

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

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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.

Keywords: Impact of Use of Farming Technology on Livelihood of Small- Scale Dairy Farmers.

ABBREVIATION AND ACRONYMS

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

1. INTRODUCTION

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 its 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 depends on milk yield and extension visit (Tebug, Chekegwa and Wiedemamn. 2012). The study actually 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 being 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 return; 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 set up (ILRI, 2007).

The background study has identified that there is need to undertake a similar research in Longisa sub county Bomet county Kenya to identify the impact of adoption of dairy farming technology on 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 is very minimal; Cost of feeding, breeding, transport is very expensive and hardly do farmers get to break-even point. Gain is only realised during festive season and period of drought (Halake and Mamo, 2013)

Factors of production such as labour utilization, training, feeding, breeding, skill labour effect 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 been a dairy farming area in Bomet county a study was need to be undertaken to establish impact of dairy farming technology on 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.

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.

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.

Research Objectives:

This 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

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?

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.

2. REVIEW OF RELATED LITERATURE

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.

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 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 purebred Friesian, Ayrshire, Guernsey, jersey and their crosses that produce more milk than the indigenous breed.

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 andBekele, 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-Saharan (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.

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.

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).

Theoretical Framework of the Study:

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

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.

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.

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.

3. RESEARCH METHODOLOGY

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.

Target Population:

The study covered 688 small scale dairy farmers who are members of Kembu, Kiprereres, 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.

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	1	10	2
	Kiprereres	147	27			10	2
	Merigi	106	20	3		10	2
Kembu Cooling Plant	Kembu	138	26		1	10	2
	Chemaner	186	34			10	2
Total		688	128	6	2	50	10

From table 1, it can be seen that 128 farmers, Agricultural officer and 10 milk collectors were sampled 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.

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.

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).

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

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.

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

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.

4. DATA PRESENTATION, INTERPRETATION AND ANALYSIS

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 (%)
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.

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
Total	128	100

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 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

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

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

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

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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.

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

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

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

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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 %
Applied	66	61.6
Not applied	41	38.4
Total	107	100

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 MilkMarkets’ 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

Milks Market Adequacy	Frequency	Percentage (%)
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

Breeding technology	frequency	Percent %
AI	36	33
Natural	71	67
Total	107	100

Table: 4.10 indicate that 33% of small scale dairy farmers use 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 use 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

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

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 level
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.

5. SUMMARY OF FINDING DISCUSSION, CONCLUSION AND RECOMMENDATION

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.

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.

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.

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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.

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