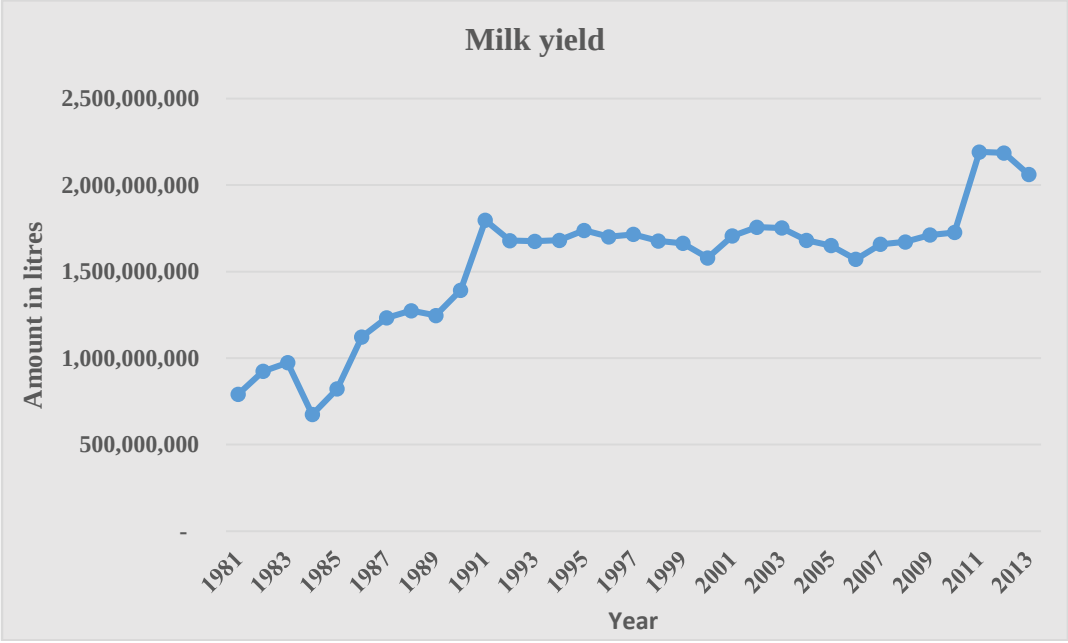
4.2.1 Descriptive Statistics

4.2.1.1 Table 1 Summary of Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
No. of Cooperatives	33	40	147	92.65	30.756
No. of Dairy Cattle	33	26275	1127298	619113.39	400229.014
Milk (Litres)	33	674145000	2191117955	1535727800.36	378601612.921
Credit Amount (Kshs)	33	700000	732900000	94458607.76	156867104.888
Valid N (list wise)	33				

Table 1 above shows Number of Cooperatives fluctuate between a high of 147 in 2013 and a low of 40 in 1981 averaging at 92 for the period. Milk Yield fluctuates between a high of 2,191.117 million litres in 2011 and a low of 674.145 million litres in 1984 averaging at 1,535.78 million litres over the period. Number of dairy cattle for the time span range between a maximum of 1,127,298 in 2011 to a minimum of 26,275 in 1987 averaging at 619,113. The credit amount for the time span range between a maximum of 732.900 million Kshs in 2012 to a minimum of 700,000Kshs in 2000-20001 in 1987 averaging at 94.458million Kshs.

4.2.1.2 Figure 1: Milk Yield

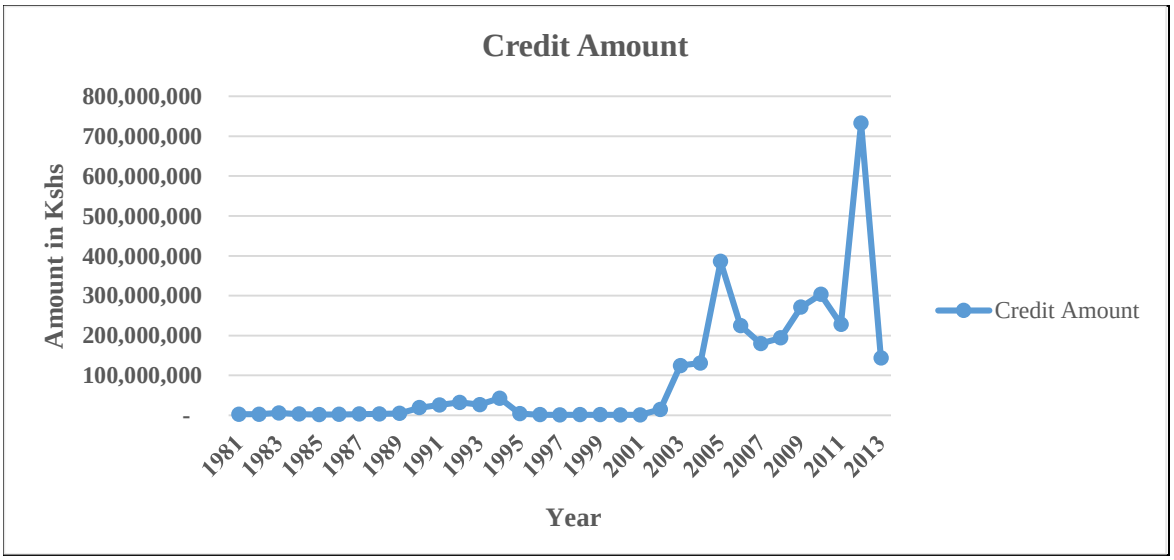


From the Figure 1 above, milk yield trends have different trends based on the development stage in the milk industry in Kenya and prevailing climatic conditions. Historical data in this trend

analysis shows milk production rising steadily from 791 million litres in 1981 to 1796 million litres in 1991 until liberalization. There is stagnation till 1999 and a decline to 1579 million litres in 2000due to the problems at various marketing channels, the cooperatives. Government interventions through policies and entrance of development partners in the dairy sector stabilized the situation. There is a spike from 1711 million litres in 2009 to 2191 million litres in 2011 due to high rainfall in late 2009 which resulted to increased milk production.

The increased milk production led to overstretching of major milk processors which led to the government proposing various short, medium and long term interventions to deal with increased production in future. These interventions saw increased involvement of the private sector milk processors and hence the increase in milk production due to additional milk marketing and financing channels.

4.2.1.3 Figure 2: Credit Amount



From the above Figure 2, illustrates the trend of credit amounts advanced to dairy farmers in Central Kenya from 1981 to 2013. It shows low volumes of credit from 1981 to 2001 since the government was the main player in the dairy sector. There is a rise in trend from 2003 due to a

change in government and politics. There is a spike in 2012 due to major reforms and developments among private sector players. The dip in 2013 was due to political uncertainties.

4.2.1.4 Figure 3: Trend Analysis for Milk Yield and Credit Amount

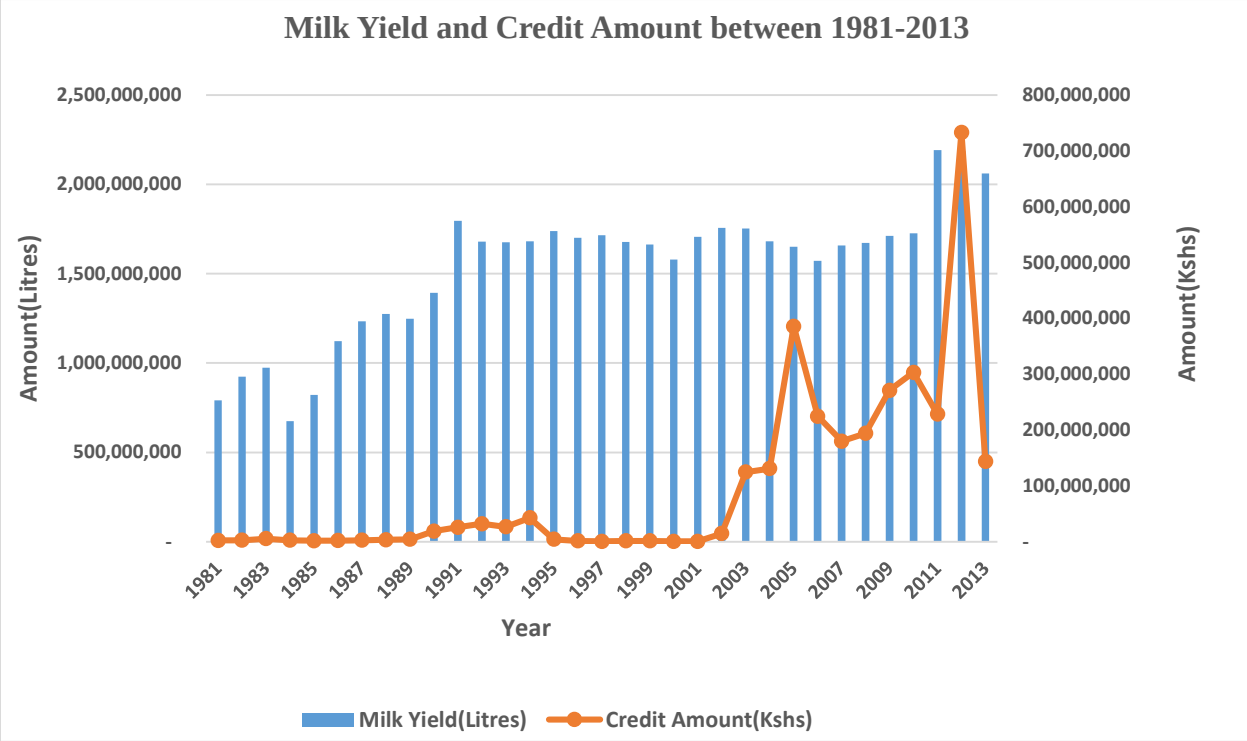


Figure 3 above shows a steady increase in the milk yield for the past 33 years despite the dip in 1984 due to drought and 2000 due to problems within the marketing channels. At the end of the duration its notable the milk yield has maintained a trend of above 2000 litres. Credit amounts have a slow upward trend from 1981 to 2002 then experienced a steady upward trend from 2003 to 2012 and then a dip in 2013 due to political uncertainties. A passing glance at the graphical depiction of the two variables also indicates that they have a positive direct relationship over the period.

4.2.2 Inferential Analyses

Inferential statistics is concerned about making predictions or inferences about a population from observations and analyses of a sample.

Correlation analyses were conducted on the data to establish relationships between the variables; analyses were done first between Milk Yield and Credit Amount then between Milk Yield and all the other variables (Credit Amount, Number of Cooperatives and Number of Dairy Cattle).

4.2.2.1 Table 2: Correlation Analyses Milk Yield and Credit Amount

		Milk (Litres)	Credit Amount (Kshs)
Milk (Litres)	Pearson Correlation	1	.507**
	Sig. (2-tailed)		.003
	N	33	33
Credit Amount (Kshs)	Pearson Correlation	.507**	1
	Sig. (2-tailed)	.003	
	N	33	33

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

The Pearson Correlation was computed for Milk yield and Credit amount data series resulting in a correlation coefficient of 0.507 at the 0.001 (2-tailed) significance level which indicates a strong positive correlation between the variables; this means that there is a significant relationship between financing and productivity of dairy farming in Central Kenya.

4.2.2.2 Table 3: Correlations Analyses for all the Variables

		Milk (Litres)	Credit Amount (Kshs)	No. of Cooperatives	No. of Dairy Cattle
Milk (Litres)	Pearson Correlation	1	.507**	.844**	.912**
	Sig. (2-tailed)		.003	.000	.000
	N	33	33	33	33
Credit Amount (Kshs)	Pearson Correlation	.507**	1	.371*	.492**
	Sig. (2-tailed)	.003		.033	.004
	N	33	33	33	33
No. of Cooperatives	Pearson Correlation	.844**	.371*	1	.866**
	Sig. (2-tailed)	.000	.033		.000
	N	33	33	33	33
No. of Dairy Cattle	Pearson Correlation	.912**	.492**	.866**	1
	Sig. (2-tailed)	.000	.004	.000	
	N	33	33	33	33

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

From the Table 3 above, it's evident that productivity (milk yield) has a strong positive correlation with Credit, Number of Cooperatives and Number of Dairy Cattle. Similarly, Credit has a strong correlation with Number of Cooperatives and Number of Dairy Cattle. This implies that an increase in credit amount will have a positive impact on the number of cooperatives and number of dairy cattle.

4.3 Regression Analysis and Hypothesis Testing

In addition to the above analysis, the researcher conducted a multiple regression analysis so as to test the relationship among independent variables. The researcher applied the Statistical Package for Social Sciences (SPSS Version 20) aid in computation of the measurements of the multiple regressions for the study. The findings are as shown in the table 4 below:

4.3.1.1 Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.922[a]	.850	.835	153817402.348

a. Predictors: (Constant), No. of Dairy Cattle, Credit Amount (Kshs), No. of Cooperatives

The coefficient of determination explains the extent to which changes in the dependent variable (Milk Yield) can be explained by the change in the independent variables (credit, number of cooperatives and number of dairy cattle).

The three independent variables that were studied, explain only 85.0% of the changes in Milk Yield as represented by the adjusted R^2. The R column represents the multiple correlation coefficients which measures the quality of the prediction of dependent variable. In this case the value of R is 0.922 which shows a strong level of prediction. However, the R^2 which is the coefficient of determination is 0.850 indicating that 85.0% of milk produced in Central Kenya can be explained by credit amounts to farmers, number of cooperatives and number of dairy cattle, the other 15.0% can be explained by other variables which were not in the model.

4.3.1.2 Table 5: Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3900719797117132300.000	3	1300239932372377600.000	54.956	.001[b]
	Residual	686134004684311420.000	29	23659793264976256.000		
	Total	4586853801801443800.000	32			

a. Dependent Variable: Milk (Litres)

b. Predictors: (Constant), No. of Dairy Cattle, Credit Amount (Kshs), No. of Cooperatives

To test for the existence of a linear relationship between productivity measured by milk yield and financing variables, ANOVA was employed. The results from the analysis of variance as per table 4.6 shows that the regression relationship between productivity measured by milk yield and financing variables are statistically significant at 5% level of significance (F value = 54.956, p-value = 0.001< 0.05), meaning that there is a significant effect of the credit, number of cooperatives and number of dairy cattle on productivity of dairy farming in Central Kenya. This can be shown by the significant level which is 0.001 which is less than 0.05.

4.3.1.3 Table 6: Coefficients of Determination

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	976737029.801	65999539.414		14.799	.000
	Credit Amount (Kshs)	.173	.207	.072	.834	.411
	No. of Dairy Cattle	761.937	121.316	.805	6.281	.000
	Cooperative Membership	494.407	685.143	.090	.722	.476

a. Dependent Variable: Milk (Litres)

The researcher conducted a multiple regression analysis so as to determine the relationship between financing and productivity of dairy farming in Central Kenya and the estimated model was:

$$\acute{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + é$$

$Y=976737029.801+0.173X_1+761.937X_2+494.407X_3$……. Unstandardized Equation

$Y = 0.72X_1 + 0.805X_2 + 0.90X_3$ .....Standardized Equation

Std. Error [976737029.801] [0.207] [121.316] [685.143]

t- Statistics [14.799] [0.834] [6.281] [0.722]

$R^2 = 0.850$

Adjusted $R^2 = 0.835$

Multiple R = 0.922

Durbin Watson Statistic = 0.595

Total variation explained by the regression model as indicated by R square and adjusted R is 0.85 or 85 % and 0.835 or 83.5% show that the model is strong for the study. It is clear that there are other variables that affect productivity as depicted by milk yield not explained by the model. So the variation explained by the independent variable credit is positive.

The mean milk yield intercept of 976,737,029.801 indicates that for every increase on the variables considered, there are 976,737,029.801increases in Milk yield. The Durbin Watson Statistic of

0.595 falls between 0 and 4 and more closely to 0 indicating that the model is good. This means if Credit will change by 1 billion, Log of Milk Yield will change by 0.173, which means milk yield will increase by 1.173 billion. The regression coefficient represents the amount of change in the dependent variable for a one unit change in the independent variable. (Hair, 2006)

The multiple R of 0.922 indicates that there is strong relationship between productivity as measured by milk yield and variables considered. The regression model result is pointing out that Financing (Credit) has a positive impact on Productivity (Milk yield).

The t – statistics were used to test the hypothesis that there is a relationship between Financing (Credit) and Productivity (Milk Yield) in the regression equation above.

H0: $\beta 1 \neq 0$: Agricultural Financing has a relationship with productivity

H1: $\beta 0 = 0$: Agricultural Financing has no relationship with productivity

From the analysis, the t – statistics is 0.835, the F value is 54.956 and the p value is 0.001

P value $< \alpha$ (0.05) and the p value $\neq 0$; thus accept the null hypothesis.

The general conclusion is that there is positive fairly significant relationship between Financing and Productivity of dairy farming in Central Kenya.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The objective of this study was to determine the relationship between Agricultural Financing and Productivity of Dairy farming in Central Kenya. This chapter is a recap of the findings detailed in the previous chapters and recommendations for further research to researchers and policy makers.

5.2 Summary

The study sought to determine the relationship between Agricultural Financing and Productivity from the year 1981-2013. In summary, there is a positive relationship between Agricultural Financing and Productivity of dairy farming in Central Kenya. This is because financing facilitates acquisition of input resources for improved productivity such as additional dairy cattle, animal feeds, and improved technology and extension services. The farmers apply the trade –off theory by first assessing the additional benefits of accessing credit being better inputs above the cost of the credit.

Number of cooperatives and number of dairy cattle also have a positive relationship with productivity. One of the core functions of cooperatives in Kenya include marketing of members' produce (over 76% of dairy produce is marketed through cooperatives), and facilitating production through training, input supply, provision of financial services and milk collection and bulking (FAO, 2011).

5.3 Conclusions

From the period of study, it was established that there is a positive significant relationship between financing and productivity of dairy farming that is financing increased access to input resources required for enhancing production. Farmers will only access the credit if it will have improved the productivity of their dairy farmers and subsequently improve their livelihoods. If production is to increase, they also focus on the marketing channels available for their produce. This means even though production may increase as a result of financing, if there is no available channel for selling their produce, they will not access the credit.

5.4 Policy Recommendations

In this study, it was observed that the relationship between financing and productivity of dairy farming in Central Kenya have a significant relationship. Since the study focussed on one aspect of financing, credit, various stakeholders in this industry should strive to carry out researches on other forms of financing which are also key to the productivity of dairy farming. These forms include grants, personal savings and supplier's credit. This will enable them to know which form of financing is more impactful and hence be increased. A study of the entire nation is also recommended since the dynamics of every region are different.

Number of dairy cattle was also observed to have a significant relationship with productivity. Nevertheless, data available from various sources was not harmonized and the researcher opted for government statistics in this study. We recommend an extensive survey be undertaken on the population of dairy cattle and harmonized for reliability of data. Data on Milk Yield also needs to be harmonized to include also amounts consumed and sold to informal traders as opposed to

current statistics that only relate to milk produced and sold to registered traders. This data will be key in establish areas of intervention in the milk industry.

This study will help policy makers and various stakeholders in developing financial products for the dairy farmers.

5.5 Limitations of the Study

There were various limitations which related to this study which need to be mentioned to ensure that a researcher puts them into consideration when planning for a research project. Some of these limitations are outlined as below.

This study only focussed on one form of financing, credit, to establish the relationship between financing and productivity of dairy farming and hence there is need to focus on all forms of financing in existence.

The milk production data from MOLAD and KDB has various shortcomings such as; it's only collected from all licensed premises, some are not based on any documented questionnaire/structured form, they are based on assumptions made that vary from region to region, there's no verification on the completeness and reliability of the data.

Dairy cattle population data as obtained from KNBS and MOLAD who are the main source has its own shortcomings such as; the technical staffs that collect the data have no formal training on sound and objective procedures for collecting data, there's no information on the number of farms

on which the data is collected, no birth and death rates, no culling rates and at times the data is obtained from special projects undertaken within the region by NGO's. The only livestock census done by KNBS was in 2009.

5.6 Suggestions for Further Research

Further research could be done on the relationship of financing and productivity of dairy farming in Kenya. This could be through the study of other forms of financing such as grants, personal savings and gifts. The research could go further and study all forms of financing available to farmers at a particular period and its impact on their agricultural production.

Another important extension of this study is to replicate this research to all the regions in the country and eventually to the East African Community (EAC) as the EAC propagates to have a well-established and feasible trading bloc.

CHAPTER SIX

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APPENDICES

APPENDIXI: DATA COLLECTION FORM

Year	1980	1981	1982	1983	…….	2011	2012
Number of Cooperatives							
Milk Yield in Litres							
Number of Dairy Cattle							
Credit Amounts to Dairy Farmers							

APPENDIX II: DATA OBTAINED FOR VARIOUS VARIABLES

Year	Number of Cooperatives	Number of Dairy Cattle	Milk (Litres)	Credit Amount (Kshs)
1981	40	41,950	791,295,000	2,279,023
1982	43	41,250	924,065,000	2,673,090
1983	44	41,700	973,410,000	5,497,538
1984	47	41,550	674,145,000	2,703,212
1985	54	41,600	821,825,000	1,668,446
1986	55	30,200	1,122,510,000	2,115,589
1987	60	26,275	1,232,915,000	2,682,567
1988	61	28,775	1,274,095,000	3,401,495
1989	74	27,625	1,246,760,000	4,313,096
1990	75	27,550	1,392,665,000	18,900,000
1991	76	775,000	1,796,300,000	25,900,000
1992	77	775,000	1,679,150,000	32,200,000
1993	81	750,000	1,675,600,000	26,600,000
1994	82	775,000	1,681,280,000	42,700,000
1995	104	800,000	1,738,080,000	4,200,000
1996	113	800,000	1,701,160,000	1,400,000
1997	122	850,000	1,714,650,000	700,000
1998	126	833,000	1,677,020,000	1,400,000
1999	129	871,000	1,662,820,000	1,400,000
2000	131	855,350	1,579,040,000	700,000
2001	129	877,620	1,705,821,300	700,000
2002	129	903,600	1,756,318,368	14,700,000
2003	93	901,200	1,751,653,512	124,600,000
2004	94	864,800	1,680,903,193	130,900,000
2005	97	849,000	1,650,192,889	385,700,000
2006	98	808,200	1,570,890,333	224,700,000
2007	101	852,900	1,657,773,280	179,900,000
2008	103	860,000	1,671,573,480	193,900,000
2009	106	880,500	1,711,419,127	270,900,000
2010	108	887,909	1,725,819,927	303,100,000
2011	122	1,127,298	2,191,117,955	228,200,000
2012	134	1,124,535	2,185,747,539	732,900,000
2013	147	1,060,355	2,061,001,509	143,500,000