FACTORS INFLUENCING CHOICE OF MARKET AND EXTENT OF PARTICIPATION AMONG SMALLHOLDER DAIRY FARMERS IN KURESOI NORTH SUB-COUNTY, KENYA

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DECLARATION AND RECOMMENDATION

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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Recommendations

This thesis has been submitted to the graduate school with our approval as university supervisors

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DEDICATION

I dedicate this work to my parents for their sincere love and commitment towards my studies. My dedication also goes to my beloved wife and children for their sacrifice, prayers, social and moral support. It was a sacrifice on their part but I hope the quality of their lives will improve in the years to come.

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ABSTRACT

Kuresoi North Sub-County has experienced a rapid expansion in milk production and there exist both formal and informal milk market outlets. With these abundant opportunities, much of the produced quantities are expected to enter the market and farmers' livelihoods be improved. However, it is not clear whether the smallholder milk producers are exploiting the existing and emerging market opportunities. The specific objectives of this study were: to characterize the milk markets and smallholder dairy farmers; to determine the factors influencing choice of milk market outlets, and to determine the factors influencing market participation and the extent among small holder dairy farmers in Kuresoi North sub-county. Multistage sampling procedure was employed to select 196 respondents and a semi-structured and pre-tested questionnaire was used to collect data from smallholder milk producers. SPSS and STATA computer programs were used to analyze the data. The results showed that occupation of the household, group marketing, access to credit, distance to market point, number of cows, milk volume, price of milk and type of breed significantly influenced the choice of milk marketing outlets. Education level, credit access, number of cows, milk volume and mode of payment significantly influenced the decision to participate in milk marketing. Further, gender, price information, price of milk, marketing experience, household size, distance to market and marketing under contract significantly influenced the extent of market participation. This study recommended that, for improved market participation among smallholder dairy farmers in the sub-county, extension service which was identified to be lacking in the study area must be put in place. The county government and other policy makers should also increase marketing information and capacity building by promoting expansion of dairy farming and linking the farmers to alternative markets thus improving their returns.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

CBS	Central Bureau of Statistics
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GoK	Government of Kenya
IEBC	Independent Electoral and Boundaries Commission
ILRI	International Livestock Research Institute
KCC	Kenya Cooperative Creameries
KDB	Kenya Dairy Board
KNBS	Kenya National Bureau of Statistics
MVP	Multivariate Probit
MoLD	Ministry of Livestock &Development
NCIDP	Nakuru County Intergrated Development Plan
NGO`s	Non-Governmental Organizations
RUM	Random Utility Model
SDP	Smallholder Dairy Project

CHAPTER ONE

INTRODUCTION

1.1 Background information

Dairy farming is one of the key economic activities practiced in most parts of developing countries. It is one of the income generating activities that contributes to the alleviation of poverty and ensuring that farmers get regular cash flows as opposed to other intermittent incomes such as crop cultivation and other forms of livestock keeping, like bee, poultry, sheep and pigs (FAO, 2011).

In Kenya, dairy farming subsector contributes about 4.5 percent of the country's Gross Domestic Product (GDP) and approximately 14 percent of total agricultural products output (KDB, 2014; KNBS, 2009). About 70 percent of the dairy farmers in Kenya are smallholders, many of whom are situated in the Rift Valley and Central regions (Smallholder Dairy Project, 2008). This subsector also contributes a highly significant share of food for the majority of the Kenyan population as well as providing a direct livelihood opportunity to more than 650,000 smallholder farmers. The subsector creates employment in various parts of country, milk processing plants, development of industries dealing with manufacture of inputs such as animal feeds, milk cans, and pesticides. Some of the milk products like cheese and butter are rich in proteins, fats, mineral salts and vitamins which are essential for human health (KDB, 2014).

The dairy sector in Kenya recorded significant growth between 2005 and 2012, as evident from the increases of recorded milk production from 2.650 to 3.733 billion litres, dairy herd size growth from 3.5 million to 4.2 million and per capita per cow milk output increase from 757 to 898 litres over the same period (FAO, 2014; GoK, 2013). Kenya is currently the leading milk producer in the East African countries and the demand for milk by its consumers is estimated to be growing at 3.6% per year (FAO, 2014). This is because of the increasing population, high milk purchasing power and more so, the increasing market penetration into the previously non-milk consuming areas.

Annual milk production has been rising steadily in Kenya over the years despite the land sub-divisions in the country. The increase in milk production which has led to surplus and

unprocessed milk with the concurrent increase in the volume of imported skimmed milk may be attributed to lack of appropriate or weak marketing outlets and inefficiency of processing plants, which hardly utilize the 50 percent of the installed annual processing capacity of 985 million litres in Kenya (KDB, 2013). Though the farmers have reduced the number of animals kept due to small land holding, they are still practicing dairy farming leading to an increase in milk volume produced. The large quantity of milk available for sale therefore implies that there are significant number of households that are involved in the milk value chain either as producers, processors, marketers or consumers but do not participate in the existing marketing outlets.

The expansion of milk market and its products has been an incentive for many smallholder farmers who engage in dairy farming as well as meeting the daily basic needs. Majority of these farmers are taking dairy farming as a business with the aim of maximizing profits but produce for unidentified markets. This exposes their milk produce to market and price shocks which are never determined. Farmers try to integrate their production with other activities along the value chain produce milk for an identified market in addition to seeking new market opportunities that offer higher returns and hence improving their economy.

Despite the growth in milk marketing and productivity, the dairy sub-sector is faced with infrastructural bottlenecks that are caused by poor road networks, lack of appropriate cooling and storage facilities and poor road infrastructure in the smallholder production areas. During the glut months, surplus milk cannot be absorbed in the domestic market. In most parts of the dairy production areas, it has been identified that milk production has a potential to increase the income generating productivity of smallholders' assets (Wambugu *et al.*, 2011). The opinion that the dairy sector's performance has not lived up to its potential underscores the importance of understanding what motivates households to practice dairy and choose to participate in dairy markets, and why some households appear to exploit attractive production and marketing opportunities while others cannot.

Kuresoi North sub-county is one of the leading milk producing zones in Rift Valley region of Kenya, with majority of its residents practicing dairy farming. There has been an increase milk production in the sub county. For instance, in the year 2013/2014, there was an increase in production from 78,757,297 liters to 103,364,483 liters per year. This is an

approximate of 35% increase, which is a tremendous impact in the sub county (KNBS, 2015). According to Daily Nation (2015), the major milk processors in the country have partnered with cooperatives in the sub-county to collect and bulk members' milk before selling it to processors. The county government of Nakuru also planned to install coolers in this sub-county in partnership with milk processor Brookside.

According to Mutua-Kiio and Muriuki (2013), 35% of total milk output in Kenya is consumed on farms while the rest is marketed. Moreover, it is estimated that, 20% of marketed milk flows through KCC and private processors like Brookside (FAO, 2014). The remainder of the marketed milk is sold as unprocessed milk to informal markets such as hawkers, neighbors, hotels, institutions, milk bars, small scale processors, or converted to *mala* (KDB, 2014). The dramatic increase in the number of informal milk traders in milk marketing is a phenomenon prompted by the liberalization of dairy sub-sector.

In a properly functioning market, marketing outlets have to guarantee that milk consumers can buy and that producers can sell their milk at reasonable prices in the market place. Although such opportunities stand to generate additional income to smallholder farmers, the outlets still remain under exploited among the farmers. Additionally, inability of smallholder dairy producers to participate in markets is one of the major limitations in harnessing opportunities in the country's dairy production and marketing. Availability of marketing outlets guarantees economic returns to smallholder dairy farming. Therefore, the importance of facilitating market access by dairy farmers is a valuable precondition in improving their livelihoods. Hence, the expansion of smallholder market participation forms one of the most important factors in economic growth and poverty reduction in rural areas**.**

1.2 Statement of the problem

Kuresoi North Sub-County has experienced a rapid expansion in milk production and there exist both formal and informal milk market outlets. Majority of farmers have ventured into milk production due to the high market value associated with the product and its contribution household income. Markets and improved access by smallholder famers in the rural areas, like Kuresoi north, are a precondition for increasing agri-based economic development and related smallholder household incomes. There is high demand for milk in both rural centres and urban

areas of Nakuru County. With these abundant opportunities, much of the produced quantities are expected to enter the market. However, it is not clear whether smallholder milk producers in Kuresoi north are exploiting the existing and emerging market opportunities. If the smallholder producers cannot participate in these markets, it leads to low farm incomes and thus reduced welfare. Therefore, this research sought to identify the determinants of choice of markets and the extent of market participation among smallholder dairy farmers in Kuresoi North Sub-County.

1.3 Objectives of the study

1.3.1 General objective

The general objective of this study was to contribute improved household incomes through establishing determinants of choice and extent of market participation among the smallholder dairy farmers in Kuresoi North Sub County, Kenya.

1.3.2 Specific objectives

i. To characterize the milk markets and smallholder dairy farmers in Kuresoi North sub-county.
ii. To determine the factors influencing choice of market outlets and quantity among smallholder dairy farmers in Kuresoi North sub-county.
iii. To determine factors influencing market participation and the extent among small holder dairy farmers in Kuresoi North sub-county.

1.4 Research questions

i. Which are the market outlets and what are the characteristics of smallholder dairy farmers in Kuresoi North sub-county?
ii. What are the factors influencing choice of market outlet among small holder dairy farmers in Kuresoi North sub-county?
iii. What are factors influencing market participation and the extent among small holder dairy farmers in Kuresoi North sub-county?

1.5 Justification

In the recent past, efforts of developing agriculture in Kenya have mainly focused on the demand side of the sub-sector without giving much attention to the supply and the market choices. Most studies have shown that smallholder farmers have not benefited from increased livestock production in the absence of markets. Dairy farming plays a major role in Kenya's economic development and is a key contributor to poverty reduction in the country. In this regard, milk production constitutes one of the important agricultural products in Kenya.

Literature on dairy market outlet choices has been thin, especially in developing countries like Kenya where significant factors make this question most salient. It is important to note that none of past and recent studies has identified factors affecting milk market outlet choices, participation and its extent in Kuresoi North sub-county despite the high potential of milk production and marketing in the area. It is common to see household choices among these market outlets. The basic question to ask is on the factors influencing the choice of marketing outlets and the extent of participating in these outlets. This is a crucial phenomenon of identifying the factors faced by households in choosing marketing outlet on realizing the millennium development goals.

Since dairy farming is the main agricultural occupation in Kuresoi North Sub-county, it was important to ensure that the activity is improving the welfare of the farmers. By identifying the factors that influence the choice decision of various markets and the extent of participation, it would be possible to design interventions in terms of effective policies, research, extension, and programs that would promote dairy farming and linking resource-poor smallholder farmers to markets. It further provided an empirical basis for identifying options to increase dairy market outlet choices among smallholder dairy farmers in the sub county.

1.6 Scope and limitation

This study targeted only smallholder dairy farmers in Kuresoi North Sub County who kept less than 5 dairy cows on given piece of land. The fact that smallholder dairy farmers do not keep proper records was a limitation of the study. Since they were the actual owners of the dairy enterprise, their responses were treated as accurate and reliable information.

1.7 Definition of terms

Market participation – refers to the level of smallholder's involvement in the activities of milk marketing in Kuresoi sub - county.

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

Socioeconomic factors – are factors that influence both the social and economic wellbeing of an individual farmer in Kuresoi sub - county

Institutional factors – are formal and informal rules that govern transaction activities between individual or among groups of people in the sub-county.

Market factors – any external factors that may affect the supply or price of milk by farmers in Kuresoi sub-county.

Market outlet – defines the different selling points of milk by farmers in Kuresoi sub-county

Market outlet choice – the individual farmer decision to choose where to sell their milk among the available outlets in the sub-county

Extent of market participation - it refers to the quantity of milk supplied to the market by individual farmers in Kuresoi sub-county

CHAPTER TWO

LITERATURE REVIEW

This chapter presents the literature related to choice of marketing outlets and market participation as well as the research gaps the study aimed to address. Market participation entails the ability of farmers to buy inputs and sell output in the respective markets. Market extent measures the quantity of milk sold by farmers. Therefore literature is reviewed from these perspectives.

2.1 Concept of market participation

Participation means sharing by people the benefits of development, active contribution by people to development and involvement of people in decision making at all levels of society (Barret, 2008). The involvement of people in activities through participatory approach is in the scenes such as; participation in decision making; participation in implementation of programmes and projects; participation in monitoring and evaluation and participation in sharing the benefits of development. The significance of participating in markets is based on the productivity of the farmer and incomes earned. Thus livelihoods of smallholder farmers who produced and sell are likely to improve if they have better access to markets for their produce (World Bank, 2008). Markets and improved market access for smallholder famers in the rural areas are a precondition for increasing agriculture-based economic development and increasing smallholder rural household incomes (World Bank, 2008).

Literature reveals that farmer participation in different markets is very important in improving individual's economy in the sense that humans derive benefits such as income and rural employment from farming (Chalwe, 2011; Makhura, 2001). In other words, farming in rural areas act as a form of employment for the smallholder farmers and help in income generation. However beyond production level activities, producer participation in marketing allows for the transition from subsistence production farming to commercial farming (Makhura, 2001). This implies that farmers who participate more in selling their produce are more likely to advance from small scale production to large scale production.

Milk producers do participate in different market outlet like formal, informal or both outlets. Market participation is highly for those households owning dairy cows. In this sense, ownership of dairy cows aimed at selling milk to an outlet is the relevant discrete market participation decision. For this study, market participation is operationalized by two determinant dimensions, that is, the level of smallholder's involvement in the activities of milk marketing and milk sales income. According to Best *et al*. (2005), one of the major constraints in combating poverty in Africa is the lack of market participation by smallholder agricultural households. FAO (2003) also noted that for optimal allocation of resources and economic and stimulating households to increase output for economic development, an integrated, efficient and responsive market that is marked with good performance is of crucial importance to smallholder farmers.

2.2 Factors influencing the choice of marketing outlets

Choice for the milk marketing outlet is a farmers decision on where to or not to sell their milk. The choice of milk market outlet is determined by the price the farmers receive from the sale of milk. Choice of a marketing outlet is one of the key ingredients to successful marketing of both agricultural and non-agricultural products in the world. This is so because different marketing outlets are characterized by different profitability levels and costs. According to Tsourgiannisa (2008), marketing outlets used when selling a product has a bearing on the benefits farmers may get from that channel.

Therefore, Studies on marketing outlet choice decisions are very important especially in a liberalized market economy like Kenya dairy markets, where there are many alternative market outlets and therefore open to the milk sellers/producers choice. Most of the recent empirical studies of market outlet choices done in various fields of agriculture assume that farmers consider a set (or bundle) of possible outlets and choose the particular marketing outlet that maximize profit or the expected utility. They also assume that in the event of addition or deletion of alternative outcome categories, it does not affect the odds among the remaining outcomes and the odds of choosing a particular market outlet over the other do not depend on which other outcomes are possibly chosen. However, in the present study more than one marketing outlet is available in the study area and smallholder farmers are more likely to simultaneously choose more than one market outlet at a time in order to address their needs. In this case, the dependent

variables are the dichotomous variables indicating whether sales are made through the relevant marketing outlet. Smallholder dairy farmer are likely to choose the outlet which gives higher benefits.

Marketing milk can be seen from different perspectives; At the farm level, the traditional market is represented by the private milk traders or vendors who usually buy milk directly from milk producers and supply it also directly to the urban consumers, or to informal institutional market buyers such as restaurants, tea stalls, etc. or wholesalers and other retailers. They often operate on small scale volumes of milk, handling less than 100 litres of milk per day. On the other hand, Dairy cooperatives and private formal processors, collect milk at the established collection points in villages, and unlike informal markets, milk price paid to farmers is generally scaled according to milk quality measured by the amount of fat and solid not fat.

Most of the literature provides that socio economic status of the individual household farmer influences decision making on a number of issues at farm level like the choice of market outlet to use and factors such as, income from off-farm activities, availability of capital, milk output prices, size of land, farmer education and extension trainings and availability of family labor are some of the variables which influence a dairy farmers' decision on dairy operations (Angula, 2010).

According to Zuniga and Ruben (2007), in the investigation of determinants of market outlet for mango producers in Costa Rica, the researcher found that four major factors in their analytical framework influences the choice decision. The first factor was related to the farm household (farmer experience), an outlet which is profitable. Attitude toward risk positively and negatively influences the choice attitude toward risk; the second factor dealt with production system (farm size and production scale); the third determinant was price attributes; and the last was market context (having or not a written contract, geographical location and distance to urban market).

Farmer’s experience, especially for marketing his produce influenced the farmer to choose a marketing outlet. Those who are risk takers are willing to transport their farm produces to distant places while risk averse, always resort to sell at farm-gate outlets. Montshwe (2006) stated that the farm gate sale tends to reduce farmers revenue since the prices are relatively low.

Farm size is a proxy to production scale. When the land size is large the production scale is also large and vice versa. Therefore, large production scale positively influences the farmer to sell their produce at market place mainly because of economies of scale which lower transaction cost.

Price attitude on the other hand has an influence on the choice of marketing outlet. A higher price provides an incentive to the selling point (Geoffrey *et al.*, 2014). When the farm-gate or the market place price is higher, the farmers tend to sell at that point. Contract arrangement also influences the choice of marketing outlet. Komarek (2010) in his study of determinants of banana market commercialization in Western Uganda highlighted the importance of price level in stimulating famers choice of a market and also the importance of reducing its transaction costs by reducing distance to the market which increases transportation costs in entering the market. In addition, the study pointed out that access to price information prior to information reduces fixed transaction costs or information search costs for available markets and price levels hence its importance in increasing the chances of a farmer to enter the market.

Contracts can guarantees the farmers a ready market for the produce. Most farmers more often tend to choose the outlets that have a ready market either farm gate or market place. In most cases, the farmer chooses farm gate because it incurs no transaction cost. Distance to market place influences the choice of marketing outlet. It is expected that the choice of marketing outlet among trader is negatively related to the distance to the market site. This also depends on the type road used for intake, murram road or tarmac road. Therefore, farmers tend to sell their outputs at farm gate to reduce transaction costs related to transport.

2.3 Factors influencing market participation

Most of the smallholder farmers are subsistence farmers and cannot participate in the market to sell their agricultural products. However, recently farmers are adopting modern way technologies and their productivity has seen to be increasing. Thus, this facilitates them to participate in the market through selling their surplus products to the existing markets. A smallholder farmer's decision to take part in market is influenced by many socio-economic and farm specific characteristics.

There are a number of determinants of smallholder farmers' market participation and are broadly categorized as internal and external factors. The external factors include population growth and demographic changes like political stability of the nation, natural disaster and calamities, technological change and introduction of new commodities, development of infrastructure and market institutions, development of non-farm sector and broader economy, increased labor opportunity costs, and macroeconomic, trade and sectorial policies affecting prices and other driving forces (Chamboko *et al.*, 2017). On the other hand, factors like smallholder resource endowments including land ownership, natural capital, physical capital, labor, human capital are household specific and considered internal determinants of market participation. These factors could either have negative or positive influences, which could either improve or cause a decline in the welfare of the dairy farmers (Bezabih *et al*., 2015). Socioeconomic factors include: age, gender, education, experience, household size and land size.

According to World Bank (2007), the asymmetric structure of many output markets, high transactions cost involved and the lack of technological, information and organization skills may represent some of the substantial barriers that hinder market participation among smallholder farmers. Additionally, remoteness, scarce and poorly maintained infrastructure like roads, inadequate transport means and storage facilities, and difficulties in getting reliable information on products and their prevailing prices also prevent the smallholder farmers from participating in competitive markets.

Gender of the head of the household has a significant impact in the market participation decision. Male headed household are expected to have a positive impact on market participation because they are of resource endowed than their counterpart female. Gender takes part in dairy management and mostly female contribute more labor in area of milking, cleaning of bans, feeding and selling of milk (Berhanu *et al.*, 2014). However they are constrained in terms of capital, institutional credit and extension services, thus, affecting their participation in dairy production.

Age of the household head may have a negative or positive impact on market participation. In most cases, young aged tends to produce and sell more than the old age; therefore it is hypothesized to affect milk market participation. Balirwa *et al.* (2016) in their

study of factors influencing smallholder dairy farmers' decision to participate in milk markets in Uganda found age to have a positive effect on participation in markets system. This could be from the fact that old aged farmers have acquired skills and experiences in milk trade, which enabled them to take advantages of market participation more than the young people.

Education level of a household has been found to influence market participation and is expected to have a positive effect because it enhances the skill and ability to utilize better on market information (Kumar *et al.,* 2013). Literate households are expected to have better skills and better access to information and ability to process information. Education plays an important role in adoption of new technologies and believed to improve readiness of a head to accept new ideas and innovations. Education enables a head to get updated demand and supply information (Ayieko *et al.*, 2015). The literate households may have information on the benefits of the high value market. Therefore, formal education of household head is hypothesized to influence milk participation market participation positively.

Institutional factors like membership in the group, extension service, and infrastructure have an influence on market participation (Magogo *et al.,* 2015). According to Olwande and Mathenge (2010), household head membership of group or association increases access to information which is important to production and marketing decisions. Most farmer groups/associations engage in group marketing, bulk purchasing of inputs and also credit provision for its members. It is therefore expected that membership to a group will positively influence market participation of the smallholder dairy farmer in the sector. Extension service gained by a household in dairy industry also plays an important role in market participation and is expected that the services offered will influence market participation since it helps increases household knowledge with regard to use of improved dairy technologies. Agricultural extension services enhance households' skills and knowledge, link households with technology and markets (Lerman, 2004). The number of extension agent visits improves household's intellectual capitals and helps in improving dairy production and impacts milk market outlet choices.

According to Kembe and Charles (2016), Credit access as factor influence market participation. This is mainly because the smallholder farmers are able to increase their productivity through the use of available capital. The amount of milk sold should be understood

in terms of the linkages that exist between input and output market. The unavailability of credit impacts negatively on the producers' ability to participate in the markets hence access to credit is expected to have a positive relationship with the level of market participation. Furthermore, credit is also one major constraint limiting market access, participation and the competitiveness of the industry (Abeykoon *et al*., 2013).

Resource endowments like ownership of transport and communication equipment have an impact on market participants. Sigei *et al*. (2013) in their study suggested that Vehicle ownership positively and significantly influences the extent of pineapple market participation. The results show that an increase in vehicle ownership increases the proportion of pineapple sale of a farmer as it helps in lowering the transport cost as well as boosting the volume of transport and this increases the proportion of pineapple sales to the market it is also expected that the ownership of the transport facility will influence both market participation and the extent.

Market factors have been found to positively and negatively influence market participation (Poor access to market information result in information-related problem, namely moral hazard and adverse selection which in turn increase transaction costs and hence discourages participation in the market by some farmers). Most studies that have dealt with agricultural commercialization like Goetz (1992), Key *et al*. (2000) and Makhura *et al*. (2001) have identified high transaction costs as one of the major and key reasons as to why smallholder farmers failed to participate in various markets. Most of the farmers are located in remote areas with poor transport systems, market infrastructure and lack of reliable information on the existing markets and potential exchange partners. In some cases, these transaction costs are so high that markets can be said to be 'non-existing'. The higher the farmers' access to market information the higher the probability of participating in marketing of the products (Yanbeba & Tewadros, 2013).

Market information helps farmers to supply their produce at the right time and at the right place. Most farmers who have more access to market information incur less transaction cost that is related with searching for market information, less transaction cost and thus leads to increase in their market participation.

Distance from the farm to point of sale, and market information has been found in a couple of studies to be a major constraint to intensity of market participation. Ohen *et al.* (2014) in his study stated that, as the distance between the farmer and the market increases it becomes costly to farmers to transport the produce to the market. The nearer a farmer is to the market, the easier to take the products to the market since the farmer may not incur a high cost for transportation

2.4 Empirical studies on factors influencing market participation and extent of market participation

An effort to bring about agricultural transformation in the developing countries is a result of promotion of smallholder market participation. In African countries, increasing market participation in agricultural markets is one of the key factors to lifting rural households out of poverty (Delgado, 1995). However, smallholder subsistence farmers especially in these countries, find it difficult to participate in markets because of a range of constraints and barriers reducing the incentives for participation (Makhura *et al*., 2001).

Dairy farmers as the agents of economic growth in the world would be expected to graduate their operations to medium enterprises through expanded herd size, use of modern technology, advanced operating skills and knowledge, diversified portfolio of dairy products brought about by processing activities and use of appropriate marketing outlets (Ortner *et al*., 2000). Despite Kenya's dairy sector having great significant contribution to the national economy growth, there are a number of technical, economic and institutional problems of milk production, processing and marketing of milk surpluses (Karanja, 2003). Therefore, the ability of the dairy sector to participate and effectively compete in the domestic and regional markets is highly affected (Wambugu *et al.,* 2011).

Farm household's decision to participate in the market can be affected by different factors in the context of the different developing countries. The scale of commercialization in one enterprise enhanced commercialization in the other enterprise and household's scale of commercialization. For instance, the crop and livestock commercialization status are independent and the determinants are different (Goshu *et al*., 2012). The decision of smallholders to enter markets is influenced by many household (micro) and macro level factors (Ataul & Elias, 2015).

A number of studies have focused on market participation for instance; Abeykoon (2013), Sigei *et al*. (2013), Berhanu (2014), Ismail (2014), Ohen *et al.* (2014), Ataul and Elias (2015) and Balirwa (2016). Most of these studies used Heckman double hurdle model to assess different factors perceived to influence household market participation. However, Hlongwane *et al.* (2014) used a logistic regression to analyze factors affecting market participation by maize farmers in Limpopo and found that gender, farmers' access to credit, marital status, market information and infrastructure were positively significant while distance to output markets, external source of income, and experience in arming negatively influence participation.

Abeykoon *et al*. (2016) used a two - step Heckman model to obtain determinants of market participation by indigenous poultry farmers in Sri Lanka. The first step o results showed that households' decision to participate in the poultry market was significantly ($p<0.05$) affected by sex of household head and religion. The second stage estimation results revealed that the value of poultry sales was significantly ($p<0.05$) affected by the availability of market information, the number of children below 15 years in the household, bicycle ownership, type of breeds owned and the location of households (village).

Price is one of the factors perceived to influence market participation. The output price is an incentive for sellers to supply more in the market. Komarek (2010) used a double hurdle approach where in the first hurdle, factors that influenced the decision of the banana producer to enter the market were determined using a probit model. Yield (amount produced), the output price, and access to price information of the bananas prior to sell was positive and significantly influencing the decision to enter the banana markets, while distance to the banana market negatively influenced the decision to participate in the market. Access to price information prior to information as a determinant reduces information search costs for the available markets and price levels therefore increasing the chances of a farmer to enter the market. The lack of access to market information clearly highlights that smallholder dairy farmers are at a disadvantage as they have to make their market decisions without access to up to date market information.

The second hurdle determined the extent of market participation using a truncated model. The study noted that the market price of banana, yield, size of household, ownership of land and access to banana price information positively influence the extent of market participation, while

off-farm income negatively influenced it. The study showed that for intensity to be increased, smallholder farmers should produce substantial yields to enable them have market surplus. Additionally, farm producers should also own production assets such as land.

Olwande and Mathenge (2011) evaluated market participation among poor rural households in Kenya using a double hurdle model by assessing factors that influenced market participation among four commodity producers namely; maize, vegetables, fruits and milk producers. The findings showed that being a member of a farmer organization, ownership of transportation asset and the region positively influenced the decision to enter the market among maize producers, while dependency ratio negatively influenced the decision to enter the market. Among vegetable producers being a member to a farmer organization, ownership of cell phone, price and region positively influenced the decision to enter the market, while lack of formal education and distance to tarmac road negatively influenced the decision to enter the market.

Fruit producers were positively influenced by per capita land size, ownership of cell phone and negatively influenced by lack of formal education. Further, milk producers were positively influenced by price, being a member to a farmer organization, education level of household head and region, while age of household head and distance to tarmac road negatively influenced the decision to enter the market among milk producers. Intensity of market participation also varied among maize, vegetable, fruit and maize producers. For example, distance to tarmac negatively influenced maize producers but positively influenced fruit producers. Output price was found to negatively influence fruit producers but positively influenced maize producers. In addition per capita land size only influenced fruit producers and maize producers positively. Dependency ratio only influenced vegetable producers negatively only. This study highlighted that market participation within a country was commodity specific and could not be generalized.

Yanbeba and Tewodros (2013) determined factors influencing market participation decision and extent of participation of haricot bean farmers in Ethiopia. The findings suggested education level, farming experience, membership to an organization, farm size, access to credit, and value of haricot bean produced, distance to market and access to market information influence market participation. In their second stage of the Heckman two stages model, (OLS

regression) used to estimate the factors influencing the extent of market participation by haricot bean farmers, only four variables namely; farm size, access to credit, access to input supply and value of haricot bean produced positively influence extent of haricot bean market participation significantly.

Reyes *et al*. (2012) evaluated market participation and sale of potatoes by smallholder in central highland of Angola using a double hurdle. The study included the production decision to determine if the factors that influenced quantity produced, the decision to enter the market and extent of participation were different. The findings showed that the decision to produce was positively influenced by; gender of household head, quantity of seed used, used fertilizer and production cost. While the decision to enter the market was positively influenced by gender and dependency ration while number of adults in a household and access to public market negatively influenced the decision to enter the market. Intensity of market participation was positively influenced by ownership of bicycle, presence of extension officer in the village, index of home assets and lastly index of productive assets. The findings showed that any intervention aimed at stimulating any of the three stages; increase quantity produced, increase entry into the market or increase intensity should target different variables because variables that influenced each level were different.

Sigei *et al*. (2013) determined factors influencing market participation among small-scale pineapple farmers in Kericho County, Kenya using Heckman two-stage model. In the first stage, the results showed that gender, education level, age and pineapple yields significantly influenced the decision to participate in pineapple marketing.in the second stage of the model analysis, gender, marketing experience, price information, vehicle ownership, group marketing and marketing under contract significantly influenced the extent of market participation.

2.5 Review of approaches to model market participation

Various models have been used to understand determinants of market participation. These include tobit, double hurdle, triple hurdle and Heckman two-stage. The tobit model was used initially but the draw backs of the tobit model is that it results in clustering of zeroes for non-participation and treats those with zeroes as if they did not sell because they did not want to, but in contrast they may have not sold because there was no market. The other major limitation

of the model is that it assumes the same set of parameters and variables determine both the probability of market participation and intensity of market participation (Reyes *et al*., 2012). The tobit model is appropriate where the decision to sell and the quantity sold were made simultaneously.

According to Barrett (2007) households face a two-step decision making process with regard to market participation. The first step involves deciding whether or not to participate in the market while the second one focuses on the quantity to sell once the participation decision has been made. The models suitable under conditions where decisions are not jointly made include double-hurdle and the Heckman two-step (Mather *et al*., 2011). Both the double-hurdle and Heckman models use the probit model in the first step to determine the probability of participating in the market. The second step uses a truncated model to evaluate the factors influencing the quantity of produce sold in the market from the double-hurdle, while the Heckman two-step uses a regression model.

In an event that some participants in the sample did not sell, then selection bias problem will arise and the double-hurdle is inappropriate due to its failure to account for the selection bias. Sample selection bias arises when a random sample is not observed in the population of interest. In the linear regression, selection bias occurs when data on the dependent are missing non-randomly conditional on the independent variable. This yields biased and inconsistent estimators of the effect of the independent variables. In such a situation, selection model is appropriate and the Heckman two-step to be specific (Green, 2003). The model uses a probit regression to assess the probability of participation and ordinary least squares (OLS) to determine the intensity of market participation. The selection bias is captured by an inverse Mills' ratio derived from the first stage model and incorporated in the second step the regression (*Ibid*).

Some studies that used Heckman two-step in analyzing market participation include; Siziba *et al*. (2011) evaluated the determinants of cereal market participation by SSA smallholder farmer using pooled data from 8 African countries namely; Nigeria, Niger, Uganda, Democratic Republic of Congo (DRC), Rwanda, Mozambique and Zimbabwe. Using the Heckman tow-step, the study found that the decision to enter the market was positively influenced by experience of

household head, use of animal manure, access to price information prior to selling, road network, ICT and area planted, while household size negatively influenced it. Intensity of market participation was positively influenced by ownership of radio, off-farm income, access to extension services, research part, access to price information prior to sell and ICT, while the amount of credit accessed and membership to farmer organization negatively influenced it.

Gani and Adeoti (2011) used a logit model to analyze market participation and rural poverty among farmers in northern part of Taraba State, Nigeria. Their results indicated that with the exception of training and farmers experience all other explanatory variables included in the model (market information, family size, distance, size of output, age number of extension visits, and co-operative membership, training, farming experience, education and gender) had positive influences on market participation of farmers as expected.

Distance to the market had a negative sign in contrast with the prior expectation. The decision by smallholder households to participate in market in the study area was significantly influenced by the household socio-economic variables that included; market information, distance, size of output, extension visit, co-operative membership, family size, and education. Conversely, farming experience in contrast with a prior expectation. It might be that more mouths (consumption) was high. Other studies (Bellemare & Barrett, 2006; Holloway *et al*., 2000; Makhura, 2001) have a similar view in the market that human capital, physical capital and financial capital have significance effect on market participation.

Sebatta *et al*. (2012) looked at the determinants of smallholder farmers' participation in the potato market in Kabale and Mbale using a Heckman two-step model. The study found that the decision to enter the market was positively influenced by condition of the road to the nearest market, age of the farmer and distance to the nearest market. Extent of market participation was positively influenced by output price, total farm land owned and the Inverse Mills' ratio was also significant at 5%.This study will also use a Heckman two-step because of the selection bias that is anticipated in the data since some farmers do not sell their milk. This normally will result in a selection problem and the Heckman two-step model is therefore adequate to handle this problem

2.6 Theoretical framework

The decision to either participate in milk marketing or not in this study is built on random utility theory. This depends on whether the participation gives the Smallholder dairy farmer a higher utility than non-participation. Smallholder farmers face different types of decisions in relation to market participation and involves a discrete decision over whether or not to participate in a given market as either a buyer or a seller, and a continuous decision as to how much to buy or sell conditional on market participation (Boughton *et al.*, 2007).

Most of the dairy farmers are marginal and small farmers and they have limited participation in the output market. Some farmers are subsistence farmers and cannot participate in the milk market to sell their milk product. However, recently farmers are adopting modern technologies and their productivity has increased. Thus, this facilitates them to participate in the market through selling their surplus products. A smallholder dairy farmer's decision to take part in market is therefore influenced by many socio-economic and farm specific characteristics (Gebreselassie, 2008).

The decision to either participates in milk marketing or not is dichotomous and therefore a binary choice model has been identified as appropriate for such estimation. However, this is only possible under the following assumptions: that the households are faced with only two alternative choices and that any choice an individual chooses depends on their characteristics (Bellemere & Barret, 2006).

These choices are guided by net returns to market participation. Each dairy farmer faces a parametric market price for the milk $M^{tm}$and transactions costs,$\tau(Z, A, G, Y)$ that may depend on both public goods and services (extension service information on milk marketing strategies, distance to market) and household-specific characteristics (educational attainment, gender, age, that might affect search costs, negotiating skills) reflected in the vector Z, and its assets, A, and liquidity, Y (Boughton *et al.*, 2007).

In this study the choices are represented by the indicator variable *M*, which takes value one if the household participate in the market and zero otherwise takes *N* as indicator variable. Interpretation of data on individual choices is provided by the random utility model. In Nakosteen–Zimmer framework, Y^m and Y^n represent the individual's utility of two choices,

which we might denote U^m and U^n. Therefore, U^m be the utility of market participation and U^n that of non-market participation. The observed choice between the two reveals which one provides the greater utility, but not the unobservable utilities. Hence, the observed indicator equals 1 if $U^m > U^n$ and 0 if $U^m \leq U^n$ (Greene, 2002).

A common formulation for the linear random utility model,

$$U^m = x'(H_a) + e_a \quad \text{.......} \quad (1)$$

$$U^n = x'(H_b) + e_b \quad \text{.......} \quad (2)$$

Then, if we denote by $Y = 1$ the consumer's choice of alternative *m*, we have

$$prob[Y = 1|x] = prob[U^m > U^n] = prob[X'H_a + e_a - X'H_b - e_b > 0|X]$$

$$= prob[X'(H_a - H_b) + e_a - e_b > 0|X]$$

$$= prob[X'H + e > 0|X] \quad \text{.......} \quad (3)$$

Where, U^m is the expected net utility of household *i* from participating milk market and U^n is the expected net utility of household *i* from non-participation in the market. *m* denotes milk market participation while *n* denotes non-participation while H_a and H_b are independent variables denoting farm, institutional and household characteristics and e_i is an error term.

The expected net utility from each of the decisions will then be compared. To compare, Y_i will be used as an indicator of whether household *i* participates in the market or not, so that Y =1 if participates and Y= 0 if not, as indicated in equation (3) above.

Equation (3) implies that the probability that the household *i* participates in milk market is given by the probability that the expected net utility derived from participation is greater than the expected net utility derived from non-participation. While the probability that the household *i* does not participate is given by the probability that the expected net utility derived from participation is less than the net utility derived from non-participation.

2.7 Conceptual framework

Economists have generally treated the household's decision to participate in markets as a two-step process: first, producing households decide whether to participate (buying or selling) or

remain autarkic, then, conditional on participation, how much to buy or sell (Bellmare & Barrett, 2006; Goetz, 1992; Holloway *et al.*, 2001; Key *et al.*, 2000). However, when considering a market such as dairy in Kenya, it is important to first acknowledge that not all households are milk producers.

The relationship of key variables involved in the study that influence the decision of the household to participate in milk market and the extent of participation is conceptualized in a framework in the Figure 1. Dairy farmers have a choice to market their milk directly to processor and to sell through the brokers or other traditional channels who buys directly at the farm gate. The decision of participating in the market is influenced by the market, institutional factors as well as farmer and farm situations (socioeconomic factors). Market participation leads to the extent of participation which in turn will lead to increase in household income.

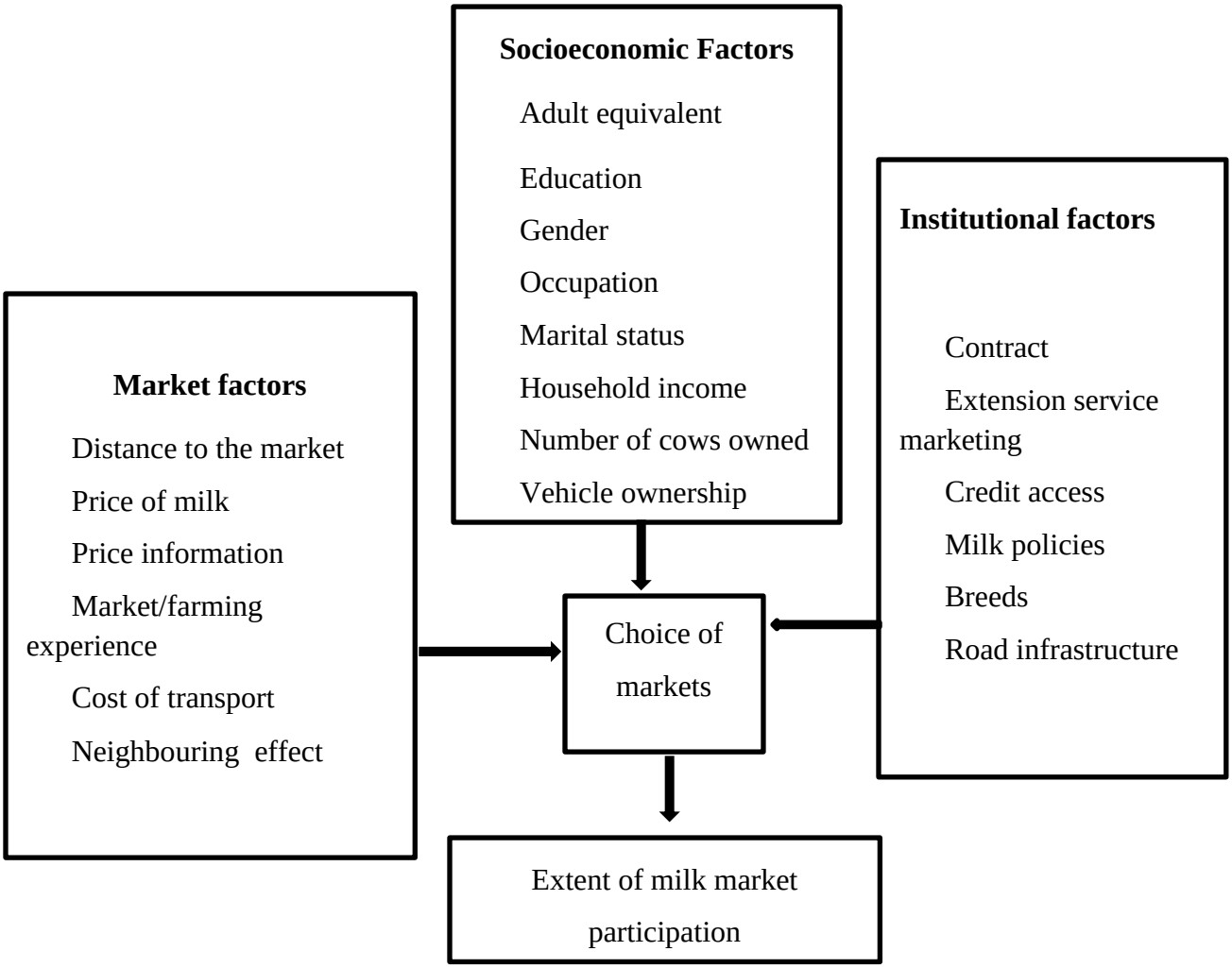

Figure 1: Conceptual Framework

CHAPTER THREE

METHODOLOGY

3.1 Description of the study area

Kuresoi North Sub County is one of the nine sub counties in Nakuru County. The Sub County occupies a total area of 559.70 km^2 and has a population of 124,050 people (GoK, 2010). Administratively, the sub county has four wards: Kiptororo, Nyota, Sirikwa and Kamara which are further, divided into locations and sub-locations.

Economic activities in Kuresoi north sub county include potato growing; dairy farming; commercial businesses and other agricultural products that include; maize, beans, vegetables, coffee, and tea. Temperatures range from a high of 29.3^oC between the months of December, January, February, and part of early March to low temperatures of up to 20^oC during the month of June and July. The area receives rainfall of between 950 and 1500 mm per annum and covers areas with an altitude of between 900-1800m above sea level. The county has a bimodal rainfall pattern where short rains fall between October and December while the long rains fall between March and May (NCIDP, 2013).

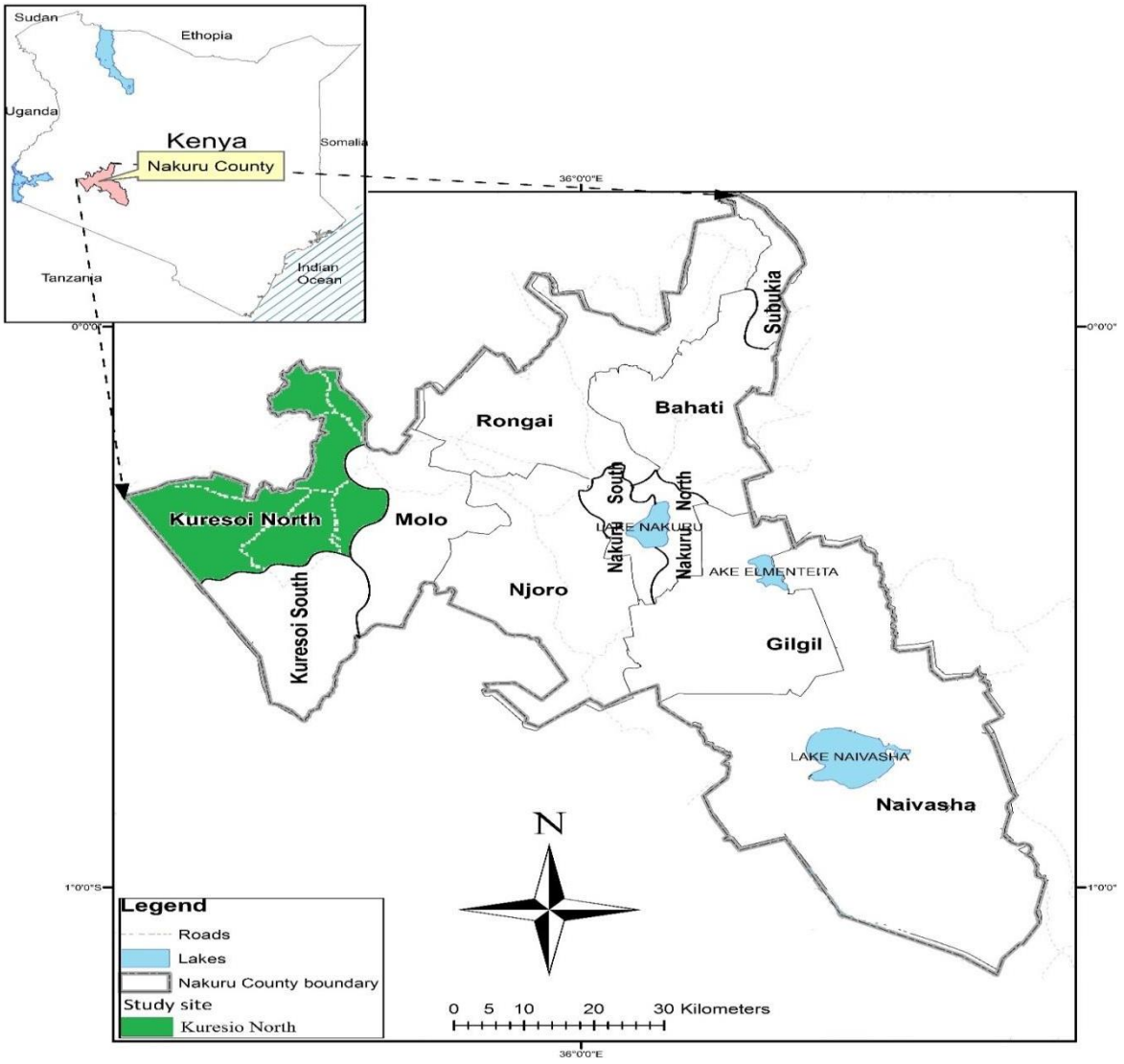

Figure 2: Map of Kuresoi North Sub County, Nakuru County

Source: Ministry of Devolution and Planning (2013)

3.2 Research design

The study employed a survey research design. This kind of design was appropriate because it involved collection of primary data. A sample was taken from the population of smallholder dairy farmers drawn from 4 wards in Kuresoi North Sub County.

3.3 Sampling procedure

Multi-stage sampling procedure was used to select the sample. The first stage involved the purposive selection of Kuresoi North sub-county because dairying is a major economic activity for majority of the population. In the second stage, the four wards (Kiptororo, Nyota, Sirikwa and Kamara) were also purposively selected because they are the leading milk producing areas in the sub-county. Lastly, random sampling of smallholder farmers was done and face to face interviews were carried out.

3.4 Sample size determination

Determination of sample size was based on the formula by Anderson *et al.* (2007). The sample size was determined at 95% confidence level with a z-value of 1.96. The margin of error was 7%. The sample therefore was estimated using the following formula;

$$n = \frac{pqz^2}{E^2} \quad \text{..... (4)}$$

Where, n = sample size, p = proportion of the population containing the major interest, q = 1-p, z= confidence level (α = 0.05), E = acceptable/allowable error. Since the proportion of the population is not known, p=0.5, q = 1-0.5= 0.5, Z = 1.96 and E = 0.07.

Replacing the values above to the formula gives the following

$$n = \frac{0.5 \times 0.5 \times (1.96)^2}{(0.07)^2} = 196$$

$$n = 196 \ \ respondents.$$

Since the proportion of the smallholder dairy farmers was not known per each ward. The number of respondents per ward is presented in Table 1.

Table 1: Sample Proportions per Ward

Ward	Population size	% of population selected
Kiptororo	37590	$\frac{37590}{124050}$ x $196 = 60$
Nyota	39455	$\frac{39455}{124050}$ x $196 = 62$
Sirikwa	17042	$\frac{17042}{124050}$ x $196 = 27$
Kamara	29963	$\frac{29963}{124050}$ x $196 = 47$
Total	124050	196

3.5 Data collection and data analysis

Primary data was collected through administration of a pre-tested semi- structured questionnaire on the 196 respondents with the help of trained enumerators. Secondary data used from different sources was well acknowledged. The data collected include information on market characteristics, institutional arrangement and household characteristics in relation to choice of milk market outlets and market participation.

3.6 Methods of data analysis

SPSS and STATA Microsoft Excel programs were used for data management and processing. These programs involved both statistical and econometric analysis.

Objective 1: Socioeconomic characteristics of smallholder dairy farmers

The first objective was analyzed using descriptive statistics which measures the central tendency, dispersion and relations. The average value of the sample was compared with the population averages for significance using the t and z test statistic. Variance and standard

deviation was also presented to help in analyzing the normality of the data in terms of distribution**.**

Objective 2: Factors influencing the choice of market outlets

To analyze the factors influencing dairy farmer's choice of milk market outlet, multinomial logit model was employed. Multinomial logit can be derived from the assumption of random utility model of utility maximization which assumes that if an individual i makes a choice j from a complete list of channel bundle then the utility of that particular channel is maximum (Green 2003; McFadden, 1983zx). Smallholder dairy farmer sold milk to either formal or informal or both. The utility associated with the three outlets was denoted by; Z^{F}_{io}, Z^{I}_{io} and Z^{FI}_{io}, respectively. The utility levels in a marketing outlet are a function of personal characteristics and household composition. In this case, a dairy farmer was assumed to make choice decision among the three outlets, he can also be delivering to more than one outlet and therefore to determine factors that influence this decision, the use of random effects to model the dependence across sequential decisions was necessary.

The choice variable (dependent variable) has more than two unordered options in this case. The outlet independent variables can consist of features/attributes of the alternatives and characteristics of the respondent such as, age, marital status, off-farm income, education. McFadden (1974) first introduced the multinomial logit model (MNL) to explain the choice of transportation modes of urban commuters with the random utility model. The multinomial logit model continues to be a popular choice model because choice probabilities formula has a closed form and is readily and easy interpretable.

Multinomial logit model was preferred in the study since it permits the analysis of decision across more than two categories in the dependent variable hence making it possible to determine choice probabilities of different milk market outlets. Furthermore, MNL is simpler to compute compared to multinomial probit which poses a challenge in computing multivariate normal probabilities for any dimensionality (Greene, 2002).

Assume the utility of household i choosing market outlet J is given by U_{ij} is a linear stochastic function of exogenous household characteristics X and endogenous household choices Z:

$U_{ij} = \alpha X + \beta_Z + \varepsilon$……..…….…. (5)

The parameter estimates of the MNL model only provide the direction of the effect of the independent characteristic variables on the dependent (choice) variables; thus the estimates represent neither the actual magnitude of change nor the probabilities. Marginal effects are then computed and are used to measure the expected change in probability of a particular marketing outlet choice being chosen with respect to a unit change in an independent variable from the mean (Greene, 2002). The following model was specified for market channel choice analysis; Where $Y_{ij} =$ choice is the dairy market outlet used by the farmer (informal market, formal market and both formal and informal market), while β are coefficients associated with each explanatory variable and the ε is the error term. Several factors were hypothesized to influence the farmers' choice of milk market outlet. The choice of these explanatory variables was mainly based on the general working hypothesis and partly on empirical findings from literature, and therefore, a positive or negative sign was assigned depending on the potential influence of a particular variable on choice of market outlet. The implicit function form therefore was given as

$$Y_{ij} = \alpha + \beta 1\, Age + \beta 2\, Gend + \beta 3\, Mrts + \beta 4\, Educ + \beta 5\, Hsize + \beta 6 Slnd + \beta\, 7 Exts + \beta 8\, Crdt + \beta 9\, Yfm + \beta 10\, Occup + \beta 11\, Dist + \beta 12\, Mpay + \beta 13\, Neigh + \beta 14\, Plt + \beta 15\, Contr + \beta 16\, Expe + \beta 17\, Pinf + \beta 18\, Exp + \beta 19\, N\ cow + \beta 20\, Brd + \beta\varepsilon \quad \text{(6)}$$

Where Y_{iJ}^{*} is the marketing outlet choice.

α – Constant,

β 1,2,3 ….17 −Factors to be determined

ε-Error term

Table 2: Variables used in Choice of Market Outlets

Variables	Variable code	Measurement of the variables	Expected sign
Age in years	*Age*	Years (continuous)	−
Gender	*Gend*	1=Male, 0=Female (Dummy)	±
Marital status	*Mrts*	1= married, 2= Not married (dummy)	±
Education level	*Educ*	Levels of education (categorical)	-
Household size	*Hsize*	Number of household members (adult equivalent)	+
Size of the land in acres	*Slnd*	Size in acres (continuous)	-
Milk volume	*Milkvol*	Amount of milk produced and sold(continuous)	±
Extension services	*Extns*	Access=1 otherwise =0 (dummy variable)	±
Experience of the farmer	*Expe*	Number of years of practicing dairy(continuous)	+
Credit services	*Crdt*	Access=1 otherwise= 0 (dummy variable)	-
Price information	*Pinf*	Access=1 otherwise= 0 (dummy variable)	+
Market contract	*Contr*	Access=1 otherwise= 0 (dummy	±

		variable)	
Farm income	*Yfm*	Kenyan shillings (continuous)	-
Type of occupation	*Occup*	farmer=1, businessman=2, employed=3	±
Off-farm income	*Oyfm*	Off-farm income, (Dummy 1=have off farm income, 0= Otherwise	-
Group membership	*Grpm*	Membership (Dummy 1=yes, 0=otherwise	+
Distance to selling point	*dist*	Kilometers (continuous)	+
Price of milk per litre	*Pltr*	Kenyan shillings(continuous)	+
Neighborhood effect	*Neigh*	Yes=1 otherwise=0	
Mode of payement/time	*Mpay*	Cash / bank (Monthly/weekly/daily)	+
breed of the cow	*Brd*	Jersey=1, Freshian=2, zebu 4=crossbreed	+
No of cows	*Ncow*	Number of cows (continuous)	+
Market outlet	MktOutlets	(Formal=1,informal=2, both=3,)	+

Objective 3: Factors influencing the decision of market participation and the extent

Most of the farmers in Kenya are marginal and smallholder farmers and they have limited participation in the output market. Some are subsistence farmers and cannot participate in the market to sell their milk. However, recently farmers are adopting the modern technologies and

their milk productivity has increased. Thus, this facilitates them to participate in the market through selling their surplus milk product.

Heckman two stage selection models were used to determine the factors influencing the market participation and extent of participation. These factors included social, institutional and economic factors. The model was used because the farmers' behavior is driven by the need to derive or maximize the utility associated with the practice (market participation). Therefore, a choice has to be made whether to participate or not. The model determines the farmer behaviour which lead to a particular choice and can determined as decision to participate in the milk market, followed by the extent of market participation.

Heckman two-step procedure was identified as an appropriate model for such independent estimation. The model involves estimation of two equations: First, is whether a household participated in the milk market or not, and the second is the extent of market participation (proportion of milk sales). The proportion of milk is conditional on the decision to participate in the market.

The model considers that observations are ordered into two regimes. These regimes are defined by whether the individual farmers sell their milk. The first stage is referred to as the selector equation and defines a dichotomous variable indicating the regime into which the observation falls:

$$S_i^* = \tau' Z_i + \cdots \text{ .... } (7)$$

$$S_i = 1 \text{ If } S_i^* > 0 \text{ and } S = 0 \text{ if } S_i^* \leq 0 \text{ .... } (8)$$

Where S_i^* is a latent variable indicating the utility for Market participation, S_i is an indicator of milk market status, the Z_i denotes the factors influencing the milk market participation, $\tau'$is a vector of associated parameter estimates, and u_i is an error term having a standard normal distribution. After estimating τ using the probit maximum likelihood method, the second stage involves estimating an OLS regression of market participation conditional on $S = 1$ and a vector of explanatory variables *x*: (Heckman, 1979; Hoffman & Kassouf, 2005)

$$E\left(\frac{y_i}{S_i} = 1, x_i\right) = \beta' x_i + E\left(\frac{e_i}{S_i} = 1\right) = \beta' x_i + E\left(\frac{e_i}{u_i} > \tau' Z_i\right) \text{ .... } (9)$$

Where; y is the dependent variable, measured here as extent of market participation x_i are the explanatory variables, and β' are associated parameters to be estimated. Letting the degree to which the normally distributed error term, e_i of this second stage regression correlated with the error term of the probit be represented by ρ . Under the assumption that the joint distribution of u_i and $e_i$is bivariate normal, we can then express the expected value of e_i conditional on e_i as:

$$E\left(\frac{e_i}{u_i > \tau' Z_i}\right) = \sigma_e \sigma_u \lfloor \frac{\emptyset(\tau Z_i)}{\Phi(\tau Z_i)} \rfloor \qquad \text{……(10)}$$

Where; σ_u and σ_e are the error variances of the probit and OLS models. Note that because the term u σ is unidentified, it is subsequently set to 1. The bracketed term on the right hand side of equation (7) represents the inverse Mills ratio, defined by the ratio of the density function of the standard normal distribution, φ to its cumulative density function,Φ .

When incorporated in the second-stage estimation of level of participation, this ratio serves as a control for potential biases arising from sample selectivity. Denoting the inverse Mills ratio as λ outcome equation can then be written by substituting (7) into (6):

$$E\left(\frac{y_i}{S_i} = 1, x_i\right) = \beta' x_i + \rho \sigma_e \lambda_i \qquad \text{……(11)}$$

Where ρ gives the covariance estimate of the unobserved effects on market participation and extent of participation decisions. If significant, this estimate indicates that sample selectivity is present. The model, which comprises an equation determining sample selection and a regression model, can be estimated using the maximum likelihood technique, with estimates of the inverse Mills ratio used as starting values in the iteration process.

Model specification

Heckman two-step procedure

Heckman (1979) proposed a two-step procedure which only involves the estimation of a standard probit and a linear regression model. The two equations for the two steps are specified as follows: The variables to be used in Heckman two stages are shown in Table 2.

Step1. (Selection equation)

$P(0, 1) = \beta 0+\beta 1X1+\beta 2X2+ \ldots\ldots\ldots +\beta nXn+ \varepsilon$ ……..(12)

$$P(0,1)= \beta 0 + \beta 1\, Age + \beta 2\, Gend + \beta 3\, Mrts + \beta 4\, Educ + \beta 5\, Hsize + \beta 6 Slnd + \beta\, 7Exts + \beta 8\, Crdt + \beta 9\, oyfm + \beta 10\, Occup + \beta 11\, Dist + \beta 12\, Modp + \beta 13\, Neigh + \beta 14\, Pltr + \beta 15\, Contr + \beta 16\, Milkvol + \beta 17\, Prinf + \beta 18\, Exp + \beta 19\, N\ cow + \beta 20\, Brd + \varepsilon$$

Step2. (Outcome equation) (Yi)$=\beta 0+\beta 1X1 +\beta 2X2+\ldots\ldots\ldots+\beta nXn+ \varepsilon$ ……..(13)

Participation (Yi) $= \beta 0 + \beta 1\, Age + \beta 2\, Gend + \beta 3\, Mrts + \beta 4\, Educ + \beta 5\, Hsize + \beta 6 Slnd + + \beta 1 Lndtn\, \beta\, 7Exts + \beta 8\, Crdt + \beta 9\, Yfm + \beta 10\, Occup + \beta 11\, Dist + \beta 12\, Mpt + \beta 13\, Tfd + \beta 14\, Pltre + \beta 15\, Contr + \beta 16\, Milkvol + \beta 17\, Prinf + \beta 18\, Exp + \beta 219\, N\ cow + \beta 20\, Brd + \varepsilon$

Table 3: Description and Measurement of Variables used in the model

Variables	**Code**	**Measurement of variables**	**Expected sign**
Market participation	*Mpart*	Dependent variables for selection equation. (Dummy), =1 otherwise=0	±
Extent of market participation	*Extmp*	Dependent variable for the outcome equation	+
Age in years	*Age*	Years (continuous)	-
Gender	*Gend*	1=Male, 0=Female (Dummy)	±
Marital status	*Mrts*	1= married, 2= Not married (dummy)	±

Education level	*Educ*	Levels of education (categorical) 1= No education, 2=primary, 3=secondary, 4=tertiary, 5= other	-
Household size	*Hsize*	Number of household members(continous)	+
Size of the land in acres	*Slnd*	Size in acres (continuous)	-
Extension services	*Extns*	Access=1 otherwise =0 (dummy variable)	±
Neighbourhood effect	*Neigh*	Yes=1 otherwise =0 (dummy variable)	+
Credit services	*Crdt*	Access=1, otherwise=0(dummy variable)	-
Farm income	*Yfm*	Kenyan shillings (continuous)	-
Type of occupation	*Occup*	employed=1, not employed=2(Dummy)	
Off-farm income	*Oyfm*	Off-farm income, (Dummy 1=have off farm income, 0= Otherwise	-
Group membership/marketing	*Grpm*	Membership (Dummy 1=yes, 0=otherwise	+
distance to the milk selling center	*dist*	Kilometers (continuous)	+
Price of milk per litre	*Pltr*	Kenyan shillings(continuous)	+
Price information	*Pinf*	Dummy(1 = Yes, 0 = No)	
Milk volume	*Milkvol*	liters (continuous)	+
Contract Arrangement	Contr	Dummy(1= present, 0 = Absent	
mode payment/time	*Modpay*	Cash/ Bank (Monthly/weekly/daily)	+
breed of the cow	*Brd*	Jersey=1, Freshian=2, zebu=3 others=4	+
No of cows	*Ncow*	Number of cows (continuous)	+

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the results of the study. It begins by presenting descriptive results of significant variables on socio-economic characteristics such as age, gender, household size, price, number of cows, volume of milk, experience, distance, access to credit, extension service and group membership in relation to choice of marketing outlet decision of smallholder dairy farmers and market participation. Secondly, it presents empirical results of the multinomial Logit model and Heckman two-stage model explaining the factors which influence farmer participation and extent in milk marketing.

4.1 Descriptive results

4.1.1 Socio-economic characteristics in relation to milk market participation in Kuresoi sub-county

The results in Table 4 summarize the variables among the participants and non-participants in the milk market.

Table 4: Socio-economic characteristics in relation to market participation in Kuresoi sub county

Market participation	Variable	Min	Mean	Max	Sd
Non Participants	Age	21	40.78	79	12.05
	Household size	1	5.08	10	2.03
	Land size	0.2	1.68	7	1.55
	Number of cows	1	2.05	3	0.92
	Milk volume	1	5.77	16	3.10
	Experience	1	4.11	20	3.31

Participants	Age	23	39.00	71	10.29
	Household size	1	5.00	10	1.97
	Land size	0.2	1.63	5	1.44
	Number of cows	1	2.69	5	0.93
	Milk volume	3	12.31	80	11.03
	Experience	1	5.00	21	4.23

The mean age of market participants was 39 years while the non-participants was 40.78 years. The mean household size was about 5 members for both groups and this corresponds with the Kenyan national mean of 5 members per household (KNBS 2010). The volume of milk produced varied considerably among the two groups with the mean quantity of 5.77 litres and 12.31 litres for non-participants and participants whereas the mean sizes of the land owned were 1.68 and 1.63 acres respectively.

Land in Kuresoi North is one of the major constraints that limit the smallholder farmers' production potential as indicated by the number of dairy cows owned, which was 3 and 2 acres for participants and non-participants respectively. This reflects that milk producers in the sub-county are typically smallholders. It is apparent that the dairy enterprise is fairly new in the area because the mean number of years of practicing dairy was 5 and 4.23 years among the participants and non-participants respectively.

4.1.2 Continuous socio-economic characteristics in relation to choice of market outlets in Kuresoi sub-county

Table 5 characterizes the smallholder dairy farmers in relation to choice of market outlets in terms of their age, household size, price, milk volume, number of cows, experience, land size and distance to the market. The effect of continuous variables over market outlet choice is

examined by using mean comparison as Berhanu *et al*. (2013) and Geoffrey *et al*. (2014) have used.

Table 5: Continuous socio economics Characteristics in relation to market outlet in Kuresoi Sub- County

Market Outlet Choice	Variables	Min	Mean	Max	SD
Informal market	Age	21	40.42	79	11.34
	Household size	1	5.10	10	1.95
	Land size	0.2	1.48	5	1.36
	Number of cows	1	2.13	5	0.88
	Milk volume	1	6.61	40	5.19
	Price per litre	20	37.07	60	10.09
	Experience	1	4.10	21	3.42
	Distance	0.1	1.26	5	1.25
Formal market	Age	23	39.34	68	11.43
	Household size	1	4.68	9	1.97
	Land size	0.2	2.00	5	1.66
	Number of cows	1	2.55	5	1.08
	Milk volume	3	12.42	80	13.08
	Price per litre	20	41.75	45	5.91
	Experience	1	4.71	20	4.15

	Distance	0.1	4.43	8	2.07
Both (Formal and informal)outlet	Age	24	39.29	70	12.00
	Household size	1	5.29	10	2.37
	Land size	0.3	2.18	7	1.83
	Number of cows	1	2.92	5	1.02
	Milk volume	1	11.79	30	7.44
	Price per litre	30	38.42	60	7.75
	Experience	1	6.13	20	4.27
	Distance	0.1	2.63	7	2.09

Various Marketing outlets through which farmers sold sell their milk with their respective characteristics existed as shown above. Farmers had a choice of selling exclusively to informal or formal market outlets as well as splitting the quantities between the two outlets. Formal outlets comprised cooperatives and processors while neighbors, middlemen, hotels, or schools are informal outlets. The mean household size for farmers selling to informal outlet were 5.10 members, to formal were 4.68 while to both outlets were 5.29 members.

Dairy farmers selling milk to informal outlet had a mean age of 40.24 years, while farmers selling to formal and both outlets were 39.34 and 39.29 years, respectively. Prices offered differed in the three outlets. Smallholder farmers received a mean of KES 37.74, KES 41.75 and 38.42 KES per litre of milk when sold to the informal, formal and both outlets respectively. This implies that the formal market offer better prices though prices are unstable.

The effect of prices was reflected in the quantity of milk sold in each outlet. The mean in the informal market outlet was 6.61 litres compared to 12.42 litres and 11.79 litres of formal and

both markets, respectively. The mean distance to the selling point were 1.26 kilometers, 4.43 kilometers and 2.63 kilometers among the farmers selling milk to formal, informal and both market outlets. The longer distances to formal outlets is determined by the location of the collection centers.

The mean number of years for practicing the dairy farming among the famers selling to formal, informal and both outlets were 4.10 years, 4.71 years and 6.13, respectively. Farmers selling milk to informal outlets owned a mean of 2 dairy cows each while those selling to formal and both outlets owned 3 dairy cows each.

4.1.3 Socio- economic characteristics in relation to market outlet choice decision

Table 6 shows the categorical socio-economic variables in relation to the choice of market outlet decision among the smallholder dairy farmers in terms of their gender, marital status, education level, occupational status, type of breeds, market participation, group, price information, off-farm income, extension and contractual agreement of farmers with their market outlet in percentage

Table 6: Categorical Respondents' socio-economic characteristics in relation to market outlet choice decision (%)

Variable	Category	Informal	Formal	Both	Chi 2
Gender	Female	31.33	36.84	20.83	
	Male	68.67	63.16	79.17	1.7682
Marital Status	Married	78.38	78.94	75.00	
	Not married	21.64	21.05	25.00	0.1557
Education Level	No formal education	8.21	10.53	12.50	
	Primary	42.54	28.94	20.83	
	Secondary	43.28	47.37	54.17	
	Tertiary	5.97	13.16	12.5	7.0209
Occupation Status	Farmer	89.55	78.94	79.17	20.35

	Businessman	8.21	0.00	12.50	
	Employed	2.24	21.06	8.33	
Market Participation	Yes	60.45	73.68	95.83	
	No	39.55	26.32	4.17	12.45
Type Of Breed	Jersey	22.39	31.57	20.83	
	Freshian	36.57	50.00	54.17	
	Zebu	14.92	2.63	12.5	
	Crossbreed	26.12	15.80	12.5	9.808
Price Information	No	38.06	28.94	29.17	
	Yes	61.94	71.06	70.83	1.5147
Off Farm Income	No	30.60	44.74	20.83	
	Yes	69.40	55.26	79.16	4.31
Extension Service	No	73.13	63.15	58.33	
	Yes	26.87	36.84	41.67	2.97
Contract	No	61.94	52.63	54.17	
	Yes	38.06	47.37	45.83	1.35
Group	No	67.91	55.26	45.83	
	Yes	32.08	44.74	54.17	5.376

The distribution of gender in Kuresoi North was equal among participants and non-participants. The male headed households who used formal, informal and both (informal and formal) as a choice of market outlet were 68.67%, 63.16% and 79.17%, respectively while 31.33%, 36.84% and 20.83% of the farmers were the female headed households who sell to formal, informal and both market outlets. The number of males was more than that of females in

the three outlets, an indication that men perceive milk production as an economic activity compared to female headed households.

Dairy farmers were categorized on their occupational status as farmers, businessmen and employed. About 89.55%, 78.94% and 79.17% of those selling to the formal, informal and both outlets were farmers. The businessmen (engaging in off farm business in addition to dairy farming) selling to the formal market were 8.21% and 12.50% to both outlets while the employed and selling to formal, informal an both outlets were 2.24% and 21.06% and 8.33% respectively. Among the farmers, 38.06%, 47.37% and 45.83% who sell to formal, informal and both (informal and formal) had contract with their buyers while 61.94 %, 52.63% and 54.17% did not have any contracts with their buyers. Farmers who had off-farm income was 69.4%, 63.15%, and 58.33% in the formal, informal and both markets, while 30.6%, 55.26% and 79.16% in the formal, informal and both markets, respectively did not have off-farm income.

Farmers have either accessed extension services from different extension officers or not. It is revealed that 26.87%, 36.84% and 41.67% of farmers using formal, informal and both outlets respectively had access to extension services. This shows that extension services have not been much felt in the Sub County.

Several types of dairy breed have been genetically developed through Artificial Insemination to produce good quality and high quantities of milk to meet demand for household consumption and marketing purposes. The study sought to assess types of dairy breeds farmers keep for milk production in Kuresoi North Sub County. Four types breeds; Jersey, Friesian, Zebu and crossbreed were among the dairy breeds kept in the sub-county. Most farmers liked Friesian breed as compared to the others. Among the farmers who sold milk to informal outlet, 22.39%, 36.67%, 14.92% and 26.12% were keeping Jersey, Friesian, Zebu and crossbreed respectively. Of the farmers selling milk to formal outlet, 31.57%, 50%, 2.63% and 15.8% were keeping Jersey, Friesian, Zebu and crossbreed respectively, while 20.83%, 54.17%, 12.5% and 12.5% of the famers selling milk to both outlets were keeping Jersey, Friesian, Zebu and crossbreed, respectively.

Farmers who had information on the prevailing prices and selling to formal, informal and both markets were 61.94%, 71.06% and 70.83 % respectively, while the rest were without price

information. An access to information plays an important role in empowering the farmers to choose an outlet which can help in maximizing their profits from milk given the high likelihood of increasing volume of sales. Membership to a farmer group showed that, 32.08 %, 44.74 % and 54.17% sold to formal, Informal and both (informal and formal), respectively. Belonging to a farmers group is an important social capital that helps in increasing farmers bargaining power.

4.2 Factors influencing the choice of milk market outlets

Table 7 presents the results of the Multinomial Logit model. The Chi-square value of -109.73 showed that likelihood ratio statistics are highly significant ($P < 0.000$) suggesting that the model had strong explanatory power. The pseudo-R square was Pseudo R of 0.3297 indicating the explanatory variable explained about 32.97% of the variable in the choice of milk market outlets.

Before the marginal effects were run, the likelihood coefficients were estimated to provide the direction of the effect of the independent variable on the dependent variables. The marginal effects from the Multinomial Logit model measure the magnitude of change in the probability of a particular choice of market outlet being made with respect to a unit change in an independent variable. The significant variable values also known as the p-values shows whether a change in the independent variable significantly influences the Logit at a given level (Gujarati, 2007).

Table 7: Marginal Effect from Multinomial Logit on the Choice of Milk Marketing Outlets

	Informal			Formal			Both Formal and informal		
Variable	dx/dy	SE	P>|z|	dx/dy	SE	P>|z|	dx/dy	SE	P>|z|
Gend	0.024	0.075	0.751	-0.050	0.082	0.537	-0.009	0.061	0.882
Occup	-0.110	0.069	0.107	0.117**	0.062	0.060	0.020	0.052	0.697
Age	0.032	0.003	0.992	0.004	0.004	0.264	-0.003	0.003	0.285
Mrts	0.045	0.091	0.618	0.041	0.081	0.611	-0.056	0.085	0.505

Hsize	0.018**	0.019	0.353	-0.030*	0.021	0.139	-0.002	0.015	0.872
Educ	0.016	0.043	0.709	-0.009	0.045	0.843	-0.017	0.036	0.639
Slnd	-0.023	0.023	0.333	0.011	0.020	0.591	0.006	0.017	0.735
Ncow	-0.091**	0.038	0.016	0.073*	0.040	0.069	0.045	0.027	0.103
Brd	0.061*	0.035	0.080	-0.061	0.037	0.102	-0.003	0.027	0.904
Milkvol	-0.011*	0.007	0.099	0.014**	0.006	0.018	0.003	0.004	0.475
Prclit	0 .157	0.004	0.689	0.013***	0.005	0.006	0.008**	0.003	0.014
Pinf	-0.069	0.072	0.333	0.059	0.077	0.443	0.007	0.061	0.908
Expe	0.003	0.011	0.981	-0.011	0.011	0.358	0.009	0.007	0.192
oyfm	-0.126**	0.089	0.052	0.178**	0.0803	0.027	0.0310	0.0652	0.634
Neighef	-0.078	0.070	0.268	0.025	0.078	0.751	0.100*	0.059	0.089
Contr	0.062	0.069	0.373	0.066	0.076	0.379	-0.003	0.052	0.950
Dist	0.064***	0.022	0.003	0.047**	0.022	0.030	0.038**	0.016	0.020
Grp	-0.064**	0.080	0.070	0.029**	0.075	0.069	0.119**	0.076	0.012
Crdtt	-0.293**	0.122	0.016	0.095	0.105	0.365	0.153	0.111	0.169
Extns	-0.391	0.084	0.242	0.104	0.092	0.261	-0.005	0.055	0.935

LR chi2(40) = 107.93 Prob > chi2 = 0.0000 Log likelihood = -109.73115 Pseudo R = 0.3297

*, **, ***: significance at 10%, 5% and 1% level respectively.

4.2.1 Factors influencing choice of choice of market outlets

Table 7 indicates that there was a negative relationship between the number of dairy cows a household head owned and the choice of informal outlet at 5 percent significance level. A unit increase in the number of milking cows owned by a household reduced the probability of using

informal market outlet by 9.1% (ME= 0.091). This means that, as the herd size decreases, smallholder dairy farmer shifts to a less organized milk market outlet because of the decrease in milk volume hence the negative relationship with informal channel. On the other hand, there was a positive relationship between the number of dairy cows and the choice of formal market at 10 percent significance level. A unit increase in the number of milking cows owned by a household head by one unit increases the likelihood of that household to sell to formal market outlet over other channels by 7.3% (ME=0.073). As the herd size increases, the quantity of milk produced also increases and the smallholder dairy farmer shifts to more organized market outlet choice (the formal market outlet).

The advantages of formal outlet include lower transaction costs as well as price incentives or higher prices because of greater bargaining power. This is consistent with findings by Kumar *et al*. (2013) who stated that farmers that produced huge volume of milk sought to sell their milk to channels that can more easily accept larger and possibly more variable quantities of milk. However, the results are contrary to Vijay *et al.* (2009) who noted that there is a negative relationship between herd size and choice of cooperative marketing channel among dairy producers.

Milk volume variable showed a negative relationship in choice of informal outlet and significant at 10 percent. An increase in total milk produced by one unit reduces the probability of that household selling its milk through informal outlet by 1.1% over the other outlets. This plausible since formal markets buy milk in bulk compared to small traders (informal) who buy at farm gate in small quantities. The implication is that farmers who produce large volume of milk prefer selling to the channel which is capable of absorbing all amounts of milk. Dairy farmers who produce small amounts of milk could reasonably sell at farm gate to avoid transport costs. These results are consistent with Tsougiannis *et al*. (2008) who reported a positively relationship between volume of milk produced by the farmer per day and choice of cooperatives marketing channel.

The size of the households positively influenced the choice of informal market outlet but negatively influenced the choice of formal market at 5% significant level (ME=0.018, ME= -0.030), respectively. An increase by one adult increases the likelihood of selling milk to informal

market by 1.8 % but reduces the likelihood of selling milk to formal markets by 3.0%. This result is in conformity with Staal *et al*. (2006) who established that the higher the number of adults in a household, the more likely the household is to sell milk through the private trader channels and cooperative processors channel than the individual customer channels. This is possible because farmers will retain more quantities for home consumption as there are more mouths to feed. With less available quantities, the farmer will shift to informal outlets.

Working off farm and having dairy farming income was significant in the choice of informal market and formal market at 10% significance level respectively. Whereas the variable had a positive influence on the choice of formal market outlet (ME= 0.178), it had a negative influence on the choice of informal market outlet (ME= -0.126). Working off farm and having multiple sources of income had a positive effect on participation in the formal. This means that the farmers who have other sources of income apart from milk production income increases participation in the formal market by 17.8%. This could be attributed by increased in farmers' exposure to new opportunities and information on the income generated by the off-farm activities hence increasing the likelihood of selling via this outlet. The finding concurs with Barrett *et al*. (2007) where farmers with off farm activities sold their produce to the modern outlets which accommodate their large quantity produce and in turn give them a chance for the other activities.

However, the findings contradict the results of Davis *et al*. (2013) which revealed that farmers with high off farm income and producing fresh fruits were more unlikely to participate in in state sponsored fruit marketing programs in Tennessee. On the other hand, off farm income reduces the probability of selling to informal market by 12.6%. The results implied that, farmers who had off farm income generating activities and other farming enterprises were less likely to sell to informal market as opposed to the formal and both formal and informal markets. This is due to the fact that farmers who have access to non-farm income are not quick enough to sell their milk to informal market for temporary cash need because they can derive income needed for the household basic needs from other investments activities like trading. Additionally, farmers who have been engaged in off-farm activities have more knowledge in economic value of selling milk in other market outlet if farm gate price of milk diminishes. According to Omiti *et*

al. (2009), non-farm income contributes to more marketed output if the non-farm income is invested in farm technology and other farm improvements. Otherwise, marketed farm output reduces if off farm income triggers the diversification.

The distance to milk marketing outlet point significantly determined the probability of farmers choosing the market outlet at 1% significant level in the informal market. It had a negative influence on the informal market outlet choice (ME= - 0.064). As the distance to the market increases by 1 kilometer, the likelihood of selling to informal market decreased by 6.4%. As the distance to market point increases, there is an increase in the transaction costs of small buyers.

This finding concurs with the study of Apind (2015) who stated that as the distance increases, the probability of farmers selling to private millers increases compared to other outlets. It also coincides with findings of Wanjiru *et al.* (2012) who stated that an increase in distance to the market increases the probability of selling to the local traders and brokers in the case of banana marketing. On the other hand, distance to market was positive and significant at 5% level in the formal market (ME= 0.47). This means that, with the increase in distance to the selling center, the probability that a farmer would sell milk to the formal market over other market outlets increased by 4.7%. The explanation for this positivity is that informal outlets are uncertain and a farmer must move from one point to another hawking and thus incurring extra costs as compared to formal market with well-defined delivery points.

Additionally, there is increasing competition between formal players like the KCC and Brookside which procure milk directly from farmers through milk collection centres strategically located in proximity to producers. The results are consistent with findings by Sharma *et al*. (2008) who found out that the proximity to milk collection point facilitated the preservation of the traditional way of selling milk and those farmers, who have easy access to other markets with less transaction.

Moreover, distance to market was positive and significant at 5% significant level in both outlets (informal & formal) (ME= 0.38). With the increase in distance to both outlets, the probability that a farmer would use the outlets increased by 3.8%. This can be attributed with the fact that most of the smallholder farmers sell to the reliable and available market nearest to

them. In this case, farmers will sell their milk to either formal or informal market depending on proximity. The results conform to the results of Omiti *et al*. (2009) who found that traders in urban centers sold more of their produce than those that were in rural areas because the former could access immediate markets at lower transportation and transaction costs than the latter.

Group marketing negatively influenced choice of informal market at 5% significant level (ME = -0.064). Farmers are 6.4% less likely to sell their milk to informal outlets when they are in groups. This is possible since the informal market may lack information and few liters of milk are sold to this market. In essence, membership to a group increases access to information which is important to production and marketing decisions (Olwande & Mathenge 2012). Most farmer groups engage in group marketing, bulk purchasing of milk and credit provision for its members prefer the formal markets. Group marketing positively influenced participation in the formal market at 5% significance level (ME = 0.029).

The probability that farmers who marketed their milk as a group sold to formal outlet was 2.9%. This is plausible because of the volumes involved. Njuki *et al.* (2009) found that besides reducing transaction costs, group marketing helps in empowering farmers to negotiate for better prices in the market and trading terms Anderson *et al*. (2013) also stated that, collectively, the ability to negotiate with the buyer prompts the farmers to sell to a particular market outlet.

Group marketing positively influenced market participation for both formal and informal markets at 5% significance level (ME = 0.119). Farmers in groups have high bargaining power as well as informed prices on their production therefore increasing the probability of selling to formal markets by 11.9%. According to Jagwe *et al.* (2010), belonging to a farmer group is an important social capital aspect that increases farmers bargaining power and significantly influenced choice of farmers' participation in banana markets. This finding is also similar with the findings of Rutto *et al*. (2013) who noted that promoting collective action among smallholder farmers helps to improve their economies of scale in input and output markets since the information flow among them hence market participation. However, the results contradict Apind *et al.* (2015) who found a negative relationship in rice group marketing among the market participants. This could only be possible if the quantity demanded in the outlet for those who sell

as a group is less than the quantity supplied. This will force group members to reduce their deliveries to the market resulting in the negativity of the variable.

Access to credit was negative and highly significant at 5% significance level in the informal market outlet. This is possible since most of the informal buyers do not offer credit to farmers like in the formal where contracts are signed and banks can give them credits. The results show that access to credit in the other outlets reduces the probability of choosing informal market outlet by 29.3%. According to Kembe and Charles (2016), Credit access as factor influence choice of an outlet mainly because the smallholder farmers are able to increase their productivity through the use of available capital. The unavailability of credit in the informal market therefore impacts negatively on the producers' ability to choose the markets which offers credit to the farmers.

Occupation of the household head was positive and significant among smallholder dairy farmers who sell their milk to formal markets at 5% significant level. The result indicated that the farmers who are employed or have other business apart from their dairy activities are 11.7% likely to sell their milk to formal markets than the informal or both. This result was expected because of the fact that farmers who have other occupations may prefer formal markets which make payments through banks compared to cash transactions of the informal outlets.

Price of milk per litre was positive and significant among the farmers selling their milk to formal market and both formal and informal at 1% significant level. The results showed that smallholder dairy farmer was 1.3% likely to sell milk to formal market over the other market channels. This means that the price offered by the formal channels induces the farmers to sell through this outlet. Artukoglu *et al*. (2008), and Tsougiannis *et al*. (2008) noted that the choice of the marketing outlet by dairy farmers heavily depended on the price offered by that outlet.

Marketing outlets that offered price premiums to farmers received large volume of milk compared to those outlets which were offering low prices. Price of milk per litre was positive and significant among the farmers selling their milk to both market outlets (formal and informal) at 5% significant level. The results showed that smallholder dairy farmer was 0.8% likely to sell milk to both markets over the informal and formal market. This means that the price offered by this channel makes the farmers to sell milk to the two markets depending on the needs of the

farmer at that particular time. The results are consistent with Tsougiannis *et al*. (2008) who noted that the choice of the marketing outlet by dairy farmers heavily depended on the price offered by that outlet. Marketing outlets that offers good prices to farmers received large volume of milk compared to those outlets which were offering low prices.

Neighborhood effect was significant to those famers selling their milk to both channels (formal & informal). The farmer is 10% more likely to sell their milk to both channels compared to formal and informal channels. This can be explained by the fact that famers who inquire information on market condition and the prices will tend to sell their milk depending on the needs of the farmer, For instance if the farmer wish to get money for urgent needs he will sell to informal and if not then the farmer sell to formal market.

4.3 Factors influencing milk market participation and the extent of participation

Heckman two-step procedure was used to determine the factors influencing participation and extent of participation in milk marketing. The variables included in the model were age, gender, marital status, education level, occupation, household size, price of milk (selling price), contract, price information, milk marketing experience, group marketing, household income, and distance to collection point (market). The data was analyzed and post estimation of the selection equation results was done to obtain the marginal effects for interpretation purpose since the coefficients of selection equation have no direct interpretation (Heckman, 1979).

4.3.1 Factors influencing milk market participation.

To determine the factors influencing market participation of milk among the smallholder dairy farmers in Kuresoi North Sub-County, a probit model was estimated in the first step of the Heckman selection equation and the results presented in Table 8. Five variables (Education level, Breed, number of cows, credit and mode of payment) were significantly found to influence the farmers' decision to participate in the milk market. The Inverse Mills Ratio (IML/Lambda) term was significant and positive at (0.0396), which suggests that the error term in the selection and primary equation were positively correlated and that there was little sample selection bias. There were no unobservable characteristics affecting the household milk market participation decision and extent of their participation. The unobserved factors that make participation in milk

marketing are more likely to be associated with higher scores on the dependent variable. The marginal effects were used to interpret the results.

Table 8: Factors Influencing Market Participation (Heckman Selection Model)

Variable	Coefficient.	SE	P>z
Age	-0.0014	0.0072	0.8470
Gend	0.1038	0.1034	0.3160
Mrts	-0.0206	0.1981	0.9170
Educ	0.0766**	0.1025	0.0450
Hsize	0.0289	0.0454	0.5240
Slnd	-0.0490	0.0353	0.1660
Extns	0.0392	0.1232	0.7500
Crdtt	0.1879*	0. 1050	0.0730
Oyfm	-0.0364	0.1188	0.7600
Occup	-0.0794	0.0911	0.3840
Dist	0.0048	0.0320	0.8810
Prclit	0.0045	0.0095	0.6340
Neighef	0.0522	0.0874	0.5500
Contr	0.0091	0.1634	0.9560
Pinf	0.2601	0.2379	0.2740
Expe	-0.0050	0.0142	0.7240

Ncow	0.0960**	0.0471	0.0420
Brd	-0.0242	0.0403	0.5480
Milkvol	0.0151***	0.0056	0.0070
Modepay	0.3003***	0.1128	0.0080
_cons	-0.9111	1.3649	0.5040

*, **, ***: significance at 10%, 5% and 1% level respectively.

Level of education of the smallholder dairy farmer was positively significant at 5% significance level in influencing market participation. An increase in the level of education increases the probability of milk market participation by 7.66%. The positive sign of education variable on participation decision arises from the fact that education plays a significant role in increasing acceptance and uptake of milk productivity enhancing technologies such as improvement of dairy breeds and information technology. Educated dairy producers can make informed market decisions. These findings are in conformity with findings of Barret (2006) and Geoffrey *et al*. (2014) who illustrated the positive influence of education level to the amount of supplied to the market. Education enables farmers to adopt new innovations that enhance their capacity to produce milk for the market. This suggests that higher level of education provides a greater opportunity for the farmers to participate in market found that education level of the household head was highly significant and positive in influencing market participation. An increase in the level of education increases dairy farmer skills and successful implementation of improved milk production and marketing practices (Omiti *et al*., 2009). These findings call for increased government investment in extending market participation skills training to smallholder farming communities in the milk producing areas and the whole country through the extension services.

As expected, the marginal effect of access to credit was positive and significant at 10% significance level. An increase in credit access by the smallholder dairy farmers has a probability of increasing the participation by 18.79%. This can be explained by the fact that

access to credit helps the smallholder dairy farmers to invest in different inputs for milk production purposes. Additionally, the burden of repaying the loan motivates the farmer to improvise ways of producing and selling more output. These results are similar to Alene *et al.* (2007) and Yaynabeba and Tewadros (2013) who also found positive and significant relationship between access to credit and market participation decision.

The total number of cows owned by a household head was found to influence the market participation decision. The variable was positive and significant at 5% significance level. The positive relationship indicates that as the number of milking cows increased by one, the probability of the market participation by smallholder dairy farmer increases by 9.6%. This result can be explained by the fact that as the number of dairy cows increased the quantity of milk increases and therefore increasing the probability of participating in the market. Kumar *et al.* (2014) revealed that cattle ownership positively increases market participation. The number of dairy cows owned by the household is a vital policy variable that indicates possible market policy interventions that can be implemented to enhance milk market participation among the smallholder dairy farmers.

Volume of milk produced in the farm influenced the market participation at 1% significant level. The probability of participating in the milk market increases by 1.51% as milk yield per day per household increases by one litre. The strong and significant influence of milk volume on farmer market participation decision implies that the more milk produced by the lactating cows, the more milk surpluses, which compels any farmer to dispose of surpluses through the market. This result is similar to Balirwa *et al.* (2016) who noted that market participation increases with an increase in milk production per lactating cow per year in Uganda market.

Mode of payment as expected was positive and highly significant at 1% level to influence market participation. The probability that a famer participates in the market increases by 30.03% regarding the mode of payment in the market. A producer can choose the option of receiving daily/weekly payments or monthly payments through bank accounts. This flexibility gives a leeway to participate in milk markets. The advantage of cash sales that the farmers can immediately convert the money into other preferred uses. This concurs with the results of Staal

et al. (2006) who found out that cash payment mode negatively and significantly affected accessing cooperative and private trader milk market outlet selection as compared with accessing consumer individual milk market outlet.

4.3.2 Factors influencing extent of market participation

To determine the factors influencing the extent of milk market participation, OLS regression was estimated in the second step of the Heckman outcome equation. The results are presented in Table 9. Out of the sixteen variables included in the model, only seven variables (gender, Household size, price of milk, price information, marketing experience, distance to the market and contract) were significantly found to influence the extent of milk market participation.

Table 9: Heckman two-step showing extent of market participation

Variable	Coef.	SE	P>z
Age	0.0166	0.0104	0.1090
Mrts	-0.4629	0.2324	0.5820
Gend	0.1281*	0.2675	0.0840
Educ	0.2292	0.1487	0.1230
Hsize	-0.1052**	0.0591	0.0750
Slnd	-0.0298	0.0728	0.6820
Extns	0.2073	0.2404	0.3880
Oyfm	-0.1519	0.2300	0.5090
Occup	-0.1227	0.1886	0.5160
Dist	s-0.0344**	0.0644	0.0430

Prclit	0.0240*	0.0125	0.0560
Contr	0.3574*	0.2112	0.0910
Pinf	0.5300**	0.2355	0.0240
Expe	0.0191**	0.0318	0.0548
Ncow	-0.0072	0.1204	0.9520
Brd	-0.0084	0.0969	0.9310
_cons	-1.8896**	0.8455	0.0250
Lambda	0.3960	0.8329	0.634
rho 0.8022	sigma .49369753		

*, **, ***: significance at 10%, 5% and 1% level respectively.

Gender of the household head significantly and positively influences the extent of milk market participation at 10% significance level. Being a male-headed household increased the proportion of milk sales by 0.1281 units. This suggests that the male-headed households are more market oriented than female, hence they participate more in the market for profit in their dairy production. The male-headed households are believed to have strong bargaining power which in turn increases the proportion of milk sales (Berhanu *et al.*, 2014). The result is consistent with that of Cunningham *et al*. (2008) who argued that men are likely to sell more due to their argument in bargaining, negotiating and enforcing contracts. This argument was advanced by Dorward *et al*. (2004) who concluded that the discriminatory tendencies against women tend to weaken their negotiation prowess and therefore making them less influential in agro-commodity market However, they are contrarily with Sserunkuuma *et al.* (2010) and Balikowa (2011) which indicated that although female-headed households are less likely to produce milk than a typical male-headed household, when they do, they are more likely to participate in milk market outlets.

Price information about local market informs the farmer on prevailing pricing condition. As expected, price information significantly and positively influences the extent of milk market participation at 5% significance level. The higher the farmers' access to price information the higher the probability of participating in marketing of the milk. The result shows that an increase in the price information by one unit increases the proportion of milk sales by 0.53 litres. This indicates that access to price information increases milk market participation and leads to understanding of the workings of the market, prices, and other market information that improves decision making of the smallholder dairy farmer. Accessibility of market information related with price condition in local market fosters choice of market outlet. This is in line with the Geoffrey *et al*. (2014) who indicated that market price information had a positive influence on the choice of the local market hence farmers who have price information about the existing marketing trend tend to sell more of their produce than those without. The results are also consistent with the findings of Alene *et al*. (2008) and Geoffrey *et al*. (2014) who stated that there is existence of a positive relationship between the price information and the market participation among the smallholder farmers.

Since almost all the farmers accessed market information, market information sources were examined to determine their influence on extent of market participation. Irrespective of the source of information, it remains critical for a farmer to participate in the market. These results seems to affirm the notion that market information gotten by the farmer about a certain marketing outlet increases probability of a farmer willingness to participate in that outlet hence and he is more likely to increase his output sales through that marketing outlet (Jagwe *et al*., 2010; Otieno *et al.*, 2009).

The coefficient of contract marketing was found to be positive and significant. Being in contract marketing increases the proportion of selling milk to the market by 0.3574. This denotes that the farmers who were marketing under contract sold more of milk produce due to availability of the ready market. This finding is in line with that of Jari and Fraser (2009) who stated that there is an increase in formal market participation with the availability of contractual agreement amongst smallholder farmers. According to Delgado (1999) contract farming, gives the producers or marketers the advantage of an assured supply of the commodity at known

intervals at a fixed price and a controlled quality. They can help to provide the option of making collateralized loans to farmers. The contracts also provides better relations with smallholder farmers than large scale farmers, avoiding the expense and risk of investing in the enterprises, sharing production risks with the farmers, and ensuring that farmers supply their produce of a consistently.

Marketing experience was positive and significant at 5% significant level. An increase in a farmers' milk marketing experience by one year increase the proportion of milk sale by 0.0191 This implies that a one year additional experience in dairy production will enhance the knowledge and understanding of the household head with regard to the prevailing market conditions. This can be explained by the fact that marketing experience has direct relationship with the farmer's production level and marketing network in the society. The relationship also implies that experienced farmers had better knowledge of cost and benefits associated with various milk marketing outlets; consequently they are likely to increase the quantities supplied through the milk marketing groups to benefit from economies of scale. As farmers gain more experience, it is expected that the many years of practice will positively influence their decision-making skills. The experience enable them to adopt better farm management practices, knowledge of milk production, market and marketing system which in turn, enhances risk taking characteristics of the household. Makhura (2001) stated a possible reason that households with more experience in dairy farming have over time developed some understanding of market dynamics and therefore improve their decisions about market participation. The finding concurs with that of Abay (2007) who found that an increase in farmer's experience increases tomato market participation in Fogere, South Gonder.

The distance to the milk collection center, which was used as a proxy for access to milk markets of the smallholder dairy farmer was significant at 10% significance level. As hypothesized, distance to the milk collection center affected participation negatively. The marginal effect from the study indicates that, when the household is located one Kilometer away from the market the probability of market participation decrease the proportion of milk sold by 0.344. This indicates that as one move further away from the milk collection point, there is an increase in the transportation costs and there is likelihood of getting losses due to milk spoilage

overtime and less access to information and facilities offered by the milk outlets, thereby impacting participation negatively. The nearer a farmer is to the milk market collection center, the lesser the time taken and the easier to take the milk to the market since the farmer may not incur a high cost for transportation. According Bardhan *et al*. (2012), distance from the farm to the market is noted as a major constraint to the extent of market participation by the smallholder farmers. The result is in conformity with the study of Geberemedhin *et al.* (2009) which revealed that the longer the distance to the nearest market outlet, the lower the participation of smallholder farmers in the marketing of their produce.

The coefficient of house hold size was negative (-0.1052) and significantly influenced the extent of market participation among the smallholder dairy farmers at 5% significant level. Smallholder dairy farmers who had large household size had a higher probability of reducing the proportion of milk sold to the market by 0.1052. This implied that as the number of family members' increases in size, the number of mouths to feed also increases hence the responsibility of providing food for the family. This gives the necessity to withhold more milk for home consumption purposes. This study coincides with the study of Mwema *et al.* (2013) and Apind (2015) which stated that large household size negatively influences the extent of farmer's market participation.

Finally, price per litre of milk as expected positively influenced milk market participation at 10 % significant level. The output price is important in the market participation because milk producers will only enter a market at a particular threshold when they are able to cover the transaction costs (Key *et al*., 2000). The results indicated that as the price increases by a unit, farmers tend to enter in to the market by a proportion of 0.024. This result is in conformity with Omiti *et al.* (2009),who noted that better output prices in the market is a key incentive for increased output sales.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the descriptive and empirical results relating factors influencing choice of market and extent of participation among smallholder dairy farmers in Kuresoi North Sub-county. The results are presented in two parts: descriptive and empirical. Descriptive results explain the influence of socioeconomic factors in the choice of milk markets. On the other hand, empirical results present multinomial logit results factors significant in determining factors influencing the choice of milk marketing outlet and Heckman two-stage model on factors which influence the extent of market participation. There are three conclusions in line with the objectives of the study. Following the conclusions, three policy recommendations were given to help in enhancing market participation as well as choice of marketing outlets among smallholder dairy farmers. Consequently, suggestions for further are presented in order to strengthen the development of market outlets and enhance household incomes.

5.1 Conclusions

i. Descriptive results revealed that farmers were either selling their milk to formal, informal or both (formal and informal) markets. Majority of the farmers sold to informal market compared to formal and a combination of both with varying prices in the outlets. Formal markets provide comparatively better milk prices than informal outlets.

ii. Multinomial logit model results indicated that, nine factors significant in determining factors influencing the choice of milk marketing outlet. These were: occupational status, group marketing, number of cows owned, price information, type of dairy breeds, milk volume, distance to market, neighbouring effect, and distance to market point. However, the amount of milk, group marketing and price of milk greatly influenced the choice of market outlet.

iii. The Heckman results on extent of milk market participation was positively influenced by: gender, household size, distance to market point, price of milk, price information, milk marketing experience, and contract marketing.

5.2 Recommendations

i. Since majority of the farmers sold to the informal market, which offer comparatively lower prices, there is need to promote extension services as a way of increasing awareness in price variations. Further, formal markets must ensure regular and predictable payments for milk delivered so that they can compete effectively with informal markets which buy the milk by cash.

ii. Because the choice of market outlet greatly influenced by the amount of milk, group marketing and price of milk, it is important to promote all the outlets and minimize the variation in prices so that economic benefit of farmers can be maximized. To ensure that smallholder dairy farmer participate in the existing market outlets there is need to promote extension services as a way of increasing awareness. This will assist in advising farmers not only on the choice of market outlet but also to increase milk output.

iii. The extent of milk market participation was positively influenced by: gender, household size, price of milk, distance to market point, price information, milk marketing experience, and contract marketing. Given the significance of access to market information in influencing milk market participation, it is important to promote farmers' access to market information. This can be done by strengthening farmer contacts, group marketing, extension services, radio publicity agricultural shows, field days, and exhibitions by the county government.

5.3 Suggestions for further research

The factors influencing choice of market outlets, decision to participate and its extent of market participation were studied only in Kuresoi North Sub-County. However, the situation may be different in other areas of the country and for generalization purposes of the whole country; it is worth enough if a research considering the remaining part of the country is done. This study also focused only on the common smallholder dairy farmers and included selected marketing outlets despite the fact that there are many types of dairy breeds and several other marketing outlets that exist. Further studies can be conducted on the other breeds and marketing

outlets not covered in this research. Similarly, a study to identify factors that lead farmers to join the marketing outlets should be conducted. Such studies would help to guide policy makers to facilitate the development of market outlets and strengthen their effect on household income.

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APPENDICES

Appendix 1: Questionnaire

This study is conducted to find out the factors that determine market participation among smallholder dairy farmers in Kuresoi North sub county, Kenya. The information provided will assist in the formulation of policies and programs that will improve dairy marketing in the sub county. The information will be treated with strict confidentiality.

Questionnaire Identification

Questionnaire number…….

Division …….

Location…….

Name of enumerator……..

Name of farmer……

SECTION A: DEMOGRAPHIC DETAILS

Please tick (√) the appropriate choice

A.1. Gender: 1) Male { } 0) Female { }

A.2. Relation to head (*Tick where appropriate*) (1=Head, 2= wife, 3= sibling, 4= other)

Head	Wife	Sibling	Other(specify)

A.3. what is your employment status /Occupation of the head (*Tick where appropriate*)

1. Employed { } 2. Not employed { }

A.4. Age of the household head ……. (Years)

A. 5. Marital status of the head, 1. Married { } 0. Not married { }

A.6. Household size (*number of people living and eating together*)…….

A.7 (a). What is the highest educational level the head of household has completed?

No Formal Education	Primary	Secondary	Tertiary	Other (Specify)

KEY: (1= no formal education, 2= primary, 3= secondary, 4= tertiary, 5= other)

(b). How many years of schooling…….. (Years)

C: CHARACTERIZATION OF MILK MARKETING

C. 1.what is he size of land under dairy?..... (ha)

C.2a .How many dairy cows do you have? .....

C. 2b. What is the total amount of milk produced in the farm every day in …….. litres

C.3a. Do you sell your milk? 1. Yes { } 2. No { }

C.3b. If yes in 3a above, where do you sell most of your milk produced

Market place	Tick where appropriate	Reason
Farm gate (informal)		
Processing companies (formal)		
Both (formal/informal		

Key: 1=formal, 2= informal, 3= both

C.4a. How much milk do you sell every day to the above channel (s) in …… litres

C.4b. At what price do you sell your milk per litre ?…….. Ksh

C.4c. Do you perform price surveys, before selling? 1. Yes { } or 2. No { }

C.5. How many years have you been selling milk to the market? ..... (Years)

C.6a. Do you always find ready market for your milk produce? 1. Yes { } 2. No { }

C. 6b. If No what happen to unsold milk (tick where appropriate)

Lost to spoilage	Household consumed	Sell at low price	Store and sold later	Processed

KEY: (1= lost to spoilage, 2=consumed, 3=sell at low price, 4= store and sold later. 5= processed

C.7. How difficult is it to find the buyer (tick where appropriate)

Easy	Fair	Difficult

KEY: (1= easy, 2= fair, 3= difficult)

C.8a Do you have access to market information? 1. Yes { } 2. No { }

C.8b. If yes in 8a above, from which source do you get the information on dairy markets?

1. Other dairy farmers { } 2. Personal observation { } 3. Radio { } 4. Broker { }

5. TV { } 6. mobile phone { } 7. Extension agents { } 8. Newspaper { } 9. Other { }

C.9. On sclale of 1-5. 1 being the lowest and 5 being the highest, How much do you trust information from these sources? .....

C.10. Do you have contractual agreements or a guaranteed? YES [ ] NO[ ]

C.11. How is your milk produce moved to the marketing point (tick appropriate)

	Type of transport				
	Bike	Motorbike	Truck	Nissan	Other (specify
Own transport					
Hired vehicle (individual)					
Hired vehicle (group)					
Move by donkey cart					
Buyer transport					
Public transport					

C.12 How far is marketing point from your farm? ..... Kms.

C.13 How much do you pay for single trip to the market if any? Ksh ……

C.14 Complete the below for payments and how long it take to receive the payments

List the	How are you paid	Time taken for payment

marketing outlet				
	Cash	Cheque	Other (specify)	

C.19 When selling do you combine, with other farmers? 1. YES { } 2. NO{ }

D. INFRASTRUCTURE

D.1 What type of road do you use to the market?

MURRAM	TARMAC	BOTH

KEY: 1-Murram, 2-Tarmac, 3-Both

D.2.On a scale of 1-5, 1 being lowest and 5 being highest, How can you rate degree of satisfaction towards your road ?

1. Very satisfied { } 2. Satisfied { } 3. Unsure { } 4. Dissatisfied { } 5. Very dissatisfied { }

D3. Are you satisfied with the number of roads that links you to the market? 1. Yes { } 2 No { }

F. MEMBERSHIP TO FARMER GROUP

F.1. Are you a member of any farmers group? 1. Yes { } 2. No { }

F.2. What benefits do you get from the group?

Market together	Acquire Inputs	Credit Access	Information Access

KEY:1-Market together, 2- Acquire inputs, 3- Credit access, 4- Information access

F.3. How do you rate the degree of satisfaction toward services received from your milk-group?

1. Very satisfied { } 2. Satisfied { } 3. Unsure { } 4. Dissatisfied { } 5. Very dissatisfied { }

G. ACCESS TO CREDIT

G.1. Have you ever had access to credit? 1. Yes { } 2. No { }

G.2. If yes in G.1 above, how often do you access? (*tick where appropriate*)

Daily	weekly	monthly	yearly	Others (specify)

G.3. List the institutions from which you obtain your credit.

a) .....

b) .....

c) .....

G.4. Where do you get the money to repay your loan? (*tick where appropriate*)

Sale of milk	Non-farm income	Others (Specify)

H: EXTENSION SERVICES

1. a. Do you have access to livestock/ dairy extension services? 1. Yes { } 2. No { }

1.b. If yes, mention the source …….

1. c How often do the extension officers visit you? 1) Weekly { } monthly { } yearly { } never happen { }

2a. Did you find the advice from extension agent adequate 1. Yes { } 2. No { }

THANK YOU FOR YOUR PRECIOUS TIME AND PARTICIPATION

Appendix 2: Publication

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Factors influencing choice of milk market outlets among smallholder dairy farmers in Kuresoi north sub-county, Kenya

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Kuresoi North Sub-County has experienced a rapid expansion in milk production and there exist both formal and informal milk market outlets. With these abundant opportunities, much of the produced quantities of milk are expected to enter the market and farmers' livelihoods be improved. However, it is not clear whether the smallholder milk producers are exploiting the existing and emerging market opportunities through the choice of market outlets. The objective of this study was to identify factors influencing choice of milk market outlets among small holder dairy farmers in Kuresoi North sub-county. A total of 196 respondents were selected using multistage sampling and a semi-structured and pre-tested questionnaire was used to collect data. SPSS and STATA were used to analyze the data. Results showed that occupation of the household, group marketing, access to credit, distance to market point, number of cows, milk volume, price of milk and type of breed significantly influenced the choice of milk marketing outlets. The study recommends that the county government in collaboration with other stakeholders in the milk sector should increase marketing information and capacity building by promoting expansion of dairy farming and linking the farmers to alternative markets thus improving their welfare.

Key words: Smallholder milk producers, market outlet, choice of market outlet.

INTRODUCTION

Dairy farming is one of the key economic activities practiced in most parts of developing countries. It is one of the income generating activities that contributes to the alleviation of poverty by ensuring that farmers get regular cash flows as opposed to other intermittent incomes such as crop cultivation and other forms of livestock keeping, like bee, poultry, sheep and pigs (FAO, 2014). In Kenya, dairy farming subsector contributes about 4% of the country's Gross Domestic Product (GDP) and approximately 14% of total agricultural products output (KNBS, 2010). About 70% of the dairy farmers in Kenya are smallholders, many of whom are situated in the Rift Valley and Central regions (Smallholder Dairy Project, 2008). This subsector also contributes a highly significant share of food for the majority of the Kenyan population as well as providing a direct livelihood opportunity to more

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