# RESEARCH THESIS

## Evaluation effectiveness of the dairy park project in Busia County

**Bwire Elizabeth Adero**

**Van Hall Larenstein University of Applied Sciences**
**the Netherlands**

**SEPTEMBER 1, 2021**

# Evaluation effectiveness of the dairy park project in Busia County

**Research Thesis Submitted to Van Hall Larenstein University of Applied Sciences in partial fulfilment of the requirements for degree of Master in Agricultural Production Chain Management, Specialization Livestock Chains**

**By**

**Bwire Elizabeth Adero**

**Supervised By:**

**Marco Verschuur**

**Examined By:**

**Prof. Rik Eweg**

**September, 2021**

**Van Hall Larenstein University of Applied Sciences, Velp.**
**The Netherlands**

**ACKNOWLEDGEMENT**

Special thanks to the Dutch government for providing me with a scholarship to continue my education in the Netherlands.

I want to express my gratitude to the Ex-Director of Farming system Kenya Dr. Raphael Kinoti and the entire team of Farming Systems Kenya for the support and time given to me to continue with my studies.

I would like to extend my sincere thanks to the Department of Livestock Busia county for providing some of the data referenced in this chapter.

I sincerely thank my supervisor Mr. Marco Verschuur for the guidance, supervision, encouragement during my studies and as the course coordinator of the Master of Agriculture Production Chain Management-Livestock Chain. I am very grateful for the support, positive critics, and scrutinize this research project.

I would like to acknowledge all staff of Van Hall Larenstein University of Applied Sciences for their contribution, time, and patience during the entire study period at the University. Your efforts have contributed immensely to shaping this study through your advice, directions, suggestions, and criticism.

**Dedication**

I dedicate this research to the Almighty God for his grace and divine strength throughout the entire study period. To my parents John Bwire and Regina Bwire for their support, encouragement, and prayers. My brothers Peter, Simon, and Joakim. My nieces Agatha, Christina, and Gena, nephew Junior Peter and Donell your love and concern during my stay away from home while I was pursuing masters in Agricultural Production Chain Management-Livestock chain. Lastly to my friends Lydia, Bijan, Florence, Olivia, and Patricia for your moral support, patient, and encouragement during my studies. God bless you abundantly.

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**List of abbreviations**

| | |
|---|---|
| **ATC** | Agriculture Training Centre |
| **DFCS** | Dairy Farmers Cooperative Society |
| **ECF** | East Cost Fever |
| **FAO** | Food and Agriculture Organization |
| **FPG** | Farmer Producer Group |
| **FSK** | Farming Systems Kenya |
| **GDP** | Gross Domestic Product |
| **GOK** | Government of Kenya |
| **KALRO** | Kenya Agricultural & Livestock Research Organization. |
| **KCSAP** | Kenya Climate Smart Agriculture Project |
| **KDB** | Kenya Dairy Board |
| **KEBS** | Kenya Bureau of Statistics |
| **KNBS** | Kenya National Bureau of Statistics |
| **NGO** | Non-Governmental Organization |
| **PO** | Producer Organization |
| **PWD** | People with Disabilities |
| **SHG** | Self Help Groups |

**Abstract**

Research was conducted with an aim to evaluate the socio-economic impact of the dairy park project on the dairy value chain more specifically on the livelihoods of smallholder farmers, youths, women, and PWD to formulate recommendations that will improve the performance of the dairy park.The research was carried out on smallholder dairy farmers organized under the dairy park project in Teso North and Butula sub-counties. Simple random sampling was used to draw a sample of 48 smallholder dairy farmers from two sub-counties (24 Teso North and 24 Butula) to ensure representatives of the whole population. Other source of data included desk study, semi structured interviews with key informants, focus group discussion, and observation. Results showed that 100% of respondents had improved fodder planted on their farms, improved breeds and 26% of the respondents conserved fodder and pasture on their farms to use during the dry season. Planting of fodder and having improved breeds on the farm has increased milk production by 1-2 liters. 26% of farmers use silage bags to conserve the fodder and 68% of farmers buy feeds from neighbours. More milk was sold to the informal market due to higher pricing of Ksh 60 per liter and ready market. Self-help groups had a membership of 15-25 members and the cooperative had 75 members. Members in the self-help groups are involved in table banking, merry go round, selling of hay, pass on of the heifers and giving members chicks. Farmers have been trained on feed and feed management, disease control, animal husbandry and nutrition. It was observed that farmers in the study area constructed the zero grazing unit but the floor was not concrete making it hard to collect the manure and the dairy construction unit is 80% complete. After the project intervention there is increase of milk production 1-2 liters, increased income at the household level, Jobs have been created both directly and indirectly for youths, women, PWD and men and access to market linkage. The self-help group have taken up the initiative of farmer to farmer learning and use of lead farmers as a way to extend the extension services. The self-help groups are empowering members and providing credit to help members to think in the direction of entrepreneurship which helps farmers not to rely so much on one source of income. Group dynamics, leadership, market orient, access to financial services were seen as the barriers for groups to perform better.

# Chapter One: Introduction

The dairy industry in Kenya is vibrant and contributes 14% of the agricultural GDP, 40% of the livestock sector GDP, and 4% of the national GDP, and currently grows at an average of 5–7% annually (KDB 2015). The livestock sector has consistently overtaken the crop sector in terms of productivity, and demand for animal products in developing countries is projected to more than double by 2030 (Thomson, 2003). Over 1.2 million people have been employed directly and indirectly by the dairy sector (KDB 2015). Around 80% of Kenya's milk output is produced by smallholders who own one to three cows (Makoni et al., 2014). As a result, livestock is an asset for many Kenyans living in rural areas. Kenya's demand for milk and dairy products is increasing, contributing to the country's long tradition of using milk in its diet, as well as population growth, urbanization, a growing middle class, as well as export possibilities (Rademaker *et al.*, 2016). The Kenyan dairy sector's potential to raise production to satisfy rising consumer demand and improve livelihood benefits has not gone unrecognized (Ngeno, 2018). Despite widespread recognition of Kenya's rising need for milk products, the dairy sector has been unable to meet this need, owing to problems in dairy production.

These challenges are largely similar across other developing countries and include low productivity driven by limited access to quality and affordable inputs and services, and output markets (Rao *et al.,* 2016). Restricted access to the supply market raises the cost of production, locking households in a vicious circle of low input and low output (Rao *et al.*, 2015). Smallholder dairy households live in distant and dispersed locations with insufficient access to adequate facilities, resulting in higher transaction costs and other barriers in terms of access to input and output markets (Rao *et al.,* 2016). Poor cattle breeds for dairy production, diseases, and low adoption of technologies in the dairy industry (Makoni *et al.,* 2014), and high cost of the transaction (Kilelu *et al.,* 2016).

## 1.1 Dairy sub-sector in Busia County

In Busia County, Integrated Development Plans II (2018-2022) Livestock development is one of the Pillars in Agriculture to addressing food and nutrition security gaps and promoting manufacturing. This focuses on achieving the county agriculture strategic plan, regional plans (Lake Region Economic Block), and the country's development plans: Big Four Agenda, Kenya Vision 2030, and Kenya Climate-Smart Agriculture Project (KCSAP).

Dairy development is the flagship project of livestock production. This focuses on improving production interventions and management of the dairy sector to increase milk production. Currently, the county produces 28 million liters of milk per year with a population of 18,800 dairy animals and 193,101 zebu animals which are also milked. 5 milk coolers have been installed but are currently underutilized. The county demand is 60 million liters per year. There is a net deficit of 32 million liters of milk with many imports of milk from a neighboring country (Uganda). Small scale but very minimal processing is done for milk. Few women groups process milk for yogurt.

Currently, farmers are practicing dairy farming on an individual basis characterized by a high cost of production and poor access to extension and marketing services. With an average farm size of 1.71 acres, most farmers are not able to keep 1 dairy animal. The available poor-yielding indigenous breeds and few crosses produce 1-2 liters. This cannot sustain the livelihood of the rural farmer.

## 1.2 Dairy Park Project Description

The Dairy Park in Busia County was implemented in Teso North and Butula Sub Counties by the Department of Agriculture and Animal Resources of Busia County in 2019. It was designed to reach 1,500 smallholder dairy farmers in the sub-counties with the overall goal of the project to improve the livelihoods of smallholder dairy farmers in Busia County through increased quality and yield of milk, increase rural incomes, and employment. Improving dairy producers' market prospects and building skills among chain participants to co-create solutions (Auma *et al.,* 2017).

The Dairy Park project in Busia county has the aim to create best practices and knowledge in cost-effective dairy farming for small-scale dairy farmers in Busia County alongside having a milk collecting system that allows for the collection and storage of increasing quantities of high-quality raw milk. This will help to increased the welfare of all people in the rural areas covered by the dairy parks. The major activities include construction of a modern dairy park, equipping of the project units, training of farmers on fodder production and management, the housing of dairy cows that will boost milk production, and monitoring and evaluations. The expected outputs are two dairy parks are established and equipped and in operation, improved farmers knowledge on fodder production and management, heifers delivered to farmers, and lastly, monthly, and quarterly reports on the progress.

However, the County has adopted 'aggregated Production Parks' in what is termed Community Dairy Parks. In this system, the Livestock Ministry identifies and organizes dairy farmers into Farmers Producer Groups by locations, formulates the Park management unit, identifies the central location where Dairy Park will be located and supports the farmer producer groups. The enterprise is managed on behalf of the small-scale farmers who is the 'investor' by the park management unit. Farmers get their investment returns at the end of every month.

The county, therefore, is supporting farmers' organizational development through the formation of cluster production groups at the ward level to increase and boost milk yield, which is merged into primary cooperative societies and cooperative unions at the county level. This organizational development support helps to improve input supply, access to farmers' extension service, technology transfer to other farmers, improve bargaining power, and improving market access. The project aims to improve the livelihood of the farmer especially economic empowerment and involvement of youths, women, and PWD in dairy farming. Income generation for the beneficiaries from the sale of milk, fodder, manure, and bull calves. The dairy park creates both direct and indirect job opportunities, few women groups process milk for yogurt.

The main training included improved fodder production and management (Napier grass, Rhodes grass, Brachiaria grass, Desmodium) and feed conservation by baling hay and making silage. Each beneficiary avails one acre of land for the fodder production and in each sub-county, one hay storage is constructed on the community land. Distribution of heifers from the dairy park to group members, for every first heifer, calved is passed on to other beneficiaries as this will ensure inclusivity of majority of community members a veterinary officer will be attached to the park for routine health checks and breeding. Identification of the lead farmers and training on good animal husbandry practices.

The director of livestock and veterinary service shall give a progress report during the construction phase of the project. At the start of operations, the management unit headed by the farm manager, who will be a county staff shall submit the monthly report to the county director of livestock production. Monthly meetings at the dairy park shall form the communication channels. Members will be updated on the progress and paid their returns on monthly basis.

## 1.3 Problem statement

The Dairy Park project was implemented in 2 sub-counties in Busia, by the Department of Agriculture and Animal Resources of Busia County. The dairy park project was commissioned to address the issue of inefficient production of milk, poor dairy management system, and poor yielding indigenous breeds. The project has been running for over 2 years; however, no evaluation has been done to assess the performance and impact of the dairy park project on the livelihood of smallholder dairy farmers and other inhabitants of Busia County. The project was funded by KCSAP and partially Farming Systems Kenya (NGO) however, the donors are exiting and the project will be handed fully to the County Government of Busia. Hence, this research is essential for the continuation of the project as the information gathered will help to identify the progress made so far and to adjust to what needs to be addressed. The problem owner is the Department of Agriculture and Animal Resource Of Busia County.

## 1.4 Research Objective

The research aims to evaluate the socio-economic impact of the dairy park project on the dairy value chain more specifically on the livelihoods of smallholder farmers, youths, women, and PWD to formulate recommendations that will improve the performance of the dairy park project.

## 1.4 Research Questions

**1. What is the Socio-economic impact of the Dairy Park Project at the dairy value chain level?**

1.1 What are the roles of the stakeholders and their functions in the project?

1.2 What is the production improvement and adoption of technologies in smallholder dairy farms?

1.3 What is the contribution of the project to market linkages within the value chain?

1.4 To what extent has the project contributed to job creation for youths, women, and PWD in the dairy sector?

**2. What is the performance of the self-help groups under the dairy park project?**

1.1 What is the participation of members in the self-help groups?

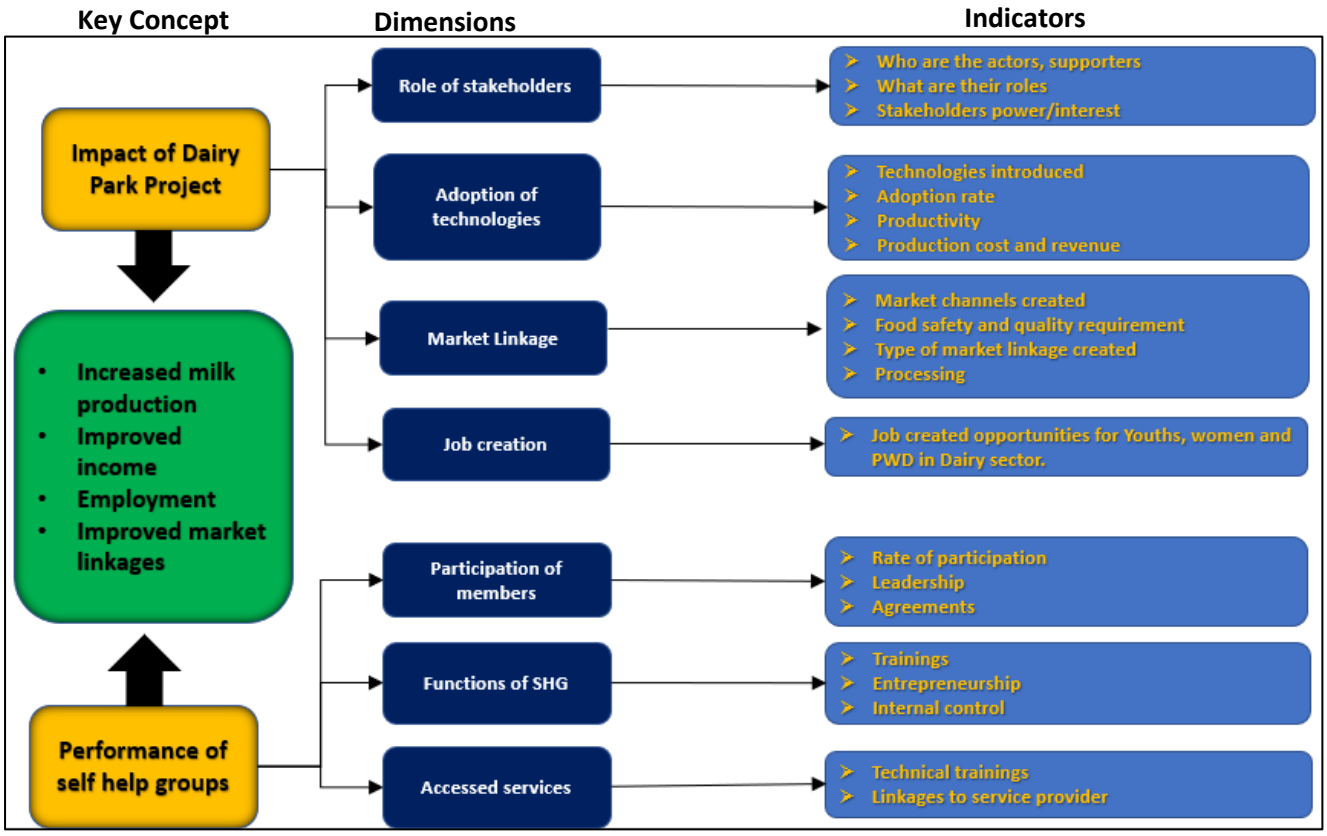
1.2 What are the functions of the self-help groups?

1.3 What are the benefits accessed as a self-help group from the project?

## 1.5 Conceptual Framework

The conceptual framework gives an overview of the key concept, dimensions, and indicators. The dimensions were derived from the project indicators adopted from the log frame.

*Figure 1: A conceptual framework*



# Chapter Two: Literature Review

## 2.1 Dairy Value Chain in Busia County

Porter (1985) coined the term "value chain" to describe the entire range of activities needed to bring a good or service from conception to various stages of production, distribution to consumers, and final disposal after use. It is believed that if the commodity moves from one player in the chain to the next, it will accumulate value (Hellin and Meijer, 2006).

However, according to KIT (2006) says that the direct actors include input suppliers, milk producers, traders, milk collection centers, processors, and consumers while indirect actors are those that do not directly get involved in the chain and are called chain supporters or influencers who include financial service providers, NGOs, government, extensionists, and researchers, among others.

Table 1 shows the different stakeholders in the Busia county dairy value chain highlighting their roles and interests.

*Table 1: Stakeholder matrix*

| **Actors** | **Roles** |
|---|---|
| Input Suppliers (Agro-vets, private sectors) | Supply of feeds, AI services, animal health care, administering of bulls.<br>Provide information to farmers. |
| Producers | Keep dairy cattle, produce milk, and sell to consumers and milk collection centers. |
| Dairy Park/MCCs | Collecting, bulking, chilling, quality checks, and selling to the customers and sometimes deliver to cooperatives.<br>Help in marketing, provision of inputs and services to farmers.<br>Breeding of the heifers. |
| Cooperatives | Chilling, pasteurization, packaging, value addition, and quality examination. |
| Traders and retailers | Buy milk from farmers and dairy parks and supply it to consumers.<br>Retailers include milk bars, kiosks/shops, and supermarkets |
| Consumers | These are the end-users of the milk and milk products. |
| **Chain supporters and influencers** | |
| NGOS<br>Farming Systems Kenya<br>Kenya Climate Smart Agriculture Project | <br>Mandated with the providing farmers with seeds and heifers.<br>Provision of funds |

| | |
|---|---|
| Department of Agriculture and animal resources | Mandated with providing farmers with extension and other services to farmers by county government. |
| Veterinary Department | They are mandated to provide veterinary services and perform disease surveillance and funded by the national government |
| County government | Control of county dairy planning Fund extension and livestock department to serve farmers |
| Financial institutions | They support dairy actors by providing credit.<br>Banks, savings and credit societies, micro-credit institutions. |
| Kenya Agricultural and Livestock Research Organisation (KALRO) | Provision of dairy research services. |
| Kenya Dairy Board (KDB) | Responsible for policies, strategies, and regulations governing the quality of milk delivered to processors and consumers. |
| Kenya Bureau of Standards | Product standardization and certification |

**Source: Compiled by author**

### 2.1.1 Input Suppliers

Most of the agro vet shops are owned and managed by animal health service practitioners who offer advice to farmers, alongside the sale of products and, in some cases, AI services (Auma *et al.,* 2017). Individual animal health practitioners, both in private and public practice, give breeding services for a cost, but not for the cost of extension services given. Organized producer organizations have taken up this function to cushion the effects of high costs by utilizing the economies of scale to avail the inputs at relatively lower costs in addition to access to animal health, AI, and extension services (Auma *et al.,* 2017).

### 2.1.2 Producers

The majority of milk producers are smallholder farmers with one to four cows, mostly local and crossbreeds, with a few pure exotic breeds (Auma *et al,* 2016; 2017; 2018). The feeding system is mainly open grazing and semi-zero grazing, however, the few with exotic breeds practice zero grazings. Even among farmers with better breeds, the usage of feed additives is quite low, and poor animal husbandry methods hinder productivity (Auma *et al.,* 2016; 2018). The smallholder dairy farms are low-input, low-output, and as a result, an increasing number of ambitious smallholders are pursuing dairy as a primary business.

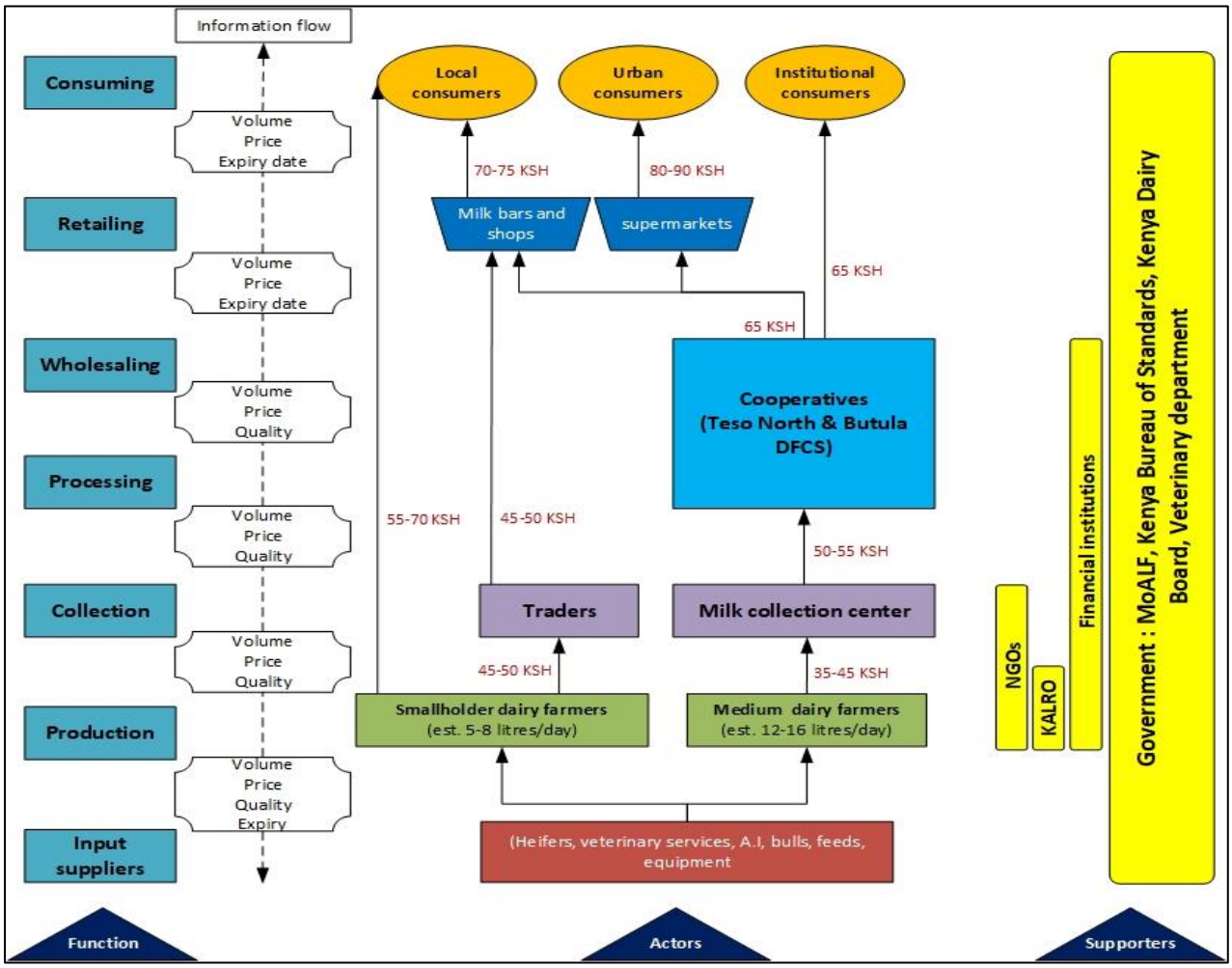
### 2.1.3 Milk collection centers (MCC) and cooperatives.

According to Auma (2018), fresh milk is sourced and bulked directly from farmers (both SHG members and non-members) and within the community by the cooperatives. Members simply send a tiny amount of their milk to stay in good standing and have access to this market outlet when the informal market becomes less competitive. The majority of these cooperatives have milk chilling facilities thanks to development aid in the form of initiatives funded by donors (Auma *et al.,* 2018). The farm gate price per liter of milk in the formal chain is between Ksh 35-45 depending on the season. According to Kruse (2012) reports that milk chilling has a storage capacity of roughly 6000 liters per day, which is regarded as the breakeven point for the business. Given that the average smallholder farmer produces less than 5 liters of milk per day, a chilling plant would require more than 1,200 suppliers to meet the daily capacity requirements (Kruse, 2012).

### 2.1.4 Traders, retailers, and consumers

According to the Kenya Dairy Board report (2014), around 20% of the marketed milk in Kenya is sold on the formal market while the majority, about 80%, is sold on the informal market. About 90% of the smallholders sell milk through the informal channel whereas most medium and large-scale farmers sell their milk in the formal channel through the milk collection center to the co-operatives. This chain is characterized by a majority of the milk produced going to the milk traders and middlemen on the other hand the small-scale farmers are selling directly to the restaurant, kiosk, and consumers directly (Serve, 2008). Informal merchants acquire milk from farmers directly and deliver it in plastic containers ranging from 5 to 20 liters via bicycle. Traders handle 70-80% of all marketed milk, therefore their significance in the milk value chain cannot be understated (Birechi, 2006; FAO, 2011; SDOL, 2010; van der Valk, 2008; SNV, 2013). Traders sell 50 to 100 liters of raw milk every day in both rural and urban areas, at less than half the cost of processed milk on the collection, they pay cash. and, aside from freshness and wholesomeness, the quality of milk is not checked since there is no strict implementation of food safety and hygiene precaution at this point adulterants such as hydrogen peroxide and water are added to milk, lowering its quality.

*Figure 2: Dairy Value chain map of Busia County*



## 2.2 Production Improvement on the adoption of technologies.

According to Gupta *et al.* (2020), explain that green fodder is such an important component of the animal diet that it should be accessible all year round. Various fodder production and conservation methods, such as growing annual fodders, perennial grasses, tree fodders, and implementing various fodder conservation methods, such as silage and hay, may assure year-round green fodder supply. Using diverse fodder production and conservation methods, year-round feed security and balanced feeding of cattle might be achieved (Gupta *et al.,* 2020).

Feed conservation is in dry form as hay such as Rhodes grass and legumes such as Lucerne or wet form as silage (maize, sorghum, and Napier grass). To keep milk production going throughout the dry season, some farmers store fodder. According to Njarui *et al.* (2011), approximately 95% of dairy farmers preserved crop residues for their cattle, but the storage methods were insufficient to sustain quality, and 93 percent of smallholder farmers faced seasonal variations in feed availability and milk production.

Gupta et al. (2020), further state that during the rainy season fodder production may exceed the requirements and, in this condition, it is recommended to conserve the excess amount of fodder for use in the dry period. Hay conservation technology grasses or legumes can be cut first at the flowering stage and put in storage after lessening their moisture content up to 15-20 percent. Proper handling and storage will give good quality nutrition to the dairy animals. The main feed resources utilized by dairy producers are conserved hay, agro-industrial by-products, and commercial concentrate rations, and inadequate forages lead to low milk output (Tegegne *et al.,* 2010). During the dry season, silage is fed as a green forage to keep animals productive. When tropical grasses are added with Lucern to the dairy cow diet, milk output can increase from 10-12 to 14-15 liters per cow per day (Infonet, 2010).

When cross-bred cattle are fed pastures and crop residues, their milk output improves steadily if their diet is supplemented with high-protein fodder shrubs (Wambugu *et al.,* 2006). Poor fodder management is a major issue in dairy production in most places, resulting in inadequate output from natural and developed pastures (Patil *et al.,* 2012).

According to Mutinda *et al.* (2015), fodder production is dependent on rainfall, the number of available feeds on the farm is seasonal. As a result, feed supply will be determined by the rainy seasons, with gaps during the dry season and excesses during the wet. Consequently, surplus fodder must be saved throughout the rainy season for use during the dry period. In addition, the material must be preserved at the appropriate time of growth. Most farms often experience a serious shortage of forage during the dry seasons.

According to Ndambi *et al.* (2017), the development of Kenya's dairy business is hampered by high on-farm production costs and supply chain transaction expenses. Due to a lack of standard cost calculation methods, solid information on the cost of production and transaction expenses along the chain is insufficient. Farm advisers require a tool to assist them in advising farmers on improved farm management to increase farm efficiency by reducing production costs. Policymakers also lack a mechanism to assist them in establishing regional dairy production objectives based on competitiveness. Various cost calculation methods exist, but their accuracy and user-friendliness are limited (Ndambi *et al.,* 2017).

## 2.3 Establishment of Dairy Parks as market Linkage for farmers.

The dairy hub is collective farmer-managed milk bulking and/or chilling business from which farmers obtain other services they need for their regular operations (Mutinda *et al.,* 2015). Rademaker *et al.* (2016) further say that dairy hubs have demonstrated to be a potentially strong platform for improving access to markets, inputs, and services for both men and women dairy farmers. They are transforming rural regions (Kilelu *et al.*, 2016; Mutinda *et al.*, 2015).

Furthermore, if adequate attention is devoted to expanding market access, there is a significant potential to boost dairy production and productivity. The dairy parks aim in transitioning the selling of milk from informal to formal market to enhance smallholder dairy farming and profitability through integrated interventions in dairy production, market access, increased knowledge, and capacity. County Government of Busia (2020), reports that the average production is 8 liters/day/cow this equates to 549,000 liters per year contributing to Kenya shillings 32,940,000 to the economy of Busia County however this is far below the expected herd average of 12 liters/day/cow.

According to Ndambi, *et al.* (2017), says better milk quality testing and payment schemes based on quality would help farmers and collectors become more conscious of quality. Mutinda *et al.,* (2015) say when milk is tested for quality control, helps to retain a good market outlet. The PO might incorporate tracking measures into its milk collecting, bulking, and testing systems Currently, milk payment is based on quantity and not quality. Milk processors do not offer premium prices based on the quality of the delivered milk discouraging farmers who are producing quality milk (MOALF, 2013).

According to Ndambi *et al.* (2017), farmers are compensated primarily on the quantity of milk they produce rather than its quality. The majority of customers prefer to buy low-cost raw milk, a key challenge for value chain implementation has been to make formal sector dairying more attractive. Ndambi *et al.* (2017) continue to say that the use of poor-quality animal feed, non-food grade plastic containers for milking and transportation, and inadequate testing and rejection at collecting locations are all examples of non-compliance with milk quality and safety regulations. This is worsened by limited consumer knowledge, processor competitiveness for volume over quality, poor milk handling procedures across the supply chain, and a lack of enforcement of milk quality and safety requirements (Ndambi *et al.,* 2017). Pasteurized milk, in comparison to raw milk, is seen to give better value in terms of quality and safety, and so retails at a higher price. For processors to sustain their competitiveness in the wake of increased production and imports, they need to assure consumers of the high quality and safety of the processed milk (Bebe *et al.,* 2018).

As explained by Omondi *et al.* (2017), selling to many outlets is a risk-manage approach that allows hubs to earn profit from possibly higher pricing at non-processor outlets. Although processor pricing is lower, they give affiliated farmers more consistent pricing and hence more constant revenue streams throughout the year. Non-processor pricing is vulnerable to wide fluctuations that may erode gains from seasons of higher milk prices. As a result, varying on the percentage of a hub's milk that goes to non-processor outlets, farmers associated with such hubs may see lower average prices and, as a result, reduced income. Disparities in market channels suggest changes in the revenues that a hub may create, as well as differences in the assurance of a stable flow of payments for farmers (Omondi *et al.,* 2017).

In accordance with Millns (2006), producers frequently face barriers to market access due to a lack of information about where or to whom they should sell their goods. Information exchange between producers and processors can help to promote change and innovation. Producers' negotiation position is strengthened by market information, which helps them to determine whether to sell their products. Producers also utilize annual price series data to choose what to do and when.

## 2.4 The role of the dairy park as a source of employment.

David-West *et al.* (2018), state that hubs offer common places where individuals with diverse ideas, skills, and experience may work together to catalyze innovation and produce new forms of knowledge. Through the hubs, people enhance their skills through training and workshops, as well as the usage of virtual learning platforms. These expand and deepen the pool of highly competent entrepreneurs in Africa (David-West *et al.,* 2018).

In segmenting jobs created within the informal sector, the dairy value chain creates almost 20 full-time jobs (17 direct, 3 indirect) for every 1,000 liters of milk traded (FAO, 2011). Notably, about

500,000 liters of milk are sold daily in the informal market in Kenya (KDB, 2017). Mobile milk merchants, milk bars, shops, and kiosks are all examples of self-employment options. Milk bars, which are semi-formal, generate about 14 jobs (11 direct, 3 indirect) per 1,000 liters of milk sold daily (Kyule and Nguli, 2020). In the formal segment, the dairy value chain has been projected to make an average of 12.5 (11 direct and 1.2 indirect) full-time employments per 1,000 liters of milk handled daily. According to research conducted by the Smallholder Dairy Project (SDP), around 84 000 persons worked full-time in the dairy sector in 2008 (Staal et al., 2008). It is also significant that the formal sector dairy value chain provides more stable employment compared to the informal dairy value chain (Mbugua *et al.,* 2012).

Farm labourers, feed manufacturers, veterinarian suppliers, animal breeding service providers, and government extension officials are among the job opportunities at the input supply and service, as well as the production stage of the value chain (McKague *et al.,* 2014). At the farm gate farm laborers, do a range of jobs include feeding the cows, milking cows by hand, selling milk, and observing the overall well-being of the animals for any symptoms of disease, injury, or strange behaviour of cattle.

The milk processing level forms one of the most important components of employment in the dairy sector and accounts for about 10 percent of the workforce engaged in the dairy sector (FAO, 2011). Milk marketing provides off-farm work to a huge number of individuals, who rely on it for a significant percentage of their household income (Auma *et al.,* 2019).

Women and youth, as well as men, are expected to benefit from small-scale dairy farming. Value-added products can help poor people, children over the age of one year, and undernourished pregnant women diversify their diets, while milk sales provide a steady income that is often available to women, while value-added products can help poor people, children over the age of one year, and undernourished pregnant women diversify their diets (Weaver *et al.,* 2013). Income from livestock can be advantageous to women even if they do not solely own the animals; participation in a dairy value chain program to increase the value of assets jointly owned by women and men and gave women a wider range of options in saving or accessing credit (Quisumbing *et al.,* 2013).

## 2.5 Participation of farmer producer group

According to EADD-1 before using the group extension approach, the PO and facilitator must understand that creating, establishing, and developing a farmer group is a time-consuming and labor-intensive procedure. As a result, it's critical to resolve the following issues; farmers who have a common interest and issues that they feel may be solved in part by working together should create an organization, dairy producers, whether they're already in operation or just starting, It's best if the gathering isn't too big—15 to 30 farmers are excellent, the key organizational concept is geographical location since it determines communication and transportation activities. Lastly, Members of the group should view their involvement and interests as long-term friendships (Mutinda *et al.,* 2015).

The existence of leadership and management abilities seem to be critical to a group's success. Without these qualities, a group's prospects of long-term achievement are limited. Mutinda *et al.* (2015) continue to say that women and other marginalized groups should not be forgotten. Women are heavily involved in farming in most POs. As a result, it is critical that they get engaged in the PO's governance roles at all levels, and that they are urged to attend meetings and take part in decision-making. The PO can create a gender policy, commit to include women and other vulnerable groups, and provide recommendations on how to do so. With the help of EADD-1, several POs were able to put the one-third gender rule, which is enshrined in national laws in most East African nations, into effect (Mutinda *et al.,* 2015).

Millns (2006), says that members must be devoted to using the group's facilities and services, and control must be in the hands of the most dedicated members. This can be stated in terms of the amount of high-quality product delivered to a group, the amount of product purchased by the group,

or the overall utilization of services. Investing in a group, receiving benefits, and exercising voting rights must all be linked to these obligations; otherwise, an unproductive and inefficient group structure will emerge.

According to Shepherd (2007), side-selling for greater prices than those negotiated with the contractor may appear to make sense from the standpoint of a farmer with few income-earning alternatives and who is frequently in need of cash. It is tough for a farmer to overcome this "jackpot" attitude and see the potential benefits of forming a long-term relationship with a dependable client, especially if that customer appears to be paying poor prices. Extension workers and other service providers will have to put in a lot of effort to build confidence between the various stakeholders. If prices or expenses vary too much, contracts should always allow for renegotiation.

Draaijer (2002), explains that records assist the group in remembering what has occurred, tracking progress, and evaluating activities. If members or outsiders have doubts, the records will illustrate what the group is doing, how money is spent, and so on. Keeping accurate records might be crucial to a group's success. Official membership lists, group constitutions, information about group members, certificate of registration, minutes of meetings, correspondence/letters, milk collection records, breeding, and artificial insemination records, milk processing and marketing records, financial records, animal health, treatments, and vaccination records are all examples of records that can be kept.

## 2.6 Functioning of the farmer producer groups.

According to FAO (2021), throughout the world, milk producer organizations have played a critical role in dairy development. Cooperatives of small-scale farmers, for example, were essential in the growth of India's dairy industry, which has resulted in the country being the world's largest milk producer. The formation of producer groups in countries like Bangladesh, Kenya, Nepal, and Uganda has also aided dairy growth.

Milk is frequently produced in small quantities daily by many farmers, and marketplaces for milk products are frequently located in urban areas. Forming together a group to target these markets delivers a significant benefit such as economies of scale, risks are shared, ability to pool resources, better access to input support services, gender equity, youth employment, etc to the members of the group. Therefore, milk producer cooperatives are particularly well adapted to raising household income (Draaijer, 2002).

Mutinda *et al.* (2015), say that procedures such as the regularity with which suppliers are paid for milk delivered to the dairy should consider as many of the realities that farmers encounter as feasible. The PO should create a scheme based on the demands of the providers, negotiations with the processor, and the hubs cash flow situation. Forming a savings and credit system or linking farmers with a current program within the catchment could help utilize a variety of compliant financial services, such as cash advances or check-off systems. Some of the motives for side-selling and preferring alternative market channels that rely on payment-on-delivery to entice farmer supply can be significantly decreased by doing so (Mutinda *et al.,* 2015).

FAO (2010) states that producers' organizations' inclusion in rural development initiatives has fostered more collaboration between farmers' organizations and major development agencies. The necessity to increase capacity via the development of core competencies such as management, coordination of operations, training, and monitoring and evaluation has been emphasized to deliver planned objectives.

Group marketing activities have a better chance of success when attention is paid not only to capacity building in areas directly related to marketing, such as researching markets and negotiating with buyers but also to overall organizational and management skills, such as basic problem-solving and conflict-resolution skills, that could help the groups operate independently (Shepherd, 2007).

Mutinda *et al.* (2015), further explain that associating producers to profitable milk market outlets is a key aspiration of best POs. The PO must demonstrate that it can maintain the required volume and quality of milk to be dependable milk purchasers (traders and processors). As a result, improving and maintaining milk production should be at the center of a PO's objective. According to Millns (2006), members of the group may expect to get regular and timely updates on the market situation, as well as pricing, charges, and payments. Meetings must be done properly, decisions must be documented, and a monthly report on progress and finances must be provided.

FAO (2010) states that producer organizations are acknowledged for playing an important role in providing and improving extension services. Their capacity to build connections between extension providers and small-holder farmers has been emphasized as critical to the development of suitable and successful extension practices. Extension networks can also provide administrative help to producer organizations in their early phases of formation. According to research from Tanzania, the function of extension agents in guiding membership through the formation and registration procedure was linked to the implementation of micro-projects by small farmer organizations (Wambura *et al.,* 2007).

## 2.7 Benefits accessed as farmer producer groups.

According to Mutinda *et al.* (2015), seminars and meetings with carefully chosen community leaders can be beneficial in highlighting in what way enhancing the efficiency of their dairy operation may increase community livelihoods and the critical role a PO can play. Facts and data must be presented to persuade potential leaders of the opportunities and ways for raising the income of many farmers while also contributing to the region's economic growth.

Producers in the hub should use proper dairy cow farming technologies to boost milk production. Increased milk supply may be accomplished by either increasing the number of animals or increasing the amount of milk produced per animal. The latter approach is preferred since it is less expensive and has a lower environmental impact. Increasing production per animal can be achieved with improved breeds, management, and feeding (Mutinda *et al.,* 2015).

According to Mutinda *et al.* (2015), farmers' abilities must be assessed, and training requirements evaluated to ensure that the training program covers their requirements and gaps in dairy management abilities. The program should then be adjusted to fill in the gaps. Farmers in a PO are likely to have diverse abilities and not all have the same gaps and training needs, making it difficult to develop a uniform training program. However, the key topics to be covered are likely to be the same. Topics include:

- **Improving breeds** -The genetic aptitude of the cow is one of the most important drivers of milk supply. It becomes vital to enhance genetics when improvements are achieved in feeding and other management factors. Superior animals can be introduced (by purchasing heifers or adult cows) or current cows can be upgraded to enhance breeds with good qualities.
- **Addressing feeds and feeding challenges** -The superior genetics achieved must be maintained by better feeds and feeding methods to fully achieve the cow’s potential. Farmers must be taught how to make high-quality feeds on their farms, how to store extra feeds, and how to assess the quality of acquired concentrates. In addition, to guarantee that growth and production objectives are fulfilled, training on feeding practices is required.
- **Training to improve animal health-** The illness susceptibility of improved cattle is higher than that of local breeds. Capacity for diagnosing and treating common health disorders, as well as illness prevention, is required. This may be accomplished by teaching these skills to community animal health practitioners and farmers.

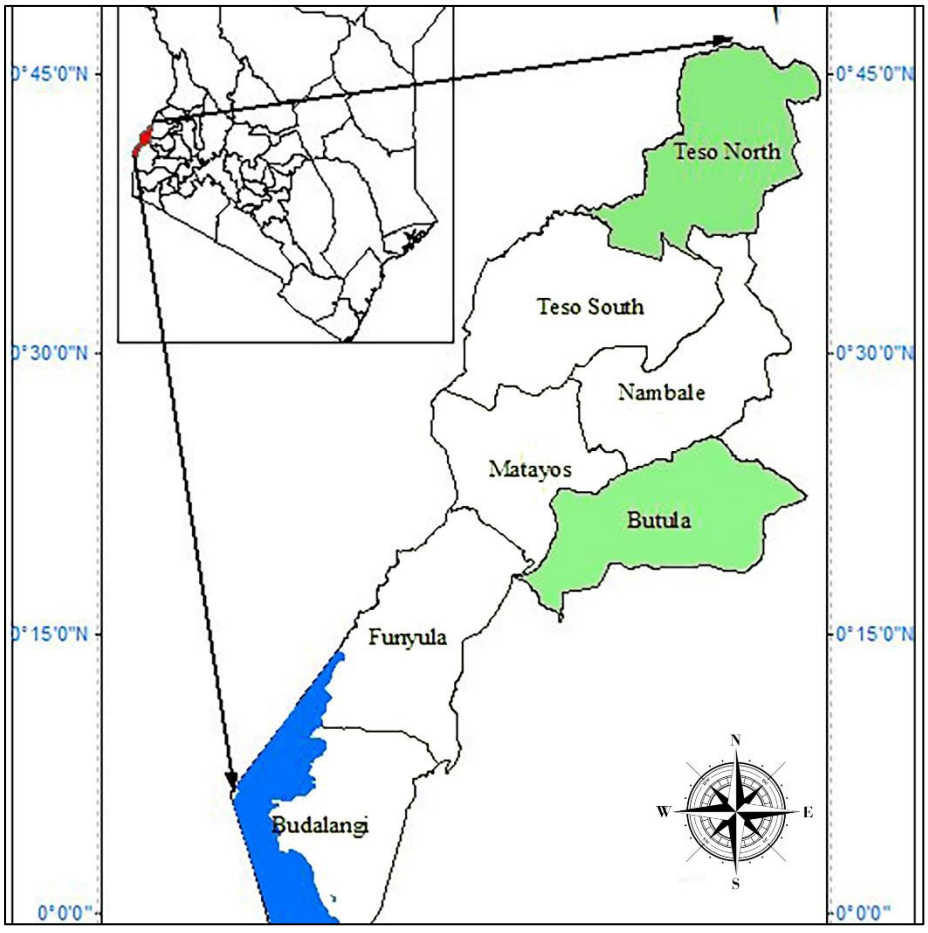
- **Training to improve herd fertility** -Herd fertility must be managed well to attain a one-year calving interval. When AI is used, fertility is dependent on heat sensing, and when either bull or AI is utilized, fertility is dependent on timely service. Heat detection can be done by observing the animal's behavioral or physical changes, or by using an estrous detection tool.
- **The housing of all dairy animals-**All dairy animals, including calves, heifers, cows, and bulls, should be housed for protection from the elements (wind, rain, direct sunshine), the convenience of control during feeding, and predators. The facility should be large enough to enable unrestricted circulation, well-lit and ventilated, and have easy-to-clean flooring.
- **Clean milk production and post-handling** - Milk can become contaminated and spoilt after it has been collected. Clean milk production, therefore, requires safeguarding that milk is exposed to minimize environmental contamination. Proper milking handling should be used to reduce contamination.

# Chapter Three: Methodology

## 3.1 Study Area

Busia County has a total area of 1695 square kilometers (KNBS, 2013b) It is in the western region of Kenya. The county is part of the Lake Victoria Basin, which supports the livelihoods of about 25 million people (Swallow et al., 2009). The average temperature in the County is about 21-27$^0$ C (Jeatzold *et al.,* 2011) while the yearly rainfall is about 750-2000mm (GoK, 2014), however, it varies across the County with regions near Lake Victoria receiving the minimum rainfall of about 760-1015mm and Butula and Teso North sub-counties getting the highest rainfall. The agricultural sector is the main source of income in the County. It employs about 78% of the labor force and contributes about 50% to household incomes (GoK, 2013a). Crop cultivation is one of the most important agricultural operations in the county (mainly cassava, sorghum, maize, groundnuts, sugar cane, and some horticultural crops such as local vegetables and mangoes), livestock rearing is mainly unrestricted-range poultry, sheep, and goats as well as cattle and fish production. The county has 25,358 dairy cattle 210,443 are beef cattle but dual purposed for they are also kept for milk production, manure, and breeding stock sale (income). Currently, Busia produces 27,367,551 million liters/year of milk with Nambale, Teso North, Teso South, and Butula leading in production, respectively.

*Figure 3: Map of Busia county*




Source: Adopted from Mulefu *et al.,* 2016.

## 3.2 Research Strategies

To find answers to the main questions of the research, both quantitative and qualitative data were collected and triangulated. The research was aiming to evaluate the socio-economic impact of the dairy park project on the dairy value chain more specifically on the livelihoods of smallholder farmers, youths, women, and PWD to formulate recommendations that will improve the performance of the dairy park. Therefore, the research involved carrying out a desk study to get familiar with the literature about the study area as well as smallholder dairy production under the dairy park project. The instruments used included questionnaires, checklists, and MIDCA tool which were developed, the questionnaire was tested before submission to the farmers to ensure the questions are well understood and clear for farmers within the area. Reminders were sent two weeks before the deadline to get enough feedback and give the farmers enough time to answer the questions. In addition to desk research, data collection involved surveying smallholder dairy farmers' farming, semi-structured interviews, focus group discussions as well as farm and dairy park observations.

## 3.3 Target population, and sample size

The target population in this study was smallholder dairy farmers involved in the dairy park project. Simple random sampling was used to draw a sample of 48 smallholder dairy farmers from two sub-counties (24 Teso North and 24 Butula) to ensure representatives of the whole population. Two communities were randomly selected by the researcher from each sub-counties, from each community 1 Self Help Group (SHG) was selected. The SHG then selected 4eFF representatives to participate in the focused group discussion total (14). 6 key informants' interviews were done to ensure the objective of the research is recognized. The total was 74 respondents.

## 3.4 Data Collection

### 3.4.1 Desk study

The desk review will be of internal documents, log frame, reports, journals, books, and credible online sources such as Google scholar, Greeni, among others. This will be combined with a review of literature that can place the experiences of the program in perspective of other experiences of dairy sector development such as literature on dairy commercialization through value chain development and how it relates to livelihood.

### 3.4.2 Focus Group Discussion

The extension officer organized two focus group discussions with 14 representatives from the selected SHG in each community at the dairy park project who met at a central place for members. Covid restrictions were observed and implemented in terms of the number of people per session, social distance, wearing of masks, and all the protocols needed to facilitate the gathering of information. The MIDCA tool (integrated organizational assessment model) was used by cooperative members and SHG members in determining their strong points and areas for growth. The cooperative and SHG were evaluated based on internal management, production, and sales capabilities, among other things. Open and straight questions followed by probing was done to get insight and in-depth information on the participation of members, ownership, existing farmer producer groups, services from the project, and general information on improvements, ideas, the challenges, and benefits of SHG to improve quality and yield of milk. The discussion was recorded with the consent of the respondents, in this way the researcher gathered insights through analysis of the valuable source of data.

### 3.4.3 Survey

A survey was conducted on smallholder dairy farmers organized under the dairy park project in Teso North and Butula sub-counties. The structured questionnaire was administered to 40 smallholder dairy farmers with the assistance of the research assistant to translate for those who cannot express themselves easily in English. The questionnaire was divided into sections for effectiveness to capture data on a different aspect of research. The section included demographic information of the

respondent, adoption of technology on the farm to increase productivity, market linkages, and cost-benefit.

### 3.4.4 Observation

An extensive field visit will be done by the research assistant who will be briefed on the pointers to check during the observation. The observation will be conducted on smallholder dairy farmers' farms and dairy parks to gather more supportive information through observing the different dairy production practices, the dairy park unity capacity, and the equipment installed to achieve milk production and collection chain in the study area. The observation method helped to identify the type of fodder production and structures for conservation, the machines used on the farmers, the type breeds on the farms, established dairy park capacity and equipment's efficiency used that supports or impedes improvement of milk production.

### 3.4.5 Interviews

Interviews were done by the researcher via phone call at the comfort of the interviewee to collect the data from stakeholders and key informants through semi-structured interviews. Key informant interviews were relevant for collecting qualitative data. These were conducted through the use of customized checklists that were administered to different key informants. The key informants include livestock extension officer, FSK extension officer, staff from co-operative, a trader, and kiosk seller. The checklist was helpful to guide the interviews that aim to collect data on the main aspect of the research such as the capacity building of farmers, market linkage, employment, stakeholder's role in the value chain, and other general information.

## 3.5 Data Analysis

Both qualitative and quantitative data were collected during the research. Quantitative data was collected using questionnaires during the survey. The questionnaires were coded, and data were entered appropriately to computer software which includes Microsoft Excel version 2010 and Statistical Package for Social Science (SPSS) version 25. Descriptive statistics were used to analyze the data which included demographic information on demographic information of the respondent, adoption of technology on the farm to increase productivity, market linkages, and cost-benefit. The analyzed data were summarized and presented in appropriate tables and figures such as pie charts and graphs.

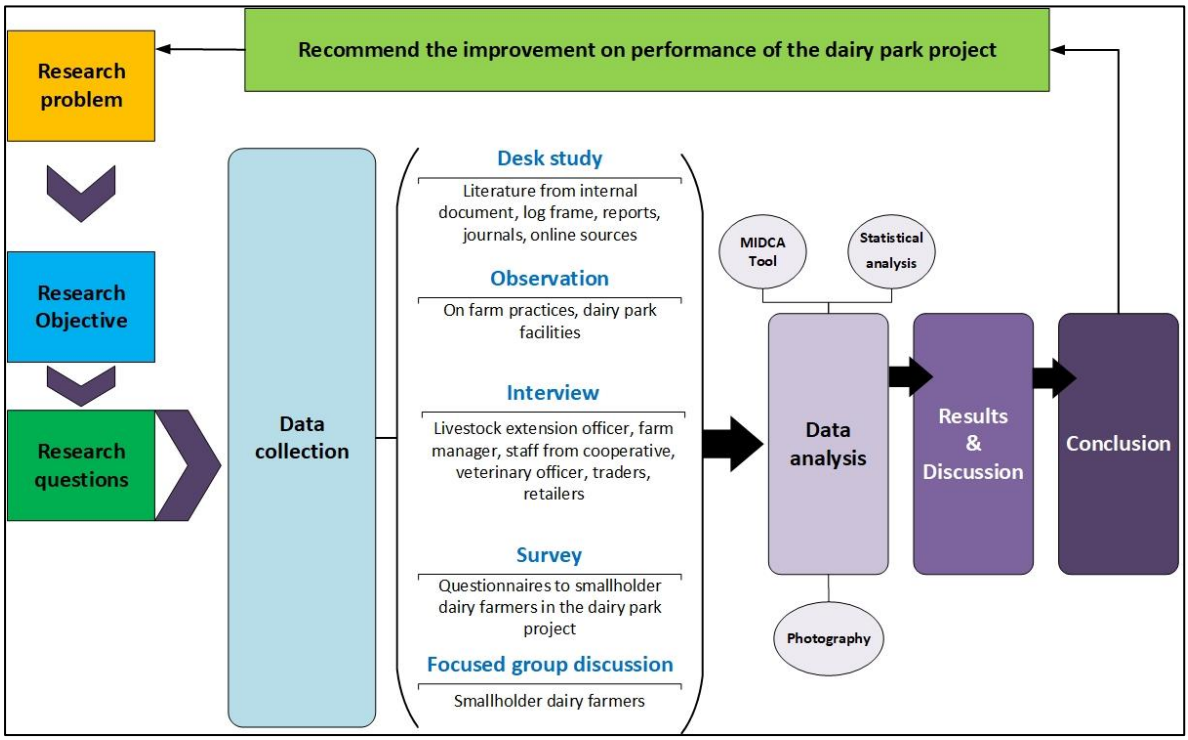
Qualitative data was collected through interviews, discussions, and observations. The collected data was descriptive, and narrative of capacity building of farmers, market linkage, employment, stakeholder's role in the value chain, type of fodder production and structures for conservation, established dairy park capacity and equipment used that supports or impedes improvement of milk production, participation of members, ownership, existing Farmer producer groups, services from the project, and general information on the challenges and benefits of SHG to improve quality and yield of milk and other general information. Findings were recorded, and data processing was coded and grouping of data according to different categories. Stakeholder matrix, chain map, MIDCA was used to give brief and clear information that provided answers to the research question.

*Table 2: Summary of data sources and analysis techniques*

| Elements of Sub-questions | Source of Data | How to collect data | How to analyze data | Expected output |
|---|---|---|---|---|
| **Roles of the stakeholders and their function.** | Literature<br>Key informant. | Desk study to collect secondary data.<br>Semi-structured interview. | List of actors and supporters | Value Chain map<br>Stakeholder analysis |
| **Production improvement on the adoption of technologies.** | Field visit<br>Questionnaire | Observation<br>survey | SPSS<br>Microsoft Excel | Graphs, descriptive statistics<br>Cost-benefit Analysis |
| **Contribution of the project on market linkages.** | Key informant<br>Questionnaire | Semi-structured interview<br>Survey | SPSS<br>Microsoft Excel | Graphs, descriptive statistics |
| **Contributed to job creation for youths, women and PWD.** | Key informant<br>Questionnaire | Semi-structured interview<br>Survey | SPSS<br>Microsoft Excel | Graphs, descriptive statistics |
| **Participation of farmers.** | Key informant<br>Questionnaire<br>Group Discussion<br>Ranking and scoring | Semi-structured interview<br>Survey<br>FGD | MIDCA | Graphs, descriptive statistics |
| **Functions of SHG** | Group discussion | Semi-structured interview<br>FGD | MIDCA | Graphs, descriptive statistics |
| **Benefit accesses as SHG** | Group discussion<br>Ranking and scoring | Semi-structured interview<br>FGD | MIDCA | Graphs, descriptive statistics |

## 3.6 Research Framework

*Figure 4: Research Framework*




## 3.7 Ethical issues

The respondents were informed of the aim of the research and were requested to give consent before being interviewed. The information was treated with confidentiality.

## 3.8 Research Limitation.

The research was conducted during the corona pandemic which has provided exceptional insights into qualitative research approaches and methodology. Shifting to remote for data collection had limitations with the covid restrictions which were adhered to. As a researcher, I depended on the research assistant to conduct FGD, observation, and survey to provide findings from the respondents and field visits, however, the research assistant was trained by the researcher before going to the field to understand the objective of the research and what points to consider and check when collecting data. For FGD, the restriction of numbers of participants was influenced however, the number planned to attend was reduced, and also the time was very limited to gather more information which was resourceful to the research. During the interview there was a language barrier, however, due to interpretation, there was some missed information that could be important. Due to corona restrictions of working from home, an interview with staff from KCSAP was not possible thus getting information from the main stakeholder on what they have achieved and yet to be achieved in the project was a challenge.

# Chapter Four: Findings

The information in chapter four was obtained through a series of key informant interviews, Focused Group Discussion, and survey. Narrative and descriptive data were acquired, analyzed, and summarized to provide a comprehensive picture of the dairy park project and activities, as well as the dairy value chain in Busia County, as shown in the sections below.

## 4.1 Dairy Park Project

The Dairy Park in Busia County was implemented in Teso North and Butula Sub Counties by the Department of Agriculture and Animal Resources of Busia County in 2019. It was designed to reach 1,500 smallholder dairy farmers in the sub-counties with the overall goal of the project to improve the livelihoods of smallholder dairy farmers in Busia County through increased quality and yield of milk, increase rural incomes, and employment.

**Input Supply**

The information was obtained from a series of key informants, extension officers one from Teso North, one from Butula sub-counties, and one from Farming Systems Kenya, a trader, cooperative manager, and milk kiosk seller.

**i) *Extension officers in Teso North and Butula***

The Dairy Park project started in 2019 to empower dairy farmers, at the inception stage dairy farmers were informed about the project. Some farmers worked already in groups but other new farmers were requested to join or form new groups with a condition one must have a dairy cow and be willing to construct a zero-grazing unit before getting a heifer. 100 and 118 heifers and 70 bulls have so far been distributed in Teso North and Butula Sub County respectively. The ongoing dairy activities include construction of a modern dairy park, passing on of heifers, distribution of heifers, training on feed and feeding management, animal husbandry, diseases control, and pasture seed bulking sites. Farmers in the wards take care of the animal given to the group however, some heifers died due to diseases especially East Coast Fever(no specific number). Other group members support the day-to-day management of the animal in both feeding and disease control. The project's overall target was to reach 1,500 dairy farmers both in Butula and Teso North Sub-county. At the time of the research, the total number of farmers who have been registered under the project is approximately 1,000 smallholder farmers. In Teso North, under the project, 15 youth are host farmers who got the heifers, and 70 (40 in Teso North and 30 in Butula) groups have benefitted from the project with membership ranging from 15-25 in Butula and Teso North sub-county. Extension officers have a monthly plan to visit the groups and conduct training on feed and feed management, animal husbandry, disease control, and nutrition, follow-up is done through phone calls. During the pandemic, most of the activities done as a group were stopped because there were no more gatherings which affected the field visits and training. Farmers access the extension service as a group through farm visits, field days, farmer exposure tours, phone, and office visits. The extension officers linking farmers to markets (Butula Cooperative DFCS), training organized for farmers includes feeding and feed management, disease control, demonstrations on fodder establishment, and milking spray for ectoparasites control.

According to the extension officers from Butula and Teso North, the Dairy Park project has partially achieved the objectives such as an increase in milk production 10-12 liters per day though it is minimal, farmer preparedness before the animal acquisition, little adherence to proper management on feeding and disease control, improved nutrition at the household level, improved incomes which are used in paying school fees for children, success stories of table banking, economic empower of the Youth, PWD, and women through income-generating activities i.e vending milk. However, the building of the plant is 80% completed, but Agriculture Training Centre (ATC) is now temporarily used for housing the 20 heifers and seed bulking sites. According to the extension officers the constraints met during the project implementation include high costs of animal disease control i.e. Kshs. 4500-6000

for ECF treatment; AI Services;- sexed semen- 6000/=and unsexed semen- 2000-2500/=, poor timing for Artificial Insemination, farmers not adhering to recommended feeds and feeding regimes, convincing farmer to take credits from the local lending institutions, poor recording keeping of the pass on heifers, slow uptake of the technologies (feed material utilization and conservation-hay and silage) and stakeholders rarely write reports (minimum data is available). The role of the department on value chain development has linked the dairy farmers to markets (cooperative in Butula), offer technical services, farmers have been linked to financial Institutions i.e Agricultural Development Trust Fund (ADTF), Agricultural Development Fund (ADF), and Akukurunat Development Trust are well suited to dairy farmers. Members in Farmer Producer Groups have a creation of ownership of the project activities, participate in farmer to farmer training, create awareness and train other farmers, organize farmer tours, prepare the farmer who is to receive the cow, and groups run their activities i.e table banking, merry- go round and writing proposals to source for funding i.e Government grants vary from Ksh 150,000 to 200,000.

**ii) *Farming Systems Kenya***

Farming Systems Kenya is a local NGO that works with rural smallholder farmers. The extension officers work with groups and less of individual farmers. Since 2019, 70 groups exist with a membership of 15-25 members. 218 heifers and 70 bulls were distributed to Butula and Teso North sub-counties with the help of extension officers from the county. Heifers were given half the number of the group members and 1 bull which will help to serve the cows in the groups. The rest of the members who did not get were expected to receive from those who received first (pass on method). There is no exact number of how many heifers have been passed on but farmers report that 6 heifers died due to East Coast Fever while some got bull which they cannot pass on to other members hence the process gets more delays. Before the farmers are given the heifers they sign an agreement with Farming Systems Kenya that they will take care of the heifers, build a zero-grazing and pass on the first female to other members. Every farmer paid Ksh 5,000 before receiving the heifer as a way of commitment to the project. 5 seed bulking sites have been established in each sub-county to facilitate farmers with splits and seeds to plant on their farms. They include Napier grass, Rhode's grass, Brachiaria grass, Desmodium. The majority of the farmers have planted the fodder under one acre though it is not enough to feed their cows.

Due to delays in the completion of the dairy park construction and equipping, Agricultural Technology Centre (ATC) is used at the moment temporarily to house the 20 heifers and also the main seed bulking site for planting materials. At the moment there are 4 (2 women and 2 men) persons employed to work on the farm to generate income, the persons are responsible for planting, harvesting, and selling the seeds to farmers. They work closely with extensions officers from FSK and also from the government. The heifers in the ATC have a veterinary officer who checks and makes sure the animals are safe and in good condition. 2 youths have been employed at the station to provide water, food and clean the shelter for the heifers every day. Farmers have been linked with ATC where they can purchase planting materials at an affordable price. Efforts did by Kenya Climate Smart Agriculture Project, the county government, and Farming Systems Kenya has been distributing tsetse fly repellent nets to some farmers as well as vaccination programs to help prevent diseases.

***iii) Producers***

The majority of the dairy producers are smallholder farmers with two to five cows, the majority have constructed dairy units for the animals, the feeding system is mainly semi-zero-grazing while few practices zero grazing. The milk production per cow varies between 8 to 13 liters of milk per day, depending on the household and seasons. The type of breed commonly kept by the farmers is exotic breeds. More information on the survey.

***iv) Traders***

Traders sell 50 to 100 liters of raw milk every day in the area, they collect and buy milk from farmers at Ksh 50 per liter and they pay cash to the farmers. Traders move from home to home to get the milk because of reliability and at the point of taking the milk, the quality is not check. The milk is carried on a 50-liter stainless can where they mix all the milk collected from farmers and they sell to kiosks and local consumers at Ksh 60 per liter.

***A case scenario of Simon in Butula Sub County***

**Simon milk trader in Bumutiru market**

*Simon is 27 years old married to one wife and blessed with 2 children, Simon finished high school in 2012 and he did not manage to join university due to lack of fees. He has been working as a Boda Boda rider until 2017 where he decided to start selling milk to consumers. In 2017, Simon started selling milk in the Bumutiru market, he collected milk from 3 farmers average of 20 liters a day and he could pay the farmer the next day when he collects the milk. He bought the milk at Ksh 40 per liter and he could sell at Ksh 45 per to the consumer. Later he discovered that more people needed milk, but he cannot supply them with the milk because of the distance also, he did not have enough milk. In 2019, he bought a motorbike from his savings to help him take the milk to far distance. He increased his sourcing of milk to 7 farmers where he gets an average of 70 liters per day but due to seasonality milk fluctuates. The milk is carried in 20litre jerricans and is arranged on the crate so that they don't fall. Depending on the season the milk price fluctuates, and he buys between Ksh 45-50 shillings, and he sells to the local consumers at Ksh 60 per liter. Simon reported that "The demand for milk is high, but the production is still low." he continues to say, "Sometimes I receive phone calls from customers to take milk but I tell them it's finished but I will bring for you in the morning as a priority." Simon sells the milk in the morning and later continues to do Bodaboda riding and in the afternoon again he resumes to buy the milk and sell it to the customers. He pays the farmers cash daily and gives information to the farmers on the type of milk the consumers want. Simon is planning to buy a 50-liter stainless can to help him carry the milk because consumers are complaining of the smell of the jerrican on the milk and the hygiene of the jerricans. Per day he spends Ksh 3,325 to buy 70litres of milk and receives Ksh4,400 after selling the milk a profit of Ksh 875 per day.*

Source: Milk trader interview for this study.

***v) Milk collection center***

There are 11 milk collection centers in Butula, the nearby MCCs to the cooperative are owned by the cooperative while the ones which are far are owned by the farmers in SHG. Farmers in SHGs organize themselves and collect the milk at one central point in each location from where the cooperative motorbikes can pick the milk and deliver it to the cooperative. The central point for milk collection is accessible by all members in terms of distance average less than 500 meters from their homes since most members walk to the location for milk delivery. Some farmers transport milk by bicycles while some on foot and milk are carried on milking cans. Milk quality is tested at the collection center and any non-conforming milk is rejected at that point before mixing into the collecting cans. Milk is collected twice per day in the morning and afternoon after the farmers have milked the cows. The milk collection stops at 9 am and 6 pm to allow the transporters to transport the milk to the cooperative on time to be stored on coolers to reduce milk spoilage and be able to supply also on time to the different consumers. Milk prices fluctuate depending on the seasonality during the rainy season the milk price will be Ksh 40 and during the dry season, the price goes up to Ksh 45 per liter. Currently, the dairy park is not equipped and still not in operation, but the farmers are organized in different groups, and they decide the central place where they collect their milk. The milk collection centers averagely collect 100 liters of milk per day from farmers who are organized in a group.

***vi) Cooperative***

Butula DFC started in 1992 with 12 members which expanded to 3000 in 2016. In 2017, it collapsed due to corrupt leaders. It was revived in June 2020 with support from the MCAs and the membership stands at 75 with 30 men and 45 women who are currently active. Some of the members are inactive due to a lack of confidence in the cooperative management, delayed payment, and fewer liters of milk produced per day. Butula DFC sources milk from different areas, currently they are working with 75 farmers who supply the milk daily at the cooperative. The average milk per day they handle is 500 liters per day. Currently, there are 11 milk collection centers Buhuyi, Mung'abo, Tingolo, Ligulu, Ogallo, Butula Township, Bulemia, Bumutiru, Esigoma, Bumala A, and Murumba where farmers collect their milk collectively. The milk is collected twice a day, the cooperative buys the milk at Ksh 45 per liter and sells it out at Ksh 60 per liter. The major outlets for the milk are hotels, schools, hospitals, and local consumers in the area. The cooperative faces some challenges which include milk perishability, hygiene, alteration of the milk, dishonesty of collectors, lack of transparency, transportation of milk, pricing per liter perceived to be too low, competition- cheaper milk from Uganda- borderless dairy- sell at Ksh 40 in the same outlets and members press the management to pay for the milk delivered when gets spoilt. The cooperative acknowledged that members have increased milk production from 8-10 liters per day to 10-15 liters attributed to good management of fodder/forage since the project started. However, the impact is still minimal since there is no sufficient milk taken to the cooperative. Through the help of the government, the plant was established and equipped with milk cans, coolers, generator booster, Artificial Insemination can, weighing scale, lactometer, deep freezer, computer, and motorbikes to help facilitate the processing of milk. The milk is delivered to the cooperative using bicycles and motorbikes when the milk is delivered the quality check is done and they look at the hygiene, odour, color prefers cream yellow, the stickiness of the milk on the container, and the type of container used to carry the milk. There are 14 milking cans with different sizes 50L, 20L,10L, and 5L, the milk is stored on the coolers before being sold. Members of the cooperative pay registration fees of Ksh 1,000 and a yearly subscription of Ksh 500. Members of the cooperative get benefits such as capacity building for farmer producer group members on fodder/forage establishment and management, general livestock husbandry, facilitation of farmer exchange visits, provision of bull service and AI, and disease control management- animal health. The milk sellers contracted by the cooperative are paid on commission based on the number of liters sold.

Teso North- Adongosi DFCs started in 2010 and registered in 2015 with 20 members and expanded to 65 members (20 men and 43 women). The cooperative sourced milk from farmers who were both members and non-members. The buying price of milk was Ksh 45 and sold to institutions (school and hotel) at Ksh 60. Later in 2017, the cooperative failed due to insufficient milk from members and the mismanagement of funds by the leaders. Members tried to revive the cooperative but it did not succeed since the milk production is still low and farmers are selling directly to the consumers who offer better pricing of a liter of milk.

***vii) Milk Kiosks***

In Butula sub-county there are 12 milk kiosks where milk is sourced from different traders, farmers and some owners are also milk producers, the buying price is Ksh 55 per liter from traders and Ksh 50 per liter from farmers and sells at Ksh 60 per liter. Per day the kiosk manages an average of 25litres, the milk is sold to local consumers around the area. The challenges faced when selling the milk involve defaulters- consumers not paying on time, competition from traders who get milk from Uganda who sell cheaply, lack of package materials, milk hygiene not observed. Farmers who bring the milk to the kiosk carry milk using stainless steel cans, the quality is checked, and the attributes include the color of the milk and preference is cream yellow, density-sticks to the container, smell, and taste.

Teso North sub-county- Milk is sourced from different farmers also from their farm, buying price from farmers is Ksh 45 per liter and is sold at Ksh 60 per liter. Daily 20L is sold to the local consumers in

Lukolis. The constraints when selling milk includes competition from traders who get milk from Uganda who sell cheaply, lack of package materials, and milk hygiene not observed.

*Table 3*: Dairy Park Project stakeholder matrix

| Actors | Roles | Numbers |
|---|---|---|
| **Input Suppliers (Agro-vets, private sectors)** | Supply of feeds, AI services, animal health care, administering of drugs.<br>Provide information to farmers. | |
| **Producers** | Keep dairy cattle, produce milk, and sell to consumers, milk collection centers. | 1,000 |
| **MCCs** | Collecting, bulking, chilling, quality checks, and selling to the customers and sometimes deliver to cooperatives.<br>Help in marketing, provision of inputs and services to farmers.<br>Breeding of the heifers. | 11 in Butula |
| **Cooperatives** | Chilling, pasteurization, packaging, and quality examination.<br>Selling in bulk to institutions. | 2 |
| **Traders and retailers (Milk Kiosks)** | Buy milk from farmers and sell directly to the consumers | Est 20 milk kiosks and 70 milk traders. |
| **Consumers** | Buy and consume milk. | |
| **Chain supporters and influencers** | | |
| **World Bank-Kenya Climate Smart Agriculture Project-** | Donor | 1 |
| **NGO Farming Systems Kenya** | Providing farmers with seeds, heifers, and bulls. | 2 extension officers. |
| **Department of Agriculture and animal resources** | Oversee the day to day running of the Dairy Park Project<br>Farmers adhere to feeding standards<br>Source market for milk produced by farmers<br>Train farmers on general animal husbandry<br>Facilitate the extension services<br>Organize dairy farmer groups into a cooperative.<br>Train farmers in group formation and management. | 7 extension officer |
| **Veterinary Department** | Provide veterinary services and perform disease surveillance.<br>Provide AI Services to the farmers.<br>Train farmers on animal health practices and safe use of animal drugs.<br>Provide both preventive and curative services | 3 officers |
| **County government** | Control of county dairy planning<br>Facilitate extension and livestock department to serve farmers | 1 |
| **Financial institutions (Banks, savings and credit societies,** | They support dairy actors by providing credit. | Est 6 |
| **Kenya Agricultural and Livestock Research** | Provision of seeds. | 1 |

| | | |
|---|---|---|
| **Organisation (KALRO)** | | |
| **Kenya Dairy Board (KDB)** | Responsible for policies, strategies, and regulations governing the quality of milk delivered to processors and consumers. | 1 |
| **Kenya Bureau of Standards** | Product standardization and certification | 1 |

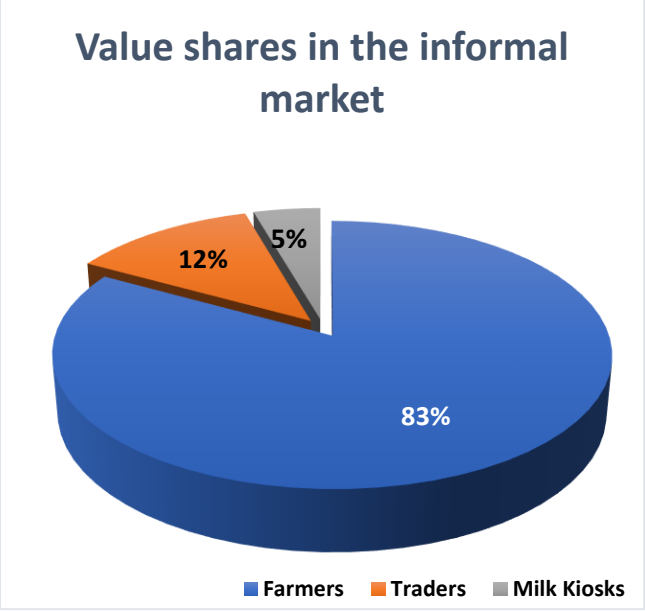
***Value shares of actors in the dairy value chain in Butula and Teso North sub-county.***

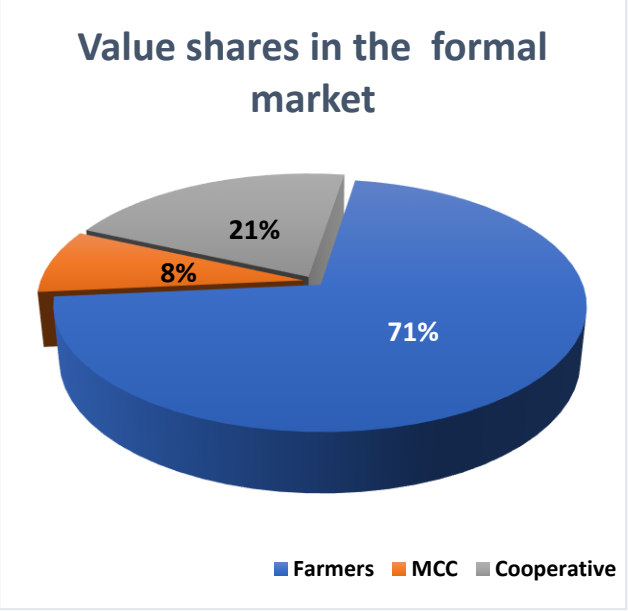
*Table 4: Value shares of actors per liter of milk in the informal market*

| Chain actor | Variable costs | Revenue-Selling price | Gross income Revenue-Costs | Added value Revenue-previous actors revenue | Gross Margin Gross income*100/revenue | Value share Added value*100/retail price |
|---|---|---|---|---|---|---|
| **Farmers** | **26.20** | **50** | **23.8** | **50** | **47.6%** | **83%** |
| **Traders** | **50** | **57.50** | **7.5** | **7.5** | **13%** | **12.5%** |
| **Kiosks** | **52.50** | **60** | **7.5** | **2.5** | **12.5%** | **4.5%** |

*Table 5: value shares of actors per liter of milk through formal market*

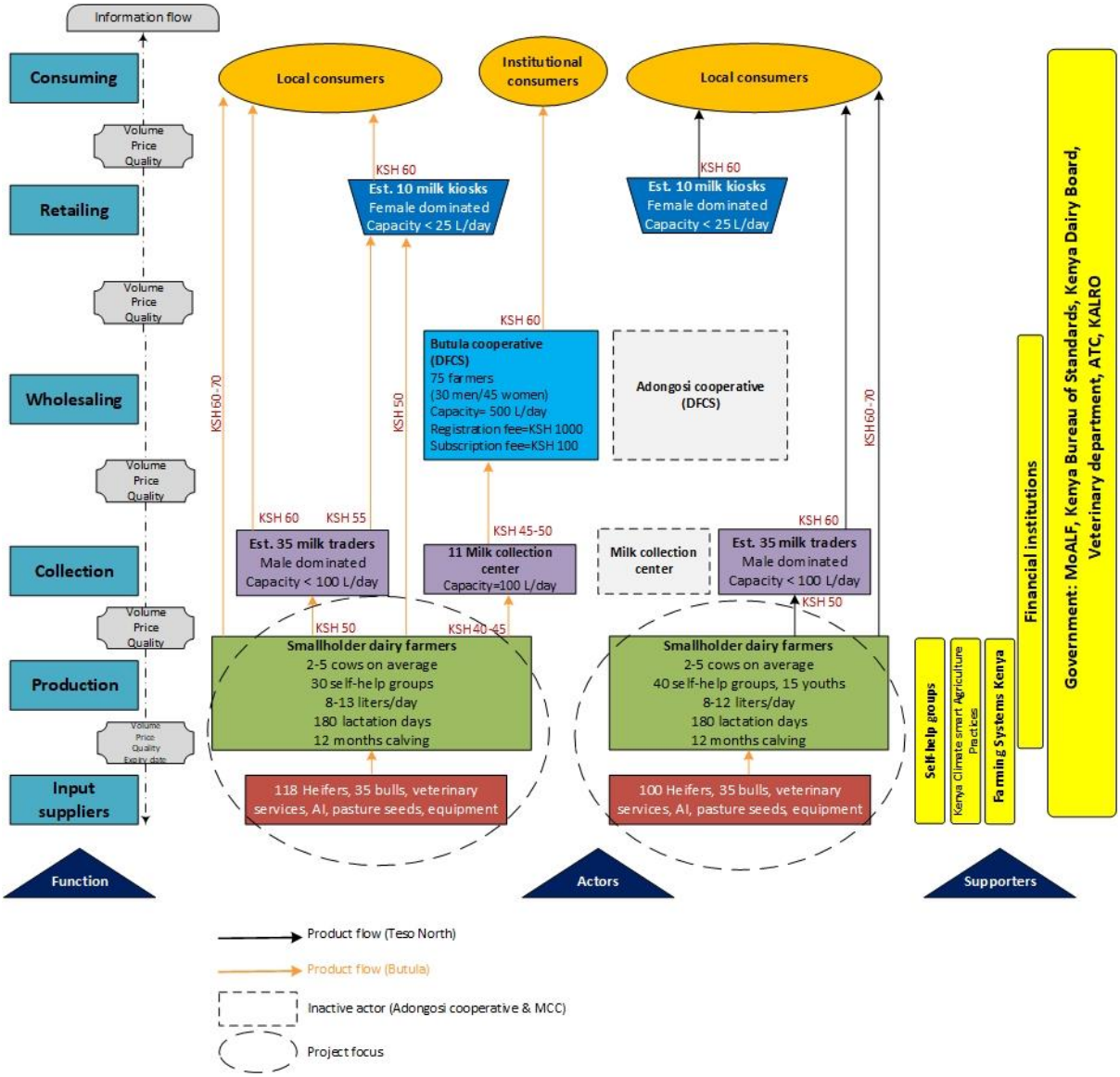
| Chain actor | Variable costs | Revenue-Selling price | Gross income Revenue-Costs | Added value Revenue-previous actors revenue | Gross Margin Gross income*100/revenue | Value share Added value*100/retail price |
|---|---|---|---|---|---|---|
| **Farmers** | **26.20** | **42.5** | **16.3** | **42.5** | **38.35%** | **71%** |
| **MCC** | **42.5** | **47.5** | **5** | **5** | **10.5%** | **8.3%** |
| **Cooperative** | **47.5** | **60** | **12.5** | **12.5** | **21%** | **20.83%** |




Informal market: It is seen that farmers have the highest value share 83% and 71% in both scenarios and the lowest value share in the informal milk is for milk kiosks 5% and MCC 8% in the formal market

*Figure 5*: Butula and Teso North dairy chain map



## 4.2. Survey/Questionnaire

The information was gathered from N=48 farmers 24 respondents from Butula sub-county and 24 respondents from Teso North.

### 4.2.1 Background information of the respondents

**I. Gender and Age of the respondents.**

In general, there is gender parity in the dairy farming workforce, with male and female dairy farmers accounting for 52% and 47% respectively (figure 6). The study indicates that the majority of the dairy farmers in Butula and Teso North is dominated by the old generation 36-59 years old which comprise (35%) and (41%) respectively compared to the youths 18-35 years old which constitute (2%) in both sub-counties are actively involved in the dairy farming (figure 7).

*Figure 6*: Gender of respondents

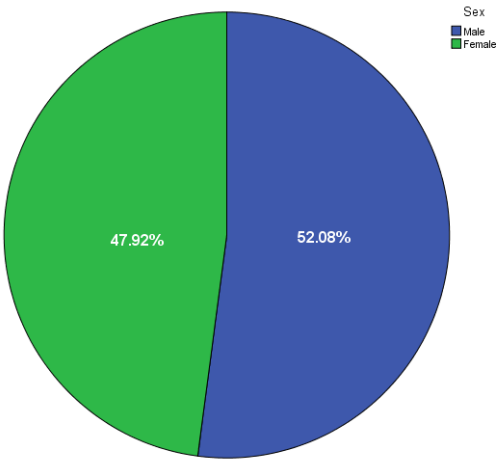
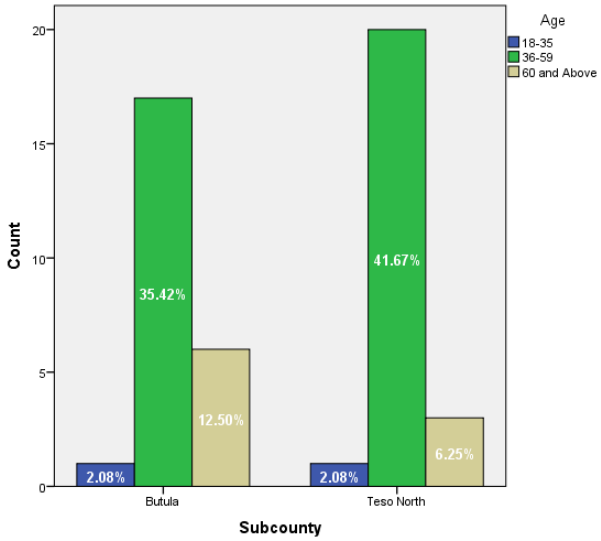
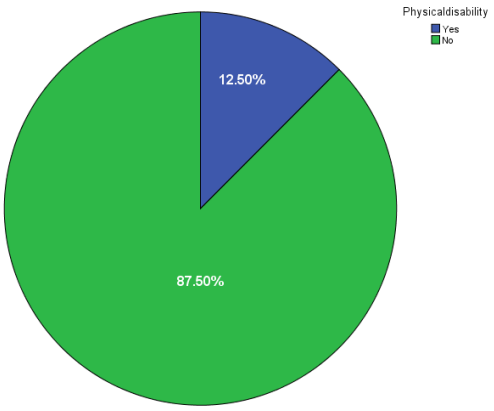



*Figure 7*: Age of the respondents




The study revealed that the majority (87%) of respondents had no physical disability while 12% indicated they have a physical disability (figure 9).

*Figure 8*: Physical disability of the respondents




**II. Level of education and source of Income for Respondents**

The study revealed that most of the respondents in Butula (27%) and Teso North (20%) had attained the primary and secondary level of education respectively while Butula and Teso North had 10% and 8% respectively of respondents had tertiary level of education as indicated (figure 9). The study

revealed that the majority (54%) of respondents depended on farming as their major source of income (figure 10).

*Figure 9*: Education level of the respondents

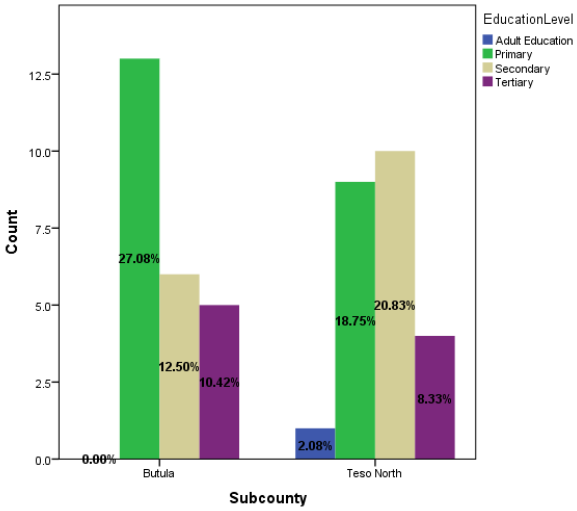
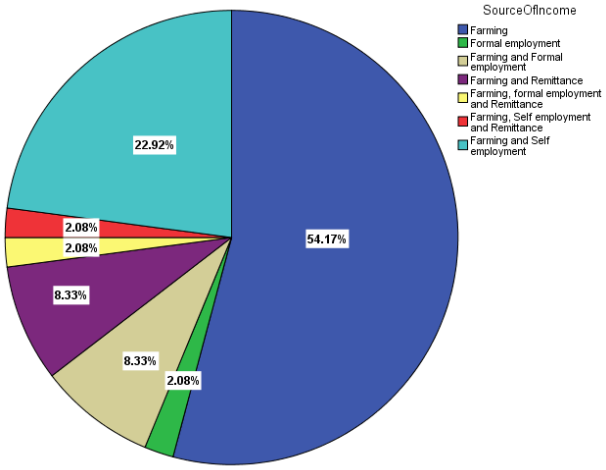



*Figure 10*: Source of income of the respondents




**III. Major Farming Activity and livestock kept by the respondents.**

The study indicates that the majority of the respondents 77% are livestock farmers (figure 11). 31% of the respondent indicated that they kept cattle, poultry, and goats while other livestock kept included pigs and sheep (figure 12).

*Figure 11*: Farming activities of the respondents

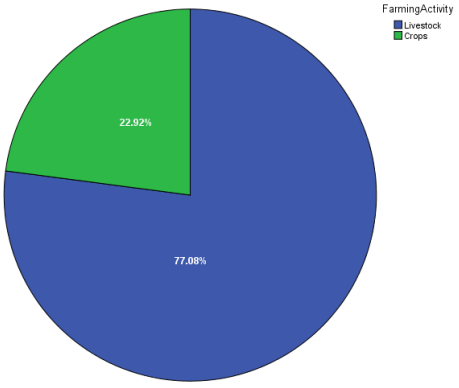
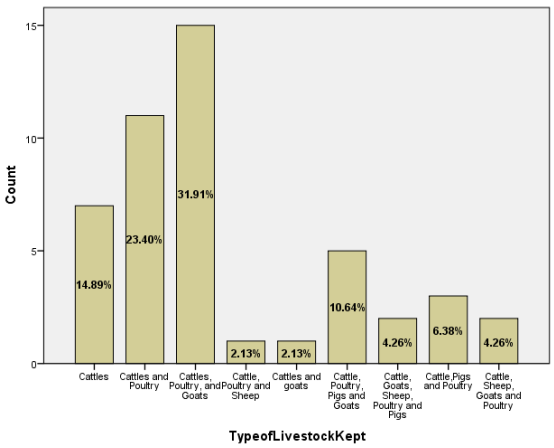



*Figure 12*: Livestock kept



### 4.2.2 Adoption of Technology

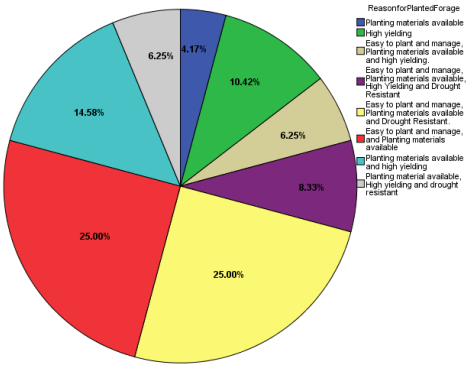
*Table 6*: Fodder Production

| Fodder/forage production and concentrates. | Sub County | | | |
|---|---|---|---|---|
| | Butula (N=24) | | Teso North (N=24) | |
| | N | N % | N | N % |
| **Total land size owned** | | | | |
| 0-2 acres | 12 | 50.0% | 7 | 29.2% |
| 2.1-5 acres | 11 | 45.8% | 16 | 66.7% |
| 5.1-8 acres | 0 | 0.0% | 1 | 4.2% |
| 8.1-11 acres | 0 | 0.0% | 0 | 0.0% |
| 11.1 and above | 1 | 4.2% | 0 | 0.0% |
| **Enough fodder on the farm** | | | | |
| Yes | 9 | 37.5% | 7 | 29.2% |
| No | 15 | 62.5% | 17 | 70.8% |
| **Feeds for cattle** | | | | |
| On farm | 2 | 8.3% | 5 | 20.8% |
| Purchase | 2 | 8.3% | 1 | 4.2% |
| On farm and Purchase | 20 | 83.3% | 18 | 75.0% |
| **Type of fodder/forage purchased** | | | | |
| Napier Grass | 16 | 66.7% | 16 | 66.7% |
| Rhode Grass and hay | 1 | 4.2% | 0 | 0.0% |
| Hay and desmodium | 1 | 4.2% | 0 | 0.0% |
| Napier and bracharia | 2 | 8.3% | 0 | 0.0% |
| Hay | 1 | 4.2% | 6 | 25.0% |
| Napier and hay | 1 | 4.2% | 0 | 0.0% |
| None | 2 | 8.3% | 2 | 8.3% |
| **Do you grow fodder?** | | | | |
| Yes | 24 | 100.0% | 24 | 100.0% |
| No | 0 | 0.0% | 0 | 0.0% |
| **Type of Improved Fodder planted** | | | | |
| Napier grass | 4 | 16.7% | 6 | 28.6% |
| Napier grass and Bracharia | 7 | 29.2% | 6 | 28.6% |
| Napier grass, Desmodium and Bracharia | 9 | 37.5% | 5 | 23.8% |
| Rhode grass | 0 | 0.0% | 0 | 0.0% |
| Napier grass and Desmodium | 4 | 16.7% | 4 | 19.0% |
| **Size of land under fodder** | | | | |
| 0-1 acres | 18 | 75.0% | 21 | 87.5% |
| 1.1-2 acres | 4 | 16.7% | 2 | 8.3% |
| 2.1-3 acres | 0 | 0.0% | 1 | 4.2% |
| 3.1-4 acres | 2 | 8.3% | 0 | 0.0% |
| 4.1-5 acres | 0 | 0.0% | 0 | 0.0% |
| 5.1 and above | 0 | 0.0% | 0 | 0.0% |
| **Type of fertilizer used on the fodder land** | | | | |

| | | | | |
|---|---|---|---|---|
| Manure | 16 | 66.7% | 16 | 66.7% |
| Compost manure | 0 | 0.0% | 0 | 0.0% |
| Inorganic Fertilizer | 1 | 4.2% | 0 | 0.0% |
| Manure and Compost manure | 6 | 25.0% | 6 | 25.0% |
| Manure and Inorganic Fertilizer | 1 | 4.2% | 2 | 8.3% |
| **Type of concentrate** | | | | |
| Dairy meal | 21 | 87.5% | 22 | 91.7% |
| Maize bran | 0 | 0.0% | 0 | 0.0% |
| Soyabean meal | 0 | 0.0% | 0 | 0.0% |
| Dairy meal and Maize bran | 1 | 4.2% | 2 | 8.3% |
| Dairy meal, Maize bran, and Soyabean meal | 2 | 8.3% | 0 | 0.0% |
| **Get your concentrate from** | | | | |
| On farm | 0 | 0.0% | 2 | 8.3% |
| Purchase | 23 | 100.0% | 22 | 91.7% |
| **Distance to Agrovet** | | | | |
| 0-1 km | 7 | 29.2% | 8 | 33.3% |
| 1.1-2 km | 5 | 20.8% | 4 | 16.7% |
| 2.1-3 km | 4 | 16.7% | 1 | 4.2% |
| 3.1-4 km | 1 | 4.2% | 2 | 8.3% |
| 4.1-5 km | 2 | 8.3% | 1 | 4.2% |
| More than 5 km | 5 | 20.8% | 8 | 33.3% |

Table 6 summarizes the different variables that were investigated during the study and includes data on fodder production and concentrates. Most of the respondents (62%) and (70%) in Butula and Teso North respectively agreed that they do not have enough fodder in their farm to feed the cattle hence they purchase extra fodder from neighbours (83%) and (75%) Butula and Teso North. Napier grass was indicated to be the most purchased fodder in both sub-counties with (66%). All the respondents in the study area grow improved fodder in their lands, more than (37%) and (28%) in Butula and Teso North respectively have Napier grass, Desmodium and Bracharia improved fodder grown in the study area which is not widely spread to farmers, and this was mainly attributed to lack of quality seeds/ splits. They also cited technological gaps in the establishment and management of the highly nutritive fodder. The study revealed that (75%) and (87%) of respondents in Butula and Teso North respectively have 0-1 acres of land under fodder production. The majority of the respondent (50%) reported the main reason for planting the improved fodders was because it is easy to plant and manage, planting materials are available, and drought-resistant (figure 13). The majority of the respondents (66%) from both sub-counties indicated that they use manure as fertilizer in their fodder lands to increase the production of the fodder and (25%) of the respondents from both the study area indicated that they use both manure and compost manure on their fodder farms, the manure was collected from the cowshed. A greater percentage rarely used inorganic fertilizers such as CAN, DAP. However, most of them used farmyard and or compost manure which was not stored or preserved well. It is mainly exposed to scorching sun or leaching of essential nutrients. All respondents in Butula purchase concentrates from Agro vets (29%) which is 0-1 km distance from their homestead and (91%) of the respondents in Teso North purchase concentrate from agro vet while (8%) make their concentrates on the farm, for some respondents (33%) the agro vet is 0-1 km near and (33%) is more than 5km to the agro vet which is far distance. Feed types were also a key factor in animal health and determined calving interval and lactation period. One of the farmers reported that "*the complete ratio with mineral supplements especially from Coopers Company limited guaranteed health and very productive livestock.*"

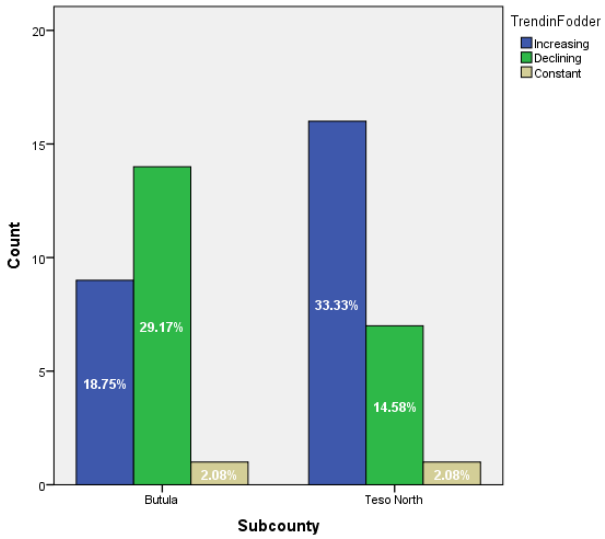
*Figure 13*: Results for planting forage




**II. Trend in Fodder production**

Most respondents (33%) in Teso North sub-county reported an increase in yields per acre in the preceding two years, mentioning top-up of fodder fields with manure from cow sheds as the cause to the increase while 14% and 2% indicated that fodder yields per acre were declining and constant respectively. In Butula sub-county, the majority of respondents (29%) reported declining trends due to stunting diseases (figure 14). Others observed that inferior cuttings with low genetic potential, adaptability, and low crude protein content directly affected livestock productivity.

*Figure 14*: Trend for fodder




**III. Enough surplus of fodder**

Generally, 66% of the respondents indicated that there was not enough surplus of fodder on their farms while 33% indicated that they had enough surplus in their farms (figure 16). 16% of the farmers conserved enough surplus into hay so that they can use it during the scarcity period (figure 15).

*Figure 15*: Surplus of fodder

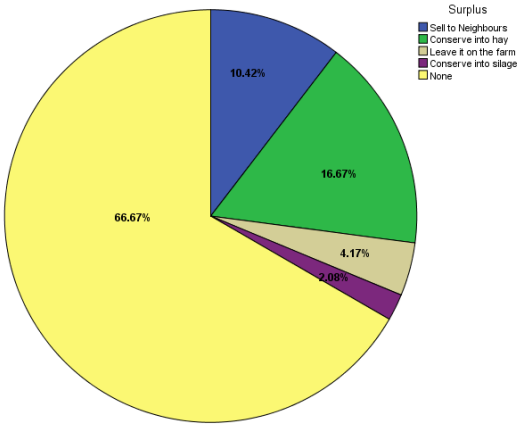
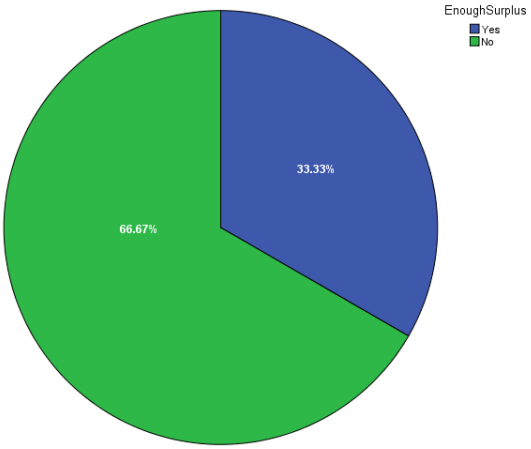


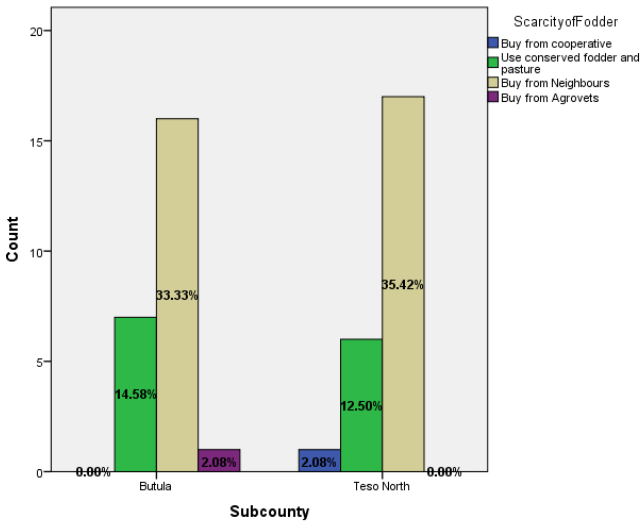

*Figure 16*: Sufficient surplus of fodder




**IV. Handling the scarcity of the fodder**

When fodder is insufficient, the majority of respondents (33%) in Butula indicated that they bought feeds from the neighbours who produced fodder in the area locally and (14%) used the conserved fodder and pasture stored (figure 17). In Teso North, respondents indicated that they buy from neighbours (35%) and (12%) use conserved fodder and pasture.

*Figure 17*: Scarcity of the fodder




## 4.2.3 Dairy production system and herd size management

The majority of the respondents (47%) and (35%) in the survey reported that they kept their dairy cattle under semi zero-grazing and zero-grazing systems of dairy production respectively (figure 19). The study revealed that the majority of the respondents kept improved dairy cattle breeds such as Friesians, Ayrshire, Guernsey, Jersey, cross, and a few kept local. The main reason for dairy farming as reported by respondents was that it was a source of income (54%) (figure 10) and for manure (66.7%) (table 6). Majority of the respondent (41%) in the survey reported that they were able to maintain their cattle breeds through use bull services which was readily available through the group and (31%) of the farmers indicated that they use the AI services (figure 18). During the survey, farmers indicated that the AI is expensive, unreliable, and not accurate for most farmers which is why they prefer to use the bulls. One of the farmers in Teso North said "*We have a few improved bulls, but they are too far*

*and too few to serve the current cows.*" Calving interval was so variable from farmer to farmer. This was mainly affected by the insufficient Artificial Insemination services (AI) and poor heat detection.

*Figure 18*: Acquired breed

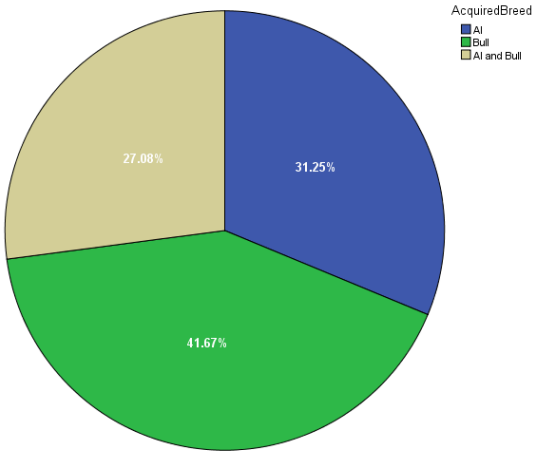
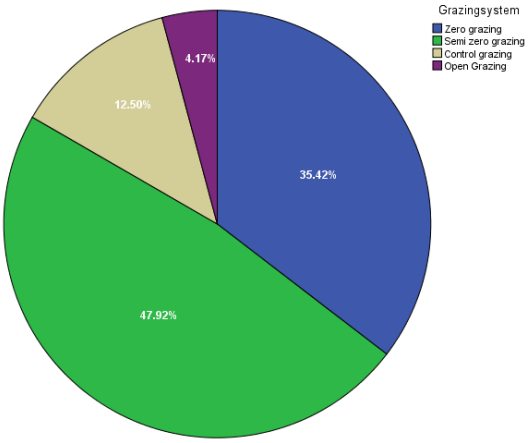



*Figure 19*: Grazing system




Results from the study table 7 indicated that most households (45%) owned 1-2 cattle's while (27%) owned 3- 4 cattle's and (27%) owned 5 and above cattle. These results indicate that farmers had small herd sizes in their homesteads. Lactating cows are reported to be the most in the herd structure (56 %), followed by calves (45%) (annex 2). At the time of the survey, every farmer had female calves since they sold off the male calves to save money on feeding and health maintenance. The majority of the respondents reported that the lactation period on their farms was 6 months (180days). The calving pattern was reported to be 12months by 85% of the respondents.

*Table 7*: Categories and herd size of dairy cattle owner

| Category | Frequency | Percentage |
|---|---|---|
| ***Herd size*** | | |
| 1-2 | 22 | 45.8 |
| 3-4 | 13 | 27.1 |
| 5 and above | 13 | 27.1 |
| ***Calving pattern*** | | |
| 12 months | 41 | 85.4 |
| 18 months | 5 | 10.4 |
| None | 2 | 4.2 |
| Total | 48 | 100 |
| ***Lactating period*** | | |
| 6 months | 36 | 75 |
| 7 months | 5 | 10.4 |
| 8 months | 5 | 10.4 |
| None | 2 | 4.2 |
| Total | 48 | 100 |

*Source: Compiled by the author.*

**II. Milk production**

An independent sample t-test was done to compare the mean of milk production between Butula and Teso North sub-counties the results indicated that the average milk production/cow/day in Butula sub-county was 13 liters while the average milk production/cow/day in Teso North sub-county was 12 liters. The test indicated that there is no difference between Butula and Teso North in milk production/cow/day in the sub-counties (independent sample t-test p=.598) (Annex 3). During the dry season, milk is reported to drop from both sub-counties with an average mean of 9 and 8 liters milk production/cow/day in Butula and Teso North respectively. It was also observed that farmers who fed their livestock on dry matter got relatively high milk yields than those who feed on wet food. One farmer from Butula said *"When you feed your cow with dry feeds, it creates a thirst for water and water is milk" he continued "milk quality is directly related to the type of feed combining high-quality feeds leads to good quality milk."*

***Butula sub-county***

- Lactation days are 180 days
- The total annual milk production per cow is 1,110 liters

***Teso North sub-county***

- Lactation days are 180 days
- The total annual milk production per cow is 1,110 liters

*Figure 20*: Milk production in Butula sub-county

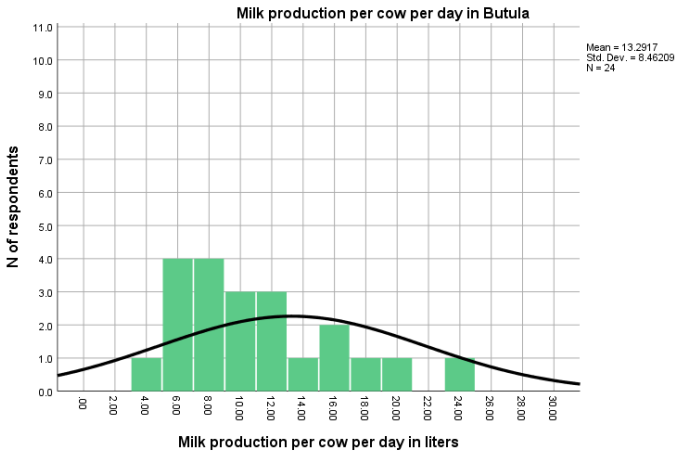



*Figure 21*: Milk production in Teso North sub-county

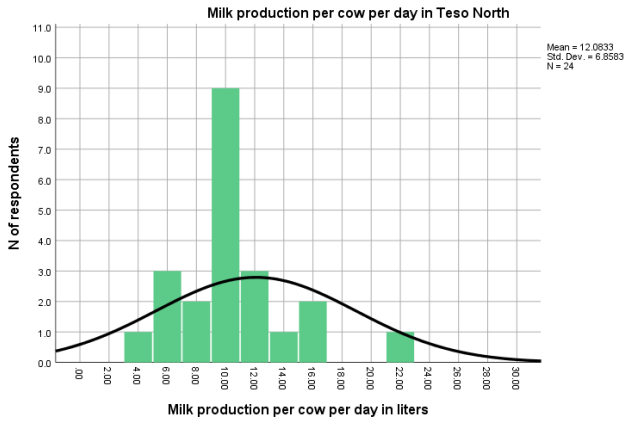
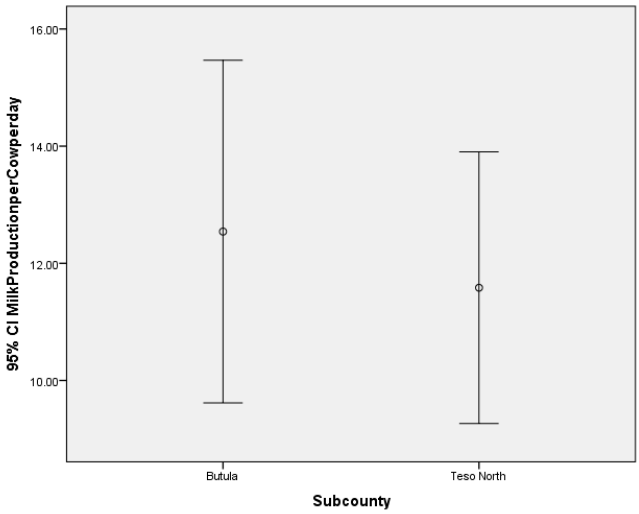



*Figure 22*: Difference in milk production between Butula and Teso North




**III. Services from veterinary and training.**

In the survey report (97%) of the respondents agreed that they received services from the veterinary (figure 24), (81%) of the respondent indicated that veterinary officer comes to treat diseases in their herd. Trypanosomiasis, East Coast Fever (ECF), Anaplasmosis, and a Black quarter were cited as the most prevalent diseases in Butula and Teso South sub-counties. Tsetse flies, ticks, and tapeworms were among the most common parasites in the survey area. Management of the above-mentioned parasite has been through spraying of acaricides and deworming after every three months respectively. Farmers have opted to use acaricides that serve two purposes i.e. control ticks and tsetse fly at the same time a case of Duo Dip and Delete. Efforts by some actors through Farming Systems Kenya and county government has been distributing tsetse fly repellent nets to some farmers as well

as vaccination programs. For every service, they received from the veterinary officer it was charged from Ksh 501-1000 per treatment.

Most of the respondents 98% agreed that they have received training (figure 23), 40% of the respondents agreed that they have been trained on feed and feeding management, disease control, animal husbandry, and 34% had also received training on nutrition. As regards disease management, some farmers reported that it was too costly to treat ECF as a dose cost up to kshs 6000. Some reported that ILRI had an immunization program for ECF at kshs 800 a process called synchronization. It was also noted that veterinary services were costly and not reliable. It was reported that livestock mortality was high, and this was attributed to misdiagnoses by some unqualified or "fake" veterinary officers. Farmers desired the re-introduction of the previous TVEs (Train and visit Extension Service) which was done fortnightly as opposed to the current demand-driven.

*Figure 23: Training*

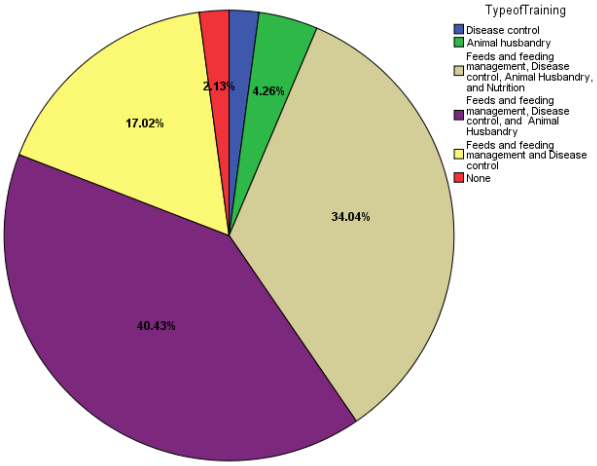
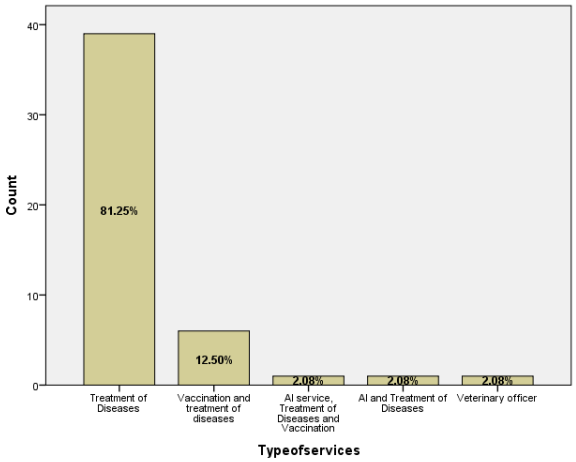
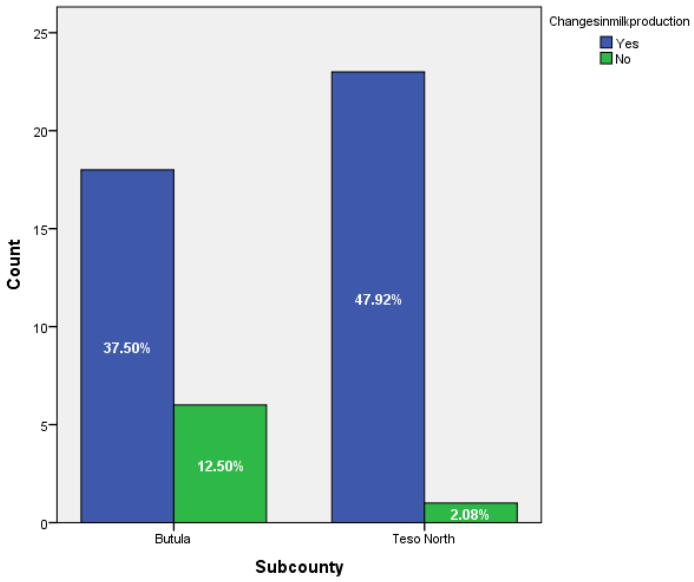


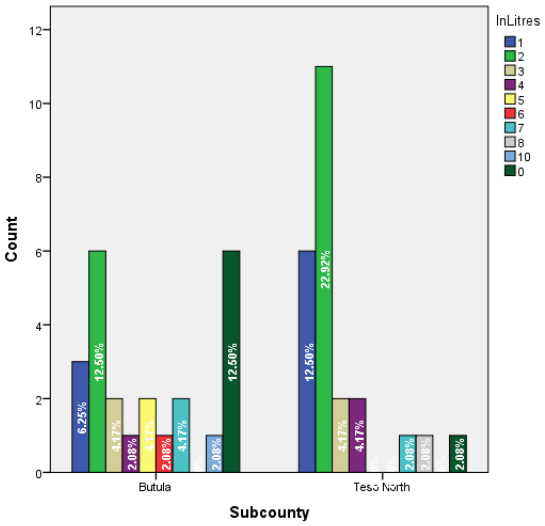

*Figure 24*: Services




**IV. Changes in milk production**

The majority of respondents 37% and 47% in Butula and Teso North sub-counties respectively reported there is an increase in milk production**.** 12% of the respondents in Butula sub-county have an increase of 2 liters of milk production per day per cow while 12% say there is no milk change and 34% of respondents in Teso North sub-county have an increase of 1-2litres of milk production per day per cow.




### 4.2.4. Market Linkages

*Table 8*: summarize market linkages

| Category | Butula Sub County (N=24) | | Teso North Sub County (N=24) | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| ***Market Channel*** | | | | |
| Milk Collection Centres | 4 | 16.7 | 0 | 0 |
| Milk traders | 0 | | 1 | 4.2 |
| Local Consumers | 8 | 33.3 | 20 | 83.3 |
| Local consumers and MCCs | 4 | 16.7 | 0 | 0 |
| Milk traders and local consumers | 7 | 29.2 | 2 | 8.3 |
| ***Reason for the market channel*** | | | | |
| Better price | 0 | 0 | 0 | 0 |
| Reliable Market | 12 | 50 | 12 | 50 |
| Offer other services | 0 | 0 | 0 | 0 |
| Near to me | 0 | 0 | 0 | 0 |
| Reliable market and near to me | 6 | 25 | 8 | 33.3 |

| | | | | |
|---|---|---|---|---|
| Better prices and Reliable market | 5 | 20.8 | 3 | 12.5 |
| ***Amount of milk sold to the above market channel (in liters)*** | | | | |
| 0 litres per day | 1 | 4.2 | 2 | 8.3 |
| 1-5 | 6 | 25 | 4 | 16.7 |
| 5.1-10 | 9 | 37.5 | 14 | 58.3 |
| 10.1-15 | 4 | 16.7 | 1 | 4.2 |
| 15.1-20 | 1 | 4.2 | 3 | 12.5 |
| 20.1-25 | 2 | 8.3 | 0 | 0 |
| More than 25 | 1 | 4.2 | 0 | 0 |
| ***Current Price*** | | | | |
| 30 | 1 | 4.2 | 0 | 0 |
| 35 | 0 | 0 | 0 | 0 |
| 40 | 1 | 4.2 | 0 | 0 |
| 45 | 2 | 8.3 | 0 | 0 |
| 50 | 4 | 16.7 | 2 | 8.3 |
| 55 | 1 | 4.2 | 0 | 0 |
| 60 | 13 | 54.2 | 19 | 79.2 |
| More than 60 | 0 | 0 | 1 | 4.2 |
| Do not sell | 2 | 8.3 | 2 | 8.3 |
| ***Payments*** | | | | |
| Daily | 10 | 41.7 | 8 | 33.3 |
| Weekly | 0 | 0 | 0 | 0 |
| After two weeks | 1 | 4.2 | 0 | 0 |
| Monthly | 4 | 16.7 | 3 | 12.5 |
| Monthly and daily. | 8 | 33.3 | 11 | 45.8 |
| Missing | 0 | 0 | 2 | 8.3 |

## I. Market Channels

Table 8 summarises the marketing of milk in both sub-counties, (33%) of the respondents in Butula sub-county sell their milk directly to the consumers followed by (29%) of respondents who sell to both the traders and local consumers within their area and the majority of the respondents (83%) in Teso North sell to the consumers directly. Majority of the respondents in both sub-counties (50%) report that they sell the milk directly to the consumers because of the reliable market. The respondents 16.7% who sold their milk through MCC to cooperatives at ksh 40-45 however they have complained with regards to delayed payment and low prices. The amount of milk sold to the market is 5.1-10 liters of milk per day (37%) of respondents in Butula sub-county and (58%) of the respondents in Teso North sell 5.1-10 liters of milk per day. The report indicates that most of the respondents (54%) and (79%) in Butula and Teso North sub-county respectively indicated the price of milk per liter sold is Ksh 60. The majority of the respondents (41%) indicated that when they sell the milk to the customer, they receive the payment daily, and (45%) of the respondents in Teso North indicated that they received payments from the customers on a daily and monthly basis. During the survey, it was mentioned that some customers find it easy to pay for milk at the end of the month after they receive their salary. The majority of the respondents (97%) in (figure 27) agree that they get information on the kind of milk the consumer prefers on the market. The information feedback the respondents (86%) receive is about the quality of milk sold to the customers (figure 28).

*Figure 27*:Feedback access

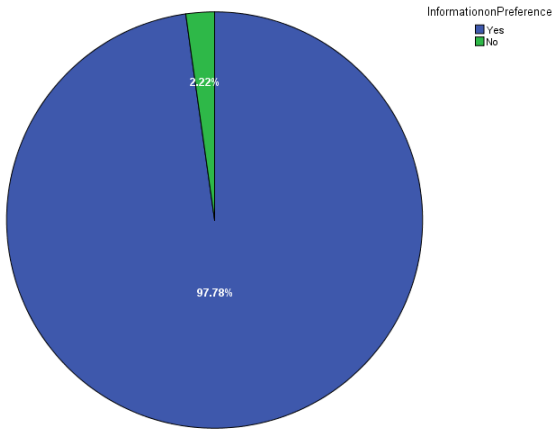
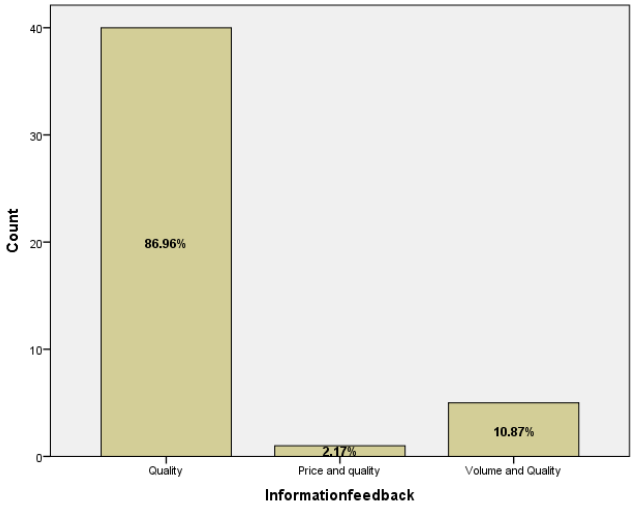



*Figure 28*: Type of information feedback




## II. Awareness of milk quality

All the respondents in the study area indicated that they are aware of the customers' quality expectations, all the respondents indicated that they check for quality before selling to the customers and 87% of the respondents checked for taste, odour, and color (figure 29). The majority of the respondents (79%) reported that they do not have any contracts with the milk customers and (20%) reported that they have contracts with the milk customers (figure 30).

*Figure 29*: Quality checks

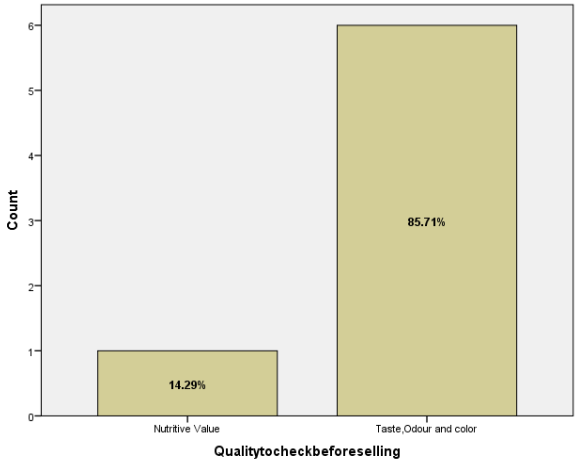
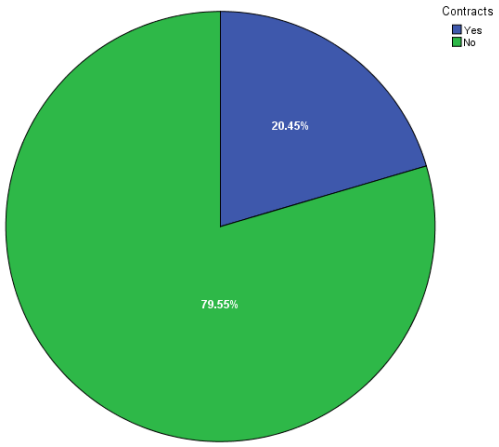



*Figure 30*: Contracts




### III. Member of any Group

The majority of the respondents (89%) indicated that they are members of a group (figure 31), in Butula sub-county most of the respondents (14%) are in cooperatives, (12%) are in the women group, (4%) are in the youth group and men group. The majority of the respondents in Teso North sub-county (25%) are in women groups, 17% are in men groups, (6%) are in cooperatives and 2% are in dairy groups (figure 32).

*Figure 31*: Member of any group

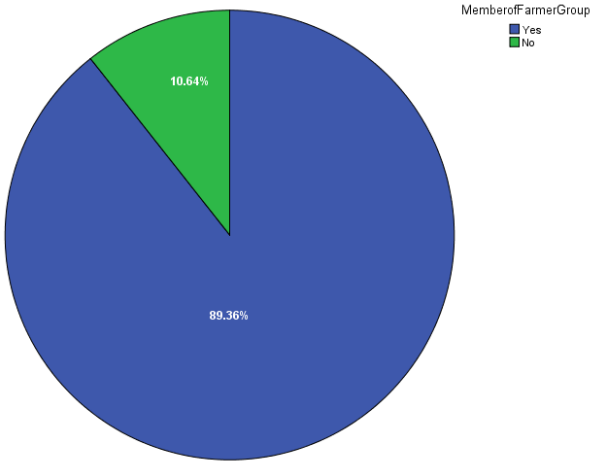
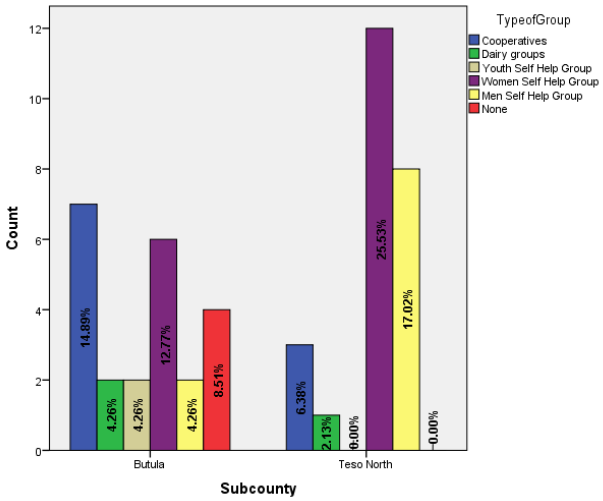



*Figure 32*: Type of group




### IV. Motivation for joining the group and processing.

The majority of the respondents (34%) joined the groups for social engagement and access to loans followed by (17%) of the respondents who joined the groups to have access to loans, extension services, and social engagements. Respondents in Butula sub-county (10%) process milk to mala and (14%) of the respondents in Teso North process milk to mala. Currently little or no efforts have been made to do processing to milk such as yogurt among others. This was due to quality standards issued

by the Kenya Bureau of Standards (KBS) as well as the lack of technical staff, infrastructure, and equipment.

*Figure 33*: Milk processing

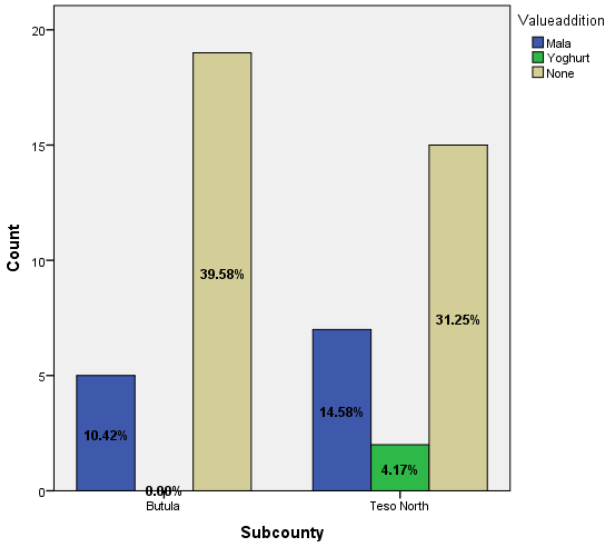
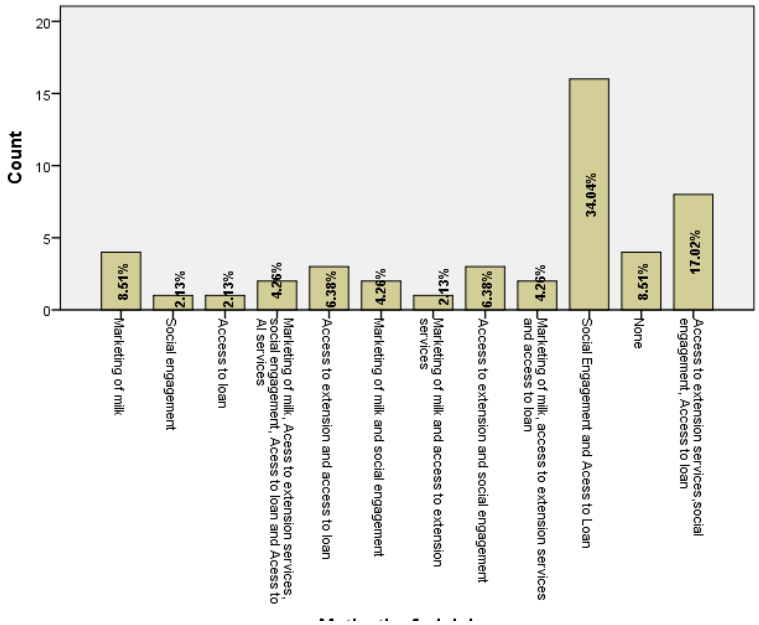



*Figure 34*: Motivation for joining the group




## 4.3 Cost and benefit Analysis

The farmer was selected because he is an average farmer whose situation is similar to the majority of the farmer and in addition, the farmer has a proper record for his farm and ease of communication.

**BACKGROUND**

**Dairy Farmer in Butula Sub-County, Busia County**

Age: 55years, Married with six Children (2 Male 4Female). He started dairy farming in 1994 with one Friesian dairy cow as a gift from a friend. The average production of milk was 10liters per day. The farmer keeps records for all dairy activities. He raised the number of dairy animals to 10 in 2018 with improved management due to various training courses he attended organized by the Ministry of Agriculture and livestock. The current average milk production for three animals is 54 liters /day. He has 4 heifer, 2 in-calf – cows, 1calf, and 3 bulls total of 13 heads on the farm during the survey. The bulls are used to serve other cows in the village where he charges for the cost. He has 2 acres of land on-farm and 4 acres off-farm which is in Matayos. The on- farm land, he uses one acre for growing maize for silage and one acre under forage Bracharia and Napier for animal feed while the other acre is used for food production. Water is supplied on-farm by Busia County which in most cases taps are dry and pay an average of Ksh 500 per month. There is electricity on-farm which he pays at an average rate of Ksh 1500 per month. The farmer buys the Napier grass from a group that is doing business in selling hay and Napier grass to the dairy farmers in the region.

*NOTE: When calculating the cost-benefit, electricity and water cost will be calculated for 2 acres of land. The farmer has 6 acres two acres (33%) of which is allocated to milk production. Hence, 33% of electricity and water costs are considered in cost and benefit analysis.*

**Electricity monthly cost**

Total land is 6 acres (100%) = KSH 1500/month

Allocated land for milk production is 2 acres (33%) = **KSH 495/month**

**Water monthly cost**

Total land is 6 acres (100%) = KSH 500/month

Allocated land for milk production is 2 acres (33%) = **KSH 165/month**

**Depreciation**

For the Zero grazing Unit and chaffer cutter, the lifetime calculated was 10 years.

Milking cans, spray pumps, drinking drums, water pumps, dehorning tools the lifetime calculated was 5 years.

According to the calculated cost of milk production per liter in the study case, a farmer in Butula sub-county needs Ksh 26.20 (annex 4)on average to produce a liter of milk. The average cost of milk production per liter in the case study was greater than the national average, which is between Ksh 16-18 per liter (Rademaker et al., 2016). It should be noted, however, that the data used to determine the cost of milk production per liter in this study comes from a single farm in the Butula sub-county. Data was also collected for only the month of July and extrapolated to provide an estimate of annual production costs in the Butula sub-county, therefore it's possible that the general cost of milk production in the research region isn't accurate. Labour, feed production, and feed purchasing resulted in high costs incurred in producing a liter of milk.

Figure 35 is the image of the farmer using a chaffer cut to cut the maize stalks into small pieces to make them ready to prepare the maize silage. The farmer uses the cart from his farm to carry the maize used for animal feeds.

*Figure 35: Chaffer cuter and Napier grass*

## 4.4 Focus Group Discussion

Seven representatives from different groups in Butula sub-county attend the meeting and seven representatives from different groups in Teso North also attended the meeting. The meetings were done on different dates, locations, and times.

**Butula Dairy Farmers Cooperative**

Butula Dairy Farmers Cooperative (BDFC) has group membership of 75 farmers with 30 men and 45 women who are currently active. Every farmer has an average farm size of 2 acres under dairy farming, the average milk production is 13 liters/per cow. The staffs include a manager**,** recorders at collection points**,** accounts Clerk. The cooperative has a structure that is comprised of a District Cooperative officer**,** Six Board of Directors**,** One Supervisor-Management**,** two technical staff**,** five salesmen**,** and farmers. The election is done after every two years according to the constitution. Currently, the Cooperative has no field technical staff but relies on the services of extension officers, and Veterinary departments. The cooperative has a written constitution and roadmap, 5-year strategic plan, and financial information of at least two years available.

Registration for members was Kshs 200 in the past but the current membership fee is Kshs. 1,000 and the annual subscription is kshs 500. Members of the cooperative are working jointly to encourage other farmers to join the cooperative and the actions to increase membership is through creating awareness through Chief's baraza, to be a member you must have milk, sensitize dairy farmers on the trust of the current leaders in the chiefs' barazas, willing to allocate at least 1 acre of land for fodder, willing to construct zero-grazing unit and recruitment of more members-must have a dairy animal. In 2019, farmers were trained at Agriculture Training Center and also at the ward levels in preparation to get the cows. Members paid Ksh 5,000 and sign an agreement to receive the heifer to show a sign of commitment to the project and also ownership. 30 cows were given through the cooperative and so far, 15 calves have been passed on to other members according to the updated record of June 2021. The main challenge to know how many are dead or passed on is not now clear because of the covid situation which affected the group meetings, it was during the group meetings where group representatives would give updates of their groups activities and give the records. The criteria used to give to members was a farmer must belong to a group with dairy keeping interests, has knowledge about dairy farming, willingness to take care of the cow and also to pass on to other farmers and deserving case. The funders of the project are the Kenya Climate Smart Agriculture Project (KCSAP), Farming Systems Kenya (FSK), and the County Government of Busia.

Currently, there are 11 milk collection centers Buhuyi, Mung'abo, Tingolo, Ligulu, Ogallo, Butula Township, Bulemia, Bumutiru, Esigoma, Bumala A, and Murumba where farmers collect their milk collectively. The milk is then transported by cooperative motorbikes, bicycles, and farmers who are around the cooperative deliver the milk daily to the cooperative. The cooperative buying price is Ksh 45, and the selling price is Ksh 60. Generally, the main challenge is that farmers sell more milk in the informal market than the Cooperative especially the Kingandole group because in the informal market the price of one liter of milk is higher than what is paid by the cooperative, the mode of payment is cash daily unlike the cooperative delays the payment. When farmers don't sell milk to the cooperative the capacity is being underutilized. Farmers have an agreement with the cooperative, but the challenge is that farmers "silently" sign to sell half of their milk to the cooperative, and the rest of the milk they sell to local consumers or traders, and this makes the cooperative underutilized. Farmers receive a commission based on the liters of milk delivered every month, the quality of milk is checked using a lactometer and milk control gun to check water content and alteration due to the addition of wheat flour and blue band, type of container used to carry milk and also the time of delivery. Transport is a big challenge because the milk is perishable, delicate, sensitive, and requires good hygiene, and cleanliness. The other challenges include lack of transparency from salespersons, delays in the

payment to farmers, and competition from other people and suppliers from Uganda and Eldoret who sell milk at a lower price of Ksh 40 per liter.

Members of the cooperative have received training on feed and feeding management, animal husbandry, nutrition, disease management-animal health, and record-keeping in addition, members have access to extension services and the veterinary officer since they are in a group. As members of the cooperative, they received heifers, bulls, and planting materials for their land, bracharia seeds of species (Piata and Balika), Napier suckers, and Rhode grass. Farming Systems Kenya has been promoting fodder and forage production at the farm level to increase milk production. Milk production for members has increased by 1- 2litres because of the fodder planted on their farms however it is not enough, and they face some challenges on the management. Farmers mentioned stunting disease of Napier grass in Butula and fodder shortage.

Members of the cooperative aside from selling the milk, have a bull scheme and selling of the splits and sweet potatoes vines (Mugenda, Kabonde, and Kenspot1) to the members. The option for sweet potatoes vines was because the root tubers it was a source of food at the household level and the vines were used as animal feeds. The bull scheme was introduced in December 2020 with 4 bulls to help members service their cows. Initially, the county government used to offer AI services to the farmers at a cost of Ksh 1000, but farmers complained of the high cost, not efficiency, and late delivery. Now they opted for bulls to serve their cows and through the help of Farming Systems Kenya when the heifers were delivered one bull was also given to each group. The bulls are good, but they are not enough to serve the cows in the area. For every servicing, the charge is Ksh 500 and now more than 100 cows have been served and the money is used to maintain the bulls. In 2020 members used to get splits from demonstration plots for free but since 2021 March they started selling per split Ksh 5 and vine of sweet potatoes at Ksh 3 members said these are activities that help them generate income. They decided to stop giving things for free because some members were not serious, they took things for granted but when they started charging for every services member became serious about it and they now come for training, farm visits, field days, and farmer exposure tours. Members get yearly dividends to motivate them.

Some group members within the cooperative have table banking which they do at the village level. Silk group members are involved in table banking savings for Ksh 500 monthly, and they give loans to members at 10%, ADRAP group is involved in hay bulking and saving. The hay is sold to farmers around and the selling price is kshs. 300 during the dry season and 200 during the wet season, the money is saved and divided among the farmers at the end of the year. The majority of the farmers acknowledged that they use the money to pay for their children's school fees. The groups have been linked to the Agricultural Development Trust Fund (ADTF) where they can access financial support through the help of the extension officers from the county.

**Teso North**

The majority of the groups in Teso North are self-help groups with members ranging from 15- 27 members per group. There are women group, men group, youth group and some are mixed groups. For instance, Alakakina Women SHG there are 4 men, and 23 women gender aspects are being considered. Farmers have an average farm of 3 acres, the average milk production is 8-12 liters/farmer. The majority of the farmers in Teso North kept the local breeds and improved breeds but the local breeds were used for dowry payment, and when the project started the group members were asked if their cows would be served with an improved breed, but members refused and said it would be better if members are given the improved breeds for dairy production. The majority of farmers in Teso North sell milk directly to local consumers at Ksh 60 while some sell to traders at Ksh 50. The cooperative collapsed due to corrupt leaders, mismanagement of the funds that members had saved which led to farmers leaving the cooperative and opting to sell to local consumers and traders. One member said, "*If only members were trained on group dynamics and leadership, the cooperative*

*would still be strong*." Milk marketing is not a challenge in Busia County the amount of milk produced is insufficient. Being in groups they have managed to get heifers and bulls in Angurai ward (58 heifers 13 bulls), planting materials (seeds for Bracharia, suckers for Napier grass, Rhode grass, and Desmodium). Working as an individual it was hard to get access to an extension officer but after being in a group, they can coordinate among themselves and call the extension officer to have training. Famers have been trained in feeding and feed management, animal husbandry, disease control, and marketing.

*During the discussion, there was a random appointment of one leader to give a summary of what their group does, and Kekieutu Idwe Self- help group (SHG) got the opportunity to talk. This was done because of the time limit given.*

**Kekieutu Idwe SHG**

Started the group in 2016 with 37 members but some left the group and now they are 20 members, 12 women, and 8 men. The group was registered with social service where they got the certificate. The group was started with the main objectives of uniting members to tackle social welfare problems facing members: - Children's education, health, housing, and food security. Members keep Indigenous cattle (after marrying, keep at least 6cows for dowry payment), goats and poultry. They are striving for every member to rear at least one dairy cow to uplift the living standard of children. The group has four official's chairperson, secretary, treasurer, and loan coordinator, the officials are elected through the ballot box, and it is done every year. The group has a written constitution and laws governing the group's conduct. In 2019, they were registered under the Dairy Park project that was funded by KCSAP, FSK, and the County Government of Busia. Farmers have fodder under one-acre majority have planted Napier grass, Bracharia, and Desmodium. The seeds were acquired from the demonstration plots where they were trained as a group by the extension officers, farmers use the manure to add to their farms and this has shown some increment of fodder production however, it is not enough especially during the dry season, so farmers have to purchase. Farmers have been trained on how to conserve fodder but buying the materials is very expensive and sometimes the conservation method is not good, and it rots which is not good for the animal to consume. The group members were trained and prepared to receive the cows, and every member paid Ksh 5,000 to Farming Systems Kenya for the agreement that they will take care of the animal and pass it on to the other members in the group who didn't receive it. The group received 10 cows and one bull to serve the cows in the group. Members pay Ksh 500 for the bull to serve their cows, the money is used to pay the veterinary officer when he comes to check the bull and also for its maintenance so that it can be healthy. At the moment there is no pass on yet.

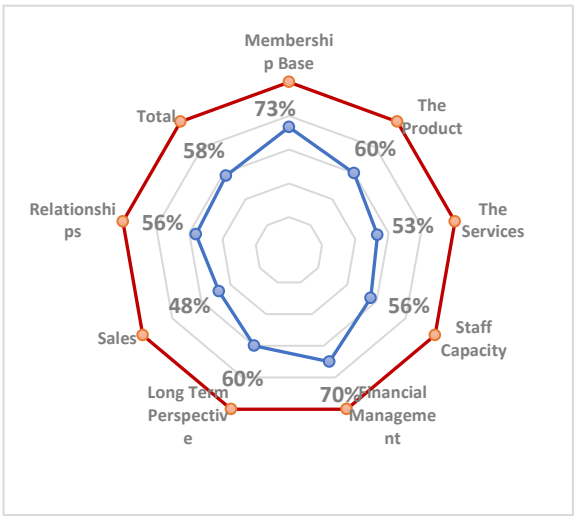
Group members are involved in table banking where it is done every month, the contribution is Ksh 300 (Ksh 200 goes to table banking while Ksh 100 is for the owner of the house where they did the meeting). The money is stored in a box that has three padlocks one key with the treasure, secretary, and chairperson of the group. The money contributed to the table banking is used to lend money to the members at 10% interest while for an outsider at 20% where the guarantors must be a member of the group. Defaulters are given up to 3 warnings before action is against them. Members rotate in everyone's house to be able to check out for each other and also monitor the cow's progress that they were given for the project and the land under fodder production if the farmer planted according to how it was taught during the meeting at the demonstration plot. In August 2020, the group decided to buy chicks for those who did not receive the cows so that they can also be active and engaged in the group. 10 members were beneficiaries of the chicks where they got 5 chicks per person, they will also do the pass on to other members so that they can be able to continue their group actively. The decision for chicks came about because men are considered to be the owners of the cows and women are considered to own the chicken.

The challenges they face as a group is feeding utilization and conservation, slow uptake for use of hay and silage making, disease control- cross border movement makes difficult for control of diseases like Foot and mouth, high cost of treating ECF Ksh 4500-6000, high cost of AI Ksh 2000-2500, high costs of feeds eg dairy meal, milk production still low due to poor management of feeds and diseases, fear to take credit from financial institutions, lack of stable markets to sell the milk, loan defaulters delay other members to borrow the money, and stakeholders rarely have joint planning sessions; therefore no sharing of reports and limited shared activities.

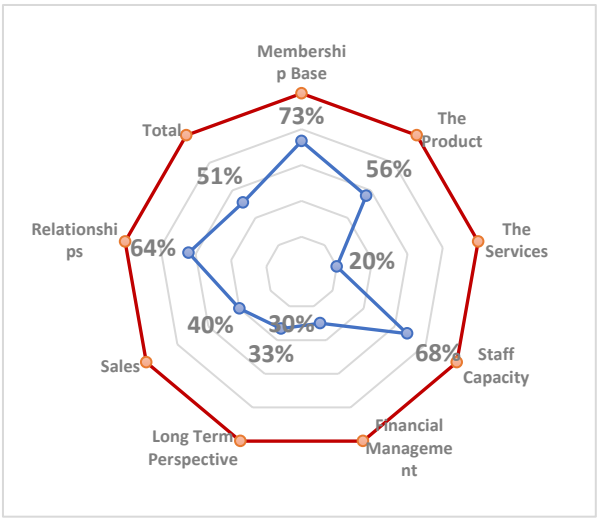
***Description of farmers from the cooperative in Butula and SHG in Teso North using the MIDCA tool***

MIDCA tool was used during the FGD, farmers in Butula sub-county described the cooperative, and farmers in Teso North described the SHG. During the discussion, there were a set of questions to assess farmers in cooperative and SHGs capacity on a specific level. The discussion was done amongst themselves and scored regarding their capacity. The percentages were generated by the tool to get the web scores which farmers agreed on the outcome of their strong and weak points.

*Figure 36*: Butula and Teso North MIDCA results




Butula cooperative




Teso North SHG

Results interpretation for MIDCA tool on percentage level was adopted from Modderman (2010) and (Bakengesa, 2011).

- Less than 50% The respondents' disagreement with the claims results in a very low score. That is, one aspect of the PO's performance was unacceptable, and there is a desire to improve or alter it.
- Between 50% and 62.5% Shows a low score, indicating that the respondents are dissatisfied; thus, change is required to fulfill the respondents' wants and desires.
- Between 65% and 75%, a good score is displayed. Respondent satisfaction isn't very high. Improving PO performance is not required, but it is recommended to raise satisfaction levels.
- Between 77.5% and 87.5% demonstrates that respondents are happy with the PO's performance. However, there is still the option of improving PO's performance.
- 90% or more demonstrates that a very high score implies that the typical respondent agrees with the statement and is extremely satisfied.

**Financial Management**- Butula sub-county has 70% and Teso North has 30% this is because in Butula farmers under the cooperative have access to the Agricultural Development Trust Fund (financial institution) to access financial support and their financial information of the last two years is available and audited. In Teso North sub-county, farmers are afraid of joining the financial institution because of the experience they had with KWFT who came and took most of their properties now they prefer to do their table banking and merry-go-rounds at group levels.

**The services-** Butula sub-county has 53% and Teso North has 20% this is because farmers in Butula when they sell the milk to the cooperative, are given extra pay according to the milk quantity taken to the cooperative, a certain percentage of milk produced by the farmer is sold via the cooperative, producers agree with the services provided by the cooperative. In Teso North, farmers sell milk directly to the local consumers and traders which is done individually which has no additional pay.

**Staff Capacity**- Butula has 56% and Teso North has 68%, this is because in Teso North more extension officers are well trained for their tasks and responsibilities while in Butula there are few extension officers and veterinary officers to train all the groups. In addition, due to few technical staff, there are trained lead farmers who train other farmers. The lead farmers go for refresher courses to be up to date with the program.

**Sales-** In Butula 48%- the average sale price of milk sold is constant, the cooperative has little efficiency to execute marketing activities to broaden the client portfolio. The time for milk to be sold to the institutions is hindered by the transportation, although to the collection point it allows producers to function properly and fulfill obligations of the cooperative. The cooperative offers a diversified products range (bull scheme and selling of planting materials) apart from selling milk so that they don't overly depend on milk selling.

In Teso North 40%- the average sale price of milk sold fluctuates depending on the seasons, the SHG has no plans to execute marketing activities since they sell as individuals. The SHG offers diversified products to the members eg table banking, merry go round, chicken pass on, selling of hay this helps the SHG not overly dependent on a single product

**Long-term perspective:** Butula has 60% and Teso North has 33%, Butula DFC has a written declaration of the cooperative vision and mission,5year strategic plan but the cooperative has no clear vision on building capital and becoming financially self-sufficient in the long term. In Teso North with the culture of table banking within the group shows that the SHG has a clear vision of building capital and becoming financially self-sufficient in the long term.

*Figure 37:Group leaders' representatives present for focused group discussion*

## 4.5 Observation

**Construction of the zero-grazing unit**

The majority of the farmers who have constructed the dairy unit have used timber and iron sheets, the floor is not covered with concrete hence it becomes hard for a farmer to collect manure. During the interview, it was observed that the farmers are not regularly checking the feeding of the animals since the feeding troughs and drinking gallons were empty. This makes the cows not feed well hence produce less milk at the end of the day. Some farmers tied the cows where there was no grass, the land is plain with dry stalks and no water troughs that the animal can go and drink, this making feeding regime very poor hence reduces the milk potential of the animals.

*Figure 38: Feeding system of the cows*

Local Feed Rations: Some farmers have gone a notch higher, and have procured equipment for feed milling and blending. Those who were interviewed said mixing maize bran, Soybean, Cotton cake, Dicalcium Phosphate (DCP) and Omena could easily yield the same as a dairy meal from FUGO limited. Others use local materials such as Calliandra, Soybean grain and haulms, groundnuts grain and haulms, maize bran, salt licks i.e. maclik supper.

*Figure 39: Local feed ration*

**Construction of the Dairy Park Unit**

The dairy park unit is 80% completed, both in Teso North and Butula.

*Figure 40: Dairy Park Unit*

**Storage of the feeds**

The silage bags are used to store the animal feeds, while some farmers cut the Napier and other feeds and give the animal directly to feed.

*Figure 41: Feeds for the animals*

**Involvement of the women in the project**

The woman is measuring the bodyweight of the bull.

*Figure 42: Women involvement*

# Chapter Five: Discussion

This chapter expands on the preceding chapters by providing a discussion of the findings as well as a comparison of the study findings to earlier literature by other researchers.

## 5.1 Stakeholders involved in the dairy value chain

The value chain refers to the various actors involved in various production and consumption activities, as well as their dynamic relationships for value creation and market linkages (Ayele et al, 2012). This is in line with the dairy value chain in Butula and Teso North sub-counties which is categorized by direct actors include input suppliers, milk producers, traders, milk collection centers, processors, and consumers while indirect actors are those that do not directly get involved in the chain and are called chain supporters or influencers who include financial service providers, NGOs, government, extensionists, and researchers, among others.

Donors, governments, and development organizations are increasingly focusing their policies and agricultural research and development efforts on supporting smallholder commercialization (Webber and Labaste, 2010), despite demands to evaluate these initiatives critically in terms of long-term sustainability and equity (Poole et al., 2013). Value chain approaches are thus seen as a way to enable inclusive smallholder innovation and enterprise development, as well as to contribute to broader development outcomes like food, employment, nutrition, and income security (Bolwig et al., 2011; McCullough et al., 2008; Proctor and Vorley, 2008; Seville et al., 2011). This is in line with the research where 1000 smallholder dairy farmers were supported by KCSAP, FSK, and County Government of Busia on various activities such as technical training sessions (feed and feeds management, good animal husbandry, disease control, and nutrition), the establishment of pasture demonstration plots, provision of improved pasture seeds, provision of 218 heifers and 70 bulls, ongoing construction of dairy park unit, planning of exchange and learning visits to strengthen the dairy value chain in Teso North and Butula sub-counties on the chain map (figure 5) to increase the milk production, create employment, and increase income security.

FAO (2018) defines semi-zero-grazing as where animals are partially confined and permitted to graze freely during the day but are paddocked and fenced in the evening when feed supplementation is supplied. Dairy cattle are frequently raised with other animals such as chickens, sheep, goats, and, on rare occasions, pigs (Staal *et al.,* 2001). Natural grass, improved pasture, and post-harvest grazing are some of the feeding methods used in different parts of the country (FAO, 2018). This result aligns with farmers in Butula and Teso North sub-counties who practiced semi zero-grazing, cows feed on the natural grass when left partly to graze on the field, feeds on the improved pasture, and cuttings of Napier grass from the postharvest. The majority of the farmers in the study area are livestock keepers who rare chicken, goats, sheep, and pigs alongside dairy cows. Through the research, it was noted that most producers had 1-2 herds who kept exotic breeds (Friesian, Ayrshire) to help increase milk production in the farm.

According to Auma *et al.* (2018), fresh milk is sourced and bulked directly from farmers and within the community by the cooperatives. Members simply send a tiny amount of their milk to stay in good standing and have access to this market outlet when the informal market becomes less competitive. This is in line with Butula DFCS sources fresh milk from different dairy producers in Butula sub-county. Butula DFCS has 11 milk collection centers where farmers aggregate their amounts of milk at one central point after which it will be transported to the cooperative using motorbikes.

Results show that farmers who are frequently visited by extension workers, attend field days, conduct demonstrations, or get media extension message are more likely to engage because they have been exposed to and are aware of the program (Khonje et al., 2015a). This finding reaffirms the value of knowledge in decreasing uncertainty regarding innovations. Extension officers in Butula and Teso North sub-counties have been the key source of knowledge about technical innovations which is critical in the dairy value chain involvement.

Because of the favourable impact of access to credit, measures that improve farmers' access to credit (favourable interest rate) might help them participate in dairy activities and increase milk production and farm revenue. As a result, policymakers assist farmers in overcoming the financial and information hurdles that impede their involvement in dairy cooperatives. Access to input supply and financing helps at booting dairy park involvement.

## 5.2 Production and adoption of technologies

On the impact of dairy park project participation of farmers on-farm outcomes, the results showed a 100% of farmers had grown improved fodder production, which resulted in increased milk production, and farm income. In particular, growing improved fodder and conserving fodder tends to have improved productivity (increased milk production of 1-2 liters a day), confirming the widely held view agricultural technologies that boost productivity can help farmers receive more profit and increase yields in developing countries. (Becerril and Abdulai, 2010). Results indicated that Napier grass was the main planted fodder (100%) because of high yield and could be grown all year round to ensure availability of the feeds for the cows and (37%) and (23%) of respondents in Butula and Teso North sub-county respectively planted other fodder Bracharia and Desmodium on their 0-1 acre. This was attributed to the availability of the seeds, drought resistance, and planting materials acquired from the demonstration plots. Compared to other fodder crops, Napier grass grows quickly with high yields and offers significant biomass per hectare of land, and can remain productive for up to five years (Ouma et al., 2007). One farmer said, "*The planting materials are available, yes but where to plant is the problem"*.

According to the present cost of milk production per liter in the research region, a farmer in Butula sub-county needs Ksh 26.20 on average to produce a liter of milk. The average cost of milk production per liter in the case study was greater than the national average, which is between Ksh 16-18 per liter (Rademaker et al., 2016). It should be noted, however, that the data used to determine the cost of milk production per liter in this study comes from a single farm in the Butula sub-county. Data was also collected for only the month of July and extrapolated to provide an estimate of annual production costs in the Butula sub-county, therefore it's possible that the general cost of milk production in the research region isn't accurate. Labour, feed production, and feed purchasing resulted in high costs incurred in producing a liter of milk.

Access to extension officers has a positive influence on milk yields and income at the farm level. The farmers who frequently attended the training at the demonstration plots and farm visits tend to be more progressive. These results reflect those of Asfaw et al. (2012), who also found that farm visits enabling farmers to learn and develop their human capital by providing them with information and exposing them to technology that can improve agricultural production and welfare. The study also revealed that (50%) of respondents attained a secondary or a higher level of education and therefore could easily understand, adapt and apply good dairy production practices. The majority of the farmers who were trained were the same implementors at their farms.

Butula and Teso North are the highest potential areas of milk production in Busia county. However, one interesting finding is that the price of one liter of milk in Busia county is Ksh 60 which is higher compared to other counties such as Rift Valley where the price is Ksh 45-50, with a better price of milk in Busia the production of milk is still low, the cooperatives are still being underutilized. This is an important issue for future research to understand why farmers are not utilizing the lucrative prices in the market.

Some farmers the early adopters indicated that they store the excess pasture and fodder during the rainy season as silage or hay and use it during the dry season. The early adopters use silage bags for storage since its relatively cheaper compared to concrete silage. Through the technology, farmers could produce the milk consistently throughout the year and milk production increased by 1-2 liters since there were feeds to feed the cows though it was insufficient. Dry crop leftovers, like maize

stovers, are reasonably easy to store and utilize for feed in times of feed scarcity and are typically available in considerable numbers (Ouma et al., 2007). Ouma et al. (2007) continue to say that, despite their low nutritional content, they may support reasonable milk production when supplemented with high-nutritive supplements like concentrates and legume fodder. The late adopters left the pasture on the land and during the dry season, they buy the feeds from neighbours which they indicated is expensive.

In Teso North, (33%) of the farmers acknowledge that fodder production has increased in the previous 2 years due to the use of manure collected from the cowshed which has led to an increase in milk production. These results showed that farmers are aware of the proper storage of manure before applying it to their farms. However, Butula (29%) reported the decline of fodder production in the past two years because of the inferior cutting with low genetics, poor storage of manure, low adaptability, and low crude protein which directly affected livestock productivity. The main concern that was reported was the stunting disease on the Napier grass, which affected the production of feeds.

Important observations that were noted during that survey are that farmers had constructed a zero-grazing unit with timbers and iron sheets, but the floor was bear with no concrete mix, this makes it hard for farmers when collecting the cow dung from the unit. The farmer leaves the dung on the unit for several days then collects it, when the dung is still on the floor it attracts the flies to come to the unit which causes discomfort to the animals. Farmers might have been trained on good animal husbandry, but the extension officers need to do monitoring on the farmer visits to give guidance on what has been done and what needs to be done efficiently. The feeding troughs and drinking troughs are empty farmers do not monitor frequently to add more feeds and water on the trough, this makes the cows not to feed adequately hence produces low milk per day against its potential of 20litres per day. Another observation noted was since the farmers are practicing semi zero-grazing, the cows are tied on a bare field where there is no grass to graze hence this results in low milk production due to poor feeding management.

The majority of the farmers in the study area have improved breeds of Friesians and Ayrshires on their farms for milk production, the breeds were maintained through the use of bull services which was readily available through the group. The majority of the farmers indicated that using AI was expensive, unreliable, and not accurate for most farmers, that is why they prefer to use the bulls. One of the farmers in Teso North said "*We have a few improved bulls, but they are too far and too few to serve the current cows.*" Tsetse fly and tick populations are high in the Teso North and Butula sub-counties, making commercial cattle raising difficult and costly. The government's approach of privatizing disease control left farmers very vulnerable to these harmful vectors, resulting in significant livestock mortality.

## 5.3 Market linkages

This study confirms that Butula DFCS has provided farmers in the rural areas with market access where they can sell their milk, access to the bull servicing, and fodder planting materials for the members. However, milk marketing remained a key constraint. The fragmented output market was a major impediment to improve vertical coordination. Individual members of the group sold milk to local milk vendors and local consumers. Butula DFCS' strong position along the chain of the formal market functioning below capacity resulted in low milk prices that discouraged farmers since the informal milk market gave somewhat better pricing, but seasonal variations made it inconsistent. Good knowledge, information flow, and a better understanding of the cooperative initiatives may increase the benefits of farmers participating in the cooperative in terms of milk yield and income. The literature suggests that markets with the capacity for adding value, stable and consistent supply, higher product quality, safer goods offer chances for smallholder farmers to upgrading (Helmsing and Vellema, 2011; Lee et al., 2012; Thiele et al., 2011; Trienekens, 2011).

The results of this study showed that Butula DFCS, milk kiosks, and consumers are aware of the food safety and requirements when they check for the quality in terms of hygiene, odour, color prefers cream yellow, the stickiness of the milk on the container, and the type of container used to carry the milk before purchasing any irregularities found leads to rejection. The farmers are compensated primarily on the quantity of milk they produce rather than its quality. Better milk quality testing and payment schemes based on quality would help farmers and collectors become more conscious of quality (Ndambi *et al.,* 2017). This finding is consistent with that of Mutinda *et al.* (2015), when milk is tested for quality control, helps to retain a good market outlet.

Farmers under the Butula DFCS explained that they sold 50% of the milk to the cooperative and 50% directly to the local consumers and traders because in the cooperative the payment is delayed while the consumers and traders pay cash. Off-farm income has a negative relationship with dairy cooperative participation, implying that having multiple sources of income lowers a household's capacity or desire in joining a dairy cooperative. This is consistent with the broader literature which argues that procedures such as the regularity with which suppliers are paid for milk delivered to the dairy cooperatives should consider as many of the realities that farmers encounter as feasible (Mutinda *et al.,* 2015). The research has also shown that farmers are selling more milk to the informal market compared to the formal market which provided higher pricing, and minimal quality checks but due to season fluctuation farmers have no stable outlet. On the other hand, cooperative pricing is lower, they give affiliated farmers more consistent pricing and hence more constant revenue streams throughout the year. The evidence from this study suggests that if the cooperative is well structured and operated will demonstrate to be a potentially strong platform for improving access to markets, inputs, and services for rural dairy farmers in Butula and Teso North. It is therefore important for the cooperative to take the initiative to work with farmers from production by facilitating input supply that will increase milk production hence both actors will have a mutual benefit.

## 5.4 Job creation

The project has contributed both directly and indirectly to job opportunities for the youth, women, and men in Butula and Teso North to help improve their livelihoods. The project has reached 1,000 farmers who work at the production stage of the value chain feeding the cows, milking the cows, selling the milk to the market, and checking the overall wellbeing of the animal. In Teso North, 15 youths are beneficiaries they received the heifers, there are an estimated 70 traders in the area of study who buy milk and sell it to the consumer. Majority of the traders are men who use the bicycle or motorbikes to sell milk and estimated 20 milk kiosks is dominated by women who have their stores in the markets. At the ATC 4 (2 women 2 men) have been employed to work at the demonstration plot for seed bulking, 2 youths are working at the dairy unit looking after the 20 heifers, and 1 veterinary officer attached to the dairy unit. 12 extension officers are working directly with farmers under the project by giving extension service and technical service. The project has been able to provide jobs for women, youths, and PWD for sustainable economic growth.

## 5.5 Participation of members in SHG

From the focus group discussions, it emerged that farmers in the Dairy Park project were organized into groups that were registered legally as self-help groups with the social service and had received the certificate. The groupings show that horizontal coordination has improved. The discussion revealed that group membership was open to any interested dairy producer in the area, willing to construct a zero-grazing unit, and willing to pass on the first female cow to the next member. In Butula DFCS to be a member, the entry fees were Ksh 1000 and a monthly subscription fee of Ksh 500 to support group activities. In Teso North, there were membership fees and weekly contributions to manage the group activities (agreed upon by members). It was noted that farmers registered under the cooperative were widely disperse making it logistically difficult for every member to attend the

meeting hence only the representatives of each group would meet during the meetings at the cooperative to discuss the progress and group activities.

During the focus group discussion, it was noted that group officials keep records of the group activities such as group constitutions, information about group members, certificate of registration, minutes of meetings, pass on records, milk records at the cooperative, financial records, and pass on of the heifer's records. This shows that farmers have proper recording skills that help them to track the group's progress at every point. Keeping accurate records might be crucial to a group's success.

## 5.6 Functions and benefits accessed as self-help groups.

Extension services provided to self-help groups in the study area have shown improvements. The services included feed and feed management, animal husbandry, disease control, and nutrition in connection to production decisions and practices. In practice, however, delivering these services to individual small farmers is expensive; being in a group makes extension services more affordable and viable. Farmers have taken up the initiative of visiting each other during their group meetings to monitor the progress of the heifers given to the member and checking the land under fodder. Farmer to farmer visit has shown independence and uptake of responsibility of the group to check on the group activities are going on well. This result is in accordance with literature that argues that producer organizations are acknowledged for playing an important role in providing and improving extension services. Their capacity to build connections between extension providers and small-holder farmers has been emphasized as critical to the development of suitable and successful extension practices (FAO, 2010).

The results from the MIDCA tool showed that in Butula and Teso North sub-counties, SHG, and cooperatives show positive outcomes on members' (men, women, youths) empowerment and access to credit. The activities (table banking, merry go rounds, bull scheme, selling of planting materials, selling of hays and pass on of the chicks among others) done as the groups help members to think in the direction of entrepreneurship which helps farmers not to rely so much on one source of income. This is consistent with the broader literature which argues that forming a savings and credit system or linking farmers with a current program within the catchment could help utilize a variety of compliant financial services, such as cash advances or check-off systems (Mutinda *et al.,* 2015). However, cooperative or SHG need to diversify their revenue sources to be self-sufficient, as well as be financially transparent to present financial sources to members.

The results from the MIDCA tool showed that Butula DFCS did not have an attached technical staff to support the members with production improvement. The absence of technical staff to assist members in their production is expected to have an impact on milk production quantities and quality. In Butula sub-county there are insufficient extension officers, however, the use of the lead farmers approach has helped farmers to share knowledge and skills with other farmers from their localities. The majority of the lead farmers have been trained on feed and feed management and the establishment of demonstration plots with improved fodder management. The lead farmer approach has helped the majority of the farmers in the area to plant improved fodder on their lands.

The results showed that farmers received a low price of a liter of milk from the cooperative but provided farmers with a consistent market throughout the year. However, the MIDCA tool revealed that the cooperative's failure to market its members' products might be due to management's lack of a marketing plan, inability to diversify client portfolios, and a product range divided into distinct product grades. It's also possible that a shortage of capital is preventing the marketing efforts from being organized. The cooperative can attract more farmers to deliver the milk to the cooperative by providing farmers a premium based on the quality of milk, information exchange and cash on delivery improves the likelihood that a member will sell via the group, and therefore the volumes consolidated by each group. As a result of the increased volume, groups appear to have been able to get better prices for their goods. Thus, for cooperatives to effectively organize their marketing operations, they

must have a marketing plan in place, diversify their customer portfolios and perhaps product ranges, and have adequate capital.

It was clear from the MIDCA tool that the self-help groups and Butula DFCS cooperative had positive relationships with their members (internal customers), supporters (Project partners), and the community, which is critical for the Butula cooperative and self-help groups' continued survival. This is what has helped the cooperatives and self-help groups in Teso North and Butula sub-counties function better. Concerning their relationship with the financial institution is seen to be still low due to fear of risk management. A positive relationship with financial institutions and other supporters opens up more options for meeting financial and other support-related requirements in the short and long term. The advantage of self-help groups and Butula cooperative interacting with other stakeholders may provide a platform for farmers to access services that they might not get as individual farmers. Hence it is better when the cooperative and self-help groups operate in a transparent way to earn trust from different stakeholders

The MIDCA tool revealed that the cooperative's constitution included a written declaration of the group's vision and mission, implying that the mission and vision statements serve as a focal point for everyone in the cooperative, ensuring that everyone is working toward a common goal. This improves the cooperative's efficiency and production. The cooperative had a 5-year strategic plan which shows that the cooperative has a sense of business direction which is very useful for guiding the daily activities' decisions, and changing approaches when moving forward. However, the cooperative did not have a clear vision of building capital and becoming self-sufficient in the long term. The findings revealed that, while the self-help groups' constitutions had objectives, the objectives were not business or market-oriented, but rather community-based support objectives. Because none of the self-help groups had a strategic plan to decide their future, it might be stated that they lack a "sense" of business direction. The self-help groups have initiated the culture of table banking within the group, this shows that the self-help group has a clear vision of building capital and becoming financially self-sufficient in the long term. According to Mutinda *et al.* (2015), the existence of leadership and management abilities seem to be critical to a group's success. Without these qualities, a group's prospects of long-term achievement are limited. Findings from Butula DFCS and self-help groups reveal that leadership skills are still inadequate within the groups. Good leadership management is necessary to offer clarity of purpose, motivate, and guide the groups to achieve their objective.

**Reflection on research methodology.**

Conducting research to come up with a report is not an easy process, identifying the problem with the commissioner, writing the objective, developing the questions, and coming up with the conceptual framework was challenging for me and through the feedback sessions with my supervisor (Marco), we were able to brainstorm and come up with a solution which helped me. The feedback sessions were helpful to me since I got insightful feedback that helped to improve my report. To answer all my research questions, it was important to select appropriate data collection methods to get results. I used the questionnaires to smallholder dairy farmers in the project to know exactly their opinions and attitude in the project, FDG to understand the social opinion about the self-help group performance, interviews with key informants to acquire in-depth information about the role of stakeholders in the dairy value chain. Observation to see the farming practices on farmer's farms and desk study to relate with what other literatures have found.

Through the help of the research assistant, I was able to collect data in 4 weeks, we prepared a schedule that helped guide me through the data collection and informing the respondents about their participation in the process. I learned that having a plan and time frame is very important because it helped me receive the data on time and hence having enough time to code and analyze the data. During the process, for instance, the questionnaires when the feedback was coming, I was able to contact the research assistant immediately for clarity on what was not clear for me. At the end of the

day, both the research assistant and researcher were able to discuss the process and give updates on how the process was the successful and challenges faced during data collection. The feedback session was very important for me as a researcher since I have improved my communication skills.

For data collection, I had a research assistant conduct survey, FGD, and observation on my behalf since I was not on the ground to collect the data myself. I selected a research assistant who was not part of the project so that farmers could be free and comfortable to express themselves. I learned that when assessing a project, it is important to have an external person to assess so that the results would not be influenced in any way.

When developing a questionnaire, I learned it is important to reflect on the sub-questions and what results in you are expecting to analyze. The questions need to be relevant so that respondents can answer the research question and not just to put any questions. Before administering the questionnaire to the farmers, I had a feedback session with my supervisor about the questionnaire I realized that I had not put enough information to calculate the cost and benefit analysis which was very important. I have learned it is important to give someone else to help in reviewing and testing the questions so that to countercheck anything that needs adjustment before administering it to the respondents.

During the coaching session with my supervisor suggested the use of the MIDCA tool during the focus group discussion. Since learning is a continuous process, I challenged myself to use the MIDCA tool which was a new name and tool to me. During the data collection, I used the MIDCA tool to assess the performance of the self-help groups in the Teso North sub-county and the cooperative in the Butula sub-county. The MIDCA tool helped me to identify the strong and weak points of the group's performance. During the focus group discussion, due to corona restrictions and time limit the respondents discussed among themselves and came up with one result which was used for results. After farmers had scored themselves, the spider web chart was presented to them, and farmers acknowledged the scoring reflected what is happening on the ground. In addition, it was a good option for allowing farmers themselves to score themselves because if the research assistant would have done on their behalf there could be some influence on the results. As a researcher, I learned that for an effective result each group should at least score themselves to get a better view and understanding of each group's strong and weak points on group performance. As an extension officer, using the MIDCA tool is very important to assess the performance of the groups.

During the focus group discussion in Teso North, the Kekieutu Idwe SHG was randomly selected to describe their group activities. First, random selection was used to improve the results' generalizability and have less likely to be subject to bias. It was important to have a group talk about their activities so that as a researcher I could get a better understanding of self-help groups' performance and having the Kekieutu Idwe SHG gave in-depth information that was useful to assess the performance of the group. It could have been good if the other two or three groups would talk about their group activities and maybe encourage them to say something different, they did apart from what other groups have said, this would gather and incorporate other groups ideas and it would help enrich the thesis report.

To answer the question of cost-benefit analysis, one farmer was selected in Butula sub-county to represent other farmers. Having only one farm as a sample did not give the accurate cost of milk production in the region. However, as a researcher, I have learned that it is important to have a larger sample of data that would have provided a clearer picture of the cost of production per liter in the research study area. During the data collection, the research assistant was able to take pictures during the farm visits. Pictures speak more, the picture helped me as a researcher to see the structures on the farmers' farm and the feeding practices done by the farmers. For instance, one of the pictures showed a zero-grazing unit but the floor did not have any concrete floor. The pictures help a researcher to visualize the farming practices done by the farmer and be able to provide advice on

areas on adjustment. I have learned that it is important to take pictures when doing field visits it helps in supporting the reports and it can be used to assess before and after projects interventions.

Conducting the interview was a great challenge for me, there was an issue of language barrier communicating with respondents was not easy. The research assistant was able to translate, and that process of translating was time-consuming. However, the presence of the translator was so important in the research since I was able to get information. Despite that translation has its disadvantages of not getting the important keywords.

# Chapter Six: Conclusion and Recommendation

The study has shown that project partners (KCSAP, FSK, County Government of Busia) provided platform activities such as providing dairy farmers with 218 heifers and 70 bulls, technical training (feed and feed management, disease control, animal husbandry, and nutrition), the establishment of pasture demonstration plots for planting materials availability, linking farmers to the Butula DFCS, organizing farmers into self-help groups and construction of the dairy park.

Results showed that farmers have planted improved fodder on their land, majorly nappier grass because of high yield and could be grown all year round to ensure availability of the feeds for the cows but few had planted Bracharia and Desmodium, this shows the diversification on some farms. However, fodder conservation was still a major challenge to farmers, resulting in insufficient feeds on the farm. Farmers need to take advantage of the rainy season and store the excess fodder which will help to increase milk productivity and reduce the cost of buying feeds from neighbours. Farmers in Teso North reported an increase in fodder production on their lands due to the use of well-stored manure. In Butula manure was not well preserved resulting in to decline of fodder on the land. Proper feeding management will help farmers improve milk production in their farms. The adoption of improved fodder production on the farm and the use of bull to improve the breeds has led to an increase of milk 1-2 liters.

It was observed that farmers in Butula DFCS sold milk both to formal and informal markets to generate income at the household level. The majority of farmers indicated Butula DFCS provided them with a market for their milk but due to delayed payments and low pricing, they sell 50% of the milk to the traders and kiosks because of the better payment. The Butula DFCS needs to address these issues to ensure that all 75 farmers deliver all the milk to the cooperative. Milk safety and quality requirements are checked before being accepted or rejected and farmers are paid based on the quantity. Adongosi DFCS collapsed due to low milk volumes and poor leadership, resulting in farmers selling the milk directly to local consumers. Farmers selling collectively will increase the volume of the milk production and increase their bargaining power hence reviving the Adongusi DFCS will help them benefit from market access. The value chain is seen to be informal and formal however, actors actively seek to support each other so that they can increase their efficiency and competitiveness to increase profits.

Results of MIDCA tool showed the total score performance of the SHG (51%) in Teso North and cooperative (58%) in Butula, which shows their performance as low score, change is required to fulfill the respondents' wants and desires. The SHG and Butula DFCS have played an important role in providing and improving extension services to other farmers through farmer-to-farmer visits and the use of lead farmers in the region. The farmers who attended the training, field visits were the same implementors. The groups are engaged in entrepreneurial activities which empowers their members to not only depend on one source of income but rather engage in different activities. When SHG and cooperatives are market-oriented based, collective action is needed to acquire benefits such as economies of scale, shared risks, ability to pool resources, better access to input support services, and employment which are not easy when accessed as an individual. For SHG and cooperatives to be successful leadership and management skills are very important qualities to achieve long-term prospects. In Butula and Teso North, this was seen as a challenge for prosperity.

**Recommendations**

- It is advised for project partners to facilitate the formation of a multi-stakeholder platform to foster the sharing of information among diverse actors in the dairy value chain. Hence it will help improve horizontal and vertical coordination.

- Farmers are advised to embrace pasture and fodder conservation technology, this will help to ensure consistent milk production throughout the year, especially during the dry season.

- It is advised that farmers embrace good manure management, this will help to increase fodder production in their farms.

- Butula DFCS is recommended to facilitate a better payment system and offer premiums based on quality since this will encourage dairy producers to improve their quality attributes at the farm level and prevent side sales of milk.

- It is recommended that incorporating group dynamics, leadership skills, and marketing plans in the training manuals will assist the strengthening of self-help groups and cooperative to perform effectively.

- It is recommended that SHG and Butula DFCS be market-oriented through collective action which will facilitate linkages with input support services, this will help farmers develop the technology and skills needed to improve milk production at the farm level.

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ANNEXES

**Annex 1: QUESTIONNAIRE FOR DAIRY FARMERS IN DAIRY PARK PROJECT.**

**Sub-county ……** **Questionnaire No. ……**

**Village ……** **Name of Respondent……**

**SECTION 1: BACKGROUND INFORMATION**

**1. Sex of the respondent**? 1. Male 2. Female

**2. What is your age? ……..**

**3. Do you have any physical disabilities?.....**

**4. What is your education level**?

□ None □ Adult education □ Primary □ Secondary □ Tertiary education

**4. How many people are in your household**…….?

**5. What is your main source of income?**

□ Farming □ Formal employment □ Self-employment □ Remittance □Other (specify)……

**6. What is your main farming activity**? ……. □ Livestock □ Crops

**7. Which type of livestock's do you keep on your farm?**

**8. Which type of cattle do you keep? □ Exotic □ Local**

**8. Total land size you own?.....**

**9. How many acres of land is allocated for cattle's…….**

**SECTION 2: ADOPTION OF TECHNOLOGIES ON THE FARM TO INCREASE PRODUCTIVITY.**

**1. Do you have enough fodder on your farm?** □ Yes □ No

**2.Where do you get the feeds for cattle from?** □ On farm □ Purchase □ Both

**3. If purchase, which type of fodder/forage do you purchase?.....**

**4. Do you grow any fodder on your farm?** □ Yes □ No

**5. If yes, which improved fodders have you planted??**

□ Napier grass □ Desmodium □ Brachiaria □ Rhode grass □ Others (Specify)....

**6. What is the size of the land under fodder in terms of acreage?.....**

**7. How do you fertilize your land under forage and fodder? □ Manure □ Urine □ Artificial fertilizer**

**8. How is your cutting regime in a season?.....**

**9. What is the main reason for choosing the planted fodder/pastures on your farm?**

□ Easy to plant and manage □ Planting material available □ High yielding
□ Drought resistant □ Other specify….

**10. Since the project started, how has been the trend in fodders production per acre in your farm?**..

**11. In the previous two years, have you had enough surplus fodder/forage?** □ Yes □ No

**12. If yes, what do you do when you have a surplus?**

□ Sell to neighbours □ Conserve into hay □ Leave it on the farm □ Conserve to silage.

**13. If not, what strategy do you have for future to increase fodder/forage production?**

**14. How do you handle with a scarcity of fodder or pasture?**

□ Buy from cooperative □ Use conserved fodder and pasture □ Buy from neighbours
□ Other (specify)……..

**15. Which type of concentrates do you use?**

□ Dairy meal □ Maize bran □ Soyabean meal □ Others (Specify)

**16. Where do you get your concentrates from? □ On farm □ Purchase**

**17. From which agrovet do you buy the concentrates?**

**18. What is the distance from where you purchase ……? KM**

**19. What is the price of purchasing the concentrates?.....Kg**

**20. What kind of grazing system do you practice?**

□ Zero grazing □ Semi zero grazing □ Control grazing □ Open grazing

**21. Which type of breed do you have on your farm?** □ Friesian □ Ayrshire □ Guernsey

□ Cross □ Jersey □ Other Specify

**22. How did you get the type of breed mentioned above?** □ AI □ Bull

**23. If AI, what was the cost of the service?**

**24. Do you receive any support from the veterinary services?** □ Yes □ No

**25. Which type of service do you receive?**

**26. What is the cost of the services you receive?.....**

**27. Have you received any trainings?** □ Yes □ No

**28. Which type of training have you receive?** Feeds and feed management □ Disease control

□ Animal husbandry other specify

**29. What is the current total herd size?** Milking cows.....Dry cows……Heifers…… Calves……..

**30. How many milking cows do you have in the farm?** ……

**31. The milk production per cow/per day in litres?.....**

**32. The total milk production during the rainy season per cow/day in litres?.....**

**33. What is the milk production during the dry season per cow/day in litres?.....**

**34. Is there any changes in milk production on the farm after joining the project?** □ Yes □ No

**35. If yes, by how much?.....**

**36. What is the average calving interval?.....**

**37. What is the lactation period? Days.....**

## SECTION 3: MARKET LINKAGE

**1. Where do you sell most of your milk?**

□ Milk collection centre □ Milk traders □ Local Consumers □ Retailers (Kiosks)

**2. Why do you choose the above-mentioned market? Tick appropriately**

□ Better price □ Reliable market □ Offer other Services (extension, bonus) □ Near to me

**3. What method do you use to deliver your milk?** By bicycle □ On foot □ Buyers collect □ Motorbikes.

**4. How many litres of milk do you sell to your market point each day?.....**

**5. How many litres of milk is used for home consumption every day?.....**

**6. How many litres of milk is used for calves?.....**

**7. What is the current price of a litre of milk you sell? ……**

**8. Does the price cover the cost?** □ Yes □ No

**9. Do you get information on the kind of milk your customer or consumer prefers on the market?**

□ Yes □ No

**10. If yes, which information feedback do you get the most about your customers' requirements?**

□ Price □ Volumes □ Quality □ Type of Container

**11. Are you aware of your customers' quality expectations?** □ Yes □ No

**12. If yes, what qualities do you look for in your milk before marketing it? (Tick as appropriate)**

□ Antibiotics □ Nutritive Value □ Taste, odour & color □ Freshness of milk
□ Use of stainless steel or aluminum containers.

**13. How do you receive your payment after selling milk? [Tick]**

□ Daily □ Weekly □After two weeks. □ Monthly □ Others(specify)……

**14. Do you have any contracts/agreements with your milk buyers?** □ Yes □ No

**15. Are you a member of any farmer group?** □ Yes □ No

**16. If yes, which one**? □ Cooperatives □ Dairy groups □ Self Help Group (Youth, women, men, Disability)

**17. What is your primary motivation for joining the group?**

□ Marketing of milk □ Access to extension services □ Social engagement □ Access to loan

□ Access to AI services.

**18. Do you do any processing**

**Annex 2: Herd size and composition**

| Category | Frequency | Percentage |
|---|---|---|
| ***Herd size*** | | |
| 1-2 | 22 | 45.8 |
| 3-4 | 13 | 27.1 |
| 5 and above | 13 | 27.1 |
| ***Milking cows*** | | |
| 1 | 27 | 56.3 |
| 2 | 13 | 27.1 |
| 3 | 1 | 2.1 |
| 4 | 2 | 4.2 |
| 0 | 5 | 10.4 |
| ***Dry cows*** | | |
| 1 | 13 | 27.1 |
| 2 | 9 | 18.8 |
| 3 | 4 | 8.3 |
| 4 | 1 | 2.1 |
| 0 | 21 | 43.8 |
| ***Heifers*** | | |
| 1 | 4 | 8.4 |
| 2 | 6 | 12.5 |
| 0 | 38 | 79.2 |
| ***Calves*** | | |
| 1 | 22 | 45.8 |
| 2 | 6 | 12.5 |

| | | |
|---|---|---|
| 4 | 1 | 2.1 |
| 5 | 1 | 2.1 |
| 0 | 18 | 37.5 |
| ***Calving pattern*** | | |
| 12 months | 41 | 85.4 |
| 18 months | 5 | 10.4 |
| None | 2 | 4.2 |
| Total | 48 | 100 |
| ***Lactating period*** | | |
| 6 months | 36 | 75 |
| 7 months | 5 | 10.4 |
| 8 months | 5 | 10.4 |
| None | 2 | 4.2 |
| Total | 48 | 100 |

**Annex 3: Milk production per cow per day independent sample test**

**Independent Sample Test**

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| Milk production per cow per day | Equal variances assumed | 2.731 | .105 | .531 | 46 | .598 | .95833 | 1.80468 | -2.67430 | 4.59097 |
| | Equal variances not assumed | | | .531 | 43.724 | .598 | .95833 | 1.80468 | -2.67941 | 4.59607 |

**Annex 4: Cost Benefit Analysis of the selected farmer**

| Description | Unit | Price/Unit | Quantity | Amount |
|---|---|---|---|---|
| **Annual Variable Costs** | | | | |
| | | | | |
| **Animal Health** | | | | |
| Tsetse fly controls | Visit | KSH 920 | 1 | KSH 920 |
| East Coast Fever | Visit | KSH 700 | 1 | KSH 700 |
| Duo Dip | 100 ml | KSH 600 | 1 | KSH 600 |
| Cyper tick | 40 ml | KSH 120 | 1 | KSH 120 |
| **Total** | | | | **KSH 2,340** |
| | | | | |
| **Purchase of feeds and concentrates** | | | | |
| Napier grass | Per roll | KSH 100 | 300 | KSH 40,000 |
| Maize Bran | 50kg | KSH 1076 | 10 bags | KSH 10,760 |
| Cotton Seed Cake | 1kgs | KSH 53 | 100 kgs | KSH 5,300 |
| Sunflower Seed Cake | 1kg | KSH 30 | 100kgs | KSH 3,000 |
| Soyabean Premix | 1kgs | KSH 70 | 50kgs | KSH 3,500 |
| Dairy meal | 50kgs | KSH 2,050 | 20 bags | KSH 41,500 |
| DCP Sachet | 2 kgs | KSH 300 | 30 sachets | KSH 9,000 |
| Macklic Supper cow salt | 1kg | KSH 250 | 15kgs | KSH 3,750 |
| **Total** | | | | **KSH 113,560** |
| | | | | |
| **Feed production** | | | | |
| Seeds | 2 kgs | KSH 360 | 6 kgs | KSH 2,160 |
| DAP Fertilizer | 50 kgs | KSH 1,500 | 1 bag | KSH 1,500 |
| Silage Bags | Roll | KSH 1,100 | 1 | KSH 1,100 |
| Transport | | | | KSH 3,300 |
| **Total** | | | | **KSH 8,060** |
| | | | | |
| **Overhead costs** | | | | |
| Water | | KSH 165 | | KSH 1,980 |
| Electricity | | KSH 495 | | KSH 5,940 |
| **Total** | | | | **KSH 7,920** |

| | |
|---|---|
| **Total annual Variable costs** | **KSH 131,880** |

| Annual Fixed Costs | | Depreciation | Maintenance | |
|---|---|---|---|---|
| Zero grazing Unit | 1 | KSH 6,275 | Ksh 627.50 | KSH 6,902 |
| Chaff Cutter | 1 | KSH 2,300 | Ksh 2,300 | KSH 4,600 |
| Milk Cans | 2 | KSH 3,200 | Ksh 1,600 | KSH 4,800 |
| Spray Pump | 1 | KSH 800 | Ksh 400 | KSH 1,200 |
| Drinking Drums | 2 | KSH 1,200 | Ksh 600 | KSH 1,800 |
| Water Pump | 1 | KSH 2,600 | Ksh 1,300 | KSH 3,900 |
| Dehorning tool | 1 | KSH 40 | Ksh 20 | KSH 60 |
| | | | **Total annual Fixed Costs** | **KSH 23,262** |

| | | | | |
|---|---|---|---|---|
| **Labour Cost** | | | | |
| Weeding | 4 ppl/day | KSH 800 | 4 | KSH 3,200 |
| Planting | 4 ppl/day | KSH 800 | 4 | KSH 3,200 |
| Harvesting | 4 ppl/day | KSH 800 | 4 | KSH 3,200 |
| Herds Boy | months | KSH 7,500 | 12 | KSH 90,000 |
| **Total** | | | | **KSH 99,600** |

| | |
|---|---|
| **Total annual costs fixed assets** | **KSH 122,862** |
| **Total annual variable costs** | **KSH 131,880** |
| **Total annual costs of Fixed assets** | **KSH 122,862** |

| | | | | |
|---|---|---|---|---|
| **Total annual Costs** | | | | **KSH 254,742** |
| | | | | |
| **Other Revenues** | | | | |
| Bull servicing | | | | KSH 1,000 |
| Sell of Breeding stocks | | | | KSH 50,000 |
| Culling off due to age | | | | KSH 22,000 |
| Home milk consumption | | Ksh 60 | 2 | 21,600 |
| **Total** | | | | **KSH 94,600** |

| | | | | |
|---|---|---|---|---|
| **Milk production Revenues** | | | | |
| Total Milk Production in Litres | Number of days | Total Litre | 50% sold to the cooperative. 50% is sold directly to local consumers. | |
| 54 | 180 | 9,720 | Ksh 53 | Ksh 515,160 |
| | | | | |
| **COST PRICE PER LITRE OF MILK** | **KSH 26.20** | | | |