

**EFFECTS OF DAIRY COOPERATIVES ON INCOMES OF SMALLHOLDER DAIRY  
FARMERS: A CASE STUDY OF MKULIMA BORA DAIRY COOPERATIVE IN EMBU  
COUNTY, KENYA**

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**A Thesis Submitted to Graduate School in Partial Fulfilment for the Requirement for the  
Master of Science Degree in Agricultural and Applied Economics of Egerton University**

**EGERTON UNIVERSITY**

**MAY 2015**

## DECLARATION AND APPROVAL

### DECLARATION

I declare that this thesis is wholly my original work and to the best of my knowledge has not been presented for the award of any degree in this or any other university.

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## **DEDICATION**

To my loving mother, brothers and sisters, who have always given me financial and moral support in my studies.

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## **ABSTRACT**

Smallholder farmers produce the bulk of total milk marketed in the country. Despite this, they face high transaction costs in marketing their milk. Theory and empirical evidence indicate that cooperatives can minimize transaction costs. This study assessed how effective cooperatives were in increasing smallholder dairy farmers' incomes through the minimization of transaction costs. The objectives of this study were to determine socioeconomic factors influencing smallholder farmers to become cooperative members, how effective the cooperative was in minimizing transaction costs and the constraints and strategies for improving dairy cooperatives. Data for this study was collected through a cross-sectional survey in Embu County. Systematic random sampling was employed to select smallholder dairy farmers who are members of the dairy cooperative society while simple random sampling was used for non-cooperative members. The sampled farmers were interviewed using a structured questionnaire. Binomial logit model was used to analyze the socio-economic factors, descriptive statistics analyzed the transaction costs faced and two-stage Heckman model analyzed the effects of cooperatives in minimizing the transaction costs. Constraints affecting dairy cooperatives were analyzed using exploratory factor analysis. The results showed that gender, age, herd size, distance to the market and the cost of transportation influenced farmers decision to participate in dairy cooperatives. Herd size, market satisfaction, amount of milk sold, household income, market access, price information, credit access and extension significantly affected the income received from milk sales thereby reducing the transaction costs faced by smallholder farmers. The study found critical constraints included delayed payments, lack of management skills, stiff competition from hawkers, inadequate milk testing, milk losses due to rejection, lack of target setting, low capital base, general insecurity an limited partnership. The study also came up with possible strategies for improving the cooperative. These strategies were increased and stable milk prices, better management, adequate staff, and timely payments among other strategies. The study recommended increased support programs by the cooperative, local government and national government, and provision of credit facilities and technical inputs to reduce transaction costs faced by smallholder farmers.

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## **LIST OF ABBREVIATIONS**

AI	Artificial Insemination
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GOK	Government of Kenya
ICA	International Cooperative Alliance
IFAD	International Fund for Agriculture Development
KCC	Kenya Cooperative Creameries
KDB	Kenya Dairy Board
KLR	Kenya Law Reports
SAPS	Structural Adjustment Programs

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Background information**

Agriculture, the mainstay of Kenya's economy, currently contributes 26 per cent of the GDP directly and another 25 per cent indirectly. The sector also accounts for 65 per cent of Kenya's total exports and provides more than 18 per cent of formal employment. More than 70 per cent of informal employment is in the rural areas. Therefore, the agricultural sector is not only the driver of Kenya's economy, but also the means of livelihood for the majority of Kenyan people (GoK, 2010).

Livestock contributes about 47% of the agricultural GDP and about 12% to the national GDP (FAO, 2005). In Kenya, the term livestock includes cattle, goats, sheep, poultry, donkey and camels. Cattle play a considerable role in the development of the country. In Kenya, farmers keep cattle for beef and dairy purposes. Dairy sector is the second largest contributor to livestock GDP following beef. The dairy sector contributes 14 percent of Kenya agricultural GDP and around 4 percent of total GDP (Muriuki, 2011). In 2008, the estimated milk production was 5.1 billion litres with a total population of 3.5 million heads of dairy cattle (GoK, 2010). Milk production is mainly from cattle with camels and goats accounting for a relatively small percentage.

Dairy sector provides income to more than 660,000 rural households. The dairy industry is characterized by smallholder producers who produce over 70% of the total milk marketed in the country (Staal, 2004). The main dairy breeds kept in Kenya are the Friesians, Ayrshires, Guernseys, Jerseys and the crossbreeds. In light of this, it can be inferred that dairy's main role in Kenya's economy is its contribution to the livelihoods of the many people engaged throughout the value chain and to the nutritional well-being of many rural communities.

Despite this, the Kenyan dairy sector has not fully realized its potential. The inability of small producers to access markets is a major limitation to harness opportunities in dairy production. The smallholder dairy farmers face very high transaction costs in terms of cost of information search, transportation search, contract enforcement mechanisms, access to credit

facilities and weak institutions. There has been a worldwide belief that cooperatives are the appropriate vehicles to reduce transaction costs and facilitate access by farmers to inputs, markets and other vital services (Ortmann and King, 2007).

The history of the dairy cooperative movement in Kenya is traced back to 1931 when three area based cooperatives; Naivasha, Nanyuki and Kipkelion merged to form the Kenya Cooperative Creameries Limited (KCC). The aim of the merger was to eradicate the creameries competition for the country's small and weak market. KCC then remains at the base of the evolution of the country's dairy industry until 1992 (Ngigi, 2005). The Swynnerton plan, 1954 recommended the opening up of commercial dairying to the indigenous people and it became the agricultural revolution, which increased the role of smallholder agriculture in Kenya's economy. Soon after the country gained independence, it recognized the importance of the cooperative movement as a tool to meeting its rural development objectives. The government subsequently gave KCC monopoly rights as the sole agent in the dairy industry (Atieno and Kanyinga, 2008). A major objective of the policy reforms implemented under the Structural Adjustment Programs (SAPs) was to remove distortion caused by government intervention policies, and consequently improving the efficiency of production and marketing. This saw the privatization of artificial insemination (AI) services in 1987 and liberalization of the milk market in 1992. This led to an increase in private firms and individuals operating in the industry. Cooperatives could no longer afford the once proactive status they enjoyed during the pre-liberalization period, coupled with reduced donor funding, and therefore, had to compete with private firms and individuals in order to maintain their position. Most of the cooperatives were not prepared for this and during this period, there were reports of general mismanagement, misappropriation of cooperative funds, leadership wrangles, corruption among other problems (USAID, 2011).

This liberalization period saw the collapse of many cooperatives. In 2003, the Ministry of Cooperative development was re-established and some aspects of the cooperative law revised in order to promote revival and better management in cooperatives. A revision of the cooperative societies act CAP 490 in 2012 is the most recent of such measures (KLR, 2012).

Most of the dairy cooperative societies are located in the highlands. The bulk of their members are smallholders who, besides keeping dairy animals, grow tea or coffee and other crops. Although the core function of all dairy cooperative societies is milk marketing, they

provide to some varying degree other services such as AI, Veterinary services, input provision among other services. The cooperatives charge farmer members for these services on a cost-recovery basis in a cost effective manner that few of their competitor milk buyers can imitate (Owango *et al.*, 1998).

## **1.2 Statement of the problem**

The dairy sector is the second largest contributor to livestock GDP. Notwithstanding, smallholder dairy farmers still have limited access to guaranteed markets, credit and are faced with high transaction costs in terms of information search, transportation search, contract enforcement mechanisms, access to credit facilities and weak institutions. This makes milk marketing very costly and hence lower profits. The dairy cooperative movement is a viable strategy to help lower transaction costs and hence higher incomes for the smallholder farmers. However, there is limited information on how cooperatives in Kenya improve the incomes of smallholder dairy farmers through minimization of transaction costs. In light of these facts, it is vital to find out the effect of cooperatives in minimizing transaction costs resulting in higher income. This will give an indication as to whether cooperatives are an appropriate solution to dealing with high transaction costs problems faced by smallholder farmers.

## **1.3 General objective**

The broad objective of this study was to assess the effects of cooperatives on incomes through minimization of transaction costs faced by smallholder farmers in Kenya.

### **1.3.1 Specific objective**

- i. To determine transaction costs faced by smallholder dairy farmers.
- ii. To determine the socioeconomic factors that influence smallholder farmers' membership in dairy cooperative societies.
- iii. To determine the effect of cooperatives on incomes through minimizing transaction costs incurred by smallholder dairy farmers
- iv. To examine constraints and strategies for improving dairy cooperative societies.

## **1.4 Research questions**

- i. What are the transaction costs faced by smallholder dairy farmers?

- ii. What are the socioeconomic factors that influence smallholder farmers' membership in dairy cooperative societies?
- iii. What is the effect of cooperatives on incomes through minimizing transaction costs faced by smallholder dairy farmers
- iv. What are the constraints and strategies for improving dairy cooperative societies?

### **1.5 Justification for the study**

Dairy production is important to Kenya's economy. It is a source of income both directly and indirectly and is a major source of nutrition. Cooperatives can play a major role in improving productivity and minimizing transaction costs faced by their members. Since independence, the government has been advocating for smallholder farmers to join cooperatives in order to improve their bargaining power, get access to inputs, trainings and increase productivity. It was also anticipated that the results from the study would benefit the farmers and policy makers in Kenya, specifically in the area of study, by helping them make a more informed, better choice when deciding whether to participate in cooperatives or not, if their goal is to minimize transaction costs. Finally, the study contributes empirically to the literature on transaction cost theory and cooperatives as an institutional arrangement for minimizing cost, in relation to smallholder farmers in a developing country.

### **1.6 Scope and limitation.**

This research work dealt with smallholder farmers in Embu County. Dairy farmers who had less than five were the target population. The sampling units consisted of households within the Kyeni and Runyenjes Divisions in Embu County. The study focused on Mkulima Bora cooperative society, which is the only operational dairy cooperative society in the region.

The socio-economic, institution and milk attributes variables to be determined were only the selected variables, but did not include all variables that fell under these areas. The study only extended to the milk marketing activities between farmers and cooperatives. It did not focus on other services that farmers might get from cooperatives such as AI services. The study collected data from both smallholder member farmers and non-member farmers.

## **1.7 Definition of terms**

**Cooperative**-A cooperative is an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise (ICA, 1995). The seven internationally recognized cooperative principles are voluntary and open membership; democratic member control; member economic participation; autonomy and independence; provision of education, training and information; cooperation among cooperatives; and concern for the community

**Dairy cooperative**- A dairy cooperative is a business owned and controlled by the dairy farmers who produce the milk used by the cooperative.

**Institutions** – These are rules and norms whether formal (for instance rules set by KDB in selling and buying milk) or informal (such as rules of measuring milk in the villages for instance using cups, rules of measuring the quality of milk for adulteration) that shapes the exchanges in the milk market. They include issues such as how transaction cost affect exchanges, information on milk market, farmer groups and other organizations that are included in the given market.

**Smallholder dairy farmers**- These are farmers who own one to five heads of cattle yielding less than 15 litres of milk per cow per day (Muriuki, 2011).



## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 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, 2005). Kenya's dairy production can be divided into two general categories: large-scale and small-scale production. These two categories differ in terms of the size of operation, level of management and use of inputs. In Kenya, smallholder farmers, who are more than one million, dominate the dairy industry and contribute to over 70% of milk produced and marketed in the country. Generally, smallholders have 3 to 5 acres of land and about two to five heads of cattle yielding about 5kg of milk per cow per day (Muriuki, 2011).

The Kenyan highlands, which are over 1000 m above sea level is where most of the dairy farming is done. 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 favourable agro-ecology for dairy farming (Staal *et al.*, 1997). The small-scale dairy farming enterprise is very profitable because of the good milk prices and growing demand for dairy products. Despite the withdrawal of some government subsidies like the AI services, the business continues to thrive, since the good market prices resulted from the liberalization of the dairy sector (Ngigi, 2005).

#### **2.2 History of Cooperatives**

The cooperative movement can trace back to 18<sup>th</sup> century in Europe. The early cooperatives were set up as a tool to protect workers, consumers, farmers and producers that are the less privileged members of society. One of the most notable cooperative was a consumer cooperative set up in Rochdale, England called the Rochdale Society of Equitable Pioneers Limited. They came up with a list of operating principles governing their organization and they form a basis for what are known as cooperative principles (Ortmann and King, 2007; Zimbelman, 2007).

Cooperatives in Africa evolved in three distinct phases. In the first phase, the colonial powers in the country introduced cooperatives in order to help the settler farmers in production,

processing and marketing. In the second phase, the governments after gaining independence introduced cooperatives. They saw cooperatives as a means of achieving their developmental goals. Most of these cooperatives were state run. The members did not own the cooperatives and as a result were not sustainable (Ngigi, 2005). The third phase was during the post liberalization period where most cooperatives gained freedom from state control to enjoy autonomy and to run in a competitive environment. Such cooperatives are grass roots based self-help business enterprises operating autonomously in a dynamic and competitive business environment (Getnet & Anullo, 2012).

The registration of dairy cooperatives is under section 11 of the cooperative societies Act cap (490). In addition, the KDB issues various categories of license to dairy co-operative societies depending on the predominant activity and products sold. The KDB licenses some as milk bars and others as producers or mini-dairies (Muriuki, 2011).

### **2.3 Role of cooperatives**

Simelane (2011) did an assessment on the role of cooperatives in smallholder dairy production and marketing in Swaziland. Results of this survey indicated that cooperatives had a positive impact in smallholders' production and marketing activities. Even though the price paid by dairy cooperatives was 35% lower compared to independent farmers in the region, farmers incurred lower transaction costs due to lower transportation costs per unit of output, access to market information as well as lower percentage of losses. The multiple linear regression model used in this study indicated that cooperative distance, access to market information, milk output and cooperative participation considerably influenced the quantity of marketable milk, and hence lower transaction costs incurred. However the study found incomes to be much lower for cooperative members, and that the contribution of cooperatives to development was still very low.

Ghosh and Maharjan (2004) analyzed the development of Bangladesh Milk Producers' Cooperative Union Limited (BMPCUL) and its overall impact in milk production and household income of the cooperative members in Bangladesh. They made a comparison between cooperative members and non-cooperative members in the surveyed villages. Their results indicated higher dairy incomes for cooperative members due to adoption of improved breeds, access to artificial insemination (AI) services, vaccination and other treatment facilities. Higher

milk production and higher incomes from sale of milk led raise incomes for the cooperative members. However the study was based on the chronological development on the cooperative and the study accrued all the benefits to it.

Using Propensity score matching, Getnet and Anulio (2012) tried to establish the livelihoods and poverty impacts of cooperatives among rural communities. They considered multipurpose agricultural cooperatives in India. They measured livelihood impacts using indicators such as household income, accumulation of productive assets, fair market and market stability, employment and other spillover effects on local communities. They found out that the impact of cooperatives on income of members was promising and their effects on savings positives. This affirms that cooperatives are important to mobilize resources and to deliver services to rural communities toward achieving poverty reduction goals(Birchall, 2003).However the fact that they found impact of cooperatives to be promising creates a knowledge gap to be addressed.

Bernard *et al.* (2008) used a two-step matching estimation to examine the impact of marketing cooperatives on smallholder commercialization of cereals in Ethiopia. They found out that cooperative membership does not necessary lead to a statistically detectable increase in output commercialization, but cooperatives on average managed to secure a 7% higher price for output marketed by their member than that obtained by non-members. The positive and significant impact of membership on price reveals that cooperatives do serve their expected purpose of commercialization through better market opportunities, higher bargaining power, and reduced transaction costs. However, price incentives may not be sufficient to ensure greater market participation by the poorest farmers. However the study through propensity score matching does not fully neutralize members' self-selection bias.

In their study, Rajendran and Mohanty (2004) reviewed the existing status of milk marketing and dairy cooperatives in India. They found out that cooperatives play a vital role in alleviating rural poverty by augmenting milk production and marketing. The cooperative model adopted eliminated intermediaries, provided cattle feeds, Artificial Insemination (A.I) and veterinary services. They concluded that there was still need to strengthen the dairy cooperatives by improved infrastructure, support development and global marketing. A study conducted by Bardhan *et al.* (2002), to analyze the factors that determine dairy farmers' choice of marketing

channel and to what degree their market choice influence the level of commercialization or market participation in Uttarakhand, found out that dairy cooperatives are an important component of organized milk markets, but milk procurement through cooperatives still remained low in India. The study implied that cooperatives were not ideal to transform smallholder dairying into commercially oriented enterprises and participation would increase with the size of landholding.

Dairy cooperatives play an important role in Kenya. A study in Kiambu revealed that they offer monthly payment which allow farmers to budget, they do not impose limit to the amount of milk a farmer can supply, offer credit on cattle feeds and AI services, they also provide cash loans, exert quality control, provide employment and provide extension to farmers (Morton and Miheso, 2000). Since they collect the milk close to the farms, farmers incur little or no transportation costs. Farmers also have a sense of ownership in the cooperative and its assets. However, the study also noted that cooperatives also have their drawbacks. Farmers cited mismanagement of accounts and factionalism, underweighting, adulteration and stealing of milk by workers being some of the reasons that dissatisfied them about cooperatives. The fact that cooperatives offered lower prices than those offered by hawkers, was not a major issue in light of the access to other services that they enjoyed by being members of cooperative societies. The study only focused on service delivery but did not consider transaction costs factors involved in milk marketing.

Holloway *et al.* (2000) recognize the fact that dairy cooperatives are potential catalysts for mitigating transaction costs, stimulating entry of smallholder dairy farmers into markets and promoting growth in rural communities. According to their study, poor infrastructure, lack of access to technical and market information make it necessary to have institutions for risk sharing and economies of scale in provision of agricultural services. Cooperatives by providing bulking and bargaining services increase market access, and help farmers avoid the hazards of having a perishable crop with no market. At the same time, cooperatives offer processors and marketers the advantage of an assured supply of the commodity at known intervals and a controlled price. However this study precludes that groups are the first step in developing sophisticated cooperative organizations.

Cooperatives are of significant benefit to both women and men. The cooperative type organization can be greater for women for a number of reasons. Most women in the agricultural sector have lower technical and managerial skills base, lower access to finance, access to inputs and services as well as to marketing and business networks, thus rendering the services offered by cooperatives a key element of maintaining and developing the performance of their economic activities (Fischer and Qaim, 2012). Furthermore, in many communities where women's participation in the public sphere is limited because of gender-based norms and division of labour, joining a member-based organization offers a means of exchanging experiences, exercising voice and accessing leadership roles that would otherwise not be open to women. In this regard, women-only or women-dominated cooperative entities are a valuable means of providing women with an opportunity for gradual confidence building and exposure to the management of group-based ventures (Majurin, 2012).

Cooperatives thus belong to members, and their responsibility is to render the best services at the lowest cost to their members (Galor, 2004). This means that cooperatives enable members to get products/services at a lower price and not for profit generation. In this essence, profit is equated to benefits that members reap from the cooperatives. Behind these principles are values such as self-help, equity, democracy, equality among members, and solidarity. Cooperatives help members to pool their resources and by submitting themselves to group discipline they can solve their problems better than when members seek to do it alone (Birchall, 2003). Cooperatives therefore provide smallholder farmers with cheaper inputs, access to better technologies, market information and access to markets. This study will seek to explore the way cooperatives help smallholder farmers through minimization of transaction costs in addition to adding to the literature of cooperative and transaction cost economics

## **2.4 Theoretical framework.**

### **2.4.1 Theory of cooperatives**

The nature of cooperative enterprise differs from the conventional business enterprise. A cooperative enterprise is like a non-profit institution guided by the principle of service at cost for the benefit of member while the business enterprise has a decision making unit motivated by profit. In the profit seeking enterprise, it is much easier to establish ways of dealing with investors, unlike in a cooperative enterprise governed by cooperative principles and policies.

There is therefore need to elect a representative board which can resolve arising issues(Sexton, 1995).

Helmberger and Hoos (1962) developed the first complete mathematical model on the behaviour of an agricultural cooperative. They proposed the treating of an agricultural cooperative as a firm. This is because it embodies persons, privately owned physical plants, mobilizes factors of production and produces goods and services. It also relies primarily on the proceeds from the sale of its products to meet the costs it incurs, as would any other business enterprise. They also acknowledged that its economic character differed from that of a typical enterprise.

### **A short run model**

Based on the Helmberg and Hoos theory (Helmberger and Hoos, 1962; Sexton, 1995; Ortman and King, 2007), assuming maximizing behaviour on the part of the cooperative enterprise, the traditional marginal analysis derives behavioural relations and positions of equilibrium. The model makes the initial assumption that smallholder farmers are bound through contractual arrangements to market their entire milk produce,  $M$ , through the dairy cooperative society in which they are members. In this model, assume each member is a profit maximizer, and has a fixed number of dairy cows. The model further assumes that, the possible output variations of any member farmer are sufficiently small to have negligible impact on the costs and revenues of the cooperative enterprise. Another assumption is that the cooperative incurs a cost.

In the cooperative,  $M$ , raw milk produce, is combined with various productive services in the production of a finished commodity,  $Y$  in respect of the following production function;

$$Y \equiv Y(X_1, X_2, \dots, X_n, M|Z) \quad (1)$$

Where

$X_i$  represents the  $i^{th}$  productive service,  $Z$ , a fixed plant

This first equation represents a production function specifying all of the technologically efficient methods of production, for simplicity, suppose that the firm purchases all  $X_i (i = 1, \dots, n)$

and sells  $Y$  in a perfectly competitive market. The goal of the dairy cooperative is to maximize the price of the raw milk produce  $P_m$  for any amount of  $M$  supplied by member famers, subject to all costs incurred including fixed costs.

In the short run, cooperative membership is fixed, and the cooperative is willing to market all the milk that the members wish to supply. Members are to receive uniform treatment (service at cost), that is, they get the same price for the milk delivered to the dairy cooperative  $P_m$ . Therefore, the revised dairy cooperative's profit function is as follows:-

$$\pi = \overline{P}_y Y - \sum_{i=1}^n \overline{P}_i X_i - P_m M - F \quad (2)$$

By setting  $\pi = 0$ , we may get cooperative performance for a given level of  $M$ ,  $\overline{M}$  noting that the cooperative enterprise views  $M$  as a parameter beyond its control.

$$S = P_m = \overline{P}_y Y - \sum_{i=1}^n \overline{P}_i X_i - F \quad (3)$$

Where,  $S$  is the cooperative surplus. The maximization of  $S$  determines a maximum  $P_m$  implying maximum profit. In order for  $S$  be a maximum, any level of  $Y$  produced, the firm must produce  $\overline{Y}$  at a minimum total variable cost defined by Equation 4.

$$C = \sum_{i=1}^n \overline{P}_i X_i \quad (4)$$

For each  $Y$ , there will be a corresponding minimum variable cost of production according to the function

$$C = C(Y) \quad (5)$$

Where  $C$  = total variable cost.

Equation 6 is a revised version of equation (3)

$$S = \overline{P}_y Y - C(Y) - F \quad (6)$$

If  $S$  is to be a maximum, the following conditions must obtain:

$$\frac{dS}{dY} = 0; \bar{P}_y = \frac{dC}{dY} \quad (7)$$

A maximum  $S$  implies that price equals marginal cost. For any given level of  $M$ , the cooperative will choose the level of  $Y$  that maximizes  $P_m$ . This relationship is the short-run net returns function. It shows the maximum price the cooperative enterprise can return to members, after covering fixed and variable costs, for the various litres of milk they might choose to supply.

To determine  $M$ , since each member is free to produce whatever amount he chooses, in making his decision as to how much to produce, each member views the net returns per unit from the cooperative as invariant with respect to his output variations and is, therefore, a price taker. This would typically be the case if the market mechanism were perfect. In line with the rapid developments taking place, there is need to include transaction cost economics in the analysis of organization costs and relationship within agricultural cooperatives (Ortmann and King, 2007).

#### **2.4.2 Transaction costs economics**

This study also applies the Transaction Cost Economics (TCE) and the theory of collective action that are part of the New Institutional Economics (Williamson, 1979; Makhura, 2001; Kirsten *et al.* 2009). The NIE helps provide an understanding of economic institutions in order to facilitate economic outcomes that are more applicable in the agricultural sector. Traditional neoclassical economics offers little insight into how such economic relationships are structured. Their focus is on perfect market where price and quantity are the main variables. Producers and consumers in these markets are faced by perfect information, no transaction costs, homogeneity in goods, among others (Sykuta and Cook, 2001; Kirsten *et al.*, 2009). By focusing on a frictionless market as the unit of analysis, there is no role for organizations and markets. NIE contributes in that it recognizes that economic actors face problems as a result of imperfect information about the behaviour of other actors in transactions and recognizes institutions which can play an important role in addressing these problems (North, 1994).

Coase (1937) pioneered transaction cost economics in his article “The Nature of the Firm” where he argued that market exchange is not costless. He emphasized that transaction costs play an important role in firms and other contracts. Transaction costs determine the boundaries of a firm and/or even the extent of vertical integration.



Transaction costs are the observable and non-observable costs associated with exchange. They are the reason why the resource poor are not able to access markets (Coase, 1937; Holloway *et al.*, 2000; Makhura, 2001). These include the cost of searching for information, search for potential buyer and sellers, bargaining, making of contracts, monitoring of contractual partners, enforcement of contracts, and protection of property rights against third party encroachment.

According to Hobbs (1997), he divided transaction costs into information, negotiation and monitoring costs. Information costs include the costs of obtaining price and product information and the cost of identifying suitable transaction partners. Negotiation costs are costs of physically carrying out the transaction such as are commission costs, costs of physically negotiating the terms of exchange, and costs of drawing up formal contracts. Monitoring or enforcement costs occur *ex post* of a transaction and are the costs of ensuring that other transaction partners adhere to the terms of the transaction (quality standards and payment arrangements).

### **Sources of transaction costs in dairy production**

Milk in its raw form is highly perishable and thus requires rapid transportation to consumption points or for processing into less perishable forms. A dairy farmer can thus incur greater losses due to spoilage as compared to other farmers producing commodities such as grain. This in turn limits marketing options for smallholder farmers. Since milk production is typically a year round activity, producers must be concerned with maintaining guaranteed outlets for their production (Staal *et al.*, 1997).

Milk is also a bulky commodity. Milk in its raw form consists of more than 80% water implying relatively high transportation cost per unit. High transportation costs limit smallholder farmers from selling their produce in remunerative markets. This is especially the case for individuals without vehicular transport. Due these high transportation costs, it becomes very expensive for farmers to transport their milk resulting in farmers selling their milk at the farm gate or to marketing outlets with lower transaction costs, but also lower prices hence lowers returns (Staal *et al.*, 1997; Holloway *et al.*, 2000; Simelane, 2011). Again, because of its perishability nature as well as natural variation, it is difficult to determine the composition and quality of milk. This implies costs of monitoring milk quality and potential losses by traders,

processors and consumers when milk is spoiled or adulterated, hence resulting in high transaction costs.

The lack of easily measurable quality standards may also allow agents purchasing raw milk from producers to reject milk without just cause when they purchase more milk than can be profitably sold (Staal *et al.*, 1997). Access to markets information is also another problem facing the smallholder farmers. Incomplete and asymmetric information also gives room for opportunistic behaviour among traders (Simelane, 2011). The cost of searching for buyers leads to a lot of uncertainty involved in milk marketing. Furthermore, dairy production is asset specific in nature, which also contributes to high transaction costs in dairy farming. Farmers have to invest in assets such as milking parlours, dairy cattle, milking equipment, which are specific to dairy production and not easily transferred to other enterprises.

Dairy cooperatives serve the purpose of reducing transaction costs facing individual producers through pooling risks, lowering unit collection costs, enhanced bargaining power and making inputs accessible to smallholder farmers. Cooperatives also reduce transaction costs for processors by lowering search costs and increased milk reliability (Staal *et al.*, 1997).

### **Choice of farmers under transaction costs**

Smallholder farmers bear transaction costs that will determine whether to sell their milk through a dairy cooperative or not. Therefore, the decision price might differ from the observed price (Makhura, 2001). Though transaction costs are largely unobservable, the presence or absence of certain factors can provide an indication of the effect of the transaction costs.

Transaction costs are fixed; those that do not vary with the amount of milk exchanged  $t_{fc}$  or varied; costs varying with the amount of milk exchanged  $t_{vc}$  (Key *et al.*, 2000). Transaction costs in smallholder farming arise from a household's differential access to assets and information asymmetries, and different households face different transaction costs. Education and contact with extension, as proxies for information, represent fixed transaction costs, while ownership of arable land, livestock and transport facilities represent variable transaction costs.

Consider a farm household maximising utility ( $u$ ) by deciding on the consumption of  $k$  goods ( $c_k$ ) production of  $k$  goods ( $q_k$ ) and sales of  $k$  goods ( $s_k$ ). That is, using  $i$  inputs for each product  $k$  ( $x_{ik}$ ), the household can produce ( $q_k$ ) which can either be sold ( $s_k$ ) or consumed ( $c_k$ ).

The objective function for a household facing transaction costs becomes

$$MaxU_t = u_t(c^t, R^t; H_U) \quad (8)$$

That is, the households can consume what it produces ( $C$ ) or gain revenues to purchase other goods ( $R$ ), given household characteristics ( $H$ ).

This is subject to an income constraint under transaction costs, that is, expenditure on all purchase must not exceed revenues from all sales and transfers. This implies that when the household is not selling its milk in the market, variable transaction costs will not exist ( $t_{vc}$ ), and only the fixed transaction costs ( $t_{fc}$ ) will determine whether the household participates or not. That is, the household's response to transaction costs involves either switching from sale of milk through a cooperative to individual selling and/or from participating in the market to consuming.

The optimal solution requires two steps as postulated in Key *et al.* (2000). That is, first solve for the optional solution on condition of whether or not the farmer sells milk, and then choose the channel leading to highest level of utility. The key emerging point is that transaction costs affect all systems of equations. For example, the utility maximization under transaction costs is different from the one when transaction costs do not exist (Key *et al.*, 2000). Under transaction costs, they consume more of the production since producers will be valuing output consumed and they will be saving on a higher purchase price. On the other hand, they will consume less of other goods ( $R_k$ ) since there is a lower propensity to sell milk.

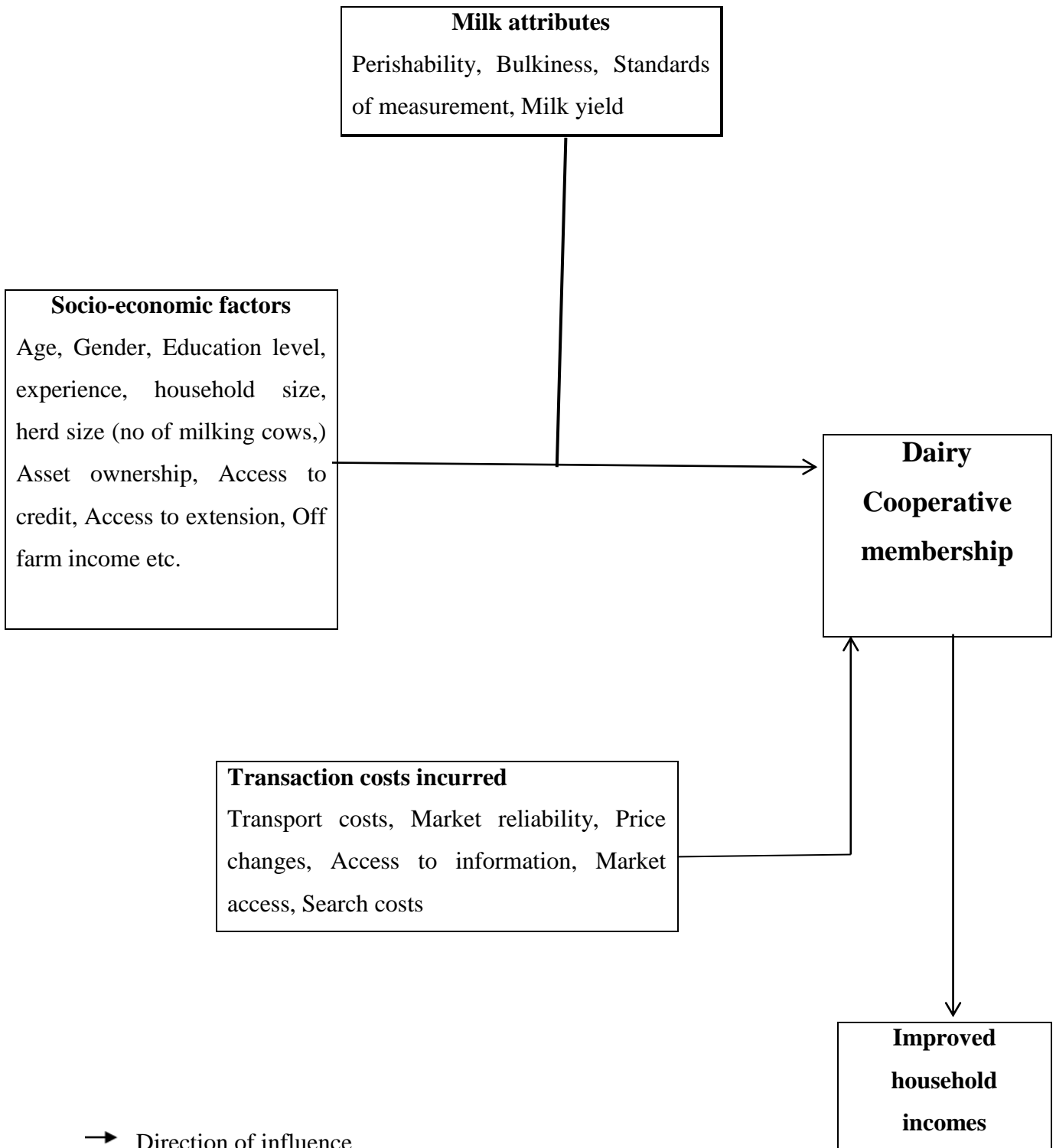
The household's supply of milk in the market without transaction costs is a function of prices and household characteristics, i.e.  $S_k = s(p, h_u, h_q)$

With transaction costs, the supply equation becomes  $s_k^t = s^t(p - t_{vc} - t_{fc}; h_q, h_u)$ , which is a function of fixed transaction costs when the households makes a decision to sell, but is affected by both fixed and variable transaction costs when the household effectively sells individually or through a dairy cooperative. That is, both the fixed and variable transaction costs will affect the

magnitude of supply. Extremely high transaction costs (particularly fixed transaction costs) will lower the decision price considerably so much, so that it might not be worthwhile to participate in the milk market (Makhura, 2001). Cooperative can help reduce these transaction costs allowing smallholder farmers to participate in these markets.

## **2.5 Conceptual framework**

Smallholder farmers can choose to be members of dairy cooperative through which they market their milk or they can choose to do so through other means. Smallholder dairy farmers will decide whether to join a dairy cooperative society in light of the social economic factors they face. Such factors include farmer's experience, age, assets in his ownership and education. Farmers with more years of education and experience will be able to understand the benefits of membership to a cooperative and are more likely to join it. Distance to a reliable milk market also has a positive relationship with participation in the cooperative. The further away the nearest market is, the more likely it will be for farmers to become cooperative members to enable them access these markets through the cooperative. Milk also has some unique attributes that will affect farmers' decision to be members of a dairy cooperative society. Milk is easily perishable thus requiring marketing within a day. Milk is also very bulky and farmers incur very high transportation costs when marketing their milk. Institutional factors also come into play. There are certain standards set forth by the Kenya Dairy Board they must meet. y. Some transaction factors also influences membership in a dairy cooperative. For instance, poor information about the buyer, availability of markets, and price changes have an impact on the level of uncertainty and opportunistic behaviour, which consequently have a bearing on the farmers' decision to become a member of a cooperative society. This conceptual framework hypothesized that once farmers decide to join a cooperative society; there will be an increase in their incomes.



**Figure 1: Conceptual framework**

## CHAPTER THREE

### METHODOLOGY

#### 3.1 Study area

This study was conducted in Embu County (Figure 2). Embu County lies between latitudes 0°8' and 0°35' South and longitudes 37°19' and 37°42' East. It occupies 2,818kms<sup>2</sup>. Its largest towns are Embu, Runyenjes, Gachoka and Siakago. It has a population of 516,212 and a population density of 183 people per kms<sup>2</sup> according to 2009 Kenya Population and Housing Census Report published in August 2010, by the KNBS (2011). The poverty rate in the County is estimated at 42% with 71.3% of the population having primary education and 15.5% having secondary education. The topography of Embu County is characterized in two categories: highland and lowlands. Highlands are the region higher than 1500m above sea levels while the lowlands are below 1500m above sea level. The County has two distinct rainy seasons. The long rains fall between March and June while the short rains come in October to December. Temperatures range from 12°C to 32°C (Gachimbi, 2002). In the Embu area, farm size averages 1 to 2 hectares. Most farmers have title deeds to their land, and thus their tenure is relatively secure. The physical features along with favourable climate conditions create a very favorable environment for growing high value crops like tea and coffee. It is also very favourable for keeping dairy animals (Franzel *et al.*, 2003).

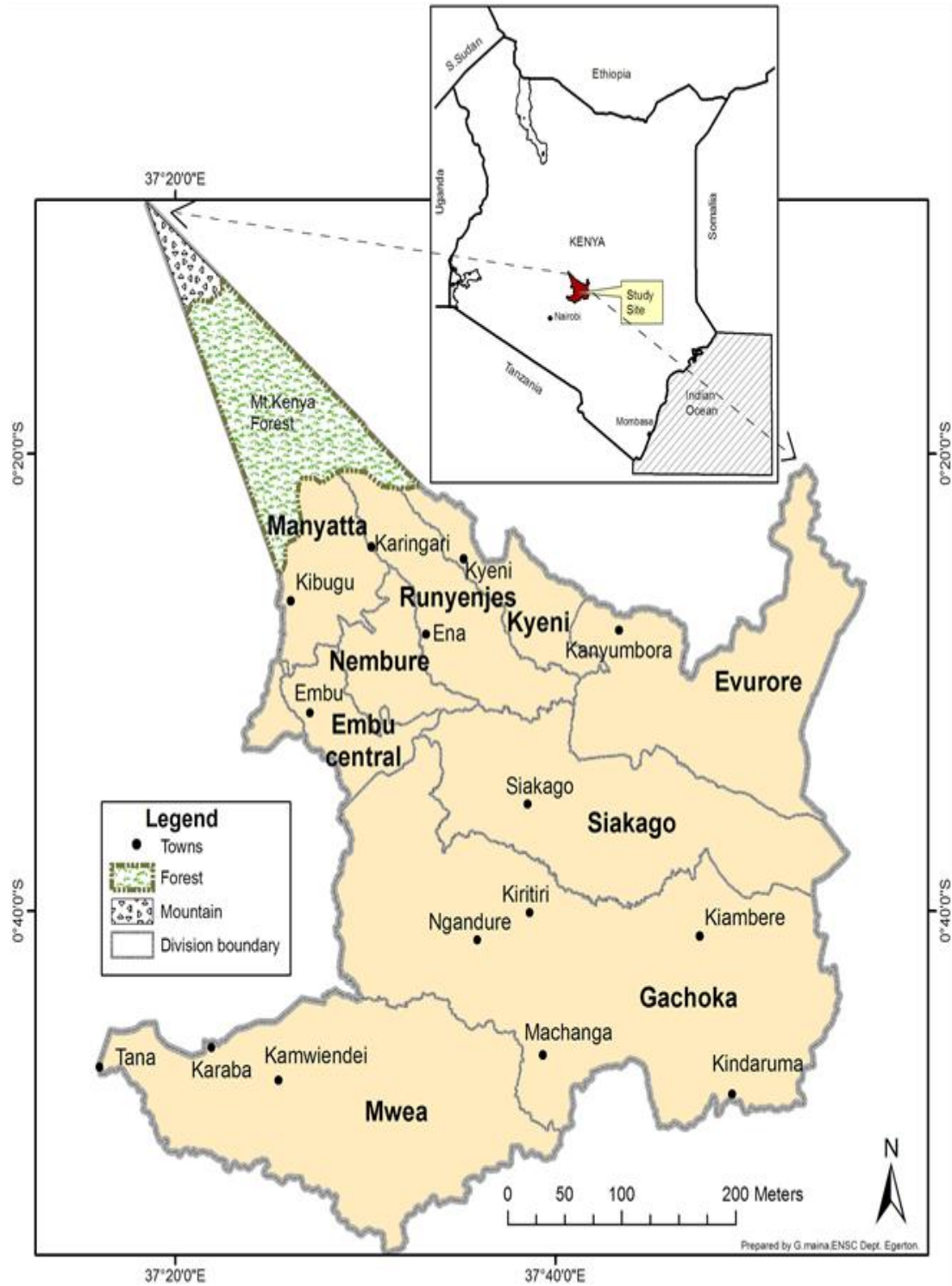
#### 3.2 Sample size determination and sampling design

Smallholder dairy farmers in Embu East District formed the population from which the sample was drawn.

The study adopted the following formula for determining sample size (Cochran, 1977).

$$n_o = \frac{(t^2)(p)(q)}{(j^2)} \quad (9)$$

Where  $t^2$  is the standard deviation score that represents the probability level of a variable of falling within a confidence interval when the variable is normally distributed



**Figure 2: Map of study area**

Source: (World Resource Institute, 2013)

(p) (q)= variance

$J^2$  = confidence interval/ level of precision

The study used probability level and confidence interval of 1.96 and 0.07 respectively indicating that the sample mean consequently has a 95% chance of being within 1.96 standard errors from the true population mean. The variables yielding the variance represent the proportion of smallholder dairy farmers who are cooperative members and those who are not. A 50% proportion for each is ideal in this situation.

$$n_o = \frac{(1.96^2)(.5)(.5)}{(0.05^2)} = 384.16 \quad (10)$$

Since there are only 610 smallholder farmers who are members of the dairy cooperative society, the sample size was adjusted using the following formula:

$$n = \frac{n_o}{1 + \frac{(n_o - 1)}{N}} \quad (11)$$

This adjustment is called the finite population correction substantially reduces the necessary sample size for small populations.

$$n = \frac{384}{1 + \frac{(384 - 1)}{600}} = 235.57 \quad (12)$$

This study will therefore collect a sample of 236 respondents in order to be able to represent the target population.

The study used systematic random sampling to select smallholder dairy farmers who were members of the dairy cooperative society from a source list available from the operating dairy cooperatives. The first respondent was selected at random and subsequent respondents were selected by taking every  $k^{\text{th}}$  item from the list where  $K$  refers to the sampling interval. Simple random sampling was used to select smallholder dairy farmers who were not members of the cooperative.



$$k = N/n \quad (13)$$

### 3.3 Data collection and analysis

The study collected relevant data from both primary and secondary sources. The study used primary data collected by means of a structured questionnaire. The questionnaire contained both open ended and close-ended questions. The study also used secondary data obtained from the Ministry of Agriculture, Livestock and fisheries and Mkulima Bora dairy cooperative.

Upon completion of data collection, two methods of analysis were employed, descriptive and econometric analysis. The study used SPSS 17 for data management and STATA 12 software to analyze the data

### 3.4 Model specification and analysis

#### Objective 1: Transaction costs faced by smallholder dairy farmers

In order to achieve objective one, the study used descriptive statistics such as graphs, pie chart, percentages, means, *Chi-square* and *T-test* to analyze the transaction costs faced by smallholder farmers in Embu County.

#### Objective 2: Social economic factors that influence smallholder membership in dairy cooperatives

Assuming that a smallholder farmer chooses from two alternatives: being a member of a dairy cooperatives or not being a member of a dairy cooperative, then the observation of the choices will reveal the farmers preference. If a smallholder dairy farmer is a member of a dairy cooperative society, this implies that  $U_{i1} \succ U_{i0}$ , where  $U_{i1}$  and  $U_{i0}$  are the utilities that  $i$  associates with being a member of a dairy cooperative and not being a member of a dairy cooperative respectively

The equation for the binomial logit method is written as (Greene, 2002)

$$p = \left( y = \frac{1}{x} \right) = \frac{\exp(\beta_o + x\beta)}{1 + \exp(\beta_o + x\beta)} \quad (14)$$

Where  $y$  is membership in a cooperative society noted by MBR (1=member, 0=non-member),  $\beta$  represents parameters to estimate and  $x$  denotes the set of independent variables listed in Table 1.

**Table 1: Description of variables for the binomial logit model**

Variable	Description	Unit of measurement	Expected sign
<b>Dependent variable</b>			
Membership in a dairy cooperative	Farmer is a member of a dairy cooperative society or not	1= member, 0=non member	
<b>Independent variables</b>			
Variable	Abbreviation	Unit of measurement	Expected sign
Age	YEARSHH	Number of years	+/-
Gender	GENDER	1=Male, 0=Female	+/-
Education level	EDUC	1=No formal education, 2= Primary education, 3=Secondary education, 4=Tertiary education	+/-
Farming experience	EXPER	Number of years	-
Household size	HSIZE	Number of people	+/-
Herd size	HERDSIZE	Number of milk cows	+/-
Access to credit	CRED	1=Credit access, 0=No credit access	+/-
Access to extension	EXTENS	1= Extension, 0= no access to extension	+/-
Off farm income	OFFINCOME	Kenya shillings	+/-
Distance to market	DISTMARK	Kilometres	+/-
Milk sold	MILK SOLD	Litres sold	+/-

### **Objective 3: Effects of cooperatives in minimizing transaction costs**

Transaction costs, especially for smallholder farmers, are difficult to measure quantitatively. In literature, proxies for information and search costs are availability and access to market information, while proxies for bargaining and negotiation costs are the number of available buyers, or how long it takes farmers to sell their produce. These proxies have been used to determine the extent of transaction costs farmers incur while marketing their produce.

This study assessed the cost of transactions by dairy cooperative relative to individual milk marketing. This study employed Heckman two-stage method. This method represents a classic way of dealing with selection on unobservable characteristics (Greene, 2002). It was expected that the incomes of the cooperative members would be higher than the incomes of non-cooperative members following the low transaction costs that are said to be associated with cooperative membership.

The simplest idea would be to fit the following equation on a sample of smallholder farmers who are members of a cooperative society.

$$Y_i = X_i\beta + \varepsilon_{li} \quad (15)$$

Where  $Y$  is the logarithm of incomes derived from the sale of milk,  $x$  is the vector of social economic and institutional factors that will affect the milk earnings. However, the sample of smallholder dairy farmers who are members of a dairy cooperative is not a random sample and this selectivity may bias the coefficients. Formally, a participation equation can be written down

$$T_i = Z_i\gamma + \varepsilon_{oi} \quad (16)$$

Where,  $Z$  is a vector of variables that predict whether a smallholder dairy farmer is a member of a cooperative society.

The first step of the two-step approach is to run a probit model of participation in a dairy cooperative society ( $T$  on  $Z$ ) using all the variables of interest.

$$f(T_i|Z_i, \gamma) = \text{Pr ob}[T_i|Z_i, \gamma] = \Phi[(2T_i - 1)Z_i\beta], \quad T_i = 0,1 \quad (17)$$

The probit model uses the estimates of  $\gamma$  to construct consistent estimates of the inverse Mills ratio term

$$\hat{\lambda}\left(-Z_i \hat{\gamma}\right) = \frac{\phi\left(Z_i \hat{\gamma}\right)}{\Phi\left(Z_i \hat{\gamma}\right)} \quad (18)$$

**Table 2: Description of variable for the Heckman two-step model**

Variable	Description	Unit of measurement	Expected sign
<b>Dependent variable</b>			
Log income	Logarithm of the income received from milk sales(quantity sold*average price)	Kenya shillings	
<b>Independent variables</b>			
Variable	Abbreviation	Unit of measurement	Expected sign
Socio-economic factor			
Age	YEARSHH	Number of years	+/-
Gender	GENDER	1=Male, 0=Female	+/-
Education level	EDUC	Number of years	+/-
Farming experience	EXPER	Number of years	+/-
Household size	HSIZE	Number of people	+/-
Herd size	HERDSIZE	Number of milk cows	+/-
Access to credit	CRED	1=credit access, 0= no credit access	+/-
Access to extension	EXTENS	1=extension access, 0=no extension access	+/-
Off farm income	OFFINCOME	Kshs	+/-
Distance to market	DISTMARK	Kilometers	+/-
Milk yield	MILKYIED	Liters produced	+/-
Transaction factors			
Market information	MKTINFO	1= Info on markets, 0= no info on markets	+/-
Knowledge about price changes	PRICEINFO	1= info about price changes, 0= no info	+/-
Market access	MKTACCESS	1= market access, 0= no market access	+/-
Transport charges	TRANSP	Kenya shillings	+/-
Membership in a dairy cooperative	MBR	1= member, 0=non-member	+/-

In the second stage, the income equation estimated by ordinary least squares includes both the original X whose coefficients are the parameters of the income equation and the constructed values of the inverse Mills ratio, which is

$$Y_i = \beta X_i + P \hat{\gamma}_i \left( -Z_i \hat{\gamma} \right) + \varepsilon_i \quad (19)$$

The outcome equation (log income equation) is expressed as

$$\begin{aligned} \text{LogIncome} = & \beta_0 + \beta_1 \text{AGE} + \beta_2 \text{GENDER} + \beta_3 \text{EDUC} + \beta_4 \text{EXPER} + \beta_5 \text{HSIZE} + \beta_6 \text{HERDSIZE} \\ & + \beta_7 \text{ASSET} + \beta_8 \text{CREDIT} + \beta_9 \text{MKTINFO} + \beta_{10} \text{PRICEINFO} + \beta_{11} \text{TRANSPORT} + \beta_{12} \text{IMR} + \varepsilon_i \end{aligned} \quad (20)$$

A description of the variables used in the Heckman two stage method are provided in Table 2

#### **Objective 4: Constraints and strategies for improving dairy cooperative societies**

To identify the major constraints facing the dairy cooperative, the study employed exploratory factor analysis. The constraints enumerated by the respondents were grouped using principal component analysis. The study employed Varimax rotation in grouping the constraint variables into major constraint factors. In factor analysis, the factor loading under each constraint represent a correlation of the variables (constraint areas) to the identified constraint factor and has the same interpretation as any correlation coefficient. The cut-off point for constraint loading will be 0.40 and above and these constraints were used in naming the factors (Ashley *et al.*, 2006). Equation 19 below represents the model.

$$\begin{aligned} Y_1 &= a_{11}X_1 + a_{12}X_2 + \dots + a_{1n}X_n \\ Y_2 &= a_{21}X_1 + a_{22}X_2 + \dots + a_{2n}X_n \\ Y_3 &= a_{31}X_1 + a_{32}X_3 + \dots + a_{3n}X_n \\ &\vdots \\ Y_n &= a_{n1}X_1 + a_{n2}X_2 + \dots + a_{nn}X_n \end{aligned} \quad (21)$$

Where:  $Y_1, Y_2, \dots, Y_3$  = the constraints facing the dairy cooperative society

$a_1 - a_n$  = constraint loading or correlation coefficients

$X_1, X_2, \dots, X_n$  = unobserved underlying factors constraining the dairy cooperative society

The farmers listed the possible strategies they thought would be best for improving on the services rendered by their cooperative. The study analyzed the responses using descriptive statistics and the responses scoring the highest cumulative percentage regarded as the best strategies.

## **CHAPTER 4**

### **RESULTS AND DISCUSSION**

This chapter discusses the empirical findings of this work. It starts by presenting the descriptive statistics for transaction costs and socio-economic factors of smallholder dairy farmers in Embu County. It also presents the results of the binomial logit model of the socio-economic factors influencing cooperative membership followed by the detailed results of Heckman two stage model determining the effects of the cooperative in minimizing transaction costs. This chapter also looks at the benefits of being a cooperative member. The results of the exploratory factor analysis identified the major constraints facing the dairy cooperative and the strategies for improving the services rendered by the cooperative.

#### **4.1 Transaction costs faced by smallholder dairy farmers**

##### **Nature of milk**

Milk in its natural raw form, requires immediate marketing and should not take more than a day before consuming. Farmers are losing money due to milk spoilage. Chilling of the milk increases the shelf life of milk and removing the transaction constraint of having to market the milk within the day of production.

According to the results of the survey indicated in Table 3, 47.5% of the total respondents had experienced milk loss due to various factors such as long distances to the market, poor milk handling and lack of chilling facilities. Out of the respondents who had experienced milk loss, 27.5% were non-cooperative members and 19.9% were cooperative members. The results indicate that cooperative members incur lower milk losses as compared to the non-cooperative members. The *chi-square* results were statistically significant at 5% level indicating that non-cooperative members incurred more losses than cooperative members did. The cooperative enables farmers to sell both their morning and afternoon milk without any limits on the amount of milk they sell. This results in a higher share of marketed milk by cooperative members as compared to the non-cooperative members. These results are consistent with the findings of Simelane (2011) who found that there were lower levels of milk losses from milk spoilages among cooperative farmers as compared to non-cooperative farmers.

Out of the respondents who attested to having experienced milk losses, 7.0% attributed this to long distances to the market, 63.5% attributed this to poor milk handling, 29.6% attributed this to having minimal marketing activities.

**Table 3: Milk losses incurred and reasons for milk losses**

Milk loss and Reasons for milk losses	Non cooperative member		Cooperative member		$\chi^2$
	Frequency	% of Total	Frequency	% of Total	
Milk loss	65	27.5	47	19.9	5.506**
Long distance to market	0	0.0	8	7.0	12.444**
Poor milk handling	37	32.2	36	31.3	5.899**
Lack of chilling facilities	21	18.3	13	11.3	0.139
Minimal marketing activities	18	15.7	2	1.7	9.547***

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

Out of the respondents who attributed their milk losses to poor milk handling and lack of chilling facilities, 50.5% were non-cooperative members while 42.6% were cooperative members. The *chi-square* results were statistically significant at 5% level indicating that non-cooperative members incurred more losses due to poor milk handling. The cooperative recommends the transport of milk in aluminum cans to enable proper milk handling and transportation. Most of the non-cooperative members use plastic containers that are susceptible to microorganisms and bacteria. Smallholder farmers do not have access to chilling facilities because of low asset base and lack of access to finances. The cooperatives provide their farmers with chilling facilities resulting in lower milk losses from lack of access to chilling facilities. The cooperative collects milk from 8 am to 3 pm allowing farmers to market both their morning and afternoon milk thus incurring lower milk losses. The cooperative also does not limit on the

amount of milk that the farmer can deliver to the cooperative. Out of the respondents who incurred milk losses due to having minimal marketing options, 15.7% were non-cooperative members while 1.7% were cooperative members. The *chi-square* results were statistically significant at 1% level indicating that more non-cooperative members incurred milk losses due to having minimal marketing outlets.

### Market access

Market access is essential to incomes and increase in the number of marketing opportunities available to smallholder dairy farmers. Market access creates income-generating opportunities resulting in market oriented as opposed to subsistence dairy production. The results in Table 4 indicate that 68.2% of the sampled dairy farmers had access to the market. Out of the total number of respondents who had access to market, 24.6% were non-cooperative members while 43.6% were cooperative members. The *chi-square* test was statistically significant at 1% level, indicating that cooperative members had better access to markets than their non-cooperative members.

**Table 4: Transaction costs faced by smallholder dairy farmers**

Transaction costs	Non cooperative member		Cooperative member		$\chi^2$
	Frequency	% of Total	Frequency	% of Total	
Access to the market	58	24.6	103	43.6	39.578***
Access to market information	42	17.8	116	49.2	104.863***
Access to price changes information	52	22.0	116	49.2	84.616***

\*\*\* Significant at 1%.

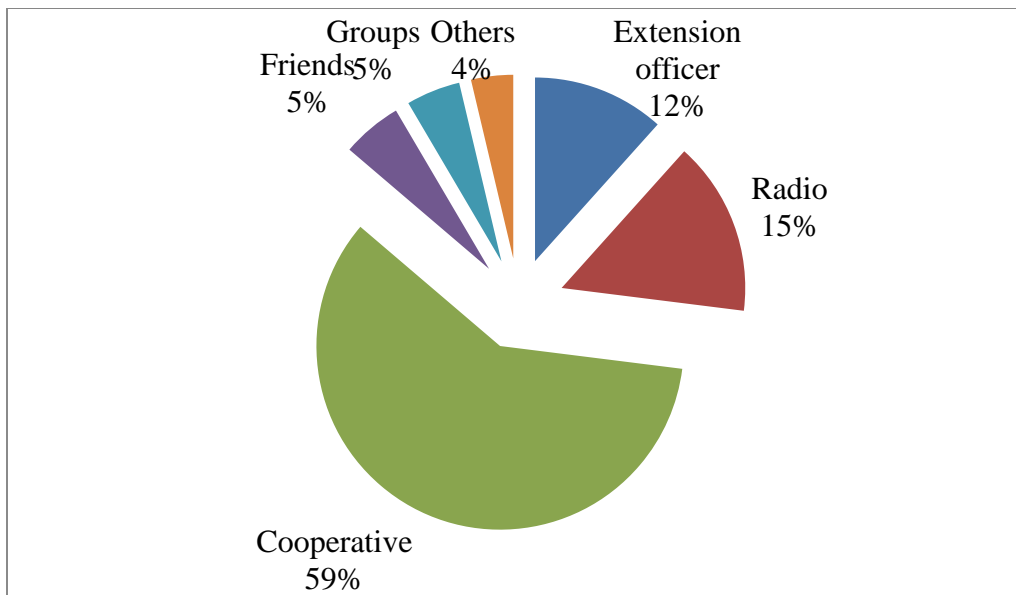
Cooperatives improve marketing access of farmers as well as strengthening their market power. The results of this survey are consistent with the findings of Bernard *et al.* (2008) who



found out that cooperatives were able to provide market access to smallholders who were predominantly engaged in cereals production and marketing.

### Market information

According to results in Table 4, 66.9% of the respondents had access to market information. Out of the respondents who had access to market information, 17.8% were non-cooperative members while 49.2% were cooperative members. The *chi-square* test was statistically significant at 1% level, indicating that cooperative members had more market information as compared to their non-cooperative counterparts. Cooperative are able to provide market information by obtaining, information about input and output markets thereby enabling increase in milk production and consequently contributing to agricultural development (Sulastri and Marhajan, 2002).



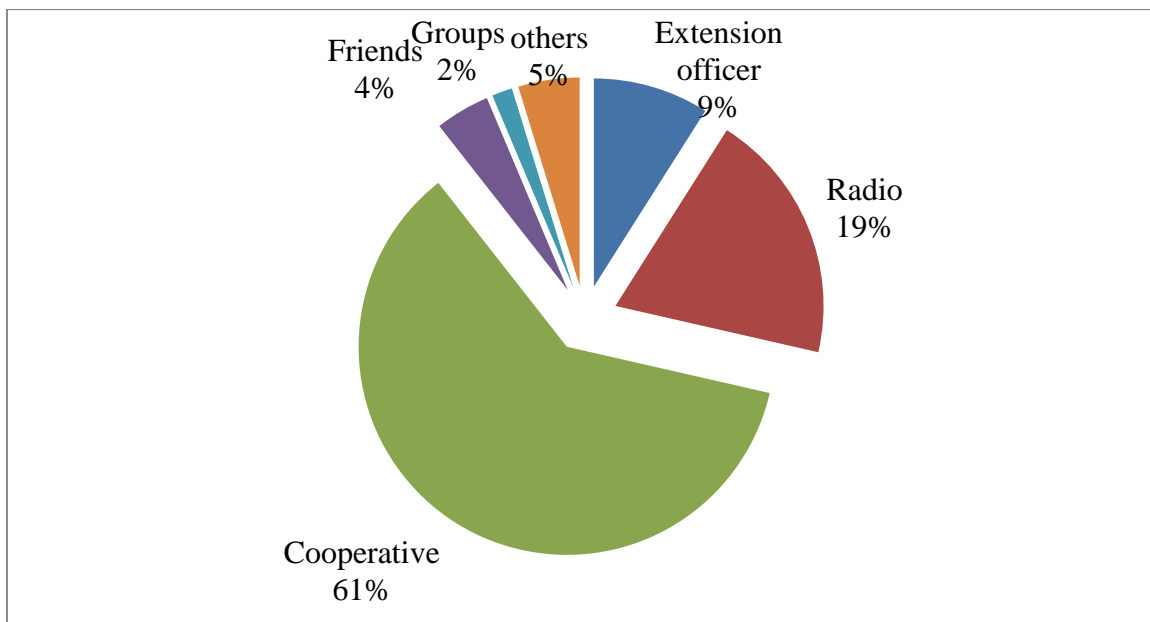
**Figure 3: Sources of market information for smallholder dairy farmers**

The results of the survey indicate that smallholder dairy farmers had various sources of market information. The main sources of market information were cooperatives, extension officers, friends, groups and the media. Cooperatives were the main sources of market information accounting for 59%, radio accounted for 15%, extension officers accounted for 12%, while friends/ other farmers accounted for 5%. Informal groups also were sources of market information accounting for 5% as shown in Figure 3. Smallholder farmers also got their market

information from other source including newspapers, NGOs, adverts, posters and vehicle broadcast accounting for 5%. Some of the non-cooperative members also relied on cooperatives as their sources of market information. Toulwase and Apata (2013), in their study found that cooperatives and agricultural extension were highly rated as sources of information dissemination to farmers. They also found out that farmers considered information from friends as an efficient means of disseminating information.

### Access to price information

The results presented in Table 4 indicate that 71.2% of the respondents had access to market price information. Non-cooperative members only accounted for 22% while cooperative members accounted for 49.2% of the respondents who had access to market price information. The *chi-square* test was statistically significant at 1% level, indicating that cooperative members had more information on price changes in the market as compared to their non-cooperative counterparts. Therefore, cooperatives lower transaction costs for farmers by reducing the need to search for reliable and current price information. The results of this survey are consistent with the findings of Simelane (2011), who found out that cooperatives have enabled improvement in information about price changes in the market.



**Figure 4: Source of market price information for smallholder dairy farmers**

The results presented in Figure 4 showed main sources of information about price changes in the market were cooperatives, extension officers, friends, groups and the media. Cooperatives were the main sources of market information accounting for 61%, radio accounted for 19%, extension officers accounted for 9 %, while friends/ other farmers accounted for 4%. Informal groups also were sources of market price information accounting for 2%. Smallholder farmers also got their market price information from other source including newspapers, NGOs, adverts, posters and vehicle broadcast accounting for 5%. Some of the non-cooperative members also relied on cooperatives as their sources of market price information.

## 4.2 Socioeconomic factors that influence smallholder farmers' membership in a dairy cooperative society

This section presents the results for socio economic factors that influence smallholder farmers' membership in dairy cooperatives.

### 4.2.1 Descriptive analysis of socioeconomic characteristics of smallholder dairy farmers

#### Age, gender and education level of sampled smallholder dairy farmers

The age of the household head is very imperative when it comes to decision making. Younger farmers tend to be risk takers while older farmers are more experienced and cautious when making decisions (Simelane, 2011).

**Table 5: Age of household head**

Age of the farmer by category	Non- cooperative members		Cooperative members		Overall Frequency	T value
	Frequency	% of Total	Frequency	% of Total		
18-24 years	2	0.8	1	0.4	3	
25-34 years	12	5.1	15	6.4	27	
35-44 years	35	14.8	31	13.1	66	
45-54 years	27	11.4	43	18.2	70	
Above 55 years	42	17.8	28	11.9	70	
Average Age		50.48		46.86	48.67	2.010**

\*\* Significant at 5%.

Results from the cross-sectional survey showed that the average age of the sampled smallholder dairy farmers was 48.7 years with the youngest respondent aged 21 years and the oldest aged 105 years old (Table 5). The average age was higher for farmers who were not member of the dairy cooperative (50.5 years) compared to farmers who were members of the

dairy cooperative (46.9 years). The sample *t* test indicates that the difference in mean age between cooperative and non-cooperative farmers is statistically significant at a 5% level of significance.

Additionally, the results in Table 6 show that out of the 236 respondents, 62.3% were male and 37.7% were female. For the non-cooperative members 44.9% were females and 55.1% were males while for cooperative members 30.5% were females and 69.5% males. This shows that women participation still lags behind men in cooperative membership. The *chi-square* test was statistically significant at 5% level of significance indicating that there were more male-headed households among the cooperative members than among non-cooperative members. This implies that women remain under-represented at the membership level in cooperatives and are consistent with the findings of Majurin (2012).

**Table 6: Gender and education level of the farmers**

		Non cooperative member		Cooperative member		$\chi^2$
		Frequency	% of Total	Frequency	% of Total	
Gender	Female	53	22.5	36	15.3	5.213**
	Male	65	27.5	82	34.7	
Education level	No formal education	12	5.1	7	3.0	5.817
	Primary education	54	22.9	42	17.8	
	Secondary education	43	18.2	53	22.5	
	Tertiary education	9	3.8	16	6.8	

\*\* Significant at 5%.

Education plays an important role in economic progress. The level of education attained determines how fast farmers adopt new technologies. Literate farmers are expected to better comprehend matters. They are better able to understand the benefits of joining cooperative through understanding the importance of collective action. The results presented in Table 6 indicate that those farmers who had no formal education only constituted 8.1% of the sampled

respondents while 91.9% had accessed some level of education indicating that a majority of the interviewed farmers were literate.

Out of the total number of sampled farmers, 8.1% had not accessed formal education, 40.7% had accessed primary education, 40.7% had accessed secondary education and only 10.6% had accessed tertiary education. The *chi-square* test revealed there was no significant difference in the education level between cooperative members and non-cooperative members. These results were consistent with the findings of Hiller (2006), who found out that cooperative and non-cooperative members are comparable in terms of their literacy levels or higher education.

### **Household size of sampled smallholder dairy farmers**

The household size is a good indicator of the available labour for dairy production. In the survey area, the average household size was 4.5 members. The average household size for cooperative members was 4.62 while for non-cooperative members was 4.44. The sample *t* test indicates there is no significant difference in average household size between cooperative members and non-cooperative members.

A closer look at the number of adults working on the farm reveals that on average, there are more adults dedicated to working on the farm for cooperative members as compared to non-cooperative members (Table 7). This would indicate that cooperative members tend to assign more labour for dairy production; hence, they produce more milk. The sampled *t* test for the number of adults working on the farm was statistically significant at 1% level. The results are similar to the findings of Verhofstadt and Maertens (2013), whose study in Rwanda showed that cooperative member households have more household members who work in agriculture. Abate *et al.* (2013) found out that farm households belonging to agricultural cooperatives have higher household size in both numbers and adult equivalents working on the farm. Meena *et al.* (2009) in their study of impact of dairy cooperatives on labour utilization found that the overall labour utilization per household per annum was significantly higher for members than for non-members. They attributed it to the keen interest created in rearing of animals in the member milk producers by dairy cooperatives that might have led them to devote more time in the maintenance and upkeep of the animals.

**Table 7: Household composition**

Variable	Mean		T test
	Member	Non member	
Number of adults working on the farm	2.36	1.86	4.698***
Number of adults working off the farm	0.75	0.69	0.351
Total number of adults	3.04	2.47	2.819***
Number of children (below 18 years)	1.58	1.99	-1.811*
<b>Household size</b>	<b>4.62</b>	<b>4.44</b>	<b>0.668</b>

\*\*\* Significant at 1%, \* significant at 10%.

### Herd size and milk sold

Table 8 indicates that on average, cooperative members and non-cooperative members had 2.4 and 1.42 dairy cows respectively. This suggests that cooperative members have a slightly bigger herd size than non-cooperative members. This might be due to the fact that they are paid monthly thus they are able to save and invest part of their earning in the dairy sector to improve the farm operations and asset base of the household, hence larger herd sizes. The sample *t* test indicates that there is significant difference in herd size between the members and non-members.

**Table 8: Dairy herd size and milk marketed.**

Variable	Mean		T test
	Member	Non member	
Dairy herd size	2.41	1.42	5.962***
Litres sold per month	968.87	327.71	6.136***
Litres sold per day	32.30	10.92	6.136***
Litres per cow per day	13.95	5.65	5.475***
Price per litre	31.53	31.68	-0.355

\*\*\* Significant at 1%.

The average milk sold was 968.87 and 327.71 litres per month for cooperative and non-cooperative members respectively and was statistically significant at a 1% level. The average milk sold per cow per day was 13.95 litres for cooperative members and 5.65 litres for non-cooperative members indicating that cooperative members enjoy higher productivity above the independent farmers. Higher milk production is attributed to improved management practices resulting from training and extension services. The differences in average milk sold per cow per day was statistically significant at 1% level, implying that on average cooperative farmers sold more milk than their non-cooperative counterparts. Ghosh and Maharjan (2004), in Bangladesh, found there was higher production of milk per cow and per household in the cooperative villages compared to the non-cooperative villages.

The results indicate that the average price per litre was 31.61 Kenya Shillings (Kshs). The highest price received was Kshs. 40 per litre for non-cooperative members and Kshs. 36 for cooperative members. Overall, the average price per litre of milk was Kshs. 31.68 for non-cooperative members and Kshs. 31.53 for cooperative members. This might be because cooperative members sell at fixed prices while non-cooperative members sell at fluctuating prices throughout the year. Cooperative members also have a fixed amount deducted to help the cooperative run the day-to-day affairs of the cooperative. However, this difference in average milk price per litre was not statistically significant. Simelane (2011) found out that in Swaziland, the average price per litre of milk was higher for independent farmers than for cooperative farmers.

### **Distance to the market and average cost of milk transport per month**

The further away the nearest reliable produce market is the more likely it will be for farmers to become cooperative members in order to access markets through the cooperative. According to the results of the survey presented in Table 9, respondents have to travel an average of 4.45 kilometres to milk market. Cooperatives members travelled an average of 6.41 kilometres while non-cooperative members only travelled 2.49 kilometres. Most farmers sell their milk at the farm-gate and to nearby homes because there is no transportation cost incurred. The t test results indicate that there is significant difference in average kilometres travelled between cooperative and non-cooperative members at 1% level of significance. These results are similar to Minot (1999), who showed that the choice of marketing outlet negatively related to marketing site.

**Table 9: Distance and average cost of milk transport**

Variable	Mean		T test
	Member	Non member	
Distance to milk market (Kms)	6.41	2.49	8.916***
Cost of milk transport (Kshs/month)	1900.85	98.64	7.831***

\*\*\* Significant at 1%.

The results presented in Table 9 show the average cost of milk transport to the market was Kshs. 999.75 per month; out of this, cooperative members incurred an average of Kshs. 1900.85 per month as compared to their non-cooperative counterparts who incurred an average of Kshs. 98.64 per month. The mean difference in cost of milk transportation was significant at 1% level

of significance. This disparity in cost of transportation induces the farmer to produce more milk. The farmers also engage in collective action in order to be able to deliver their milk to the cooperative at lower cost.

### Mode of transport

The mode of transport has a great influence on marketing because it determines the marketing outlet chosen and the time it takes to transport milk to the market. According to the results presented in Table 10, out of 3.8% of the respondents who used public transport, 0.4% were non-cooperative members and 3.4% were cooperative members. Out of the 35.2% who used their own transport, 4.2% were non-cooperative members while 30.9% were cooperative members. The term own transport in this survey includes use of bicycles, motorcycles and vehicles. A majority of the sampled respondents (56.8%) transported their milk on foot. Out of the sampled respondents, 44.5% were non-cooperative members while 12.3% were cooperative members. Out of the 3.4% who used oxcarts to transport their milk, 0.8% were non-cooperative members and 2.5% were cooperative members. Only 0.8% transported their milk through car hires. The *chi-square* results indicate that the mode of transport was statistically significant at 1% level of significance indicating that there were differences in the mode of transport preferred by the cooperative and non-cooperative members.

**Table 10: Mode of transport**

Mode of transport	Non cooperative member		Cooperative member		$\chi^2$
	Frequency	% of Total	Frequency	% of Total	
Public transport	1	0.4	8	3.4	100.368***
Own transport	10	4.2	73	30.9	
On foot	105	44.5	29	12.3	
Ox-cart	2	0.8	6	2.5	
Car hires	0	0.0	2	0.8	
Total	118	50.0	118	50.0	

\*\*\* Significant at 1%.

### Sources of income

The majority of sampled household derived their income from dairy activities. According to the results in Table 11, the average yearly income from milk sales was Kshs. 132,443.11 for non-cooperative members and Kshs. 423,279.03 for cooperative members. There were



significant differences in the mean annual income from milk sales between the two groups at 1% level of significance.

**Table 11: Household incomes**

Household sources of income	Non cooperative member		Cooperative member		T test
	Frequency	Income (Ksh)	Frequency	Income (Ksh)	
Average income from milk sales per year	118	132,443.11	118	423,279.03	4.832***
Average income from livestock sales per year	16	13,156.25	21	41,619.05	4.351***
Average income from off farm activities per month	27	180,444.44	22	301,647.27	2.000**
Average income from other agricultural activities per month	56	86,592.86	49	208,795.92	6.057***
Household average income per month	118	216,610.06	118	573,628.52	5.374***

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

The average income earned from off farm activities was Kshs 180,444.44 and Kshs. 301,647.27 for non-cooperative and cooperative members respectively. The mean difference between average incomes derived from off farm activities was statistically significant at 5% level of significance.

The average household income per year was Kshs. 216,610.06 for non-cooperative members and Kshs 573,628.52 for cooperative members. The mean difference in household incomes was statistically significant at 1% level. This is because cooperative members have larger herd sizes and produce more milk thus having higher incomes from the milk sales. Cooperative members also incurred lower transaction costs since the cooperative gave them a reliable milk outlet and gave them access to price information. The results are similar to the finding of Verhofstadt and Maertens (2013) who found out that the household incomes of cooperative members in Rwanda was 60% larger than that of non-cooperative members. Meena *et al.* (2009) found that the income per household from dairy enterprise was relatively more than non-member group and attributed it to higher milk production because of greater care and management of animals by member groups.

**Table 12: Milk marketing outlets**

Milk marketing outlets	Non cooperative member		Cooperative member		$\chi^2$
	Frequency	% of Total	Frequency	% of Total	
Cooperative	0	0.0	117	49.6	232.034***
Farm gate	97	41.1	6	2.5	142.666***
Do not sell	5	2.1	2	0.8	1.325
Other	52	22.0	10	4.2	38.590***

\*\*\* Significant at 1%.

### Milk marketing outlets and reasons for choosing the market

Milk in the surveyed area was marketed through the cooperative, direct sales at the farm gate or sale of raw milk to nearby homes, hotels, schools and shops. Out the total sampled respondents, 49.6% sold their milk through the cooperative, 43.6% sold their milk at the farm gate, 26.3% sold their milk to shops, schools, hotels and other consumers and 3.0% were not selling their milk during the survey period. According to the results, some farmers utilized more than one milking channel. The results also indicate that 13.6% of the cooperative members also sold their milk at the farm gate and to other consumers. This is shown in Table 12.

**Table 13: Reasons for choosing specified marketing outlet**

	Non cooperative member		Cooperative member		$\chi^2$
	Frequency	% of Total	Frequency	% of Total	
Offer better prices	48	20.3	44	18.6	0.285
Close to production site	49	20.8	26	11.0	10.339***
Can get immediate cash	88	37.3	22	9.3	74.171***
Collection centre nearby	19	8.1	59	25.0	30.639***
Assurance of market	5	2.1	13	5.5	3.849**
Other reasons	7	3.0	4	1.7	0.858

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

In selecting a market outlet, 46.6% of the total sampled respondents cited as the ability to get immediate cash as the reason for choosing the specified marketing outlets (Table 13). The non-cooperative members accounted for 37.3% can be attributed to mistrust of buyers and

brokers who fail to honour their payment obligation. Sampled farmers also cited the fact prices and proximity as factoring in selection of the marketing channel used. Out of the sampled respondents, 39% and 33.1% selected the market channel due to offering better prices and having a collection centre nearby, respectively. Having a collection centre nearby reduced the cost of transport that the farmer would have incurred looking for markets far away even though they would offer better prices. The *chi-square* test was significant at 1% level of significance with more non-cooperative members using this as criteria to choose their market outlet.

### Access to services

#### Access to training

Access to training helps in facilitating dissemination and adoption of new technologies by farmers thus improving milk production. According to the results presented in Table 14, out of the total sampled respondents, 41.1% had participated in dairy training in the past 3 yrs. Non-cooperative members constituted 13.1% and cooperative members constituted 28.0% of those farmers who had attended training on dairy production. The *chi-square* test revealed there was significant difference between cooperative and non-cooperative members. These results were significant at 1% level of significance.

**Table 14: Access to services**

	Non cooperative member		Cooperative member		$\chi^2$
	Frequency	% of Total	Frequency	% of Total	
Participation in dairy production trainings in the past 3 yrs.	3	13.1	66	28.0	21.442***
Access to credit	33	14.0	94	39.8	63.437***
Access to extension services	62	26.3	62	26.3	0.000

\*\*\* Significant at 1%.

The respondents were asked the type of training they had participated in, the duration of training, and the organisation responsible for provision of training. The average duration of any type of training was 1.21 days.

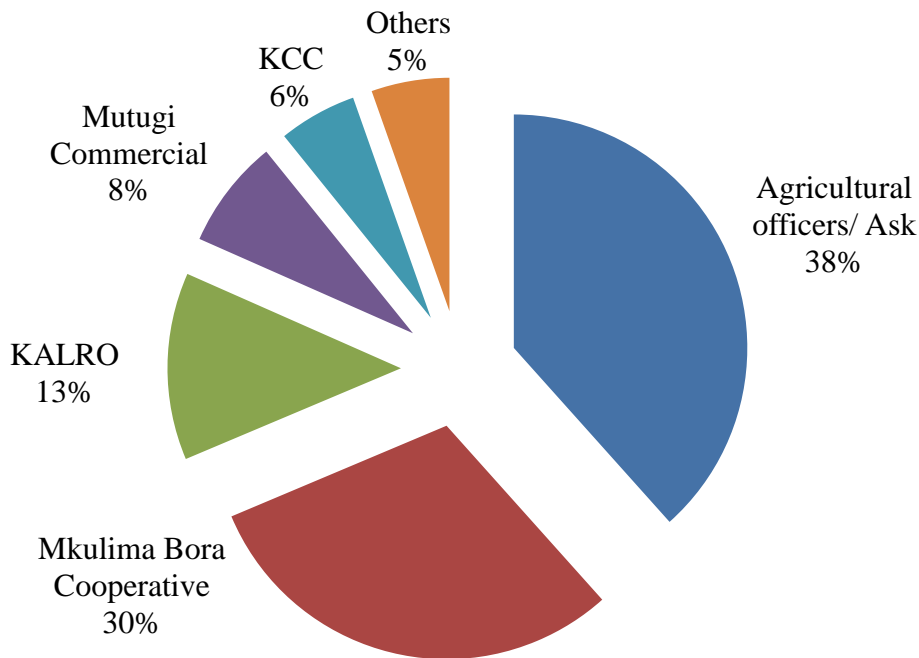
Table 15 provides information on the number of respondents who had attended the training listed in the questionnaire. The respondents who had participated in dairy training had

gained knowledge in proper milking and clean milk handling, dairy cattle feeding, record keeping, dairy health, general farm management, heat detection and milk marketing.

**Table 15: Type of training and average duration of training**

<b>Type of training</b>	<b>Non cooperative member Frequency</b>	<b>Cooperative member Frequency</b>	<b>Average Duration of training (days)</b>
1. Proper milking and clean milk handling	23	57	1.54
2. Record keeping	15	30	1.05
3. Milk marketing	12	23	1.20
4. General farm management	23	32	1.37
5. Dairy Health	15	30	1.07
6. Pasture establishment and management	12	23	1.23
7. Dairy cattle feeding	24	49	1.16
8. Heat detection	16	23	1.09

A number of organizations are involved in training the farmers in different area of dairy production. These organizations include the government, cooperative, Non-governmental organizations (NGOs) and the private sector. As shown in Figure 5, the government through its agricultural officers and its annual Agricultural show of Kenya (ASK) constitutes 38% of the total number of trainings offered. Mkulima Bora cooperative offered 30% of the total training accessed by smallholder farmers in Embu County. The Kenya Agricultural and Livestock Research Organisation (KALRO) was also active in disseminating knowledge to the farmers. It offered 13% of the total trainings on dairy production. Mutugi Commercial Group, a self-help group in the surveyed area also contributed 8% of the total trainings in the county. KCC was also one of the institutions that were conducting farmers training on milk marketing. It constituted 5% of the total trainings undertaken in dairy production.



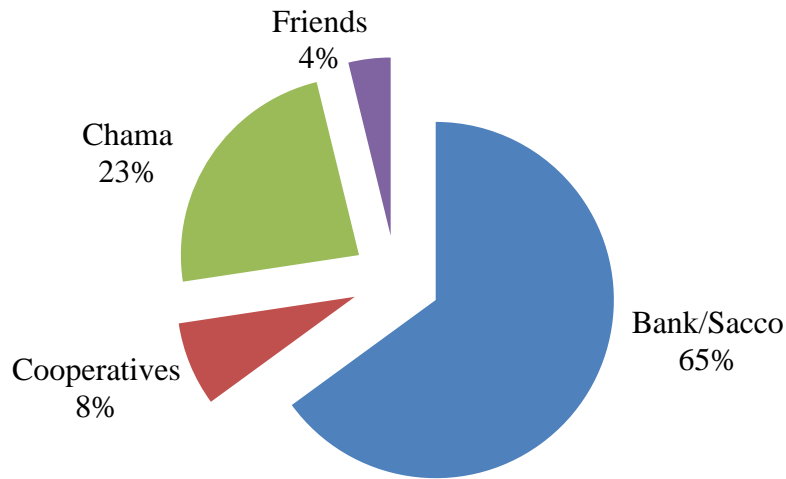
**Figure 5: Organizations responsible for and offering training on dairy production to smallholder dairy farmers**

Other players in training constituted 5% of the total trainings offered. These included Farm Input Promotions Africa (FIPS-Africa), Brookside, Turbo feeds, Ultravetis, private individuals. This only formed a small proportion of the total training offered on dairy production in the surveyed area.

#### **Access to credit**

Access to credit is one of the necessary factors for successful agriculture in the country. Credit enables farmer improve their dairy production. Cooperatives facilitate access to credit because the farmer can use the amount of milk marketed through the cooperative as collateral in accessing loans from financial institutions.

According to the results in Table 14, 53.8% of the sampled respondents had access to credit. Out of this, 39.8% were cooperative members and 14.0% were non-cooperative members. The *chi-square* test revealed that this was statistically significant at 1% level. This is a positive indication that cooperative participation had contributed in meeting the credit needs of smallholder farmers.



**Figure 6: Sources of credit for smallholder dairy farmers**

Out of the sampled respondents, 65% could access credit from banks and Sacco, 8% could access credit from tea and coffee cooperatives, 23% could access credit from “Chamas” and only 4% could access credit from friends and relatives (Figure 6). *Chama* is a Swahili word depicting informal saving and self-help groups that are used to pool and invest savings by people in Kenya.

**Access to extension**

The government of Kenya is the main provider of extension services in Kenya. The main aim of extension is to disseminate research findings and new knowledge to farmer and therefore improve their production capabilities. Only 52.5% of the sampled respondents had accessed extension services as indicated in Table 14. The number of visits by the extension officers per year also depicts the level and speed of adoption of new technologies by smallholder farmers. Out of the total respondents who had contact with extension officers, 73.8% attested to having received visits from the extension officer less than 3 times in one year, 19% had received visits 3-5 times a year. Only 1.6% had received a visit from the extension officer more than 5 times and 4% had not received a single visit from the extension officer in their area. This portrays the low level of extension services in the County.

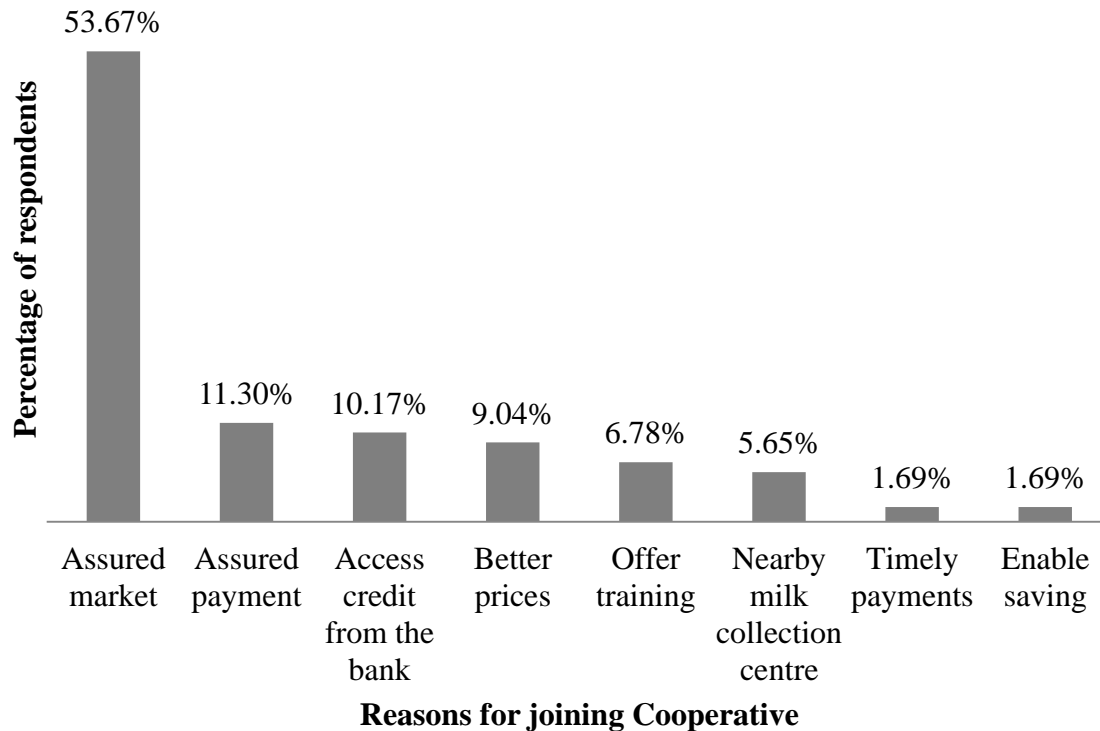
Only 75.2% of the respondents, who had an extension officer operating in the area, found the extension visits helpful in solving the problems they faced, only 75.2% were satisfied with the help they received from the extension officer. This shows that extension visits are very helpful to the farmer and there is need to have more extension officers operating in the surveyed area. The farmers were able to gain knowledge from the extension officers in areas such as improvement in general farming methods, information of disease outbreak, offer livestock vaccination services, how to improve the production and management of livestock.

### **Reasons for joining the cooperative**

There are many reasons that would prompt smallholder farmers to join cooperatives. From the results presented in Figure 7, about 53.67% mentioned that they joined cooperative because it assured them of access to a market. Access to an assured market proves to be a crucial factor in increasing production therefore acting as an incentive to join a dairy cooperative. Assurance of payment (11.30%) and access to higher milk prices from the cooperatives also motivated the farmers to join. The fact that the farmers could use their milk as collateral to access loans from the bank was also another reason why they joined a dairy cooperative.

The other reasons that farmers cited as providing an incentive to join a dairy cooperative include; the fact that they offer training (6.78%), the fact that the milk collection centre was nearby (5.65%), timely payments (1.69%) and the fact that their payment was deposited directly into their bank accounts thus enabling saving (1.69%).

The results showing the reasons why farmers join cooperatives are similar to the findings of Gasanga (2011), who found out that farmers in Rwanda joined cooperatives to gain access to markets for their milk, to be able to work with others, access services such as credit services, access farm inputs and access artificial insemination. Nyirenda (2010) found out that some of the reasons why farmers joined a rice cooperative were to access extension services, access market, it was a source of inputs and some just wanted to follow their friends. In another study by Chibanda *et al.* (2009), farmers joined cooperatives to provide food security for their families, to create employment, their desire for community development and to provide employment to disadvantaged women and orphans



**Figure 7: Reasons for joining the cooperative**

### **Benefits of cooperatives to the smallholder farmers**

Benefits of cooperatives are difficult to measure. Some are tangible or direct as in the case of net margins or savings. Others are intangible or indirect such as cooperatives' effect on market price levels, quality, and service. Most benefits are evaluated in economic terms but some also may be social. Some benefits derived from cooperatives also spill over to non-cooperative members (Mather and Preston, 1990).

In this study, farmers stated the benefits they derived from being cooperative members. From the results presented in Table 16, the main benefit of being a cooperative member is the assurance of a stable and reliable market at 29%. The cooperative has no limit on the amount of milk that their members can deliver to the cooperatives in addition to having a reliable market where they can sell both their morning and afternoon milk thereby minimizing the milk losses. Provision of an assured market is paramount in milk marketing due to its nature in that it is perishable, harvested two to three times a day and its supply and demand is counter cyclic in nature (Staal *et al.*, 1997).



Access to credit from the bank was also one of the benefits stated by the farmers accounting for 20%. This is because the cooperative farmers receive the income on a monthly basis that acts as collateral in case one needs a loan from the bank. Farmers also stated that milk marketing through the cooperative ensured them a steady income flow. Farmers also stated that the fact that cooperatives paid them on a monthly basis enabled them to save and be able to budget for the lump sum income received from the cooperative.

**Table 16: Benefits of being a dairy cooperative member**

<b>Benefits</b>	<b>Frequency</b>	<b>Percentage</b>
Assured market	47	29%
Access credit from the bank	33	20%
Source of incomes	22	14%
Able to save and budget	14	9%
Better prices	12	7%
Improved incomes	11	7%
Assured payment	9	6%
Training	4	2%
Help in upgrading breeds	4	2%
Access information	3	2%
Nearby milk collection centre	2	1%

Some farmers also stated that their incomes improved because marketing their milk through cooperative saw an increase in their milk prices as compared to when they were not members of the cooperatives and the fact that they were assured of payment provided them with an incentive to improve production. Farmers also stated that they benefited from the training and information offered by cooperatives. Cooperatives provide vital information to members on farm production and management practices..

Simelane (2011) found out that the main benefits that farmers, in Swaziland, who were members of dairy cooperatives got were secure marketing outlet for milk, improvement of income, provision of market information, access to credit and acquisition of new techniques and ideas. Gasanga (2011) found out that cooperative helped members access market for their milk, access services such as subsidized AI services, veterinary services, training opportunities. Birchall and Simmons (2009) found out that in Tanzania and Sri Lanka, cooperatives helped their members to access knowledge and training, provided technical information, supplied inputs

to their members and helped members to sell their outputs such as milk from their members. The same study also showed cooperatives also lobby local governments to build roads, provide money for infrastructural development, mediate with road construction companies and contractors and play an intermediary role between the governments and the farmers.

#### **4.2.2 Binomial logit model for socioeconomic factors that influence smallholder farmers' membership in dairy cooperatives**

In this section, selected socioeconomic variables were used to estimate the binomial logit regression model to determine the socioeconomic factors influencing smallholder farmers' membership in dairy cooperatives. Smallholder dairy farmers' decision to become members of dairy cooperatives is determined by various demographic and socio-economic factors.

The 12 latent variables were entered into the binomial logit analysis to determine the subset that would be a good predictor of the dependent variable. Table 17 presents the results of the binomial logit estimation of the socioeconomic factors influencing smallholder farmers' membership in a dairy cooperative. The model correctly predicted 86.44% of the observation. The *chi-square* result was significant at 1% level.

The results indicate that out of the total number of variables considered in the model, seven variables significantly influenced farmers' membership in the dairy cooperative. Age of the respondent had negative significant effect on smallholder dairy farmers' membership in dairy cooperative at 5% level. As the age of the sampled respondent increases by one year, the likelihood of a farmer being a member of a dairy cooperative decreases by 0.68% and was similar to the finding of Alema (2008) and Abate *et al.* (2013). This is an important discovery that younger people are more likely to become members of cooperatives. The reason is that younger farmers are risk takers while older farmers are more experienced and careful when making decisions (Simelane, 2011). The young farmers are more aware of the benefits of cooperatives as compared to older farmers who are reluctant because of cooperatives failures witnessed in the past.

The gender of the household had a positive significant effect on smallholder dairy farmers' membership in dairy cooperative at 1% level of significance. The positive significance indicates that being male increases the probability of a farmer being a member of a dairy cooperative by 15.23%. These results indicate that women remain under-represented at the

membership level in cooperatives and might be due to the asset ownership patterns as per the findings of Majurin (2012).

**Table 17: Binomial logit results for socioeconomic factors influencing membership**

Variable	Marginal effects( $\delta y/\delta x$ )	Coefficient	Standard error	P> z	
Gender	0.1523	1.3535	0.4595	0.003	
Age	-0.0068	-0.08125	0.2110	0.018	
Education level	No formal education(Base level)				
	Primary education level	-0.1155	-1.0251	0.9805	0.296
	Secondary education level	-0.1878	-1.6861	1.0762	0.117
	Tertiary education level	-0.2161	-1.9566	1.2668	0.122
Household size	-0.0116	-0.1033	0.1294	0.425	
Number of adults work on farm	0.0768	0.6823	0.2789	0.014	
Herd size	0.0604	0.5371	0.2480	0.030	
Farming experience	0.0051	0.0453	0.0438	0.301	
Income from off farm activities	-0.0525	-0.4667	0.4766	0.327	
Distance to the market	0.0450	0.3996	0.3996	0.000	
Milk sold per month	0.0000	0.0002	0.0005	0.298	
Access to credit	0.2404	2.1354	0.4283	0.000	
Access to extension	0.0596	0.5263	0.4388	0.228	
Pseudo R2		0.4874			
Chi square		159.45		0.000	
Correctly classified		86.44%			

\*\*\* Significant at 1%, \*\* significant at 5%. Standard errors are presented in parentheses.

The household size is a good indicator of the available labour for dairy production. Household size did not have a significant effect on smallholder dairy farmers' membership in dairy cooperative. However, a closer look at the number of people, over the age of 18 years, in the sampled household who worked on the farm, revealed that there was a significant effect on smallholder membership in dairy cooperative at 1% level. If one more person in the household began working on the farm, the probability of a farmer being a member of a dairy cooperative increases by 7.68%. The household size is a good indicator of the available labour for dairy production. This indicates that cooperative members tend to assign more labour for dairy

production; hence, produce more. Abate *et al.* (2013) found out that the propensity to become a member of agricultural cooperatives is high for households with large family size. Sikawa and Mugisha (2013) results indicate that the higher the number of adults in the household, the more the likely that a cooperative channel will be selected.

Herd size had positive significant effect on smallholder dairy farmers' membership in dairy cooperative at 5% level. The positive sign indicates that addition of one more cow to the smallholder farmer's herd increases the probability of a farmer being a member of a dairy cooperative by 6.04%. This is due to the need to have a more reliable and stable market for the increase in milk production (Sulastri and Marhajan, 2002).

Distance to the nearest market had positive significant effect on smallholder dairy farmers' membership in dairy cooperative at 1% level of significance. This implies that with increase in distance to market, increases the probability of a farmer being a member of a dairy cooperative by 4.5%. This means that the further away the nearest reliable produce market is, the more likely it will be for farmers to become cooperative members in order to access a markets through the cooperative. The farmers pool their milk together and deliver it to the cooperative society thereby incurring lower transportation costs. The results are similar to the findings of Bardan *et al.* (2012) who found out that distance to market significantly and positively increased the likelihood that a milk producer will sell to a dairy cooperative.

Access to credit had positive significant effect on smallholder dairy farmers' membership in dairy cooperative at 1% level of significance. This indicates that if the farmer can access credit this increases the probability of a farmer being a member of a dairy cooperative by 24.04%. This result coincides with the finding of Alema (2008) that credit accessed through cooperatives was essential to farmers to purchase better feeds, improve housing and care for animals and better dairy breeds.

#### **4.3 Effect of cooperatives in minimizing transaction cost faced by smallholder farmers**

The cross-sectional survey data collected in Embu County allows an understanding of the effects of cooperatives in minimizing transaction costs faced by smallholder farmers. Different studies indicate that the transaction costs can be determined by the level of market participation, amount of output sold or monetary value of output sold because of the difficulty in determining

transaction costs (Staal *et al.*, 1997). This study hypothesized that cooperative members incur lower transaction costs as indicated by their higher income from milk sales.

The study thus estimates, as a first step, a Heckman selection probit model to identify causal factors related to farmers decision to participate in dairy cooperative. Based on this estimates an inverse mills ratio was calculated to account for selection bias with respect to estimation of the outcome equation (an ordinary linear equation model) of incomes from milk sales. The second step is to investigate the effect of cooperatives on minimizing transaction cost by looking at the incomes received from milk sale with their membership in cooperatives included, besides other transaction variables and the inverse Mills ratio from the Heckman selection model.

### **Smallholder dairy farmers' decision to participate in the dairy cooperative**

Table 18 presents the results of the selection regression involving the probit analysis of the decision of the dairy farmers to participate in cooperatives. The inverse mill ratio (Lambda) is significant at 5% level of significance indicating that sample selection bias would have resulted if the income equation was estimated without considering the decision to participate in dairy cooperatives.

The gender of the household head positively and significantly influenced farmers' participation in dairy cooperative at 5% level of significance. The results indicate that being male increase the probability of a farmer being a member of a dairy cooperative by 13.10%. This might be due to the membership criteria which hinders not only women but also the youth as the dairy enterprise requires members to own dairy cows, land for housing etc. which are predominantly owned by men (Okeyo, 2010). Age of the respondent had negative significant effect on smallholder dairy farmers' participation in dairy cooperative at 10% level of significance. As the age of the sampled respondent increases by one year, the likelihood of a farmer being a member of a dairy cooperative decreases by 0.57%. The finding on age was similar to the findings of Mburu *et al.* (2007).

Herds size had positive and significant effect on smallholder dairy farmers' participation in dairy cooperative at 1% level of significance. The result indicates that addition of one more cow to the smallholder farmer's herd increases the probability of a farmer being a member of a dairy

cooperative by 9.62%. Increase in the herd size indicates an increase in the milk to be marketed, which requires a reliable market outlet offered by cooperative. This finding is consistent with the finding of Mburu *et al.* (2007).

**Table 18: Heckman two-step participation equation results**

Variable	Marginal effects $\frac{\delta y}{\delta x}$	Coefficient	Standard errors	P value
Gender	0.1310	0.5860	0.2332	0.012
Age (years)	-0.0057	-0.0257	0.0134	0.055
Education level				
No formal education(Base level)				
Primary education level	-0.0428	-0.1864	0.4716	0.693
Secondary education level	-0.1071	-0.4810	0.5191	0.354
Tertiary education level	-0.0773	-0.3421	0.6011	0.569
Household size	-0.0064	-0.0284	0.0665	0.669
Work on farm	0.0504	0.2257	0.1403	0.108
Herd size	0.0962	0.4303	0.1332	0.001
Farming experience	0.0059	0.0262	0.0220	0.233
Income from other agricultural activities	-0.0108	-0.0484	0.2450	0.843
Income from off farm activities	-0.0662	-0.2964	0.2578	0.250
Distance to the market	0.0434	0.1940	0.0397	0.000
Market satisfaction	0.0065	0.0290	0.3038	0.924
Milk sold per month	-0.000	-0.0001	0.0002	0.782
Cost of transport	0.0000	0.0004	0.0001	0.001
Mills lambda	-0.1695	-0.1695	0.0859	0.049
Rho		-0.4334		
Sigma		0.3910		
Pseudo R2		0.4348		
Chi square		14.65***		0.000

\*\*\* Significant at 1%, \*\* significant at 5%, \* significant at 10%.

Distance to the market had positive significant effect on smallholder dairy farmers' participation in dairy cooperative at 1% level of significance. The result indicates that the increase in distance by 1 kilometre from the market increases the probability of a farmer being a

member of a dairy cooperative by 4.34%. The cost of transportation to the milk market also had significant effect on the participation in dairy cooperative at 1% level of significance.

### **Effect of cooperatives on minimizing transaction costs.**

To determine the effects of cooperatives in minimizing transaction costs faced by smallholder farmers, the study estimated an OLS regression in the second step of Heckman outcome equation. The study employed income received from milk sales as a proxy for transaction costs in the sense that higher incomes received from milk sales would imply less transaction costs per unit of output sold.

Table 19 presents the results of the model estimation on the effects of cooperatives in minimizing transaction costs faced by smallholder farmers. As shown in Table 18, eight variables (Herd size, market satisfaction, amount of milk sold, household income, market access, price information, credit access and extension) were significant.

Price information was found to positively and significantly minimize the transaction cost faced by farmers at 1% level of significance. The results show that a unit increase in the price information increased the income derived from milk sales by 1.35. Access to price information is paramount for effective functioning of markets. In addition, farmers who had price information prior to marketing their milk tended to have higher incomes from milk sales. The results are similar to the findings of Svensson and Yanagizawa (2008), who found out that access to market price information resulted in higher farm gate prices.

Total household income also positively and significantly influenced the incomes derived from milk sales at 1% level of significance. Total income, as referred to in this study, is a composite income from milk sales, livestock sales, other agricultural activities income and off farm activities. The results indicate that one unit increase in total household income would increase the income derived from milk sales by 0.8236.

Access to extension also significantly increased the incomes derived from milk sales at 1% level of significance. The results show that a unit increase in extension increased the incomes derived from milk sales by 0.23. Extension officers provide the farmers with information on how to increase milk production, reduce livestock deaths and provide information on changes in government policy. This improves the use of resources and enables farmers to make informed

decisions and hence increase in milk sales. These results are consistent with the findings of Balagtas and Coulibaly (2007), who found out that extension visits provided technical assistance leading to increased production and thus increase in milk sales.

**Table 19: Heckman two-step income model results**

<b>Variable</b>	<b>Coefficient</b>	<b>Standard errors</b>	<b>P value</b>
Herdsizes	0.0590**	0.0284	0.037
Experience	-0.0004	0.0060	0.953
Market satisfaction	-0.1939*	0.1066	0.069
Milk sold per month	0.0002***	0.00005	0.000
Milk loss	0.1223	0.0754	0.105
Logarithm of Household income per month	0.8236***	0.0527	0.000
Training	-0.0752	0.0783	0.337
Market access	0.2402**	0.1102	0.029
Market information	-0.1087	0.2890	0.707
Price information	1.3500***	0.2801	0.000
Credit access	0.1616*	0.0913	0.077
Extension	0.2264	0.0815	0.005
Mills lambda	-0.1695	0.0859	0.049
<i>Wald chi square</i>	724.74***		0.000

\*\*\* Significant at 1%, \*\* significant at 5%, \* significant at 10%.

The milk output sold also had a significant and positive effect on the incomes derived from milk sales at 1% level of significance. The positive relation indicates that the more milk sold the higher the incomes from milk sales. Cooperatives enable farmers to sell more milk due to the fact there is no restriction on the amount of milk the farmer can deliver to the cooperative. With a decrease in the losses that they would incur, farmers therefore sell a higher percentage of milk and thus incurring lower transaction costs. These results are comparable to the findings of Simelane (2011), who found out that the more milk produced and sold the higher the income from milk sales and the lower the transaction costs incurred.

Access to credit also significantly affected the incomes derived from milk sales at 10% level of significance. Increase in credit access increased the incomes derived from milk sales by 0.1616. This might be because the cooperative facilitates farmers' access to credit through the



bank. Farmers can use their milk as collateral when accessing credit from the bank. Access to credit facilitate build-up of assets which contribute to increased and sustainable milk production which has a positive influence on income (Holloway *et al.*, 2000).

Market access had positive and significant effect in minimizing the transaction costs faced by farmers at 5% level of significance. Improvement in market access increased the incomes derived from milk sales by 0.2402. Cooperatives by providing bulking and bargaining services increase market access, and help farmers avoid the hazards of having perishable agricultural products with no market. At the same time, cooperatives offer processors and marketers the advantage of an assured supply of the commodity at known intervals and a controlled price. This finding is similar to the finding of Holloway *et al.* (2000) who acknowledged the fact that dairy cooperatives are potential catalysts for mitigating transaction costs, stimulating entry of smallholder dairy farmers into markets and promoting growth in rural communities.

Herds size was also significantly influenced the incomes derived from milk at 5% level of significance. The results indicate that one unit increase in Herds size would increase the income derived from milk sales by 0.0590. This in line with economic theory and is consistent with the findings of Sulastri and Marhajan (2002), who found out that increase in herds size will lead to a positive increase in the amount of marketable milk leading to higher incomes for dairy farmers.

It was surprising to find out that satisfaction with marketing through the cooperative was significant and inversely related with income derived from milk sale at 10% level of significance given that farmers' satisfaction with dairy cooperatives is of paramount importance especially in terms of relevance and utility of services extended by cooperatives in present context. The results indicate that increase in satisfaction decreased the income from milk sales by 0.1939. This might be because prices are fixed eliminating price fluctuation and minimal risk that the farmers take. Non-cooperative members do not have fixed prices, which might sometimes make them sell their milk at higher prices, but these prices fluctuate based on the relationship between the smallholder farmer and the buyer.

#### **4.4 Constraints and strategies for improving the dairy cooperative**

Cooperatives face many constraints that impede their ability to fulfill their objective of minimizing the transaction costs their members face. Identifying the constraint facing the dairy cooperative will help in developing strategies that enable them to meet their objectives and in turn improve the incomes of their individual members.

Exploratory factor analysis was used to group the variables into possible constraint factors. In order to improve the interpretability of the factors, *Varimax* rotation was used to maximize the loading of each variable on one of the extracted factors while minimizing the loading on all other factors. Table 20 shows the result of the rotated component matrix based on the response of the cooperative members. There were four constraint factors extracted based on a modified cooperative capacity and performance assessment tool, which identified these five factors as vital for cooperatives to achieve their goals. Factors were named using variables with loadings of 0.40 and above as suggested by Comrey (1962). The study used operations capacity, management capacity, supply, marketing and processing and adaptive capacity in naming factors 1, 2, 3 and 4 respectively as stated in USAID (2011).

The variables that loaded high under operations capacity include lack of computerization (0.774), lack of target setting (0.708), inadequate extension and input service provision (0.484), low capital base (0.544), general insecurity in the area (0.633), loans/indebtedness (0.503), manual record keeping (0.685) and use of traditional weighing scales (0.636).

The loadings under management capacity lapsed to include the following: lack of management skills (0.490), inadequate use of financial information (0.67), milk losses due to rejection (0.467), inadequate leadership skills (0.501), inadequate transportation (0.533) and delayed payments (0.424).

Specific issues with high loading under supply, processing and marketing constraints include stiff competition from hawkers (0.470), inadequate milk testing (0.410), mission not well documented and communicated to members (0.553) and inadequate milk testing techniques (0.564). Items that loaded high under adaptive capacity include women and youth not well represented (0.639), limited member involvement mainly during the Annual General Meetings (AGMs) and Special General Meetings (SGMs) (0.539), inadequate member

communication strategy (0.400), limited partnerships (0.537) and no documented strategic plan (0.433).

**Table 20: Possible constraints facing the cooperative**

<b>Rotated Component Matrix</b>				
<b>Possible constraints</b>	<b>Factors</b>			
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Lack of management skills	-0.313	<b>0.490</b>	-0.021	-0.191
Women and youth not well represented	0.049	-0.066	-0.274	<b>0.639</b>
Low member mobilization	0.092	-0.236	0.245	0.195
Limited member involvement mainly during the AGM and SGMs	-0.123	-0.029	0.161	<b>0.539</b>
Budget constraints	0.292	0.213	-0.312	-0.146
Inadequate use of financial information	0.217	<b>0.627</b>	0.266	0.097
Lack of computerization	<b>0.774</b>	0.115	-0.010	-0.021
Inadequate member communication strategy	0.227	-0.047	-0.024	<b>0.400</b>
Low milk intake during dry periods	0.199	-0.337	0.284	-0.386
Stiff competition from hawkers	0.219	-0.087	<b>0.470</b>	-0.020
Inadequate milk testing	0.158	-0.126	<b>-0.410</b>	-0.060
Challenges with value addition	0.254	-0.140	-0.397	0.076
Inadequate cooling facilities	-0.219	-0.361	0.142	-0.128
Low profit margin	0.303	0.199	-0.016	-0.205
Milk losses due to rejection	-0.106	<b>-0.467</b>	-0.067	-0.143
Mission not well documented and communicated to members	0.058	0.073	<b>-0.553</b>	0.265
Lack of target setting	<b>0.708</b>	0.015	-0.194	0.058
Inadequate extension and input service provision	<b>-0.484</b>	0.157	0.141	0.378
Low capital base	<b>0.544</b>	0.036	0.091	0.118
Lack of access to financial services	-0.210	0.011	0.112	-0.108
General insecurity in the area	<b>0.633</b>	-0.139	0.035	-0.084
Loans/indebtedness	<b>0.503</b>	0.190	-0.114	-0.105
Inadequate leadership skills	-0.284	<b>0.501</b>	-0.115	0.019
No documented strategic plan	0.258	0.166	0.225	<b>0.433</b>
Inadequate milk testing techniques	0.049	-0.122	<b>-0.564</b>	-0.060
Underutilization of resources	-0.089	-0.083	-0.033	0.221
Limited partnerships	0.000	0.264	-0.101	<b>0.537</b>
Inadequate transportation	-0.122	<b>-0.533</b>	0.036	0.145
Inadequate staffing	-0.115	-0.033	0.153	0.240
Manual record keeping	<b>0.685</b>	0.122	0.250	-0.039
Poor road networks	0.111	-0.199	0.392	0.101
Use of traditional weighing scales	<b>0.636</b>	0.050	-0.077	-0.045
Inadequate market outlets	-0.184	-0.291	0.351	-0.208
Delayed payments	0.057	<b>0.424</b>	0.008	-0.030

Factors: 1= operations capacity, 2= management capacity, 3=supply, marketing and processing and 4= adaptive capacity

Similar studies show that these problems are also experienced by other cooperatives. Simelane (2011) showed that lack of access to capital, poor management, transportation problems, low member commitment, low member participation and inadequate training were the major problems that dairy cooperatives in Swaziland experienced. Alema (2008) found out that some of the internal problems that cooperatives faced were limited capacity of board of directors and management, inadequate initial capital, poor member participation in the cooperative, lack of transparency and accountability and the failure to involve members in annual meetings. Gasanga (2011) found that at the cooperative level, board members and staff lacked the required qualifications, cooperatives lack access to credits for business expansion and low farmer participation in the cooperative activities. Cooperatives also reported lacking sufficient capacity cooler capacity to chill the milk. Sikawa and Mugisha (2013) found out that delayed payment, low milk prices and high transport costs were some of the constraints faced by marketing through formal milk channels.

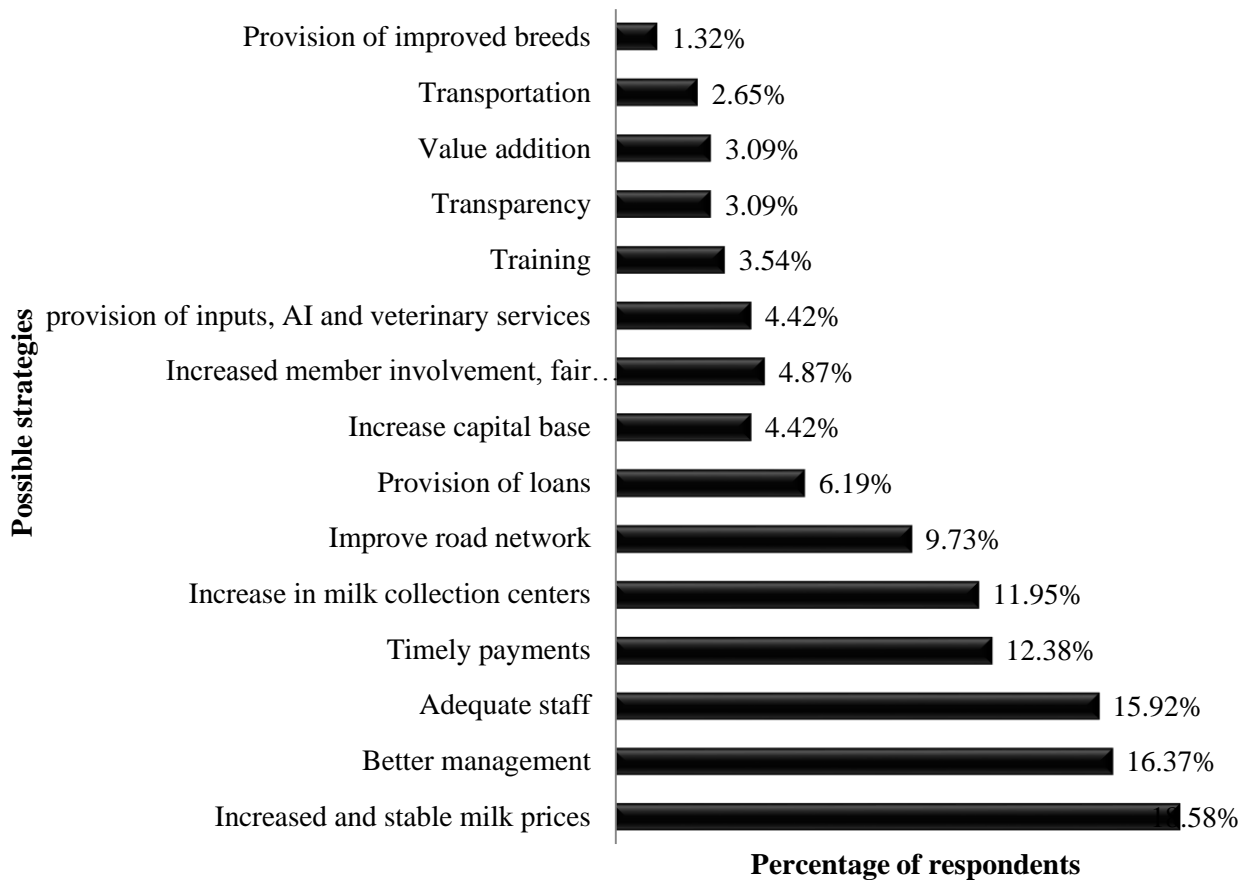
Absence of training facilities, untrained working staff, lack of improved equipment, lack of cooperation and coordination among members, delay in payment of milk, non-availability of loans for purchasing animals, low milk price, discrepant and discrete testing of fat and lack of adequate milk collection centers were some of the constraints faced by daily cooperative societies (Chaudhary and Panwar, 2004).

### **Strategies for improving the dairy cooperative**

Farmers in the study area were asked what they thought would be the best strategies for improving on the services they got from their cooperatives. According the results shown in Figure 8, about 18.58% of the responses by the interviewed farmers stated that they would like to have increased and stable milk prices, 16.37% wanted to have better management, 15.92% wanted the cooperative to have adequate staff to ensure faster and timely service delivery.

Approximately, 12.38% of the responses thought that timely payments would be a good strategy for improvement of the cooperatives. Farmers wanted the payments to be deposited in the bank accounts by the within the stipulated date and not later. Increase in milk collection centres and improvement in the road network were also strategies that the farmers thought were best for improving their cooperatives. About, 11.95% of the responses thought that the

cooperative needed to increase the number of milk collection centres in the area while 9.73% thought that improving the road network would reduce the time taken to deliver milk to the cooperative, reduce the cost of transportation incurred by farmers to reach the milk collection centres and would be an incentive for new members to join the cooperatives. Approximately, 6.19% of the responses thought that provision of loans would be a good strategy for improving their cooperative. Farmers found that although they were guaranteed loans from their bank using milk as collateral, they preferred that they got loans from the cooperative.



**Figure 8: Strategies for improving dairy cooperatives**

Some farmers felt the need for cooperatives to increase their capital base as another strategy towards improving the cooperative by giving it a competitive edge with other milk players in the country. This strategy accounted for 4.42% of the responses. The respondents also

felt there was a need to increased member involvement, fair representation and mobilization of new members (4.87%). Other strategies that the respondents felt were needed to improve the cooperative included: provision of inputs, AI and veterinary serives (4.42%), training (3.54%), transparency in the use of the cooperative funds(3.09%), value addition(3.09%), transportation(2.65%) and provision of improved breeds (1.32%).

Karki (2005) established the need for cooperatives in developing countries to give emphasis to dairy education and training, adoption of high yielding and efficient breeds, offering financial assistance to farmers. Cooperatives also need to come up with ways of containing dilution of milk supplied to the cooperatives.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATION**

#### **5.1 Summary**

The study was carried out to determine the effectiveness of cooperatives in improving the incomes of dairy farmers in Embu County Kenya. The study was done through a cross-sectional survey. A sample of 236 dairy farmers was randomly selected and interviewed using a structured questionnaire. Data was analysed using SPSS and STATA software.

In terms of the transaction costs that farmers faced, cooperative members faced lower transaction costs than non-cooperative members. Lower transaction costs were achieved through lower milk losses, higher market access among cooperative members thus creating more income generating opportunities and provision of market information to smallholder farmers resulting in increased milk production. In addition, the results also a reduction in the need for farmers to search for reliable and current price information resulted in lower transaction costs.

Econometric results for the smallholder dairy farmers' decision to participate in dairy cooperative found five factors that significantly influenced this decision. Gender, age, herd size, distance to the market and the cost of transportation were found to influence this decision. Being male increased the probability of a smallholder dairy farmer being a member of a dairy cooperative due to the membership criteria requiring members to own dairy animals. Younger farmers were also more likely to participate in dairy cooperatives due to their affinity for higher risk taking. Incurring additional dairy cows also increased the likelihood of a smallholder farmer participating in a dairy cooperative due to the need to have a reliable and stable market for the increased milk production. Distance to the nearest market also had a positive effect on smallholder membership in dairy cooperatives. Farmers who lived far away from nearest market were more likely to be members of dairy cooperative because they could access market through the cooperative.

Using income from milk sales as a proxy for transaction costs, the results of the model estimation on the effects of cooperatives in minimizing the transaction costs faced by smallholder farmers found eight variables to be significant. Herd size, market satisfaction, amount of milk sold, household income, market access, price information, credit access and

extension significantly affected the income received from milk sales thereby reducing the transaction costs faced by smallholder farmers.

On the other hand, the cooperative was facing some constraints that impede their ability to fulfil their objective of minimizing transaction costs faced by their members. These constraints included delayed payments, lack of management skills, women and the youth were not well represented, limited member involvement, lack of computerization, inadequate member communication strategy, stiff competition from hawkers, inadequate milk testing, milk losses due to rejection, lack of target setting, low capital base, general insecurity, no documented strategic plan and limited partnerships.

The study also came up with a list of strategies the smallholder farmers thought were best for improving on the services they got from their cooperatives. These strategies included increased and stable milk prices, better management, adequate staff, timely payments, more milk collection centres, improved road network, provision of loans, increase on capital base, provision of loans, provision of inputs, artificial insemination and veterinary services.

## **5.2 Conclusion**

Based on the results of this study, cooperatives have made positive contribution in minimizing the transaction costs faced by smallholder farmers in Embu County. Farmers now have a stable source of income and incur lower milk losses. Farmers also have access to information and extension services. Farmers in the study also reported to have witnessed a positive income increases since joining the cooperatives.

## **5.3 Recommendations**

Based on the results of the study, the following recommendations are necessary for the reduction of transaction costs among smallholder dairy farmers and improvement of cooperatives. Access to credit is one of the constraints faced by smallholder dairy farmers in the region. Access to credit enables farmers to increase their assets and thus improves their dairy production. There is need for the cooperative to provide credit for their members as opposed to the members using their milk as collateral when obtaining loans from the banks. The cooperative should also provide credit at a reduced interest rate and in so doing reduce the transaction costs that dairy farmers face.



Efforts towards reduction of transaction costs among smallholder farmers should also focus on increasing awareness about the benefits of cooperative membership. This will lead to improved membership base and make it economically viable to increase the number of milk collection centres. There is need for the management to focus their efforts towards mobilizing farmers into the members of the cooperatives and help cooperatives become an adept tool for economic development. There should also be increased effort to mobilize women and the youth into the cooperative.

There is need for both County and National governments to support dairy cooperatives in the marketing of their milk. This will motivate farmers and help strengthen the cooperative thus promoting better production and marketing activities. This includes infrastructure development, access to credit services and provision of training and extension services. This will enable cooperatives to diversify their operations making them effective at reducing the transaction costs faced by dairy farmers.

#### **5.4 Areas for further research**

The study was to determine how effective cooperatives were in minimizing the transaction costs in Embu County. This is only one county out of the forty-seven counties in the country, which may not be representative of dairy cooperatives in the country. It is therefore worthwhile that similar studies be undertaken in all other counties.

It is also suggested that a panel data study on the performance of cooperative be undertaken to focus on the development programs of the cooperative. This will enable identification of success and failure factors to enable replication in other areas.

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**APPENDIX**

**Data collection Instrument**

**Farmer questionnaire**

I am a student from Egerton University studying effectiveness of dairy cooperatives in increasing livelihoods of smallholder farmers in Embu County. The purpose of this study is to understand how cooperatives contribute to reducing some of the transaction costs that farmers face. Your participation in this study will be highly appreciated. Your responses are completely confidential and will be used for research purposes to help improve milk marketing. Am also talking to other farmers and your responses will be used with responses from other farmers to generate an overall feel of how cooperatives are helping dairy farmers in Kenya

**A. General Information**

Name of farmer: ..... Telephone No: .....

Date of interview: ..... Name of enumerator: .....

Village Name.....

Member of cooperative: \_\_\_\_\_(1= member, 2= non-member)

**B. Household characteristics**

1. Gender of farmer: \_\_\_\_\_ (1= Male, 2= Female)
2. Age(years): \_\_\_\_\_
3. Education Level(Years): \_\_\_\_\_ (1=No formal education, 2= Primary education, 3= Secondary education, 4=Tertiary education)
4. Household size: \_\_\_\_\_
5. Number of adults (above 18 years):

Working on the farm	
Working off the farm	
Total	

6. Dairy herd size: \_\_\_\_\_
  7. Farming Experience(years): \_\_\_\_\_
  8. Sources of income: \_\_\_\_\_ ( 1= Dairy, 2= Other agricultural activities, 3= Off farm employment, 4= Pension, 5= other)
- If other (specify) \_\_\_\_\_

Type of asset	Initial Cost (Kshs)	Estimated useful life(years)	Current value of asset (Kshs)

(1= milk parlour, 2= milk machine, 3= milking utensils, 4= dairy cows, 5= chilling facilities e.g. refrigerator, 6= other)

### C. Dairy marketing activities

9. Where do you sell your produce? \_\_\_\_\_ (1=Cooperative, 2= Farm gate, 3=Don't sell, 4=Other)

Other (specify) \_\_\_\_\_

10. Reasons for choosing the specified marketing channel: \_\_\_\_\_ (1= Close to production site, 2= Offer better price, 3= Can get immediate cash, 4= Collection centre nearby)

Other (specify) \_\_\_\_\_

11. Distance travelled to market (Kilometres): \_\_\_\_\_

12. Are you satisfied with the marketing channel you use? \_\_\_\_\_ ( 1=Yes, 2= No)

13. If not why? \_\_\_\_\_

14. Quantity of milk sold ( 1=Cooperative, 2= Farm gate, 3=Don't sell, 4=Other)

Receiving agents	Quantity sold per day (liters)	Quantity sold per week (Liters)	Price @ liter (Kshs)	Amount of money received per week(Kshs)	Amount of money received per month (Kshs)



#### D. Transport

15. How do you transport your milk to the market? \_\_\_\_\_ (1= Public transport, 2= Own transport, 3= On foot, 4= Ox cart, 5=Car hires, 6=Other)

Other (specify) \_\_\_\_\_

16. How much does it cost to use the mode of transport you have mentioned?  
\_\_\_\_\_

17. Are there any major constraints in relation to transportation of your produce to the market? \_\_\_\_\_ (1= Expensive, 2= poor roads, 3= long distances, 4= Other)

Other (specify) \_\_\_\_\_

#### E. Milk losses

18. Do you incur any milk losses? \_\_\_\_\_ (1= yes, 2= no)

19. If so how much do you lose per week? \_\_\_\_\_ (1=less than 5 litres, 2= 5-10 litres, 3= more than 10 litres)

20. What do u attribute the losses to? \_\_\_\_\_ (1=long distance to market, 2= poor milk handling, 3=Lack of chilling facilities, 4=Minimal market opportunities, 5=Other)

Other (specify) \_\_\_\_\_

21. How do you deal with spoiled milk? \_\_\_\_\_ (1= Used for home consumption, 2= Fed to calves, 3= Used to make sour milk, 4= Given to neighbour, 5=Other)

#### F. Household income

Source of income	Amount per month (Kshs)	Total Amount per year (Kshs)
Milk sales		
Livestock sales		
Off-farm employment		
Other farming activities		
Other		

#### G. PROVISION OF SERVICES

##### Training

22. Have you ever participated in dairy production training for the past three years? \_\_\_\_\_ ( 1= yes, 2= no)

23. If yes, specify the type of training and the organization responsible for the training:

	Type of training	Duration	Organization
1.	Proper milking and clean milk handling		
2.	Record keeping		
3.	Milk marketing		
4.	General farm management		
5.	Dairy health		
6.	Pasture establishment and management		
7.	Dairy cattle feeding		
8.	Heat detection		
9.	Other		

24. Has the training been helpful in gaining knowledge and skills to solve your practical problems related to dairy production and marketing? \_\_\_\_\_ (1= yes, 2= no)

If not, why?

\_\_\_\_\_

### Transaction cost factors

25. Do you have access to the market? \_\_\_\_\_ (1=yes, 2= no)

26. What is your source of market information? \_\_\_\_\_ (1= Extension officer, 2= NGO, 3=Radio, 4= Newspaper, 5= Cooperative 6= Other)

27. Are you aware of any price changes in the market? \_\_\_\_\_ (1= yes, 2= no)

28. What is your source of market price information? \_\_\_\_\_ (1= extension officer, 2= NGO, 3= radio, 4= newspaper, 5= cooperative, 6= other)

29. Do you have access to credit? \_\_\_\_\_ ( 1= yes, 2= no)

30. What are the sources of credit?

\_\_\_\_\_

(1=banks/Sacco, 2= cooperatives, 3= Chama, 4= friends, 5= other)

Others, specify \_\_\_\_\_

### Extension service

31. Do you have an extension officer operating in the area? \_\_\_\_\_ (1= yes, 2= no)

32. How many times does he visit in a year? \_\_\_\_\_ (1= < 3 times, 2=3-times, 3=5-10 times, 4. > 10 times, 5 Not at all)

33. Have the visits been helpful? \_\_\_\_\_ (1=yes, 2= no)

34. If yes, how? .....

### K. Cooperative members

**Membership of the dairy marketing cooperative and benefits obtained**

35. What were the main reasons motivating you to be a member of the dairy cooperative?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

36. How long have you sold milk to the cooperative? \_\_\_\_\_ (1=Less than a year, 2= 1-3 years, 3= Greater than 3 years)

**Benefits of being a cooperative member**

37. Ways in which the cooperative has been of help to you?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

38. Are there any changes in your income since you have been marketing your milk through a cooperative? \_\_\_\_\_(1= yes, 2=No)

39. Do you think being a member of a cooperative is more advantageous than being on your own?\_\_\_\_ (1=yes, 2= no)

Please explain why \_\_\_\_\_

40. Do you believe that the dairy cooperative is doing a good job in solving problems that farmers are facing these days? \_\_\_\_\_(1= yes, 2= no)

41. If not, what are the major commonly felt problems that are not being solved by the cooperative in your area? \_\_\_\_\_

1. Lack of adequate milk collection centers near my home	2. Lack of adequate dairy inputs for members
3. Lack of access to necessary services	4. Lack of chilling facilities to preserve milk
5. Lack of support by Government and other stakeholders	6. High transaction costs
7. Others (specify)	

**Governance of cooperatives**

42. Are you satisfied with coop leadership? \_\_\_\_\_ (1= yes, 2= no)

43. Are leaders elected through voting of members? \_\_\_\_\_(1= yes, 2= no)

44. Are you satisfied with the way elections are held? \_\_\_\_\_(1=yes, 2= no)

45. Are the leaders transparent and accountable, especially in the utilization of funds? \_\_\_\_\_ (1= yes, 2= no)

46. What are the main constraints the cooperative is faced with?

1. Lack of management skills	2. Women and youth not well represented
3. Low member mobilization	4. Limited member involvement mainly during the AGM and SGMs
5. Budget constraints	6. Inadequate use of financial information
7. Lack of computerization	8. Inadequate member communication strategy
9. Low milk intake during dry periods	10. Stiff competition from hawkers
11. Inadequate milk testing	12. Challenges with value addition
13. Inadequate cooling facilities	14. Low profit margin
15. Milk losses due to rejection	16. Mission not well documented and communicated to members
17. Lack of target setting	18. Inadequate extension and input service provision
19. Low capital base	20. Lack of access to financial services
21. General insecurity in the area	22. Loans/indebtedness
23. Inadequate leadership skills	24. No documented strategic plan
25. Inadequate milk testing techniques	26. Underutilization of resources
27. Limited partnerships	28. Inadequate transportation
29. Inadequate staffing	30. Manual record keeping
31. Poor road networks	32. Use of traditional weighing scales
33. Inadequate market outlets	34. Delayed payments
35. Other( specify)	36. Other( specify)

47. Do you wish to remain a cooperative member? \_\_\_\_\_(1= yes, 2= no)

48. What are your suggestions on improving cooperatives

1.	
2.	
3.	
4.	
5.	

**Thank you!**