

**IMPACT OF USE OF FARMING TECHNOLOGY ON LIVELIHOOD OF SMALL-  
SCALE DAIRY FARMERS IN LONGISA, BOMET COUNTY, KENYA.**

**BY**

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**A Research Project Report Submitted in Partial Fulfillment of the requirement for the  
award of the degree of Master of Arts in Project Planning and Management of the  
University of Nairobi.**

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## **Declaration**

This research project is my original work and has not been presented for a degree or any award in any University.

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L50/ 5782/2017

The research project has been submitted for examination with my approval as University supervisor.

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## **DEDICATION**

This research project is dedicated to my parents (Ronald and Teresiah), wife (Caroline) and children (Kipchirchir, Kiplangat and Cheptoo).

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## **ABBREVIATION AND ACRONYMS**

<b>ADC</b>	Agricultural Development Corporation
<b>AI</b>	Artificial Insemination
<b>AMR</b>	Automatic Milking Rotary
<b>FAO</b>	Food and Agricultural Organization
<b>GDP</b>	Gross Domestic Product
<b>ILRI</b>	International Livestock Research Institute
<b>KDB</b>	Kenya Dairy Board
<b>RFID</b>	Radio Frequency Identification Device
<b>WHO</b>	World Health Organization

### **Abstract**

The study focused on impact of use of dairy farming technology on small-scale dairy farmers' livelihood in five wards in Longisa sub-County: Kembu, Merigi, Chemaner, Kiprerer, and Longisa. An ex post facto research design was used in the study. 128 small-scale dairy farmers, two agricultural officers and ten milk collectors (drivers) were randomly sampled for the study. Data were collected using questionnaires, observations and document analysis. Data were analyzed using descriptive statistics and t-test procedure. It was found that there is a significant difference between farmers who adopted dairy farming technology and those who did not ( $t_{(106)} = -15.2240$ ,  $p = 0.000$ ) indicating that there is improvement in milk production for farmers who utilise the farming technology. In addition, the study established that the small-scale dairy farmers' level of education plays a major role in adoption of farming technology, use of credit and milk market facilities leading to enhanced income and positive impact on the farmers' livelihoods. The study findings have implications on Agricultural Education and Extension Officers, rural dairy farmers, Farmers' Training Centres and teachers of agriculture in schools.

## CHAPTER ONE: INTRODUCTION

### 1.0 Background of the Study

International livestock research institute, World Bank, coded livestock to be the most highly valued in market with fastest development (World Bank, 2008). In a study done in the East Mediterranean region of Turkey, a direct relationship was found among improved dairy breed, investment, age of farmer to adoption of technology in dairy farming (Boz, Akbay, Bas, Budak, 2011). In a study done in the Erzurum province of Turkey, a statistically meaningful relationship was found between education status, animal breed and subsidy benefits; and the innovation adoption of dairy farmers (Aksoy, Kuleka, and Yavuk, 2001). However on both studies no relationship was depicted among the studied elements and market availability, credit facilities and extension services provided to small scale farmers.

An adoption of technology has greatly changed genetic and reproductive performance of dairy animals. Technology such as AI, Embryo transplant, and sexed semen technology have drastically improved milk production. Farmers are able to control cows lactation period, improve breed and control herds (Aditya. 2001). The same technology has been used in Longisa sub-county therefore factors influencing it adoption have to be studied.

A research conducted in India, established that there was a relationship in extension service, income of farmer, age of farmer, education level, and operation land holding to adoption of technology in dairy farming (Cukur,2016) it was concluded that adoption of dairy farming technologies by rural women in India, was related to milk marketing channels, veterinary, health education ,economic, motivation social participation, fodder, incentive, attitude, awareness, extension support and knowledge (Halakatti Sassan, and Kamaraddi. 2007). The study is very extensive and it gave detailed

knowledge on most technologies applied by dairy farmers. A replica research is necessary to be conducted in Bomet County.

In Malawi it was found that adoption of technology in dairy depend on milk yield and extension visit (Tebug, Chekegwa and Wiedemamn. 2012) .The study actual depicted an inverse decision making procedure. Farmers should be working towards improving productivity not utilizing technology after getting positive results.

According to Akudugu, Ciuo and Dadzie (2011), the adoption of dairy technology depends on extension service, access to credit facilities and expected benefits on the technology. Research conducted on agricultural productivity and policy change in nine Sub- Saharan African countries namely Angola, Nigeria, Ghana, Mozambique, Guinea, Cameroon, Mali, Zambia, and Ethiopia indicated that structural adjustment on policies that led to implementation of more favourable new agricultural technologies, effective application of input led to significant change on output (Stall and Kaguongo. 2008).

The research did not address economic issues affecting farmers such as credit facilities and market.

In study performed on Ethiopia it was concluded that adoption of dairy technology by dairy farmers depends on owning agricultural land and availability of credit facilities. Dairy production in Ethiopia is mostly subsistent type and rearing indigenous breeds with low productivity (Azage and Alemu, 1998). The study did not actually explain implication of any technology application in dairy farming

An extensive research was conducted in three districts of coast province Kilifi, Kwale and Malindi these are the homeland of Mijikenda who have potential of be medium scale dairy farmers. They have been implementing dairy production program before and modern technologies application. The findings were there was no relationship between labour availability and technology application, feeding procedure, and

therefore, production was hindered by lack of rainfall. Dairying farming is one of the most lucrative farming practices, with high returns; it is the best means of eradicating poverty if it is well utilized. The high population growth has resulted in immense demand for milk both in rural and urban settings (ILRI, 2007).

The background study has identified that there is a need to undertake a similar research in Longisa sub-county Bomet county Kenya to identify the impact of adoption of dairy farming technology on the livelihood of small-scale farmers.

In Nyandarua, a research conducted indicated that government support in terms of training, infrastructure development, disease control, financial support and breeding is wanting. Therefore, milk production has declined (Kamau and Gitau, 2001). It could be the same treatment, farmers in Bomet are receiving therefore, and a research needs to be conducted.

Returns in small-scale dairy farming are very minimal; the cost of feeding, breeding, and transport is very expensive and hardly do farmers get to break-even point. Gain is only realized during festive seasons and periods of drought (Halake and Mamo, 2013).

Factors of production such as labour utilization, training, feeding, breeding, skill, and labour affect the economic benefit of zero-grazing dairy farming (Langat Dennis, 2011).

The studies which have been conducted by different scholars have never captured Longisa Sub-County. Longisa has been a dairy farming area in Bomet county; a study was needed to be undertaken to establish the impact of dairy farming technology on the livelihood of small-scale dairy farmers. The study findings have implications on Agricultural Education and Extension Officers, rural dairy farmers, Farmers' Training Centres and teachers of agriculture in schools.

## **1.1 Statement of the Problem**

Currently there is no document showing the influence of use of dairy farming technology on the livelihood of small scale farmers in Bomet County .A research was conducted to identify factors affecting adoption of technology in dairy farming.

It was therefore necessary for research to be conducted to establish the impact of use of dairy farming technology on livelihood of small scale farmers in Longisa Sub-County, Bomet County. The variables are education level of dairy farmers, availability of credit facilities and market availability.

## **1.2 Purpose of the Study**

The purpose of the study was to establish the impact of use of dairy farming technology on livelihood of small scale dairy farmers in Longisa Sub-County, Bomet County, Kenya.

## **1.3 Research Objectives**

The research study was guided by the following objectives:

- i. To determine the impact of level of education on livelihood of small- scale dairy farmers.
- ii. To establish how availability of credit facilities influence small scale dairy farmers livelihood.
- iii. To establish the influence of availability of milk markets on small- scale dairy farmers livelihood

## **1.4 Research Questions**

This research was guided by the following research questions:

- i. To what extent does level of education influence the livelihood of small scale dairy farmers?

- ii. To what extent does availability of credit facilities impact on small scale dairy farmers' livelihood?
- iii. How does milk market availability impact on small scale dairy farmers livelihood?

### **1.5 Significance of the Study**

Agriculture is a backbone of Kenya hence a decline in, standstill of production in any agricultural sector affect income for both the dairy farmer and government. The research will give government a limelight on where to invest to improve dairy productivity .The information will be useful to dairy farmer and gauging and strategies on how to improve their production. The study will be useful in prioritization, implementation, distribution and allocation of resource to dairy projects in the area by agricultural officers; it will be also useful in policy marking, planning regarding extension services and financial support.

### **1.6 Basic Assumptions of the Study**

During the study factors such as land dispute, infrastructures, was considered to be homogenous to all farmers and government policies will not change during the period of study. During the study it was assumed that element as market dynamics, infrastructure, culture are constant. Also the instruments were assumed to be valid and reliable to give the demanded results and respondent will give accurate information inference

### **1.7 Limitations of the Study**

This research challengers; these include the geographical vastness of the area under study, unavailability and unwillingness of despondence and illiteracy of despondence. The above hindrance was minimised by using a fast means of drop-collect of



questionnaires and using of observation checklist to support the collected data. The unwillingness, unavailability and illiteracy of despondency though will affect the data collected it assumed that the results will be enough to give reliable data.

### **1.8 Delimitations of the Study**

The study was delimited to 128 small scale dairy farmers, 2 agricultural extension Officers and ten milk collectors in Longisa Sub-County, Bomet County, Kenya. The variable, influencing use of dairy technology by small scale dairy farmers; the level of education, availability of credit facilities and market availability to dairy farmers was focussed on.

### **1.9 Definitions of Significant Terms**

**Dairy Technology:** Refer to use of no-traditional dairy farming tools, animal husbandry, and milk handling and feeding of dairy animals.

**Dairy Farming-** This term has been used here to refer to the small-scale cattle milk producers

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

**Dairy:** Means cattle kept for milk production.

**Level of education:** This is the skill, experience, general knowledge and awareness of animal husbandry.

- Credit facilities:** It financial support either from financial institution, Sacco and government.
- Market availability:** It is market distance and customer ready to buy milk.
- Livelihood:** living standard of small scale farmers

### **1.10 Organisation of the Study**

The study is organized in five chapters. Chapter one features background of the study, statement of the problem, purpose of the study and objective of the study. It also composed of research questions, significance of the study, limitation of the study, basic assumptions of the study, sampling procedure, limitation and delimitation of the study and definition of terms. It furthers look on the conceptual frame work and finally the summery of the literature review. Chapter three contain the research methodology of the study, it also describes the research design, target population, sampling procedure, rules and techniques of data collection, pretesting, data analysis, ethical consideration and finally definition of variables. Chapter four contain questionnaires respond rate, distribution of respondent, correlation between variables and data analysis. Chapter five contain summary of findings, conclusion, recommendation and suggestion for further studies.

## **CHAPTER TWO: REVIEW OF RELATED LITERATURE**

### **2.0 Introduction**

This chapter discussed how level of education, availability of credit facilities, extension services and market availability influence adoption of technology by small scale farmers.

### **2.1 Livelihood of Small Scale Dairy Farmers**

The Grameen Bank (GB) identified small scale dairy farming as the best means of eradicating poverty. The bank facilitated the farmers in acquiring means of earning Chowdhury, (1989). In both rural and semi- urban settlement the farming is very useful in providing income as well as food to the farmers. There is a great relationship between the dairy farming and livelihood of those who practice it (Paul 1996).

Poverty is rampant in rural areas, an intervention by government NGOs have been initiated to reduce poverty level by encouraging small scale farmers to adopt dairy technology. The initiative which have been undertaken include; introduction of improve breed of dairy animals, financial support and providing training facilities.

Economic liberalisation in the 1900s saw sudden growth of private milk processing plants, which killed the state own Kenya Co-operative Creameries which supported small scale dairy farmers. This directly affected the living standard of small scale dairy farmers (Karanja, 2003). Income from dairy farming was able to provide school fees, food, medical care and clothing to small scale dairy farmers.

### **2.2 Use of Dairy Farming Technology on Milk Production**

Application of reproductive and breeding technologies have a major impact on breeding program genetic gain and dissemination of genetic gain in dairy animals' production. According to Shook, (2006), genetic has accounted for 55% of gain of the yield traits

and a third of change of time interval required to conception. This can be accomplished through Artificial Insemination, sexed and traditional methods

. Dry matters which are balanced diet are good for dairy livestock (Idel, 2014). The cost of industrial or concentrate feeds are in most cases unreachable by small scale farmers especially in Kenya where animals and human beings are competing for food. This advocate for homemade fodder, fodder is major food stuff for dairy animals. These are green animals feed cut and semi dried Hay making is another way of storing food; green matter, edible by animals are cut and moisture content reduced to a level which cannot rot and fermented with little or no oxygen.( Idel 2014). The Adoption of innovation as an idea, practice or object perceived as new by an individual, while diffusion is the process through which the new idea spreads from a source – its original invention by a creative individual to its adoption by users. Adoption implies a decision to continue full use of the idea as distinct from a decision merely to try it, because of the benefits / advantages accruing from adopting technology. Ogionwo, (1982) argues that the more innovative the farmers are the better off the they become in terms of farm income and high level of living, implying that farmers with great resources are likely to take the risks involved in going over to a new practice. Rogers, (1968) indicate that the relative advantage of innovation, that is positive related to adoption of the practice, could be economically profitable or the new idea minimizes the costs. Rostow (1960) argues that revolutionary changes in agricultural productivity are essential conditions for successful take-off of economic growth of society. Chitere (1994) concurs with this argument and indicates that the adoption of technology of the community members will definitely bring social change in a given community. According to Chitere(1994), innovations could be introduced to a few members of a social unit, for example a rural

village, then from these few members the innovations could diffuse, trickle down or be communicated to other members of the social unit.

Adoption of technology involves application of mental and physical efforts directed to achieving a better value. Technology is a tool that provides better living conditions and enhances the capacity of the people concerned. It is a systematic application of scientific knowledge to practical purposes and includes inventions, innovations, techniques, practices and materials. Farmers implement new ideas, improve practice and use research findings in order to boost their productivity in livestock. Dairy cattle farming in Kenya were introduced by European white colonial settlers who imported the exotic breeds, mainly the Ayrshires, Friesians, Guernsey and Jersey. These breeds were later crossed with the indigenous cattle and over the years produced the national dairy cattle herd

The dairy cattle population is estimated to about 3 Million in Kenya. In dairy sector, the milk produced in Kenya is primarily from cattle, which contribute about (84%) and the rest from camel (12%), and goats (4%). The major types of cattle kept are improved exotic breeds and their crosses (60%) and indigenous zebu (24%) from the communities in drier parts of the country (GOK, 1989). However, market oriented dairy farming is concentrated in the high potential areas in Kenya where good feed supply and disease control is much better. Dairy production can be classified into large or small scale. The small-scale dominate, owning 80% of the 3 million dairy cattle which consists of pure\_bred Friesian, Ayrshire, Guernsey, jersey and their crosses that produce more milk than the indigenous breed.

### **2.2.1 Level of Education of Small Scale Dairy Farmers and Milk Production**

A study carried out in China indicated that farmers' adoption behaviour varies with education and plan to expand and risk concerning new technology (Saha and Schwart, 1994). A similar research was done in turkey and found that; education is the most basic and principle tools for farmers to adopt technology in Dairy Drought (Halake and Mamo, 2013). Education level and experience of farmer give positive moves towards adoption of technology by dairy farmers in Ethiopian (Lemna and Bekele, 2012). Survey by ministry of livestock development has shown that most dairy farmers in Imenti south district work without operation business plans and therefore they are operating in trial and error methods. Therefore, they do not keep records of their daily activities (MOLD, 2011). An educated farmer has high affinity to adopt technology. This is according to a research conducted in meru District by (Behja, Gregory, Philip, and Luyombya. (2014). It was necessary for the same research to be conducted in Longisa Sub county to establish if level of education influence small scale dairy farmers to keep records

Investment on communication, information system and network has yielded satisfactory fruits to adoption of technology by small-scale Farmers (Haggblade, 2011). Accessibility to information can reduce time and price variability and link farmers to potential buyers. Improving of national agricultural support system has been championed the best alternative of increasing dairy production in sub-Sahara (Evenson and Mwabu, 1998). Extension service was found to be a valuable channel of knowledge and communication; useful in assisting farmers in improvement of dairy technology. It facilitate in decision making and distribution of technology. These are fundamental element of dairy farming this triggered the researcher to conduct the same research in

Longisa Sub County to establish the influence of the mention factors on the livelihood of small scale dairy farmer.

## **2.2.2 Availability of Credit Facilities to Small Scale Farmers and Technology**

### **Utilization**

Initial cost of venturing into technology require a major financial and know how investments, this may engorge into financial base of dairy farmers. They therefore find it to be challenging to adopt technology thought a hand full can afford (Batz, 1996). A study done in Aflonkarahisar, Turkey concluded that farmers who have access to credit facilities have financial strength to acquire and maintain technology in dairy farming (Ankara, 2008. Small scale dairy farmer in Longisa Sub-County may be affected by the same attributes of Production this necessitate a research to be conducted.

## **2.2.3 Market Availability to Small Scale Farmers and Milk Production**

In Uganda there was an agency to study how availability of milk infrastructure can determine adoption of technology by farmers. It was found that poor market discourage adoption of technology (Staal and Kaguogo, 2003).

Most farmers concentrate on local or the nearest market( Mogoka, 2009) .The Status Of Good Dairy Farming Practice On Small Scale Farms(2010), found that dairy farmers in western work no hard to improve milk production despite availability of unsatisfied market. A study on features of dairy system supply the city of Nairobi found that dairy farmers are trying to cope with land pressure to satisfy the market (Staal, etal. 2008).

## **2.3 Theoretical Framework of the Study**

Three Models have over the years been used in agriculture technology adoption studies as below.

### **2.3.1 Innovation Diffusion Model,**

The innovation diffusion model entails that access to information, is a critical factor in the adoption and diffusion of Technologies (Feder.J, Zilberman,R.T. 1985). Suggested for the need for emphasizing the use of extension; visits, farm trials and other means to transmit technical messages so as to cut on the search costs for technology thus enhance adoption. This model is influenced by farmers characteristics like age, education among others.

### **2.3.2 Economic Constraint Model**

The economic model purports that economic constraints are major determinants to adoption. (Smale, 1994) stated that in the short run with inputs being limited adoption of technologies was challenged. However in the long run adoption decisions become feasible. This showed why technologies which appeared like having been rejected ended up being adopted after farmers long term planning.

### **2.3.3 Adopter Perception Paradigm**

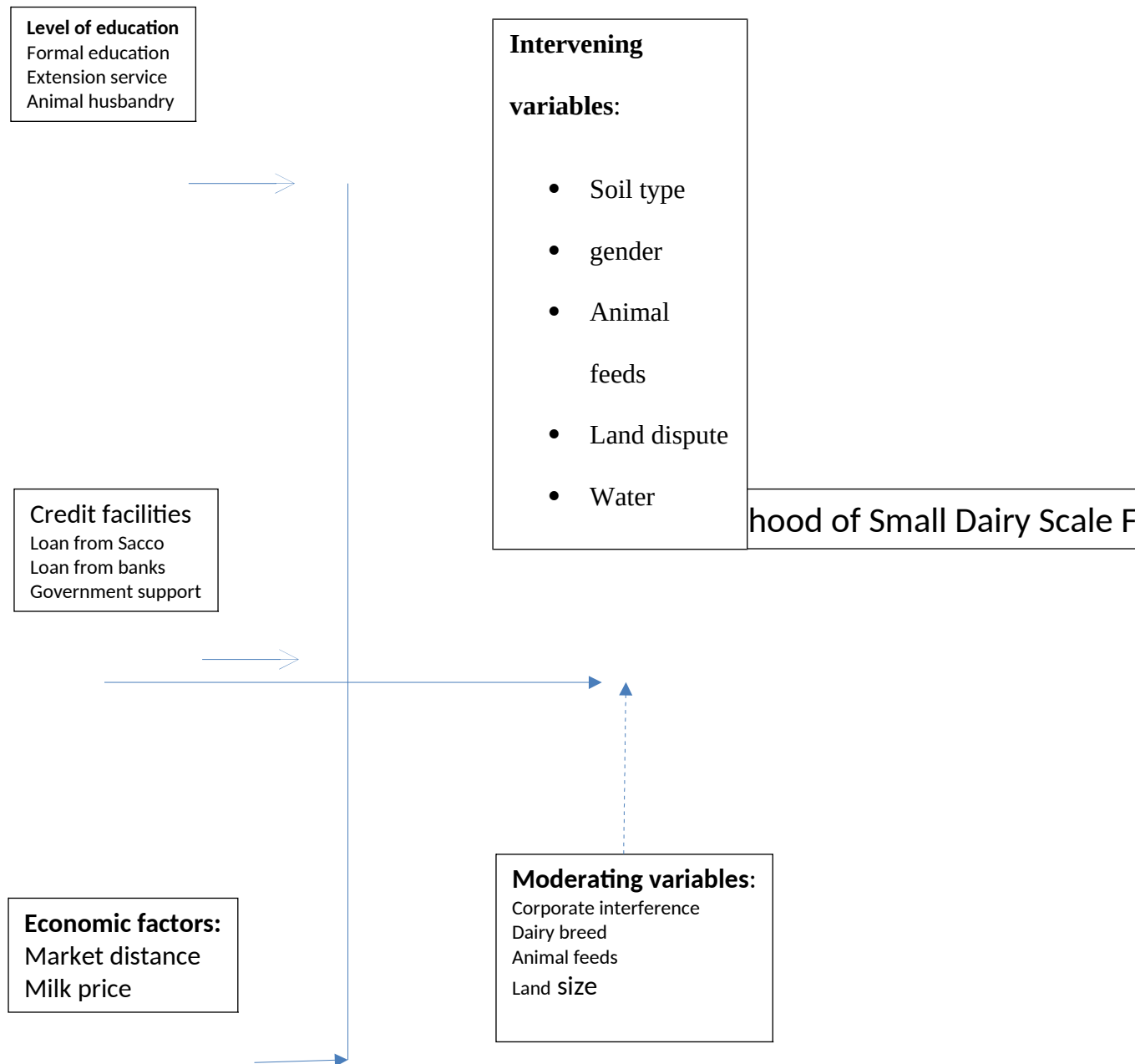
(Norris and Batie 1987) noted that even with full technical information, farmers subjectively evaluated the technology different from scientists. This therefore calls for periodic studies on technology adoption so as to address any gaps. Doss ,(2006) indicated that farmers were usually able to provide information on why they did not adopt a new technology and sometimes the answers provided were able to provide insights into the constraints facing the farmers, while other times, multiple constraints were binding so that removing the listed constraints did not necessarily result in the farmer's adoption of the technology.



Figure 1

## 2.4 Conceptual Framework

The figure below shows different variables under the study and other variables which can affect the research outcome.



Market availability for milk is considered a critical factor influencing adoption of the various dairy technologies. Farmers are expected to adopt dairy technologies under study so as to enhance and sustain milk production where the market was guaranteed. Therefore farmers travelling the shortest distance to main milk market source have a high chance of investing in terms of adopting the various technologies so as to sustain production and income. The independent variables defined the study that is market is based on the distance to the main milk market.

The dependent variables are milk production by dairy farmer per day, acreage under Napier grass, Number of times made silage and number of times baled hay. For a farmer to adopt the indicated technologies, education a critical role. However even where education is available the market needed to be guaranteed. The two independent variables therefore depended on each other. The one financing the project on the other hand issued implementation guidelines on technologies to be adopted whether it made economic sense or not. In this study apart from the project financier having guidelines to be followed in terms of technologies to be adopted, the farmers groups also had governing rules which motivated adoption. Where the owner had other sources of income ploughed into the project or mobilized family lab or then adoption of the technologies was enhanced.

The livestock sector contributes about 40% of the agricultural Gross Domestic Product (GDP) which is about 10% of national GDP in Kenya (Muriuri, 2011). Several researches have been performed in different regions in Kenya but not research has been conducted in Longisa sub-county, Bomet County to establish factors affecting use of dairy technology on milk production by small scale dairy farmers. This has attracted the research to conduct the research on the variables affect the technology use and to come

up with findings, and present the findings in the most understandable format and to give conclusion and recommendation.

## **2.5 Summary of the Review Related Literature**

Several studies have been conducted in different places concerning dairy technology, but none has been done on Longisa Sub-County concerning the impact of dairy farming technology on livelihood of small scale farmers in Longisa Sub-County, Bomet, Kenya. A study done by (Boz et. al, 2011) and (Kaleka and Yavuk) both studies have not studied done on market availability, credit facilities and extension services provided to small scale farmers.

A study done by (Aditya, R.K 2001) shows that there is a significant relationship between animal productivity and breeding, but same research has not been done in Longisa Sub- County. In Malawi a study done by (Tebud, et al 2012) shows that there is an inverse relationship between dairy technology adoption and education. A study had to be conducted in Longisa Sub-County to show the relationship of dairy farming technology and livelihood of small scale dairy farmers.

In Nyandarua, a research conducted indicated that government support in terms of training, infrastructure development, disease control, financial support and breeding is wanting. Therefore milk production has declined (Kamau and Gitau, 2001). It could be the same treatment, farmers in Bomet are receiving therefore, and a research needs to be conducted.

## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.0 Introduction**

This chapter entails description of the research design, target population, sampling size and sampling procedure, operational definition of variables and data collection. The chapter also captured data collection instruments, reliability and validity of instrument, data analysis methods, results presentation and ethical consideration.

### **3.1 Research Design**

The study adopted ex-post facto research design; this was a methodology used to investigate population by selecting sample to analysis activities and come up with results to be presented. The method is ideal for utilization of already collected data available in cooling plants and also useful in testing of hypotheses about correlation relationship. The design is useful in finding factors influencing use of technology by small scale farmers. The design will aid in collecting data from large sample and for it to use in intensive analysis and present data and finding in form of frequency, tables and percentages that make it to be understand.

The scope covered sub-county of Longisa on use of dairy farming technology adopting. The dependant variables are level of education of dairy farmers which includes formal education, extension services and animal husbandry. The second variable is credit facility availability from government and NGOs. The final variable is market availability which is composition of market distance and milk price.

### **3.2 Target Population**

The study covered 688 small scale dairy farmers who are members of Kembu, Kipreres, Chemaner, Merigi and Longisa wards, they were randomly selected. Information

covering extension service, dairy technology and financial facilities will be collected from Longisa sub-county agricultural officer.

### **3.3 Sample Size and Sampling procedure**

Sampling entities represents the actual target population and comprises all the units that are potential members of a sample (Kothari, 2008, Mugenda, 2008). In this study sample of 128 respondents were used. The sampling frame obtained from two cooling plants of Kembu and Longisa indicates all members serve by the plants. Stratified random sampling was used to obtain the sample from different locations (strata) in the Sub-county. For uniformity purposes proportionate stratified sampling method was used to ensure all the locations are represented in the study. Simple random sampling was used to select (respondents) smallholder dairy cattle farmers from each stratum. The following formula was used to come up with an appropriate sample size for the study as per Nassiuma (2000).

$$n = \frac{NC^2}{(C^2 + (N-1)e^2)} = \frac{688(0.25)^2}{((0.25)^2 + (688-1)(0.02)^2)} = 128$$

Where: n = Sample size, N = Population size

C = Coefficient of variation which is fixed between 25%

e = Margin of error which is fixed between 2%.

The sample size was calculated at 25% coefficient of variation, 2% margin of error and a population of 688 dairy farmers.

All farmers were coded and used computer generated random numbers to identify farmers to be sampled.

The study sought to establish the total number of small scale dairy farmers, agricultural extension officers and milk collectors in Logisa Sub-County data was obtained from the document found in the two cooling plants; Kembu and Longisa. Data was analysed as shown in Table 1

**Table 1: Sample of Small Scale Farmers, Agricultural Officers and Milk Collectors in Longisa Sub-County**

Cooling Plants	Wards	Target Population of Dairy Farmers	Sampled Dairy Farmers	Number of Agricultural Officers	Sampled Agricultural Officers	Number of milk collectors	Sampled Milk Collectors
Longisa Cooling Plant	Longisa	111	21	3		10	2
	Kipreres	147	27		1	10	2
Kembu Cooling Plant	Merigi	106	20	3		10	2
	Kembu	138	26		1	10	2
	Chemaner	186	34			10	2
<b>Total</b>		<b>688</b>	<b>128</b>	<b>6</b>	<b>2</b>	<b>50</b>	<b>10</b>

From table 1, it can be seen that 128 farmers, Agricultural officer and 10 milk collectors were sampled for for the study. For the purpose of this study stratified random sampling was employed. This produced estimate of overall population parameter with greater precision and give more representation for homogenous population. Population was grouped into five wards, stratum, out of each stratum random sampling was done to select

The sampled were achieved by the assistance of computer to generate the random numbers. The variation in sample figures was as a result of difference in target population.

### **3.4 Research Instruments**

Questionnaire was the main data collection instrument for collection of primary data. A structured questionnaire with both open ended and close ended questions was used for ease of interpretation and also gathering a wide range of data. One questionnaire targeted the small scale dairy farmers and another one targeted the extension service. Questionnaires were developed as per the research objectives; it was piloted where correction was made by adding more content, modification and deleting.

Observation checklist, document analysis was also developed as per the objectives.

### **3.5 Reliability and Validity of Instruments**

A pilot test was conducted to establish the effectiveness of data collection instrument. A pilot sample of 6% was used which is equivalent to 7 small scale dairy farmers (Mugenda and Mugenda, 2003).

#### **3.5.1 Instrument Validity**

Questionnaires were piloted where corrections, deletion, retention and modification were done before actual study. Proper sampling was done to ensure homogenous representation of all groups (stratum) Data collection was done within four days to avoid major events happening to change opinions and attitude of samples. Research questions were formatted to capture research objectives and expect judgement on research instruments and data analysis were considered

#### **3.5.2 Instrument Reliability**

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

following; pilot testing of instrument, training of the assistant and reduce assistance to reduce variability. The same can also be achieved by utilizing triangulation and making a document trail of research findings.

### **3.6 Data Collection methods**

Research permission was obtained from university of Nairobi; I communicated to sub-county commissioner, agricultural officer, all the respective ward administrators, chiefs and sub-chiefs about my aim of collecting the information. A requested the farmers to cooperate during my research and inform them that the study was for academic purpose.

Questionnaires were distributed to respondents who are able to read; questions were read and explained as they appear on questionnaire. They were waited to be filled and collect in case where it was not possible to be collected an arrangement for a later day collection was organised. Also informants were used to get information and data for the benefit of research. Observation was also part of fundamental tools for data collection.

The study structured interviews, where the researcher asked each respondent the same question. The researcher used a questionnaire with closed and open ended questions. To verify data collected by questionnaire observation will be employed.

A key informant is anyone who could provide detailed information and opinion based on his or her knowledge of milk production project in the study area. The study interviewed four key informants who are involved in milk production projects in the Sub County and those in leadership of the area. Key informants included; three officers from Ministry of Livestock and one official from Kenya Dairy Board (KDB).

Questionnaire was the main data collection instrument for collection of primary data. A structured questionnaire with both open ended and close ended questions was used for ease of interpretation and also gathering a wide range of data. One questionnaire



targeted the small scale dairy farmers and another one targeted the extension service provided by the District Livestock Production officers

### **3.7 Data Analysis Methods**

Collected data was edited, coded, entered in the computer and cleaned to ensure accuracy, consistency, uniformity and completeness. Statistical Package for Social Sciences (SPSS) was used to generate descriptive statistics.

### **3.7 Operational Definitions of Variables**

This section defines variables in terms of objectives, measurable indicators with related means of data collections and means of analysing the data.

Table 2: Operational Definitions of Variables

Objective	Variable	Indicator	Measurement	scale	Data collection	Data analysis
Level of education	Formal education	Literacy level	Record keeping, dairy handling	Nominal Ordinal	Interview guide questionnaire	Computation of frequency and percentage
	Animal husbandry	Number of skill farmers	Record keeping, dairy handling	Nominal Ordinal	Interview guide questionnaire	Computation of frequency and percentage
	Extension service	Number of trained farmers	Record keeping, dairy handling	Nominal Ordinal	Interview guide questionnaire	Computation of frequency and percentage
Credit facilities	Bank	government	Number of farmers with loans	Nominal Ordinal	Interview guide questionnaire	Computation of frequency and percentage
	Sacco	Funding by Sacco	Number of farmers with loans	Nominal ordinal	Interview guide questionnaire	Computation of frequency and percentage
Market availability	Distance to market	Means of transport	Availability of motor vehicle,	Nominal	Interview guide questionnaire	Computation of frequency and percentage
			Road network	ordinal		
	Price of milk	Living standard of	Availability of dairy	Nominal	Interview guide questionnaire	Computation of frequency

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### **3.8 Ethical Considerations**

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

## CHAPTER FOUR: DATA PRESENTATION, INTERPRETATION AND ANALYSIS

### 4.0 Introduction

In this chapter background information for respondents is described; the description variables are gender, age and education level. Variables under objectives; education level, credit facilities, source of information, market availability and technology will be discussed. Also in this chapter presentation of findings is discussed, analysed and presented in relationship with the objectives. Much of data was qualitative therefore was summarised and presented in form of frequency tables.

### 4.1 Participants' Response Rate in the Study

Questionnaires were administered to two groups of respondents, the first group involving the 128 small scale dairy farmers and 2 Agricultural officer and 10 drivers. The collected data were analyzed in term of percentages and results are shown in tables 4.1.

**Table 4.1: Questionnaire Response Rate by Small Scale Farmers in Longisa**

#### Sub-County

Questionnaire	Administered	Returned	Return Rate percentage (%)
Small scale farmers	128	107	84
Agricultural Officers	2	2	100
Milk Collectors	10	10	100

It can be seen from Table 4.1 that out of 128 questionnaire copies administered to small scale farmers only 107 were returned. This gave a return rate of 84%. In addition, the questionnaire administered to Agricultural Extension Officers and milk collectors had a return rate of 100%. Generally return rate is sufficient to make a true conclusion of the results.

#### 4.2 Background of Sampled Small Scale Farmers in Longisa Sub-County

The study sought to identify the distribution of respondents by gender during the study the copies questionnaire were distributed to sampled small scale dairy farmers, data analysed I percentage and found that the distribution of both genders is almost uniform. Results is shown in Table: 4.2

**Table 4.2: Distribution of Small Scale Dairy Farmers in Longisa Sub-County by Gender**

Sampled Dairy Farmers' Gender	Frequency	Percentage (%)
Male	58	45.2
Female	70	54.8
<b>Total</b>	<b>128</b>	<b>100</b>

Table 4.2 shows that the sampled small scale farmers consisted of males (45.2%) and females (54.8%). This shows that most of the respondents in the study (54.8%) were female as compared to (45.2%) males that constituted the sample. The sampled small scale dairy farmers had a fairly equal representations by gender.

The study sought to identify the distribution of respondents by age. The result of the analysed data is shown in Table 4.3:

**Table 4.3: Age Distribution of Small Scale Dairy Farmers in Longisa Sub- County**

<b>Age (Years)</b>	<b>Frequency</b>	<b>Percentage (%)</b>
19-30	35	27.34
31-50	71	55.46
>50	22	17.2
<b>Total</b>	<b>128</b>	<b>100</b>

From Table 4.3, it can be seen that that (27.34%) had ages between 19 years and 30 years. About 55.46% constituted those that were between 31 and 50 years while 17.2 % were above 51 years. The majority of small scale dairy farmers were between the age of 31 and 50. They are the energetic people and most of them are educated therefore have the ability to adopt dairy farming technology.

The study sought to establish the experience level of small scale dairy farmers in Longisa Sub-County. Data were retrieved from the filled questionnaire and analyzed as shown in Table 4.4.

**Table 4.4: Small Scale Dairy Farmers' Experience in Longisa Sub County**

<b>Dairy Farming Experience ( years)</b>	<b>Frequency</b>	<b>Percentage (%)</b>
1-5	36	33.3
6-10	30	28.4
11-15	20	18.3
>15	21	20
<b>Total</b>	<b>107</b>	<b>100</b>

**Table 4.4 shows that 33.3 % of the small scale farmers have an experience of less than 5 years of dairy farming while 28.4 % of the farmers have an experience of between 6 and 10 years. It can also be seen from the Table that 18.3% of the farmers have an experience of between 11 and 15 years while the rest of the farmers (20%) have a dairy farming experience of more than 15 years. This indicates that most of the small scale dairy farmers (66.7%) have more 6 years of dairy farming experience. They are able to utilise their skill and knowledge in acquiring farming technology and I searching for better market for their milk.**

### **4.3 Impact of Education on use of Dairy Technology by Small Scale Farmers in Longisa Sub-County**

The study sought to establish level of education for small scale dairy farmers. The collected questionnaire were coded and analysed as shown in Table 4.5

**Table 4.5: level of education of small scale dairy farmers in Longisa Sub-County**

Level Of Education	Frequency	Percentage (%)
Adult	19	17.76
Primary	14	13.08
Secondary	29	27.10
Post-Secondary	45	42.06
Total	107	100.00

The analysed data shows that 17.76% of small scale farmers have attended adult education school, while 13.06% have attained primary school certificate, those who have secondary school certificate are 27.10% and the rest 42.06% have post-secondary training. Majority of small scale dairy farmers have 69.16% have secondary school and above training. This

indicates that most small scale farmers have knowledge on dairy farming. They are also educated on the availability and application of loan facilities. They also have knowledge on the availability of market and market dynamics.

The study sought to identify how small scale dairy farmers acquire the knowledge on dairy farming ,during the study the copies questionnaire were distributed to sampled small scale dairy farmers, data analysed and results are shown on Table: 4.6.

**Table 4.6: Small Scale Farmers’ Source of Information in Longisa Sub County**

<b>Education Source</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Extension service	59	55.1
Radio	42	39.3
Social media	6	5.6
<b>Total</b>	<b>107</b>	<b>100</b>

It can be seen in Table 4.6, that (55.1%) of small scale dairy farmers received education regarding farming through extension officers. Several (39.3%) others obtained information via local radio stations while only 5.6% depended on information from social media. It was further noted that most (33.3%) of the farmers had an experience ranging from 1 to 5 years. Those who had an experience of 6 to 10 years were 28.4% while those who had experience of above 16 years comprise of 20%. Majority of small scale dairy farmers 94.4 % have an access to farming information through extension service and radio. The small scale dairy farmers are informed of the availability of farming technology, credit facilities and market availability.



#### 4.4 Influence of Credit Facilities on Small Scale Farmers' Livelihood in Longisa Sub-County

The study sought to establish sources of loan for small scale dairy farmers. Data from questionnaire analysed as shown in Table 4.7.

**Table 4.7: sources of loan for small scale farmers in Longisa Sub-County**

source of loan	frequency	Percentage (%)
Sacco	36	33.64
Bank	22	20.56
Family & Friends	15	14.01
Table Banking	34	31.79
	107	100

As shown on Table 4.7. 33.64% of the farmers get loan from Sacco, while 20.56 % of the farmers obtained loan from banks. Families and friend contribution amount to 14.01 % and farmers who obtained loan through table banking are 31.79 %. Majority of the farmers obtained loan from financial institution. The shown the farmers have enough knowledge on financial planning and management.

The study sought to find out those small scale dairy farmers who apply and those who do not applied for loan facility. The distributed and collected questionnaire was unanalysed as shown on table 4.8.

**Table: 4.8: Distribution of farmers by Credit Facilities**

Loan Application	Frequency	Percent %
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Applied	66	61.6
Not applied	41	38.4
<b>Total</b>	<b>107</b>	<b>100</b>

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From Table: 4.8 above (61.6 %) of small scale dairy farmers have applied for loan and (38.4 %) have not applied for loan. majority (61.6%) had applied for a loan while only (38.4 %) of them had not applied. This is due to availability of information regarding the loans and also high level of education for small scale farmers.

#### **4.5 Milk Markets’ impact on Farmers’ Livelihood in Longisa Sub-County**

The study sought to find out the perception of small scale dairy farmers concerning the available market. The information were achieved through use of questionnaire then analysed as shown in. The Table: 4.9

**Table 4.9: Dairy Farmers’ view about Availability of Milk Markets in Longisa Sub County**

<b>Milks Market Adequacy</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Very good	9	8.4
Good	19	17.7
satisfactory	33	30.84
poor	46	43.06
Total	107	100

Table 4.9 indicates that 8.4% of small scale dairy farmers have very good market for milk, while 17.7% have a good market for their milk, those whose have a fair market are 20.84% and the rest 43.06% believe that they have a poor market for the milk. Majority 56.94% of small scale dairy farmers are satisfied with milk market. There is a likelihood the dairy farmers are getting good return from farming, hence they have income for their family needs.

**Table 4.10: Distribution of Dairy Farmers’ Use of Breeding Technology in Longisa Sub County**

<b>Breeding technology</b>	<b>frequency</b>	<b>Percent %</b>
AI	36	33
Natural	71	67
<b>Total</b>	<b>107</b>	<b>100</b>

Table: 4.10 indicate that 33% of small scale dairy farmers uses artificial insemination while 33 %apply artificial insemination. Most dairy farmers have not adopted breeding technology (AI) Most of those who have not adopted believe that the technology is not a variable to them just by virtue of cost and availability. The natural breeding bull is most likely to be of good breed to improve the trait of offspring.

The study sought to identify type of feeding methods used by the small scale dairy farmers. The data collected in the questionnaire was analyzed and results are shown in Table 4.11.

**Table 4.11: Number of Farmers Using Feeding Technology in Longisa Sub County**

<b>Feed</b>	<b>Frequency</b>	<b>Percentage(%)</b>
Fodder	16	15
Free Range	91	85
<b>Total</b>	<b>107</b>	<b>100</b>

Table 4.11: shows, 85% of dairy farmers practice free range; this is because it is cheap and they have enough land for the practice. Those who use fodder by preparing and storage are either owner of small piece of land and/or those with post-secondary education who understand its application.

The study sought to establish milk production of farmers when they are not using and compared with when they are using dairy farming technology.. The data were retrieved from sampled farmers' records and by one on one response. The detailed data of before and after utilization of dairy farming technology were used for data analysis. The result is shown in Table 4.12

**Table: 4.12 Amount of Litres of Milk Produced in Litre per Cow in Longisa Sub-County**

Small Scale Dairy Farmers	N	Mean	Standard Deviation
Amount of milk without use of technology	107	7.5514	2.97548
Amount of milk with use of technology	107	9.9533	3.41026

Table 4.12 illustrates that total production of milk by farmers not using technology has a mean of 7.5514 and a standard deviation of 2.97548 litre of milk per cow while when farming technology is used the milk production increased to a mean of 9.9533 and a standard deviation of 3.41026 litres of milk per cow. The results show that with an intervention of farming technology there were a positive improvement in milk productivity.

Descriptive statistic was performed to find out if there is a relationship between milk production before and after using technology. Result is shown in Table: 4.13

**Table 4.13 Comparison of Small Scale Dairy Farmers Milk Production Before and After Use of Technology**

Small Scale Dairy Farmers	N	Mean	Std. Deviation	Std. Error Mean	t	P	ES(d)	95 % confidence interval
Production Before Use Of Technology	107	7.5514	2.9748					
Production After Use Of Technology	107	9.933	3.41026					
Comparison of means				0.1576	-15.24	0.000		(-2.714, -2.089)

$$t_{(106)} = -15.2240, p = 0.000$$

A paired sample t-test was conducted to see if there is a difference between the means of the milk Produced before and after adoption of technology at a significance level of 95%. From Table: 4.11, the p-value was ( $0.000 < 0.05$ ). This illustrates that there existed statistically significant difference in the means of milk production before and after use of technology.

## **CHAPTER FIVE:**

### **SUMMARY OF FINDING DISCUSSION, CONCLUSION AND RECOMMENDATION**

#### **5.0: Introduction**

This chapter is a summary of all the findings on the research in relation to dairy technology adoption. It gives conclusion of the research based on the findings. It will also highlights recommendation based on the research objectives and give gray areas for further research.

#### **5.1 Summary of Finding**

The main objective of the study of the study was to find out factors influencing use of dairy technology by small scale dairy farmer on milk production in Longisa sub-county, Bomet County, Kenya. The study independent variables were; education level for dairy farmers, availability of credit facilities to farmers, and availability of market for milk to dairy farmers. The dependent variable was dairy farming technology which was measured in terms of breeding, feeding and value addition on milk.

After the study it was established that education of dairy farmers play a major role in adoption of technology. Old farmers practice old and outdated means of rearing dairy cattle, they do not believe in adopting new technology, they are laggards. The study established that the small-scale dairy farmers' level of education plays a major role in adoption of farming technology, farmers with skills and knowledge of animals husbandry have a upper hand in using dairy farming technology. This led to improvement in milk production and subsequently a positive impact on the farmers' livelihoods.

Lack of credit facilities and unwillingness by farmers to acquire the facilities is a hindrance to technology. Farmers believe that technology is too expensive for them to use. They only consider initial capital cost and not considering return on investment and ultimate gain in technology use on improved production. The study found that the availability of credit facility to the farmers provide them with a better purchasing power to acquire farming technology which after utilized led to improved milk production and hence uplifting the livelihood of the farmers.

The research further found that the farmers are not satisfied with milk price despite the availability of market. Therefore, this has demoralized them from adopting dairy technology to improve milk output. Availability of ready market for milk provide the farmers with resource for domestic use and hence resulted in a positive influence on small scale dairy farmers' livelihood because of enhance income from milk sold

It was evident that technology had a way of increasing the farmers' milk production with a bigger margin. Before use of technology farmers produced milk with a mean of (7.5514). After adoption of technology milk production increased to a mean of (9.9533). This indicated that dairy farming technology help small scale dairy farmers to produce more milk hence their livelihood was likely to improve.

A paired sample t-test was conducted to see if there is a difference between the means of the milk Produced before and after adoption of technology at a significance level of 95%. The p-value was <0.05. It was also found that there is a significant difference between farmers who adopted dairy farming technology and those who did not ( $t_{(106)} = -15.2240$ ,  $p = 0.000$ ) this indicated that there was improvement in milk production for farmers who utilised the farming technology; which was facilitated by the level of education, availability of credit facility and availability of ready market. This indicated that technology helps in improving dairy farming



productivity. The increase in milk production is likely to have a positive influence in livelihood of the farmers.

## **5.2 Conclusion**

The study conducted in Longisa Sub-county, Bomet County to established factor influencing use of dairy technology by small scale farmers on milk production, Questionnaire were distributed to dairy farmers, interview was conducted on agricultural officer and observation was recorded. The collected data was analyzed and found that farmers with better education facility have a better affinity to adopt dairy technology. They are aware of the available technology of breeding (AI), value addition (milk fermenting, yoghurt making, and packaging) and fodder making and storage.

Dairy farmers take their personal initiative to acquire knowledge through radio, social media. Governments both central and county and NGOs have not been fully participating in educating farmers on dairy technology; this has led to poor absorption and use of technology. Education is a reliable transforming agent in technology.

The fear of uncertainty, poor milk price, failure to repay, fear of market uncertainty all these has cribbed farmer from taking the risk of procuring loans.; they do not have Sacco to facilitate loan supply neither do they have knowledge of the availability of financial support from government and NGOs .due to unstable market price and inadequate assurance for livestock financial institution fear investing on non-visible dairy business.

Market is available for milk from a relative short distance (1-4) km, despite very poor price, as per farmers opinion, they do still supply milk to the market. Farmers do not give value addition to their milk, they sell raw milk to private own chilling plants, therefore their profit margin is very minimal.

It was evident that technology had a way of increasing the farmers' milk production with a bigger margin. Before use of technology farmers produced 808 litres with a mean of (7.5514)

and a Milk production range of between 1 litre and 14 litres. After adoption of technology milk production increased to a total of 1065 litres with a mean of (9.9533) and a milk production range of between 2 litres and 18 litres. A paired sample t-test showed that there existed statistically significant difference in the means of milk production before and after use of technology

It was also found that there is a significant difference between farmers who adopted dairy farming technology and those who did not ( $t_{(106)} = -15.2240$ ,  $p = 0.000$ ) this indicated that there was improvement in milk production hence there is a likelihood of a better livelihood of the farmers.

### **5.3 Recommendations**

1. Government and NGOs need to educate farmers on the importance of using dairy farming technology; breeding, value addition and fodder making and storage. They should also improve on information dissemination both in skill building and knowledge equipping of dairy farmers.
2. Farmers should be encourage to form groups so that they can be able to get fast and most reliable training and information, secure loans through Sacco and get financial support by NGOs and government.
3. Farmers should be encouraged to channel and save their earnings in banks and Sacco so that they can be able to secure loans from the institutions.
4. Young people between the ages of (25-45) years should be encouraged to practice dairy farming. These are people with education, energy and ability to perform better than the old laggard farmers.

## 5.4 Suggestion for Further Studies

Influence of Youth in Small Scale Dairy Farming In Longisa Sub-County, Bomet Kenya.

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## Appendix 1

### Questionnaire for small scale farmers

I am Wilberforce Mutai a student from the University of Nairobi doing a research on factors influencing use of dairy technology by small scale dairy farmers on milk production in Longisa sub –county, Bomet County, Kenya. Congratulation for being selected as one of small scale dairy farmers to assist in providing information related to above named factors. The information is for academic in the University of Nairobi. Your sincere information is highly appreciated.

The questionnaire is divided into five categories namely:

- A. General information
- B. Education
- C. Credit facilities
- D. Market

<b>A. General Information</b>					
<b>Village</b>	<b>Age</b>		<b>Gender</b>		<b>Education level</b>
.....					
....	20-29		Male		None
Ward	30-39		Female		Adult
.....	40-49				primary
..					

	50-59			Secondary	
	60-69			Post-secondary	
	70-79				
	80-89				

**B. Education**

B1. What are your sources of information?

- a) Journals
- b) Extension service
- c) Radio
- d) Social media
- e) Other ( specify)

B2. Are the information's useful?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

B3. When did you last get training from government or NGOs .....

B4. What technologies did you learned?

- a) .....
- b) .....
- c) .....
- d) .....

B5. Was the technology useful?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1



Rating	
--------	--

B6. If yes what technologies have you learned from other farmers?

- a) .....
- b) .....
- c) .....
- d) .....

B7. Do you know village / ward extension service officer?

Yes

No

B8. If yes do you seeks information from the officer?

Yes

No

B9. If yes how can you rate implementation the acquired knowledge?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

B10. If no, why are you not seeking training from the officer?

- a) .....
- b) .....

B11. how long have you been practising dairy farming? In years

1-5

6-10

11-15

16-20

>21

**C. Credit facilities**

C1. Have you ever applied for loan for dairy farming?

Yes

No

C2. If yes what kind of loan you did applied?

a).....

b).....

c).....

C3. If no give reasons

a. ....

b. ....

c. ....

d. ....

C4. What was your source of capital?

a. ....

b. ....

c. ....

C5. Apart from your personal income, saving, where else do you get fund to expand your farming?

a) .....

b) .....

c) .....

C5. What is your other occupation?

a) .....

b) .....

c) .....

C6. What is your estimate income from dairy farming? .....

**D. Market**

D1. Do you have market for your milk?

Yes

No

D2. If yes, is the market adequate?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

D3.what kind of milk do you sell?

Raw  fermented  chilled

D4. How far is the market?

Less than 1 km  1-2 km  2- 4km  more than 5 km

D5. Are you satisfied with milk price?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

D6. If yes what have you done to produce more?

a) .....

b) .....

c) .....

d) .....

D7. If no, what have you done to add value to your milk?

a) .....

b) .....

c) .....

d) .....

D8. What are main challenges in milk market?

a) .....

b) .....

c) .....

D9. What technology have you applied to counter act the hindrances?

a) e- marketing

b) cooling plant

c) value addition

d) other (specify)

D1. What was your daily milk production before using technology per day per cow?

..... litres

D2. What is your current daily milk production per day per cow?

.....litres

## Appendix 2

Questionnaire for Agricultural Officers

### E. Education

E1. What are the major types of dairy records do the farmers keep?

- a. Production
- b. Feeding
- c. Breeding
- d. Health
- e. Other (specify)

E2. How are records maintained?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

E3. How do farmer utilise the information on the records?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

E4. How is the living standard of farmers?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

E5. What are technologies utilise by farmers?

- a) .....
- b) .....
- c) .....
- d) .....

E6. Do they have operation plan?

Yes

No

E7. If yes is the plan being executed?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

#### F. Credit facilities

F1. Do farmers have any form of security to facilitate acquiring of loan?

Yes

No

F2. Do farmers have capacity to service loan?

Yes

No

F3. Do farmers have capacity in term of knowledge to utilise loan very well?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

F4. Do they have financial plan?

Yes

No

F5. If yes, is the plan viable?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

**G. Extension service**

G1. Do farmers have dairy farming journals?

Yes

No

G2. Are the farmers' equipped with dairy farming skills?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

**H. Market**

H1. Do cooling plants exist?

Yes

No

H2. If yes, what is the average quantity of milk being delivered by farmers?.....litres/day?

H3. What is the means of milk delivery to cooling plants?

- a) .....
- b) .....
- c) .....

H4. What is the average price of milk per litre?.....

### Appendix 3

#### J. Questionnaire for informants

J1. What are the hindrances to small scale farmers adopting technology in dairy farming?

- a) .....
- b) .....
- c) .....
- d) .....

J2. Do farmers have motivation to adopt technology?

Yes

No

J3. If yes, what do demotivate farmers from adopting technology?

- a) .....
- b) .....
- c) .....
- d) .....

J4. Do farmers seek education relating to technology?

Yes

No

J5. Is technology appropriate to be adopted by farmers?

Key	satisfactory	very	good	Fair	poor
-----	--------------	------	------	------	------



		good			
	5	4	3	2	1
Rating					

J5how is the rate of technology transfer to farmers?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

J6. What is absorption rate of technology by farmers trained?

0-25%  26-50%  51-75%  76-100%

J7. What do encourage farmers to adopt technology?

- a) .....
- b) .....
- c) .....
- d) .....

J8. Who offer training on dairy technology?

- a) .....
- b) .....
- c) .....

How many farmers do you handle per day? .....

J10. Do you have policies to enhance adoption of technology in dairy farming?

Yes

No

J11. According to your opinion are the adopted technologies by farmers helpful?

Key	satisfactory	very good	good	Fair	poor
	5	4	3	2	1
Rating					

### Appendix 3

#### Milk Collector Questionnaire

I am Wilberforce Mutai a student from the University of Nairobi doing a research on factors influencing use of dairy technology by small scale dairy farmers on milk production in Longisa sub –county, Bomet County, Kenya. Congratulation for being selected as one of small scale dairy farmers to assist in providing information related to above named factors. The information is for academic in the University of Nairobi. Your sincere information is highly appreciated.

K1 How many litres of milk do you collect per day?..... lrts

K1 . How many farmers do collect milk from?

K3 How many do days do you collect milk per week?

K4 .What are challengers you are facing when collecting milk?

- 1.....
- 2.....
- 3.....
- 4.....

K5. What do you think are the challengers facing in relation to milk production?

- 1.....
- 2.....
- 3.....
- 4.....

K6 In your view where do farmers get education concerning dairy farming?

.....

K7 Where do farmers get loan to expand their dairy activities.....

K8. Milk market available throughout the year .....YES.....NO.....

K8. How do farmers feel about the milk price.....

K9. What are the common breeds of dairy cows farmers are rearing?

- 1.....
- 2.....
- 3.....
- 4.....

## Appendix 4

### Observation check list

L1. What are the available dairy breeds available?

1.....

2.....

3.....

4.....

L2. Are farm structures available and how are the conditions of the structure?

.....

L3. How is the living condition of the farmers?.....

L4 How many cows are available on the farm?.....

L5 How is the condition of the cows?.....

L5. Are road good for milk transport.....

L6. Are animal feed available?.....

L7. What kind of feed are in the farm?.....

L8. What is the approximate size of the farmer land?.....hectares

L9 Are milk collecting point available?

L10. Are there dairy records for animal production and health?.....