

Creating sustainable Dairy food systems in the greater Masaka Region (Uganda):

A Case Study of MADDO Dairies Ltd.



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Creating sustainable Dairy food systems in the greater Masaka Region (Uganda): A case study of MADDO Dairies Ltd

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

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I would like to dedicate this work to the Almighty God and to my beloved mother and best friend Justine Bwisho, grateful for the continuous love, support, and advice.

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Abbreviations and Acronyms

AI	Artificial Insemination
DDA	Dairy Development Association
EAC	East Africa Community
EADD	East African Dairy Development
GDP	Gross Domestic Products
GPS	Geo Positioning System
BOU	Bank of Uganda
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MADDO	Masaka Diocesan Development Organization
MCC	Milk Collection Centre
MFIS	Micro Finance Institutions
NAGRC&DB	National Animal Genetic Resources Center &Data Bank
NDA	Uganda National Drug Authority
NARO	National Agricultural Research Organization
NFD	Non-Fat Dry Milk
NGO	Non-Governmental Organization
PESTEC	Political, Economic, Social, Technological, Environmental, Cultural
COMESA	Common Market for Eastern and Southern Africa
SDGs	Sustainable Development Goals
SNV	Stichting Nederlandse Vrijwilligers ("Foundation of Netherlands Volunteers")
SWOT	Strengths, Weaknesses, Opportunities, Threats
UBOS	Uganda Bureau of Statistics
UNBS	Uganda National Bureau Standards
VC	Value Chain
VHL	Van Hall Larenstein University of Applied Sciences
DVO	District Veterinary Officer
FOA	Food and Agriculture Organization of United Nations
GBK	GBK Dairy Products (U) Ltd
ILRI	International Livestock Research Institute

NDA	National Drug Authority
SALL	Sameer Agriculture & Livestock Ltd
SACCO	Saving and Credit Cooperative Organization
UCCU	Uganda Crane Creameries Cooperative Union
UGS	Uganda Shilling
UHT	Ultra-High Temperature
VCA	Value Chain Analysis
WHO	World Health Organization
FGD	Focus Group Discussion
VSLA	Village Saving and loan Association

Abstract

MADDO Dairies Ltd has made a tangible effort to develop the dairy value chain in the larger Masaka region by providing farmers with cows, organizing them into various farmer groups, providing extension services and support to dairy farmers, and setting up milk centres. Despite attempts to reduce the informal milk chain in the greater Masaka Region, MADDO Dairies Limited is experiencing poor milk procurement due to the prevalence and competition from the informal milk chains in the region, which is a result of most farmers' side-selling. According to this study, side selling is not only done by farmers but also the milk collection centres in order to facilitate their daily operational expenses. This research was conducted with the aim of comparing the informal and formal Dairy chains, assessing MADDO Dairies Ltd.'s impact on the Dairy food systems, advising it on the best practices in the informal chains and chain upgrading strategies.

This study was carried out on the greater Masaka dairy value chain actors and supporters with MADDO Dairies Ltd as the case study. A purposive random sampling technique was used, and it covered a total of 74 respondents. The respondents included dairy farmers, milk traders, milk collection centre attendants, MADDO Dairies Ltd, milk wholesalers and retailers, financial institutions, Local government veterinary and production staff, dairy experts, extension staff and DDA. The data collection tools used were FGDs, Key informant interviews, and a survey. The key areas studied in this research were the dairy value chain governance, covering the stakeholders' analysis, robustness, reliability, and resilience of the greater Masaka dairy food systems, the best practices in the informal dairy value chains. The other key aspect covered was the performance of MADDO Dairies Ltd in upgrading the dairy values chain, covering its current business model, organization of cooperatives and its socio-economic impact in the region.

According to the findings of this study 73% of the dairy farmers in this region are women of whom most of them keep one cow because of limited land for grazing hence practice zero grazing. The average milk production per cow was found to be 10 litres daily. In the greater Masaka region, there is high demand for raw milk compared to the processed milk products and MCCs also engage in the sale of raw milk. MADDO Dairies' niche markets are schools and Kampala and DDA regulates and licenses the informal market segment. Most of the farmers deliver milk to the collection centres using jerrycans given the small milk volumes and the main means of transport is by walking. 20% of the milk produced is left home for consumption and feeding the calf and 80% is sold. Most of the farmers sell milk to the neighbours because of long distances to the milk collection centres and the need for quick cash to take care of their families and the farm. The best practices identified in the informal chains were prompt milk payments, higher milk prices, advance payments contract enforcement, and farmers not incurring transport costs to deliver milk to the collection centres. Important to state is the farmer groups organized under MADDO have weak leadership and group dynamics which explains why some of them have collapsed and have very few active members and because of delayed milk payments from MADDO, the farmers are forced to sell milk in the informal milk segment.

The identified recommendations to upgrade the dairy value chain are the establishment of the hub model at the MCCs, public-private partnerships, increased capacity building training, mentoring and monitoring of farmer groups, MADDO offering competitive prices to farmers, quality-based payments, investment in pasture production, conservation and breeding, mainstreaming the MADDO dairy value chain to only sell processed milk and increased marketing and market positioning.

Key words: sustainable dairy food systems, chain governance, formal and informal dairy value chains, organization of cooperatives, chain upgrading strategies, impact assessment.

Chapter 1: Introduction

This chapter provides information regarding the context of the research proposal. This includes the background information about the case study Description, justification of the problem, problem statement, objective, and research questions

1.1 Case Study Description:

The Greater Masaka Region is located Central Uganda and hosts 8 districts that include Masaka, Rakai, Kalungu, Lwengo, Bukomansimbi, Kyotera, Lyantonde and Ssembabule. It has a population of about 9529 million according to the 2014 census. Smallholder dairy farming systems dominate this region and practice zero grazing mainly. This region contributes 24% of the total milk output per annum (DDA, 2019). It is in these 8 Greater Masaka districts of the Central Uganda food system that the MADDO dairy value chain is embedded. This region has the highest milk output (9.8 litres/cow), as well as a high population of more productive exotic and hybrid breeds. A few farmers in this area have created fodder banks, improved pastures, and supplemented their livestock with cow feed purchased from both formal and informal animal feed producers. Farmers in the central region, obviously enjoy the benefits of being closer to the main market Kampala and Entebbe where they can market their milk directly to the consumer at higher prices (Agriterra,2012).

The informal market is highly concentrated, accounting for up to 90% of all milk traded. It is significant in scope and size because it meets a demand that the formal segment does not, guaranteeing that milk is widely available and cheap, therefore addressing the demands of most low-income households (Agriterra, 2012). According to Arnaoudov et al., (2017), this large informal and vibrant 'loose' milk segment accounts for up to 90% of all marketed milk, making unprocessed milk the most consumed dairy product. As a result, any initiatives aimed at increasing productivity across the entire dairy value chain must take this segment into account (Agriterra, 2012). Undoubtedly, the informal long and short milk chain deals primarily with the sale of raw milk, this segment has led to increased unsafe milk on the market. Raw milk marketed through the informal chains is most of the time of poor quality and does not meet standards due to the high initial bacterial load and antibiotic residues (Nada et al., 2012). Wanjala et al., (2018) further argue that microbial contamination of milk occurs when bacteria found in the udder and environment of the cow enter the milk through unsanitary milking and handling practices. During bulking and transportation, milk is handled by multiple value chain actors, increasing the risk of microbial contamination. Contamination with bacteria such as *Escherichia coli* and *Salmonella* spp is a sign of poor milk handling and hygiene practices which is prevalent in the informal milk chain (Nyokabi et al., 2021). Wanjala et al. (2017) emphasize that *Listeria monocytogenes*, *Salmonella typhimurium*, *Campylobacter jejuni*, *Staphylococcus aureus*, *Bacillus cereus*, *E. coli*, *Coxiella burn etii*, *Mycobacterium tuberculosis*, *Mycobacterium bovis*, *Yersinia enterocolitica*, and certain strains of *Staphylococcus aureus* have all been linked to foodborne outbreaks linked to raw milk consumption. Brucellosis, TB, typhoid, paratyphoid, and diphtheria are some of the illnesses caused. The presence of these pathogens is a public health concern, particularly given the widespread consumption of milk. More so, the milk reaching the consumers through the informal chains is most of the time contaminated, unsafe as a result of poor hygiene and improper handling, most of these traders do not have cooling systems during transit of the milk to the end consumers (Makoni et al., 2014). Given that milk is often a farmer's only source of recurring income, the need for daily cash to cover daily expenses drives producers to sell to informal traders/hawkers. Besides that, the informal market lacks quality control, allowing producers to sell low-quality milk that would be rejected by processors, other underlying causes include limited incentives for smallholders and informal milk traders to participate in the formal segment (Agriterra, 2012), better milk prices in the informal chains and prompt cash payments from traders (bicycle traders) and consumers (Abdulsamad & Gereffi, 2016)

Although milk production has increased over time, processors still lack sufficient raw milk to operate at full capacity (Wesana et al., 2018). Most milk Processors run below capacity and compete for milk

supplies. They, therefore, offer services (such as training) or inputs (such as milk cans) to value chain actors upstream, processors trying to increase the productivity of farmers, the quality of the milk they market, and enhance their loyalty as suppliers. However, with fierce competition between processors, dairy farmers also have more opportunities for side-selling and fewer incentives to maintain quality (Van Campenhout, et al., 2021). Agriterra, (2012) has Identified upgrading informal actors into a formal chain as one of the key investment opportunities in Uganda.

MADDO Dairies Limited is the milk processor in the greater Masaka and the problem owner. Because of the competition from the informal chains, this has affected its milk procurement. Most of the farmers and traders in the area sell raw milk, additionally, project farmers also sell raw milk on the side to consumers, traders, and kiosks. The informal milk chains have indeed affected the MADDO Dairy value chain in terms of limited milk procurement. This is further emphasized by Rademaker et al., (2016) that to maintain bargaining strength with the processors, farmers and their cooperatives must ensure their capacity to produce milk throughout the year. The seasonality of milk production and competition in milk procurement with informal sales (side-selling), which members engage in, to diversify milk income streams to the household, are the cooperatives' two largest challenges.

1.2 Problem owner: Caritas MADDO-MADDO Dairies Limited

Caritas MADDO (MASAKA DIOCESAN DEVELOPMENT ORGANISATION) is a faith-based non-profit organization established by Masaka diocese to help the locals and offers social services and development work in Masaka. It was started in 1979 when refugees stormed the cathedral for help. The offices were established in 1981. In 1988, MADDO was expanded to include development work besides social services with more technical staff. This same year (1988) it picked the name MADDO which was changed to Caritas MADDO in 2000 to promote the spirit of giving and receiving as related to love, compassion, and solidarity. The Diocese and activities of Caritas MADDO cover the political districts of Kalangala, Rakai, Ssembabule, Masaka, Kalungu, Bukomansimbi, Lwengo, and Lyantonde. Caritas MADDO enters the community using the church structure that is the 49 parishes, which are grouped in eleven deaneries and then finally the 700 sub parishes. Each level has a development committee that coordinates MADDO activities in the parishes. Households are organized into groups to utilize their different gifts for better results. Its mission is to build the capacity of community organizations for sustainable development in Masaka Diocese. To improve Caritas MADDO's efficiency, effectiveness, and responsiveness to Masaka Diocese's social and economic development needs, it collaborates with non-governmental organizations that play a key role in developing development processes while focusing on community services and outreach to improve social welfare and alleviate poverty. NGOs have been very helpful in improving the agricultural sector with special emphasis on the dairy sector in the greater Masaka region. (caritasmaddo.org, n.d.)

Since 1993, Caritas MADDO has been in partnership with Heifer Project International to boost animal husbandry in an integrated approach. Very many farmers are trained and given heifers to boost dairy in the region with the aid of Bothar Ireland and USAID. With the partnership with Heifer international and Bothar Ireland, farmers can train other fellow farmers because they can see the benefits of a heifer in the family. Extension staff from the government and MADDO help to polish up on a few issues that seem to be technical. With aid from Bothar Ireland and Heifer International, MADDO Heifer Project set up MADDO Diaries. It was launched on 23rd August 2003 with a capacity of processing 6000 litres of milk into various products. Two Milk Cooling (collection) Centres have been set up. One in Kirimya Masaka District with a loan from Bothar Ireland and another in Lwabenge – Bukomansimbi district in partnership with Land O Lakes, Local Government, and MADDO. Each centre has a capacity of 3000 litres. The program also acquired another refrigerated truck as a grant from the Province of Trento Italy with a capacity of 3500 litres. It transports raw milk from these milk cooling Centres and other farmers from far distant areas to MADDO Dairy. Additionally, Bothar Ireland has donated a cold room that has helped the dairy plant handle huge volumes of milk to be processed. (caritasmaddo.org,

n.d.) MADDO Dairies Ltd is undergoing expansion and is looking at increasing its capacity to 10,000 litres of milk daily hence the need to further streamline the formal chain in the greater Masaka region.

Project farmers are organized in 5 cooperatives in a collective parish setting, they deliver milk to the dairy through the milk collection centres and there is higher anticipation that the number will increase, as more Heifers have been extended by Microfinancing Partners in Africa (MPA). In an offer to extend living loans, MPA continues to finance the Cow project through Caritas MADDO to restore peoples' livelihoods by supporting dairy farming as a source of nutrition and income. The project also aims at enhancing household food security through improved crop production as a result of farmyard manure application. The project has also embarked on extending loans to farmers to construct Bio-gas fuels, to reduce deforestation, and promote an energy-saving environment and over 400 original animals to well-prepared farmers, by end of the year 2013. Gender equity is mainstreamed in all MADDO development programs with an emphasis on the relationship between men and women especially in the area of sharing roles. MADDO works to promote good governance and leadership that addresses gender concerns. This is done through democracy monitoring from a gender perspective, promoting effective people's engagement in multi-party politics, increasing women's participation in politics, entrepreneurship, agricultural practices, strategic leadership, and decision making. (caritasmaddo.org, n.d.)

1.3 Problem Statement

Despite the efforts to curb the informal chain in the greater Masaka Region, MADDO Dairies limited is experiencing low milk procurement attributed to the prevalence and competition from the informal milk chains in the region as a result of side-selling of most of the farmers.

1.4 Objective

This research aims to compare the informal and formal Dairy chains, assess MADDO Dairies Ltd.'s impact on the Dairy food systems, advise it on the best practices in the informal chains and chain upgrading strategies.

1.5 Research Questions

Question 1. What is the Governance of the Dairy value chain in the greater Masaka Region?

Sub questions

- a) What are the roles and interests of various stakeholders in the dairy value chain?
- b) What is the robustness, reliability, and resilience of the greater Masaka dairy food system?
- c) What are the best governance practices in the informal chains as compared to the formal Dairy chain that MADDO Dairies Ltd can adopt to upgrade the Dairy value chain in the Region?

Question 2. What is the performance of MADDO Dairies Ltd in upgrading the dairy food system in the greater Masaka Region?

Sub questions

- a) What is the current business model of MADDO Dairies Ltd?
- b) What is the organization of the cooperatives under MADDO dairies ltd in terms of milk procurement?
- c) What are the socio-economic outcomes of MADDO Dairies Ltd.'s activities in the region?

Chapter 2: Literature Review

This chapter presents literature on the different research topics from different sources including reports, journals, books, and online sources like google scholar, green I, science direct, CABI among others.

2.1 Agriculture in Uganda

Agriculture is the most important sector of the Ugandan economy because, in addition to providing direct food, it also provides jobs, accounts for nearly 20% of nominal GDP, accounts for 48% of export commodities, and provides a large proportion of raw materials for industry. Uganda's GDP is above \$20 billion (USD547 per capita), with agriculture accounting for 23% of the total (Arnaoudov et al., 2017). Poverty and equity are estimated to be 38% and about 80% of the population, the majority being women, is engaged in agriculture (World Bank, 2009). The food processing sector alone accounts for 40% of the entire manufacturing industry (MAAIF, 2010). Food and cash crop cultivation, cattle, forestry, and fishing are all subsectors of the agriculture sector, which is primarily subsistence. Coffee, tea, cotton, tobacco, and cocoa are the most important cash crops, with coffee being the most important export product. The predominant food crops are plantains, cassava, sweet potatoes, and maize, which are grown mostly for subsistence. It is estimated that there are approximately 3.95 million small and medium agricultural households who own an average farmland area of 2.5 ha, with a population of 19.3m persons (60 percent of Uganda's population), producing the bulk (over 95 percent) of the food and cash crops. (Arnaoudov et al., 2017). Livestock production is a large agricultural sub-sector, accounting for around 7.5 percent of overall GDP and 17% of agricultural GDP. Cow, sheep, goats, pigs, rabbits, and poultry are the most frequent livestock species in Uganda, with mixed agricultural smallholders and pastoralists owning over 90% of the cattle herd and all small ruminants (UBOS, 2015).

2.2 Dairy in Uganda

Small-scale farmers own almost 90% of Uganda's cattle population, making milk production a major source of income for them (MAAIF and UBOS, 2009). 165,997 households (10%) keep improved dairy breeds out of 1.7 million cattle-owning households. The majority (98.4 percent) of the households keeping improved dairy cattle, equivalent to 163,395 households, are found in the eastern, central, and southwestern regions (Arnaoudov et al., 2017). Uganda has a fertile land resource, a favourable environment (low-temperature fluctuations and good rainfall) for milk production, and dairy farmers' willingness to use productivity-enhancing technologies continues to rise in East Africa (Makoni et al., 2014). In Uganda, the livestock sector produces 18 percent of the agricultural GDP, with dairy accounting for 80 percent of the livestock sector's GDP. (Agriterro, 2012). The dairy industry provides food, income, and job to many Ugandans (UBOS, 2017). All across the value chain, the industry employs millions of people. After coffee, dairy has overtaken other traditional export sectors like tea and flowers to become Uganda's third most important export product. Ugandan dairy exports are currently comparable to those of South Africa (Van Campenhout, et al., 2021). In Uganda, dairy production is mostly based on a low-input traditional pasture-based system. As a result, Uganda is one of the lowest-cost milk producers in the world, an advantage that should be capitalized on (Ekou,2014). More so, it is one of the few African countries that has achieved 100 percent milk self-sufficiency, and indeed one of the few countries in the world that produces milk at a low cost (Balikowa,2011). Table 1 showing the milk sheds in Uganda

Table 1: Milk sheds in Uganda

Dairy Data- Milk sheds Contribution to the National Milk Production			
South -Western Uganda	25%	Central Uganda	24%
Mid-Western Uganda	12%	Karamoja	7%
Northern Uganda	11%	Eastern Uganda	21%
TOTAL= 100%			

Source: DDA, 2019

According to the DDA report (2019), the milk sheds in Uganda are Southwestern Uganda contributing 25%, followed by central Uganda contributing 24%, followed by Eastern Uganda contributing 21%, Midwestern Uganda contributing 12% and then Karamoja contributing 7% of the total milk output yearly

This sector is developing at a pace of 8-10 percent every year. This growth rate is even greater in the processed milk category, which is expected to rise at an annual rate of 11% (Agriterria, 2012). Growth is driven by a robust and unfulfilled level of demand for milk products in the country and the region. However, according to the DDA (2019), Ugandans consume 62 litres of milk per capita, well below the World Health Organization's recommendation of 200 litres (WHO). Milk can still be sold on a local market that is still sustainable. There is a need to encourage people to drink more milk rather than replacements such as juice and soda, which is the main reason for milk's low per capita consumption and the market has the potential to consume more milk (Agriterria, 2012; Balikowa, 2011). The Ugandan government has recognized milk as one of ten priority commodities for the agriculture sector's rapid development (Agriterria, 2012). Furthermore, the dairy industry provides one commodity—milk—that is available throughout the year as a source of income for the rural poor, and the dairy industry is already a focus for multiple stakeholders.

2.3 Milk Production

Milk production has been steadily increasing over the years. The country's total milk production has increased from 2.5 billion litres in 2018 to 2.7 billion litres in 2019. (DDA,2019).Table 2 showing Uganda's Milk production (Billion Litres) of the last four years (2015-2019)

Table 2: Milk production growth over the years

Years	2015	2016	2017	2018	2019
Production	2.08	2.20	2.28	2.51	2.7

Source: DDA database

According to Wozemba and Nsanja, (2008), Dairy production in Uganda takes place under any of four systems:

1. Communal grazing. This incorporates pastoral grazing and is common in Uganda's northern and eastern regions, where it is still practiced as part of the culture.
2. Free-range grazing. Cattle are moved to pastureland or grassland, where they are free to graze and drink. In the extensive grasslands of Uganda's southern region, this is a common activity.

3. Fenced/paddock grazing. This involves supplemental feeding and cut-and-carry practice. This is a popular farming strategy in areas where land ownership is restricted. Farmers who raise hybrid and crossbred cattle are the most likely to utilize it.
4. Zero grazing. The animals are confined and feed on concentrate, forage, and water, all delivered to the animal shed or enclosure.

However, Makoni et al., (2014) argue that Uganda has three main milk production systems.

1. pastoral system: This involves farms with more than 50 indigenous cattle that graze on coarse pasture all year and are milked twice a day but do not receive any supplemental feed.
2. Peri-urban small-scale mixed crop and livestock system: This system keeps, on average, less than 10 mixed dairy cow breeds.
3. Commercial dairy farming system: This system keeps 20 to 100 pure and crossbred dairy cows on planted pastures supplemented with grain by-products and oilseed cakes on land that is at least 200 acres in size.

2.4 The Dairy value Chains

In Uganda, there are two types of milk marketing channels: formal and informal. According to estimates, 65 to 70 percent of the milk produced is sold to the market, while the rest is consumed at home (Arnaoudov et al., 2017). Balikowa, (2011) states that the milk that is left on the farm is either consumed by the family, fed to calves, given as a gift, processed into traditional dairy products for home consumption, or spoiled. Approximately 5.8% of farm product is wasted.

2.4.1 Informal Dairy Value chains

Most of the milk marketed and consumed in Uganda is channelled through the informal milk chain. The informal sector deals primarily with the sale of raw milk, the milk is mostly low-quality milk as it is contaminated and adulterated. Moreover, because no value is added to the milk and no taxes are paid, most types of vendors have low overhead expenses, except for transportation to consumers (Arnaoudov et al., 2017).

Ekou, (2014) emphasizes that there are small-scale dairy households' tens of thousands of scattered middlemen trading in milk, and only a handful of dairy processors. The informal milk chain is mostly comprised of middlemen even beyond the reach of DDA operators and they are driven by prices and not quality. This huge and active 'loose' milk segment accounts for up to 90% of all marketed milk, making unprocessed milk the most widely consumed dairy product (Arnaoudov et al., 2017). As a result, any initiatives aimed at boosting productivity throughout the dairy value chain must take this segment into account (Agriterra, 2012). According to Nakiganda, and Rome, (2014) Ugandans consume mainly raw milk from the informal milk market as it is always available at fair prices to low-income earners and middle-class people. Few persons can afford to buy the packaged milk from the formal milk sector. Additionally, the informal sector mainly markets unpasteurized milk because the public Health Act that prohibits its sale is not enforced (Balikowa, 2011). Moreover, many consumers prefer milk from the informal channel because it is full fat, exceeding 3.5 percent butterfat, and there is a trusted relationship between consumers and sellers (FAO, 2017).

There are three tiers of vendors in the informal sector, primary, secondary, and tertiary vendors (Makoni et al., 2014):

- a) The primary vendor buys milk from a farmer and sells it directly to the consumer or to another vendor at roadside pooling centres or to an MCC. Many primary vendors sell their milk to privately operated MCCs or MCCs that supply processors with less strict milk quality requirements than other processors. Primary suppliers do not favour processors in general due to poor purchase prices, a delayed form of payment, and stringent milk quality requirements. However, some MCCs are supplied by a few primary vendors, particularly in areas where private vendors are not active.

- b) Milk is purchased by secondary vendors from roadside milk pooling sites. The milk pooling sites are usually located under a tree, providing shade for the sellers and their milk while they wait for secondary buyers from urban areas, particularly Kampala. Using vans and pick-up trucks, milk is collected in metal cans from various locations until the van is full. The most often used trucks can hold 80 to 120 twenty-litre milk cans.
- c) Tertiary sellers, on the other hand, are found in cities and purchase milk from secondary traders. They boil the milk and sell it at various venues when it's still warm or chilled. After boiling and/or cooling the milk, some secondary vendors offer it to retail outlets. The amount of milk traded in the informal market sector on a nationwide level is difficult to estimate with accuracy.

2.4.2 Milk collection and Transportation in the informal chain

According to Wozemba and Nsanja, (2008) milk collection and transportation in the informal chain is characterized by the following:

- There isn't a well-established milk collection infrastructure in place. Farmers send milk to a "pick-up station" set up by a trader, transporter, or his agent in aluminium cans or plastic jerrycans. A pick-up point is an open area without milk chilling equipment, usually along the roadside.
- During milk reception, there is very little quality control. Before the milk is accepted, simple quality tests such as physical appearance and lactometer reading can be performed. However, in many circumstances, quality checks are not performed, and milk may be approved even if it is adulterated with water or contains physical impurities like straw, hair, manure, or flies.
- Milk is packaged in 50-liter aluminium cans and transported by open pick-up trucks across large distances (up to 400 kilometres) to retail shops in urban areas. Within the milk shed, some of the milk is delivered to processing units.
- Traders most of the time take the milk on credit but in some cases, cash is paid on delivery. Payment is based on the volume of the milk delivered.
- The evening milk is not collected. It is either consumed by the producing household, used to make ghee, or boiled, cooled, stored, and added to the morning milk on the following day.

2.4.3 Formal Dairy Value Chain

The formal chain only takes up to 10%, milk is processed into milk products; these include pasteurized milk, UHT milk (long-life milk), cheese, yogurt, cultured milk, butter, ghee, creams, and ice cream (Agriterra, 2012). A substantial amount of milk and milk products is also imported indicating that the domestic production is not sufficient to meet market demands. Uganda also exports dairy products mainly to the regional market (Wesana et al., 2018). More so, DDA Report, 2020 states that there have been Disruptions of demand during the Covid-19 pandemic which has further affected the dairy value chain.

2.4.4 Milk collection and Transportation in the Formal chain

Due to the poor status of rural feeder roads, lack of infrastructure for rural milk collection and delivery, and poor organization of milk producers in most regions of the nation, market access for smallholders remains a serious concern (Balikowa, 2011). According to Wozemba and Nsanja, (2008), milk collection and transportation in the formal chain is characterized by the following:

- For bulking and transportation of milk, this channel makes use of well-established infrastructure. Farmers deliver milk in aluminum cans to village milk collecting centers (MCC), where it is quickly chilled. The MCC receives both morning and evening milk.
- Before the milk is accepted, it is subjected to standard quality checks. Only aluminum or stainless-steel cans of milk will be accepted. Many MCCs now reject milk delivered in plastic containers.
- The price of milk is determined by the volume delivered, and farmers get Paid after several weeks, if not after months, have passed.

- Chilled milk is delivered from the MCC in 50L milk cans on open pick-up trucks to the Milk Chilling Plant/MCC or to bigger satellite collecting centers, where it is transferred to the dairy processing plant in 10,000-20,000L milk tankers.
- The table below shows the key characteristics of milk in Uganda in the formal and informal chains. As seen in the table milk quality is emphasized in the formal chain unlike in the informal chain where milk is normally adulterated and comminated because there are no standards and measures followed.

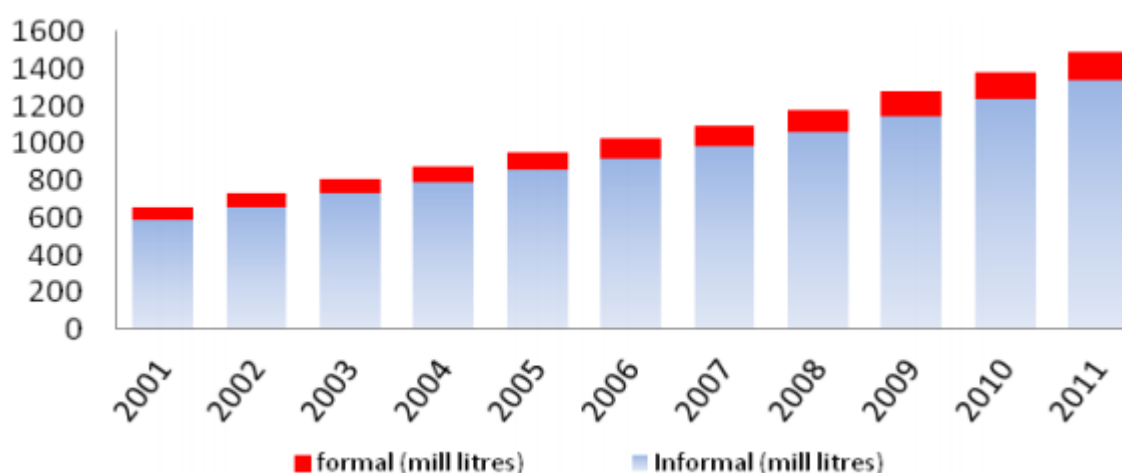
Table 3: showing key characteristics of milk in different value chains

Milk through the Formal chain	Milk through the informal Chain
Raw milk is tested at the farm level to ensure quality	Milk is not usually tested, and quality is not important
Mostly use modern methods to preserve the milk and quality is a very important Aspect.	Often using traditional methods like boiling to preserve the milk
Milk is got from key established suppliers	Milk is got from any source
Establish and maintain contact with suppliers	Mostly have no attachments to suppliers
Mainly deals in processed milk with a longer shelf life.	Mainly deals in raw milk with a very short shelf life.

Source: Wozemba and Nsanja, (2008)

Figure 1 showing milk consumption trends between 2001-2011. Informal vs formal

Figure 1:milk consumption trends. Formal vs informal milk markets



Source: (Agritera,2012)

From figure 1, it is evident that the informal segment outweighs the formal segment as many litres of milk go through the informal as compared to the formal segment.

2.5 Dairy Value Chain stakeholders

The Dairy value chain actors are milk producers/farmers, milk aggregators, transporters, milk buyers/processors, retailers, and consumers. Milk is primarily produced by indigenous and crossbred cattle reared in one of three pasture-based production systems, each with different levels of intensification. The supporters of the Dairy value chain include government bodies i.e. DDA, MAAIF, NAADS, NGOs, and financial institutions.

2.5.1 Input suppliers : (Makoni et al., 2014)

The main input suppliers include:

- Imported genetics, artificial breeding equipment and supplies, frozen bull semen and embryos: ABS TCM (U) Ltd and Worldwide Sires.
- Liquid nitrogen: National Animal Genetic Resource and Database Centre (NAGRC-DB),
- Medical Research Institute (MRI), Mulago Hospital, and Heifer International (HI).
- Bred heifers: Keirungi Farm, private enterprises.
- Dairy equipment -milk cooling and processing, milk cans and bulk transport tanks: Snowman.
- Milk packaging suppliers: Raily Packaging (Mukwano), and Multiple Industries.
- Dairy products cultures: Makerere University.
- Veterinary inputs and vaccines: Coopers, ERAM, Norbrook, MSJ Vet Pharmacy, MTK Uganda Ltd, and Quality Chemicals all sold through local agro-veterinary distributor shops.
- Commercial feed and ingredients: Unga (U) Ltd, Maganjo Millers, Ugachick Ltd, Biyinzika Farmers, and Nsava Feeds.

2.5.2 Milk buyers and processors:

There are thirteen registered processors in the dairy value chain some of the big processors include Sameer Agricultural and Livestock Limited (SALL) formerly the Dairy Corporation Limited (DCL), Pearl Dairies Limited, Jesa Farm Dairies, J.B.K Dairy Products (U) Ltd, and Shumuk Dairy products (U) Ltd. They operate at varying levels of capacity but a combined installed capacity of 821,000 litres per day. (Makoni et al., 2014).

Table 3 showing the capacity of dairy Processors

Table 4: showing the capacity of dairy processors

Company	District	Region	Installed capacity	Utilized capacity	Products
Pearl Dairy farms Ltd	Mbarara	Southwestern	800,000	500,000	Powdered milk, Ghee, butter oil, butter, UHT milk
Amos Dairies	Kiruhura	Southwestern	700,000	190,000	Pasteurized milk, UHT milk, yogurt, ghee, butter, milk powder, bongo, cream.
Jesa Farm Dairy	Wakiso	Central	160,000	150,000	Pasteurized milk, UHT milk, yogurt, cream butter, fermented milk
Lakeside Dairy Ltd	Mbarara	Southwestern	100,000	40,000	Pasteurized milk, UHT milk, ghee, butter
GBK Dairy products Ltd	Mbarara	Southwestern	10,000	40,000	UHT milk, yogurt
Vital Tomasi Dairy	Kiruhura	Southwestern	100,000	2000	Yogurt, UHT milk, pasteurized milk, milk powder.
Birunga Dairy industries Ltd	Kisoro	Southwestern	72,000	48,000	UHT milk, fermented milk, yogurt
Rainbow industries Ltd	Mukono	Central	65,000	55,000	UHT milk, ice-cream, yoghurt, ghee
MADDO Dairies Ltd	Masaka	Central	4,000	2,000	Pasteurized whole milk, flavoured milk, Yoghurt
Hillside Dairy & Agriculture Ltd	Mbarara	Southwestern	40,000	3,000	Pasteurized milk, Yoghurt
Maama Omulungi Dairy	Kampala	Central	8,000	8,000	Pasteurized milk

White Nile Dairies	Jinja	Central	6,000	3,000	Pasteurized milk, Yoghurt, Cream, Ghee
NIRMA Dairy & Foods Ltd	Entebbe	Central	5,000	2,200	Pasteurized milk, Yoghurt, Cheese
Toro Dairy Cooperative Society Ltd.	Fortportal	Southwestern	4,000	2,000	Pasteurized milk, Yoghurt
Paramount Dairies	Mbarara	Southwestern	3,000	2,500	Cheese
Family's choice	Mbarara	Southwestern	2,000	1,200	Yogurt, Pasteurized Milk, Sour Butter, Ghee
Seasons Dairy	Kayunga	Central	5,000	4,000	Cheese

Source : (DDA report 2018, Mbowa, 2019, Agriterra, 2012)

Most factories operate significantly below capacity- however, there is an increasing trend in capacity utilization –now at about 68 percent (Agriterra, 2012). Table 5 showing the largest milk exporters (Processors) in Uganda

Table 5:showing milk exporters

Company	Export value (million USD)	Share in total	Exports to	Products
Pearl Dairy farmers Ltd	55	42	COMESA countries, West Africa, India, Nepal, UAE	Milk powder
Brookside Ltd	25	20	Indian Ocean Islands, East Africa, Rwanda, Burundi	UHT milk
Birunga dairies industries	18	14	DRC, Rwanda, Burundi	UHT milk
Jesa farm dairy Ltd	15	11	Kenya	ESL(extended self-life) milk
Amos	17	13	US	Caseine
Total	130	100		

Source : (Van Campenhout, et al., 2021, DDA)

Pearl Dairies, Brookside Ltd, Birunga Dairies industries, Jesa Farm Dairy limited, and Amos dairies are the milk processing giants and largest milk exporters in Uganda as seen in table 5. There is a market for milk exports but is constrained by the low level of milk supply. Only 12 million litres of UHT- the primary milk export products are registered, amounting to only 10 percent of all processed milk. The main regional export markets are Kenya, the Democratic Republic of Congo, Southern Sudan, and Tanzania. Sameer Agricultural and Livestock Limited (SALL), the nation's biggest milk processor, claims to have existing markets in 17 countries but is limited in its ability to serve these markets due to a lack of milk supply. All of Uganda's borders are open to informal export trading (Agriterra, 2012).

Small processors/cottage industry: Although there are many small-scale/cottage milk processors, the DDA only registers and licenses 35. The actual number of these actors is unknown because many of them work in the "backyard" and are hence not licensed by the DDA (DDA, 2019).

2.5.3 Government Parastatal institutions and regulators:

The government bodies include:

- Dairy Development Authority (DDA)
- National Agricultural Advisory Service (NAADS)

- National Agricultural Research Organization (NARO)
- Ministry of Agriculture Animal Industry and Fisheries (MAAIF)
- Directorate of Animal Resources
- Ugandan Public Animal Health Service.
- Dairy training and extension in animal health,
- National Animal Genetic Resource and Database Centre (NAGRC-DB).

Other support agencies:

These include agencies giving support to the dairy industry in the form of financial services, advocacy, advisory services, etc. They include civil-society organizations supporting rural development in the agricultural sector, public sector organizations such as universities, and private organizations offering services such as feed and veterinary laboratories (Agriterra, 2012; Makoni et al., 2013).

2.6 Value chain Governance

A robust value chain integration is described as “efficient and trustful interactions between different Value Chain partners that reduce transaction costs and risks for enhancing product quality and safety and reinforcing sustainability (Rademaker et al., 2016)

Reliable institutional governance refers to public-private cooperation, co-innovation, and a public economic policy framework that supports private investment and enhances opportunities for (inter)national trade (Rademaker et al., 2016)

Resilient innovation support system involves research, Training and extension, and business development services engaged in the dairy sector. It entails interacting with the supply chain as well as policy and regulatory actors to support dynamic and continuous technical, institutional, and social innovation in the sector, including technology development, new institutional arrangements and partnerships, processing and product development, and marketing (Rademaker et al., 2016).

It also involves mechanisms to improve coordination amongst dairy value chain actors. i.e. the government, farmer organizations, the private sector, and NGOs need to come together to coordinate issues to do with the dairy development in the region. (Makoni et al., 2014)

2.6.1 Governance trends

Regulation of the dairy industry is the responsibility of the Ministry of Agriculture, Animal Industry & Fisheries (MAAIF), but it is spearheaded through the semiautonomous agency the Dairy Development Authority (DDA). DDA has a mandate to regulate, coordinate, and harmonize the liberalized sector to achieve and maintain self-sufficiency in milk production and dairy products (DDA, 2020)

Several statutes have since been promulgated under the act to facilitate its regulatory functions and, since then, it has been particularly active in enforcing milk hygiene standards and quality control. It now requires all milk traders to be licensed to meet minimum public health and milk quality standards and provides training in these areas. The Dairy Development Authority (DDA) has been closely involved in the facilitation, formation, and operations of grassroots associations, dairy cooperatives and in developing the capacity of their members (Agriterra,2012).

It also continues to work with UDISA, UCCCU, CUDFCFU, UNDATA, and UDPA in sensitizing producers and processors to the need to improve the quality of milk and milk products on the market. Even though the Authority is primarily supported by the government and is responsible for implementing government dairy policy, its governing board includes representatives from the farming, processing, and informal sectors (Agriterra,2012). The Authority also carries out market surveillance activities to ensure that the milk and milk products on the market meet the dairy standards and regulations. This is one of the ways of ensuring the safety of the milk and milk products being traded (DDA,2019). According to Agriterra,2012 Dairy farmers have been progressively teaming together, first in

associations, and then in dairy cooperatives to gain a common voice and vertical marketing integration (Agriterra, 2012)

Governance is mainly seen in the formal milk chain, as milk is collected at the cooperative or private milk collection centres and transported to processing plants. Milk quality tests are performed on delivery of the milk, thereby assuring the quality of milk. This has encouraged the producers to improve the hygiene conditions, storage, and transportation of the milk to avoid rejection of the product on delivery to the collection centre (FOA,2017).

DDA registers and inspects all facilities and equipment used to handle, process, and market milk and milk products throughout the country to ease the enforcement and monitoring of standards and quality. Only those operators whose facilities and equipment meet the basic requirements are granted operating permits. The registration of new operators is done regularly (Balikowa,2011). DDA also encourages dairy processors and traders to receive training in Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Points (HACCP), and ISO certification standards. DDA, on behalf of the government, restricted the use of specific receptacles/equipment to handle/transport milk, including plastic jerrycans, to improve quality in the dairy chain (Balikowa,2011)

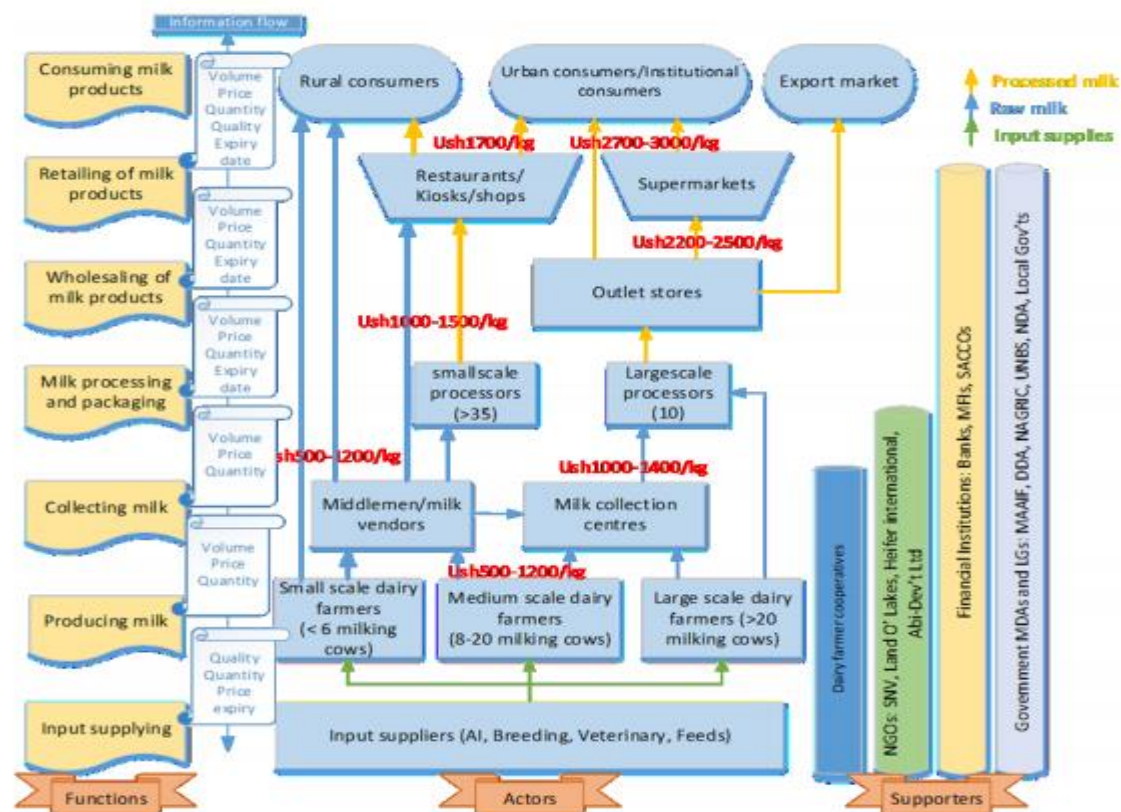
2.6.2 Dairy Cooperatives and Associations

The Dairy Development Authority, in conjunction with NGOs, continues to support and assist the development and registration of member-based organizations of dairy stakeholders at all levels, from grassroots to national. In various sections of the country, there are numerous dairy farmers, milk traders, and processor organizations. Dairy farmers are organized into self-help groups. The sub-county and district local administrations are responsible for registering the associations and self-help organizations. The central region has about 54 active cooperative groups and about 46 dormant cooperative groups (Balikowa,2011).

Associations of dairy processors and traders, the Uganda Dairy Processors' Association (UDPA) is the country's dairy processors' association. (UDPA) was founded in 2003 with the help of Land O' Lakes and the Dairy Development Authority. The Association was incorporated as a company limited by guarantee with no share capital under the Companies Act (Cap 85). UDPA mobilizes and recruits members, they include large dairy processing companies and small and medium milk processors as well as those involved in marketing(traders) (Balikowa, 2011)

The Uganda National Dairy Traders Association (UNDATA), which was founded in 1999 with help from the Uganda National Chamber of Commerce, brings together milk traders in Uganda. Individuals and organizations involved in the milk and dairy product trade, including transporters, small-scale processors, cooler operators, farmers, and vendors. UNDATA's objective is to "promote, preserve, and improve the collecting, transportation, and marketing of high-quality milk and milk products in Uganda and abroad through dairy trade and business operations and management." Milk traders can work together to address limits and obstacles in their milk marketing company by joining forces. Their urban milk sales outlets and the rural milk collection centres are registered and regularly inspected by Officials of the Dairy Development Authority to ensure compliance with the set guidelines for milk handling premises. Their milk handling workers undergo a regular medical examination and have been trained by DDA on milk quality and handling, customer care, and record keeping. Each of the milk collecting centres and retail sales outlets has an annual registration cost that the traders pay. DDA inspects and certifies their road tankers regularly. (Balikowa, 2011). Figure 2 showing the central region dairy chain map.

Figure 2: value chain map of the central region



Source: (Kiiza et., al,2020)

2.7 Value shares

Table 6 showing volumes of sales and value shares of farmers, traders, and milk collection centres in the central region.

Table 6: showing value shares of farmers, traders, and milk collection centres

	Litres	Shares
Farmers		
Traders	40L	47.6%
Transporters	15L	17.9%
Milk collection centres	18L	21.4%
Neighbours	10L	11.9%
Milk shops	2L	2.4%
	85L	
Traders and transporters		

Milk collection centres	48L	87.3%
Milk shops	3L	5.4%
Processors	3L	5.4%
Neighbours	1L	1.8%
	55L	
Milk Collection centres		
Processors	46L	69.7%
Large traders	6L	9.1%
Neighbours	14L	21.2%
	66L	

Source : (Van Campenhout, et al., 2021)

According to table 5, an average farmer in the central milk region sells about 85 litres of milk per week, 40 litres (47%) are sold to traders. Farmers also sell to collection centres either directly 18 litres, (21%) market share or by contracting a transporter to take the milk from the farm-gate to the milk collection centre 15 litres or about 18 %. Finally, about 10 litres (11%) of all the milk marketed is sold directly to neighbours.

It is estimated that traders and transporters procure 55 litres in the central Region, they exclusively ship to milk collection centres (48 litres, amounting to 87.3% of milk procured). The remaining 7 litres are shared between processors (3liters), milk shops (3 litres), and direct sales to villagers (1litre).

Interestingly, milk collection centres are important to sustain local milk consumption, as 21% of the milk is sold directly to neighbours (14 litres), they also sell to traders, this is relatively less important as only 6 litres or about 9% of total milk sold by the milk collection centre. Finally, the biggest percentage (69%) is sold to milk processors in the region through milk collection centres. (Van Campenhout, et al., 2021).

2.8 The MADDO Dairy Limited Value chain

Input supplying, milk production, milk collection and bulking, milk processing, trade, and consumption are all part of the dairy value chain. In greater Masaka where MADDO Dairies is embedded, the dairy value chain is made up of actors, supporters, and influencers who are active in various activities and at various levels of the value chain. The actors include input suppliers, milk producers, milk collection and bulking enterprises, processors, traders, and consumers, and the supporters in this chain are indirectly involved in the chain but influence the chain. These include NGOs, Government bodies, extensionists, researchers, and financial institutions (KIT, 2006). Table 7 shows the different stakeholders in MADDO Dairies dairy value chain highlighting their roles and interests.

2.8.1 Stakeholders Matrix

Table 7: Stakeholders and their roles and/or interests in the MADDO Dairies value chain dairy:

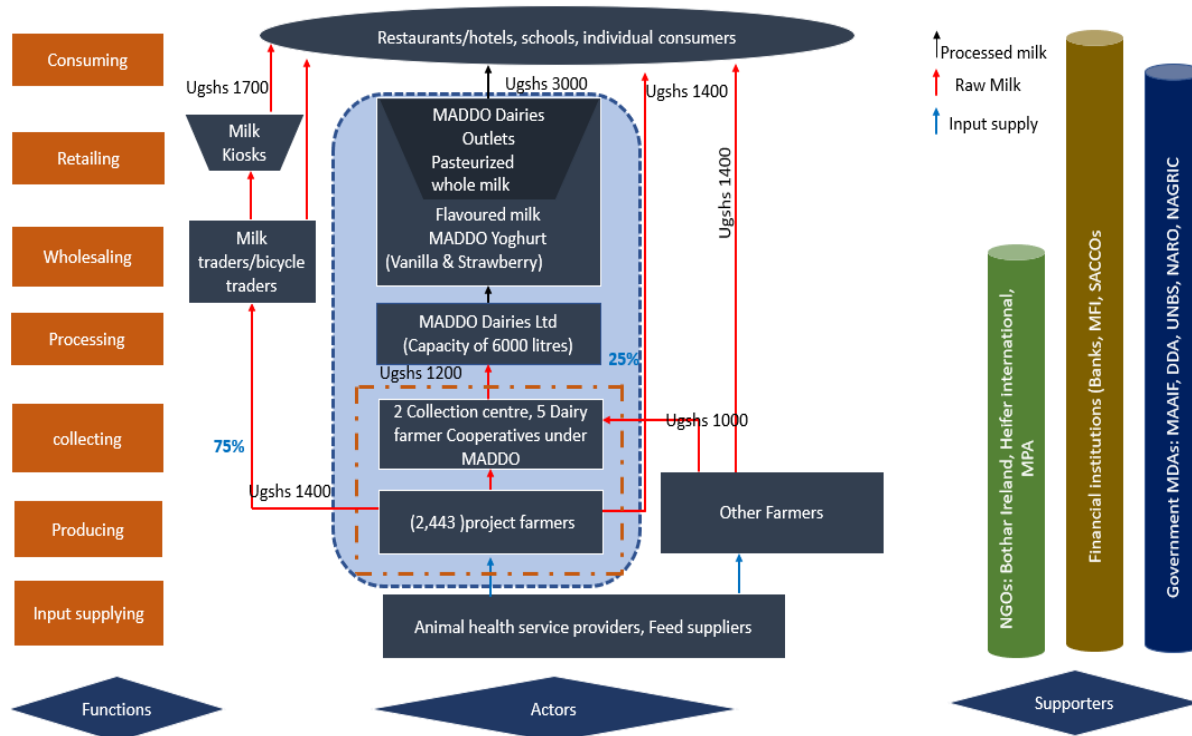
Table 7: Stakeholder's matrix

Name of stakeholders	Role/ interest
Actors	
Input suppliers	Provide farm inputs to the small-scale, medium, and large-scale Farmers. The farm inputs include-Animal feeds, Mineral Supplements, Veterinary drugs, chemicals, and farm equipment.
Producers	90% are smallholder farmers who Keep dairy cattle, produce milk, and sell it to Cooperatives and milk traders and to consumers.
Cooperatives	The smallholder farmers are organized in 5 cooperatives under MADDO Dairies Limited. They Collect milk in bulk at two collection centres in Kirimya and Lwabenge- Bukomansimbi each with a capacity of 3000 litres and later taken to processors and sometimes sell directly to traders and consumers.
MADDO Dairies Limited	Process and add value to milk. The processed milk products include pasteurized milk, whole milk flavoured milk, yogurt, before selling to consumers through their outlets.
MADDO Dairies Ltd outlets	The outlets sell the processed milk products in bulk and in small quantities to end consumers.
Consumers	Institutional consumers include schools, hospitals, restaurants, hotels, and individual consumers.
Supporters	
Role /interest	
Government Bodies	
Dairy Development Authority (DDA)	Regulate, coordinate, and harmonize the liberalizes sector to achieve and maintain self-sufficiency in milk production and dairy products
National Animal Genetic Resources Centre and Data Bank	promotion, regulation, and control of import, export, and market Animal genetic material including quality assurance.
National Agricultural Advisory Services (NAAS)	implement from funded to private sector agricultural advisory and extension services
National Agricultural Research Organization (NARO)	Conduct research and development. Also train human resources in animal husbandry, health, nutrition, extension, and milk processing.
Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)	It is responsible for the regulation of the dairy industry, national Policy Development Policy formulation, and review; Facilitate implementation of policies to create an enabling environment for other stakeholders to operate; Provision of extension and

	advisory services to other stakeholders; Research and development; Funding of various projects.
National Bureau of Standards (UNBS)	Develop and promote standards, undertake quality assurance, laboratory testing, and metrology of milk products to fit quality standards through Product standardization and certification.
Local Government	Facilitate implementation of policies to create an enabling environment for other stakeholders to operate; Provision of extension and advisory services to other stakeholders; research and development; funding of various projects; coordination of dairy and veterinary activities at the county level.
Uganda National Dairy Traders' Association (UNDATA)	Lobby on regulators and policymakers on behalf of traders. Also assists DDA in performing inspections of adulterated and contaminated milk and supports DDA in the enforcement of various regulations.
NGOs	
Heifer Project International	Boost animal husbandry in an integrated approach. Very many farmers are trained and given heifers to boost dairy in the region and extension services and participated in the establishment of MADDO Dairies.
Bothar Ireland	Participated in the establishment of MADDO Dairies and also involved in providing heifers to smallholder farmers and extension services.
MPA	Extend living loans to farmers to finance cow projects through Caritas MADDO and facilitate dairy production in the region.

2.8.2 MADDO Dairies limited- Greater Masaka Chain map

Figure 3: MADDO Dairies chain map- greater Masaka region



Source: Author

2.8.3 Producers

These are the most important players in the dairy business, with most smallholder farmers relying on milk sales as their primary and frequently sole source of income. An average herd size in this region is 26-31 cows and most farmers have adapted to the improved breeds (Van Campenhout, et al., 2021). They produce for their consumption, but also sell significant amounts of milk. Often, these are small producers that reside in rural areas.

2.8.4 Transport chain actors

These include the bicycle traders, the collection/bulking point trader, and the insulated milk tanker operators, kiosks, Dairy shops, supermarkets. (Arnaoudov et., 2017). According to Makoni et al. (2014), milk transportation remains varied from deliveries by foot, bicycle, motorcycle, trucks, and insulated bulk tankers. Daily, small traders and transporters collect milk at the farm gate in communities and deliver it to milk collection centres on bicycles, motorcycles, or, on rare occasions, a pick-up truck and also sell directly to kiosks and consumers (Van Campenhout, et al., 2021). These traders purchase the milk and transport it sometimes over long distances to the collection points some of which have cooling facilities. These actors have good relationships with the farmers and this relationship facilitates some form of value chain financing- as the farmers are able- but rarely willing- to provide the milk on credit in the morning and be paid later by the traders after they have sold the milk to the collection centres or household consumers (Agriterria, 2012).

2.8.5 Cooperatives/ Milk collection centres

Van Campenhout, et al., (2021) states that Milk collection centres play a significant role in value chain upgrading. They assist processors in obtaining the quantity of high-quality milk required to compete in today's global and local markets. Simultaneously, they provide a dependable outlet for producers (either directly or indirectly through middlemen). These centres often appear to accomplish more than bulking and chilling milk. They also offer a variety of services to farmers to enable and sustain more upstream advancements. Milk collecting facilities, for example, can assist farmers with medications and vaccinations, allowing them to adopt improved cross-bred cows that produce more milk. Importantly these collection centres are for enhancing quality assurance. Agriterra, (2012) further states that farmer organizations under associations and cooperatives are an important feature for highly successful milk value chains. Farmers are organized into a well-structured cooperative union and registered, making it simpler for them to not only access a good market for their milk but also to receive adequate support from national and international development players.

2.9 SWOT Analysis

The dairy sector in the greater Masaka region has very high prospects, though there are limiting forces. Looking at it through the SWOT lenses, table 8 shows the strength, weaknesses, opportunities, and threats of the dairy sector.

Table 8 showing the strength, weaknesses, opportunities, and threats of the dairy sector.

Table 8: showing SWOT

STRENGTH	WEAKNESSES
• Dairy producers and processors have a good working relationship. • There are a lot of dairy farmers. • The potential for high-yielding milk with a fat content of 4.2 percent. • Farmer organizations that have aided in the development of milk collection systems	• Insufficient farm labour • Slow adaptation to improved technologies. • Insufficient capital for investment • High cost of finance • High production cost • Seasonality of production • Poor marketing and advertisement • inadequate of market information and linkages
OPPORTUNITIES	THREATS
• The growing population, which is now anticipated to be around 38 million people, provides ready markets. • Due to insufficient milk supply in Kenya, Rwanda, Tanzania, and Southern Sudan, these markets have considerable market potential. • Expansion of the local market and access to formal chain • The economy of the country is expanding, creating a favourable climate for dairy production and commercialization	• Inadequate infrastructure has an impact on marketing and service delivery. • The population's low purchasing power is because of low income and poverty. • Farmers are vulnerable to exploitation along the value chain due to unregulated markets. • Credit costs are high, and present rates are unfavourable to dairy production because of the long turnaround time.

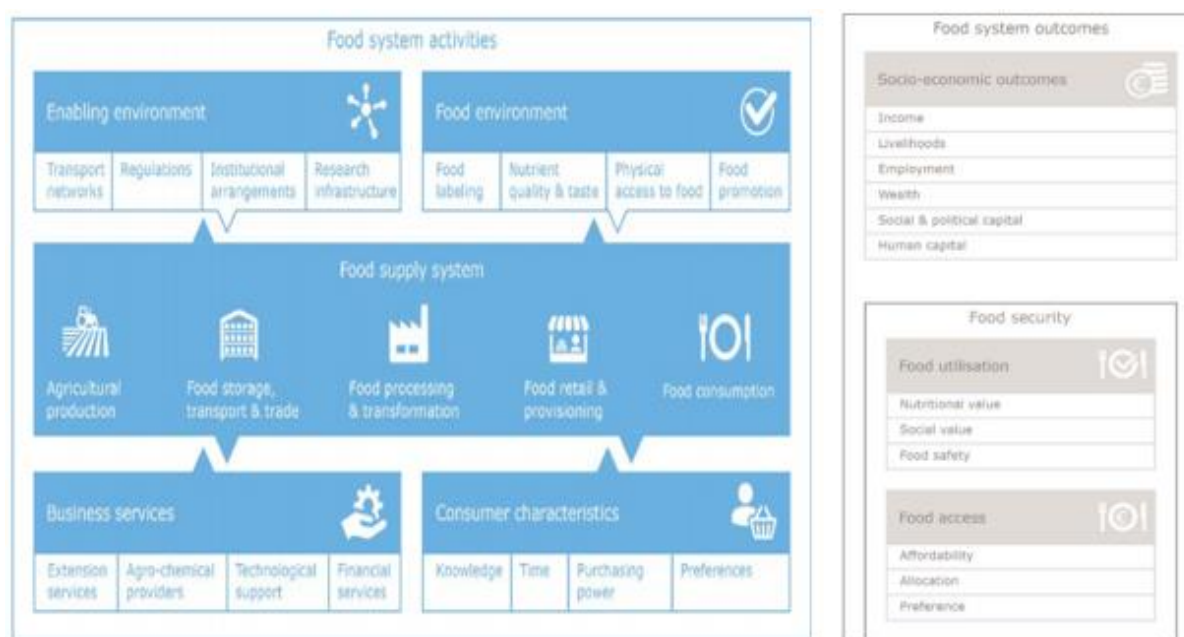
- Dairy organizations and businesses could readily promote more favourable trading policies and practices.
- Associations of dairy processors are present (Uganda Dairy Processors Association)
- Existence of a strong regulatory and legal structure, such as the Uganda National Bureau of Standards and the Dairy Development Authority.
- Internal and regional conflicts/civil wars.
- Epidemics
- Export resistance and rejection
- Alternative beverages such as black tea/coffee and juices from imported concentrates

Source : (Makoni et al., 2014), (Abdulsamad & Gereffi, 2016)

2.10 Food systems in the Greater Masaka Region

Food systems comprise all the processes associated with food production and food utilization: growing, harvesting, packing, processing, transporting, marketing, consuming, and disposing of food remains. All these activities require inputs and result in products and/or services, income, and access to food, as well as environmental impacts (Van Berkum et al. 2018). According to Westhoek et al., (2016) food system is influenced by social, political, cultural, technological, economic, and natural environments. These food system activities have an impact on socio-economic outcomes (such as income and employment) as well as environmental and food security outcomes (defined as the use of, access to, and availability of food). These three outcomes are closely linked for example, certain socioeconomic outcomes such as income can increase food availability, and better food utilization (e.g., reducing food waste) could have a positive environmental impact because it can lead to less intensive land use (Van Berkum et al., 2018) additionally, rural food systems are increasingly impaired by various driving factors. The important drivers affecting these food systems include increasing pressure on the natural production resources land and water and climate change (Henk Westhoek et al., 2016). Figure 4 shows the food system relationships and outcomes

Figure 4: showing food systems activities and outcomes



Source: (Van Berkum et al., 2018)

As seen in figure 4, food system activities contribute to outcomes at the socio-economic level (such as income and work), and in the areas of the environment and food security which involves defined the use of, access to, and availability of food. These three outcomes interact with one another. The food system activities consist of five components: the food supply system (the value chain), the enabling environment, business services, the food environment, and consumer characteristics.

The value chain is the heart of the food supply system, value is added in each step of the chain, from production, storage and transport, and processing, to retail and consumption. Agricultural production has traditionally been at the centre of the food supply system, given that 50% of the world's labour force works in that sector (ILO, 2015). In terms of added value, the emphasis of production chain activities is increasingly shifting to transport, processing, or retail (Van Berkum et al., 2018). The food supply system is embedded in an enabling environment that creates the conditions in which the system functions. Transport, regulation, institutions, and research infrastructure are part of this environment. Business services, while not at the heart of the value chain, provide services and goods to the actors in the chain. This can involve training, agricultural inputs, technical support, or financial services. Just as the enabling environment and business services support the production, transport, and processing industry, there are also two system support components at the retail and consumer level: the food environment and consumer characteristics. The characteristics of consumers can be categorized through their knowledge, available time, resources (purchasing power), age, sex, culture, religion, and therefore develop certain preferences that influence their food choices. (Van Berkum et al., 2018)

2.11 Gender in the value chain

Dairy production provides women with a regular daily income source, important to household food security and family wellbeing (FOA,2017). Gender empowerment is being emphasized in the chain, many women are being supported through NGOs and government efforts to own pure dairy breeds managed on zero-grazing units (Agriterria,2012). FOA,2017 states that Women are most of the time responsible for activities carried out at or near the home, activities required for the day-to-day care of animals, and storing, processing, and adding value to livestock products, while men are more often responsible for activities outside the home.

FOA, (2017) further argues that women do not access extension services and technology adaptation training due to restrictions in their mobility and other household responsibilities and therefore have limited knowledge of branding dairy cows, hygiene and sanitation, and quality milk production. They also lack appropriate equipment such as containers for milking, storing, and transporting milk to collection points and consequent loss of milk.

2.12 Business Canvas Model

This business model describes the way an organization creates, delivers, and captures the value of a particular sector.

The Canvas business model is a strategic management template for creating new business models or documenting old ones. It includes sections that describe a company's activities, partners, value proposition, revenue channels, critical resources, customer segments, and costs. Formal business descriptions serve as the foundation for the company's operations (Osterwalder et., 2009) With this business model design template, MADD0 Dairies Ltd 's business model can easily be described as see in figure 5.

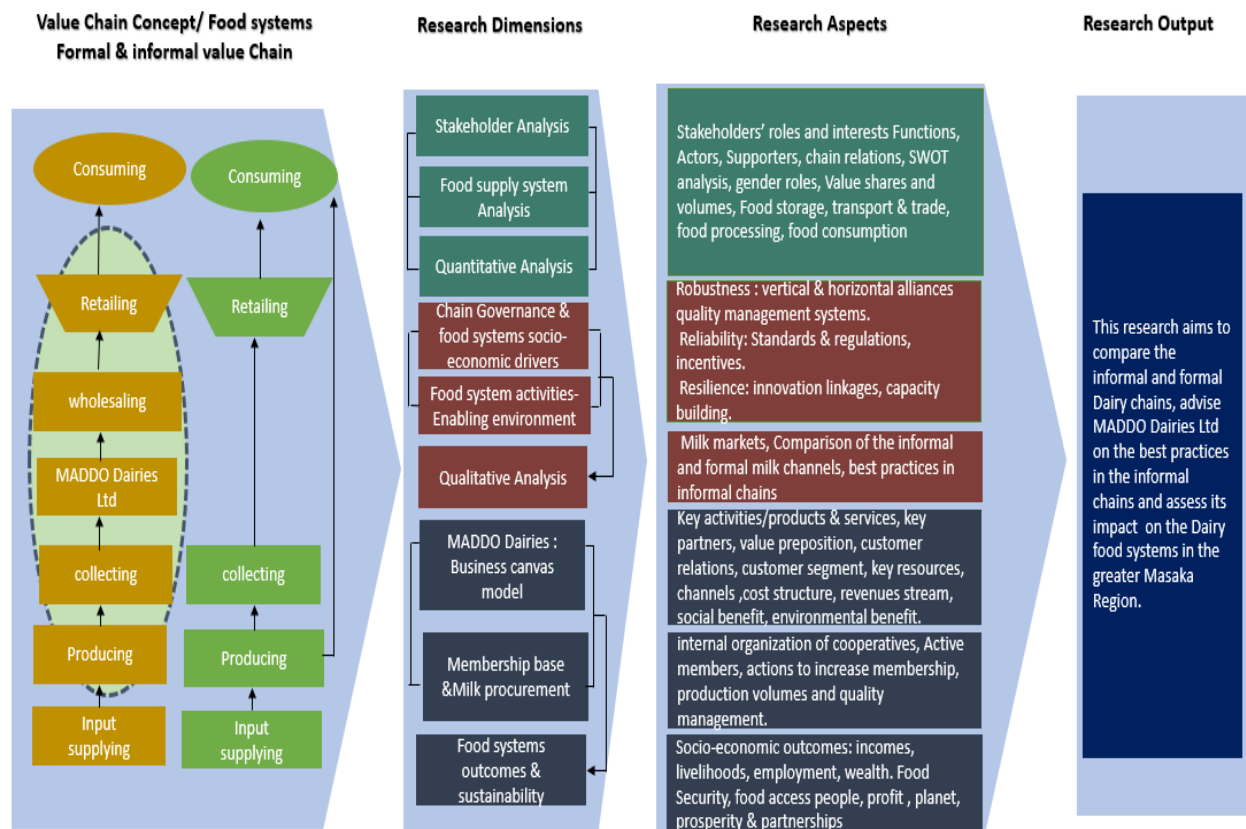
Figure 5: showing the Business Canvas Model structure



Source: (Osterwalder et., 2009)

2.13 Conceptual framework

Figure 6: Conceptual framework



Source: Author

2.12.1 Definition of Main concepts

A value chain: Refers to the full range of activities that are required to bring a product (or a service) from conception, through the different phases of production, to final consumers and disposal thereafter (Kaplinsky and Morris 2001). Further, a value chain exists when all the stakeholders in the chain operate in a way to maximize the generation value along the chain (Tschumi et al., 2008). In a value chain, each of the actors is prepared to invest in the chain and to support the other actors, to make sure that it functions smoothly. All actors benefit from having a smooth supply of a top-quality product arriving on the consumers' table (KIT et al, 2006).

Value chain Upgrading is acquiring technological, institutional, and market capabilities that allow firms (or communities) to improve their competitiveness and move into higher-value activities (de Ruijter de Wildt et al. 2006).

Formal dairy chain: The formal distribution channel can be defined as the flow of milk that falls within the local business regulatory network and is under the regulatory radar (FOA,2017)

Informal dairy chain: The informal sector consists of all goods and services that are not part of the formal handling of milk (FOA,2017). This is the opposite of the formal chain; the farmers are most of the time not organized and deal in the sale of raw milk/ unprocessed milk. It is mainly characterized by bicycle traders, there are no regulations or rules put in place resulting in food safety concerns.

Chain Actors: Are those involved in producing, processing, trading, or consuming a particular agricultural product. They include direct actors who are commercially involved in the chain (producers, traders, retailers, consumers) and indirect actors who provide financial or non-financial support services, such as bankers and credit agencies, business service providers, government, researchers, and extension workers (KIT et al.,2006).

Value chain analysis: Involves the use of the value chain concept to; identify key actors in and show their relationships in the chain, trace product flows, show value additions at different stages, identify enterprises that contribute to production, services, and required institutional support.

The food system is comprised of activities whose primary aim is to increase food security. These activities in the food system encompass not only activities within the value chain, but also service organizations (business services) and the 'enabling environment' (e.g., food safety regulations). Several factors that influence activities at the consumer level are also included: the food environment and the characteristics of (individual) consumers, both of which determine the consumer's relationship to food (Van Berkum et al. 2018)

Food systems outcomes are activities in terms of food security (including nutrition), socioeconomics (income, employment), and the environment (biodiversity, climate) (Van Berkum et al. 2018)

Chapter 3: Methodology

This chapter outlines information about the study area, research design, and tools for data collection and analysis, and stipulates the data sources for different research questions.

3.1 Study Area Description

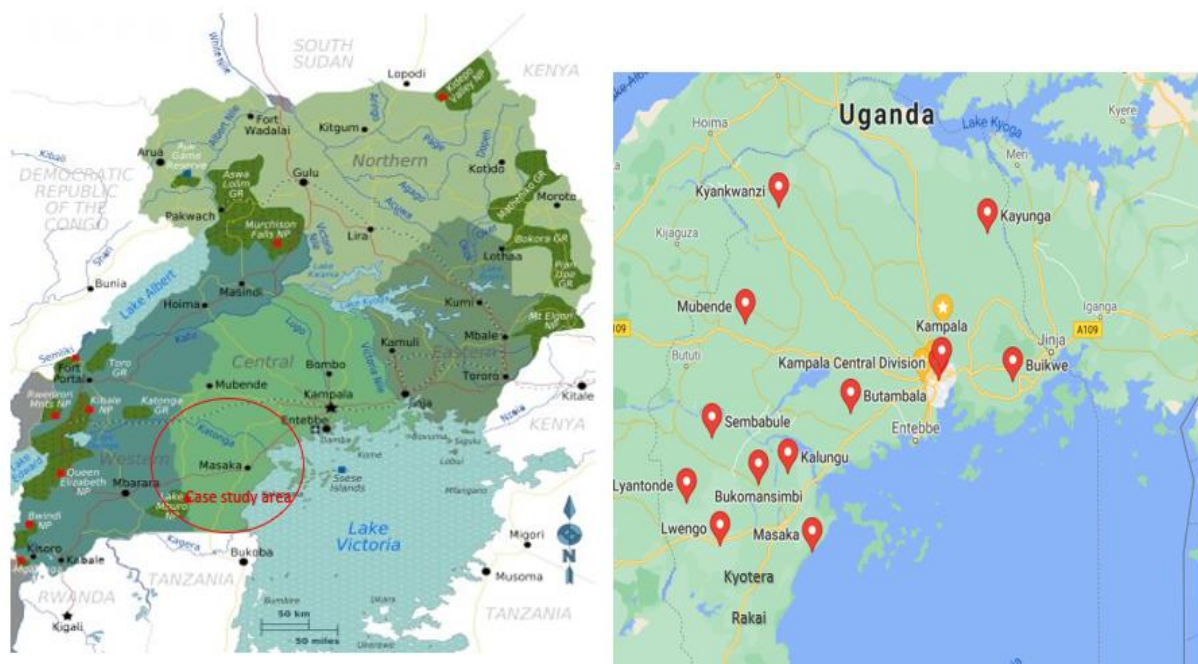
The proposed research was carried out in the greater Masaka region in Uganda which is composed of 8 districts. i.e., Masaka, Rakai, Kalungu, Lwengo, Bukomansimbi, Kyotera, Lyantonde and Ssembabule. It is in these 8 Greater Masaka districts of the Central Uganda food system that the MADDO dairy value chain is embedded as seen in figure 7.

The greater Masaka region is approximately 37 kilometres south of the equator and lies between 00-25 south and 340 east, with an average altitude of 1150 meters above sea level. This region covers a total area of 1603.3 square kilometres, including 803.5 square kilometres of land. This region covers a total area of 1603.3 square kilometres, of which 801.5 square kilometres are open water, marshes, and marshlands, and 308.3 hectares are under cultivation. The whole gazette forest estate is around 8905.6 hectares, or 6.38 percent of the district's total land area. Along the lakeshores, there are a few scattered natural forests. The topography and landscape are generally rolling and undulating, with vertical gully heads and valley bottom swamps, as well as streams that run into lakes and rivers. Most parts of the district are dotted with the hills.

Climatic conditions

The Climate of the greater Masaka region is tropical, being modified by relief and nearness to Lake Victoria. The rainfall pattern is bimodal having two seasons with dry spells between July and August, and January to March. The months of March, April, and May receive very heavy and well-distributed rains of up to 1,200mm. The second season occurs from September to December. Except for a few years of declining trend in precipitation, the annual average rainfall received is between 1100mm – 1200mm with 100 – 110 rainy days. The average maximum temperature does not exceed 300 C and the minimum not below 100 C with almost equal length of day and night throughout the year. The humidity level is generally low throughout the district with the exception of lakeshore areas where it tends to rise.

Figure 7: showing case study area



Source: Google maps

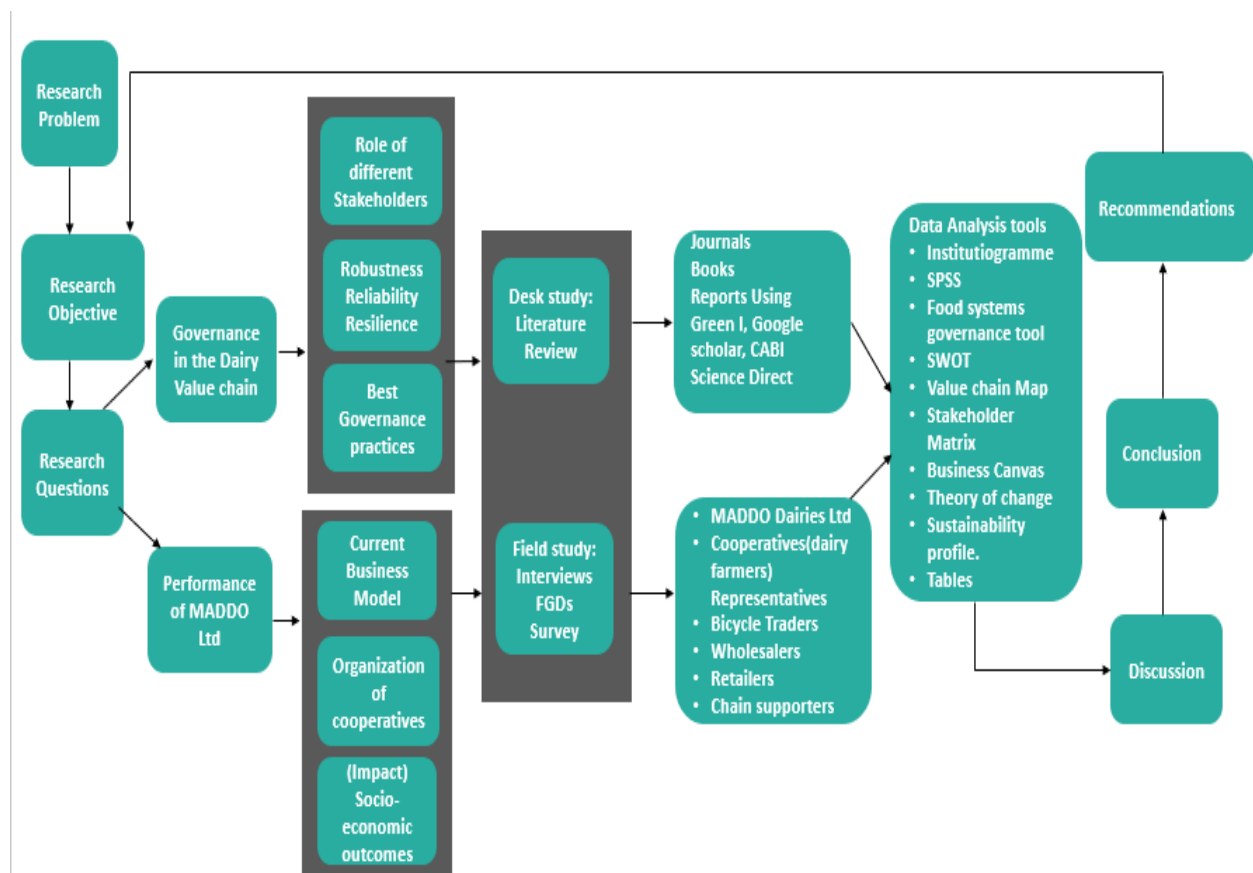
3.2 Research strategy and Design

This research aimed to compare the informal and formal Dairy chains, assess MADDO Dairies Ltd.'s impact on the Dairy food systems, advise it on the best practices in the informal chains and chain upgrading strategies. The study involved several chain actors: dairy farmers, traders/ transporters, milk collection centres attendants, a milk processor (MADDO Dairies Ltd and milk wholesalers and retailers. It also involved several dairy value chain supporters such as the district local government, NGOs, and financial institutions. The research strategies adopted in the study included a desk study, Key informant interviews, focus group discussions to collect qualitative data, and a survey was later adopted to collect quantitative information but was not initially part of the strategy. This study involved a research assistant who was on the ground in the greater Masaka region given the fact that I could not travel back home to conduct this research personally. The interviews and focus group discussions were conducted online via zoom. Matters regarding this study became more unfavourable when the government of Uganda announced a lockdown with restrictive measures on inter-district movement. Travel permits had to be secured and with the help of the local leaders in the region, this study was successfully done.

3.3 Research Framework

As seen in figure 8, this study was conducted using the desk study using literature review from sources: green I, google scholar, CABI, science Direct among others, and the field study included semi-structured interviews, Focus group discussions and a survey. The collected data was then processed and analyzed then a discussion of the results will be formulated which will lead to a conclusion and recommendations

Figure 8: showing research framework



Source: Author

3.4 Data collection:

3.4.1 Desk Study

Desk research was carried out to gather supportive information on the research concept, dimensions, and aspects from existing literature. The information sought included value chain analysis, dairy value chains in Uganda, both formal and informal chains, food systems, dairy value chain upgrading strategies, and creating sustainable food systems. Additionally, I looked out for information from other countries and also literature from other giant milk processors in the region like Brookside, Jesa with similar experiences like MADDO Dairies to be able to up credible solutions and recommendations that would support the research findings hence fill the knowledge gap. Sources of data for the desk study were articles in journals, books, and publications from research databases like Green I, google scholar, CABI, Science Direct. Additionally, other secondary information was obtained from; Uganda Government publications (MAAIF and UBOS), FAO (official publications), NGO databases (USAID, Agriterra, SNV). The secondary data provided supportive evidence and justification to the solutions sought by the research questions.

3.5.2 Field Study-Focus Group Discussions

Focus group discussions were used to address the research questions because the respondents were organized in farmer groups and associations. 3 FGDs were conducted with dairy farmers in the region and one with the milk traders. The FGDs were conducted with the help of a research assistant online. Through Zoom meetings, I was able to engage and interact with the participants on matters that were to be discussed in this study. The meetings were conducted in the local language which I could speak. The Participants were allowed to brainstorm on each question until there was a common agreement on the issue under discussion. Words such as 'why' and 'how' were used to stimulate participants for detailed discussions on important arguments. The meetings were recorded, and notes were taken during the discussions. During the planning of this study, I had anticipated that public gathering would be hard, I had therefore planned to have the FGDs in an open environment where the participants could manage to keep 1.5 metres distance and have their face masks on to avoid the easy spread of covid 19. With the help of the research assistant, this went as planned. Through group leaders, farmers were invited to the meetings and each meeting had a maximum of 12 members who maintained social distance and only removed the mask when they were going to speak. There were network interruptions, but the meetings could continue with the help of the research assistant because they were being recorded and there was a checklist in place to guide the meetings, and after the network had stabilized, I would take over and conduct discussions with the FGD participants.

3.5.3 Interviews

Interview checklists were used to gather data from KIIs. These were mainly tailored for KII based on participants' type of activities in the dairy value chain i.e. production, bulking/transporting, processing, wholesaling/retailing, extension, regulation to mention but a few, however, the checklist structure maintained a similar pattern of questions. I worked with a research assistant and the engagements with the KIIs were on zoom where I was able to interact with them, the meetings were recorded, and notes were taken during the meetings. The key informant interviews went as anticipated because the research assistant approached the interviews in their hometown and set up a Zoom appointment with me so that I could physically engage them. However, because this place is in a village setting, there were network troubles, so I had to wait until the network stabilized before continuing with the interviews.

3.5.4 Survey

A survey was adopted later to quantify data regarding the gender of respondents, age, the number of cows kept, litres of milk produce /day /cow, and other related information. At the beginning of the study, I had not planned to use a survey as a data collection tool initially but later because of time limitations given the curfew hours since this study was conducted during a lockdown, and the farmers would not explicitly answer quantitative information in the study, I engaged a second research assistant to collect the numerical data as the FGD was being held. A questionnaire was used and was administered to 30 farmers that attended different FDGs. The questionnaires were filled with the help of a research assistant because most of the farmers could not read and write English and needed help to interpret the information and answer the questionnaire appropriately.

3.6 Sample size and target population

purposive sampling was used to select the size and target group. Table 9 explicitly shows the participants engaged in this study.

Table 9: showing the sample size

Chain Function	People working in the chain Purposive selection	Activity	No. of FGDs. No of people	No of KIIs. No. of people
Production	Organized and committed farmers that belong to cooperatives under MADDO Dairies near the MCCs	Producing and selling milk & Milk bulking.	1(10)	2
	Farmer group under MADDO Dairies that are located in a distant place from the MCCs		1(10)	1
	Farmers that belong to cooperatives that stopped supplying MADDO Dairies Ltd		1(10)	1
	Lead farmers - large scale			2
	Lead farmers- small scale			2
Milk Collection, bulking and selling	Traders/ Milk Vendors/ transporters- bicycle traders, pick up traders	Milk collection, transporting and selling	1(10)	2
Collection	MCCs	Milk bulking, cooling, and selling point		3
Processing	Executive Director, Assistant Agriculture Veterinary Dairies officer, Extension officer	Processing milk into different milk products, provision of farm inputs, training and coordinating the cooperatives.		4

Milk Wholesalers/retailers	Kiosks, retail shops,	Selling of Processed and raw milk in outlets, directly to consumers		4
Chain supporters and influencers	DDA	Set standards and regulations, inspect and license dairy enterprises, regulate the dairy industry, and facilitate trade		1
	DVO	Providing extension services		3
	Production Department	Proving extension services		2
	District extension officers	Providing extension services		2
	The Living Lab team	Chain supporters		3
	Financial institutions	Financial services		2
Total			40	34

3.7 Data Processing and analysis

Data was gathered through interviews, focus group discussions. Notes, recordings, transcripts, copies of documents, and images were obtained. The information was organized into categories based on similarities and differences. It was then analysed further for contradictions and agreements and categorized accordingly. After that, subcategories were sorted according to the research dimensions using selective coding. The data was presented using tables and models. Data obtained through the survey was processed and analysed using SPSS version 28 and was presented using various graphs. Table 10 shows the different analytical tools employed in this study.

Table 10 summarizes how the research was constructed, it involves the research aspects, data source, method of collection data collection tools and tools for analysis.

Table 10: showing Research Approach

Research Sub Questions	Research Aspects	Source of Data	Data Collection Method	Data Collection Tools	Tools for Data Analysis
a) What are the roles and interests of various stakeholders in the dairy value chain?	Stakeholders' roles and interests Functions, Actors, Supporters, chain relations, SWOT analysis, gender roles, Value shares and volumes, Food storage, transport & trade, food processing, food consumption	Secondary Data	Desk Research	Literature review	Chain Map SWOT
		MADDO Dairies	Key informant interviews	Checklist	Radian institutiogra
		Project Team	Key informant interviews	Checklist	mme
		Farmer groups	FGD/Interview/survey	Checklist	Stakeholder's matrix, tables
		Milk Traders	Semi-structured interview/FGD	Checklist	
b) What is the robustness, reliability, and resilience of the greater Masaka dairy food system?	Robustness: vertical & horizontal alliances quality management systems. Reliability: Standards & regulations, incentives. Resilience: innovation linkages, capacity building.	MADDO Dairies Limited	Key informant interviews	Checklist	Food systems governance table using value chain functions:
		Farmer groups	FGD/Semi-structured interviews	Checklist	wholesaling/r
		Milk Traders/wholesalers/retailers	Semi-structured interview/FGD	Checklist	etailing, Processing, collecting, transporting & producing. Graphs
		District Veterinary officers/ District production department, DDA	Key informant interviews	Checklist	
		Financial institutions	Key informant interviews	Checklist	

		Secondary Data	Desk Research	Literature review	
c)What are the best governance practices in the informal chains as compared to the formal Dairy chain that MADDO Dairies Ltd can adopt in order to upgrade the Dairy value chain in the Region?	Milk markets, Comparison of the informal and formal milk channels, best practices in informal chains	Farmer producer groups	Focus Group Discussion	Checklist	Tables
		MADDO Dairies Ltd	Key informant interviews	Checklist	
		Milk traders	Semi-structured interview/FGD	Checklist	
		Wholesalers	Semi-structured interview	Checklist	
		Retailers	Semi-structured interview	Checklist	
2a) What is the current business model of MADDO Dairies Ltd?	Key activities /products & services, key partners, value proposition, customer relations, customer segment, key resources, channels, cost structure, revenues stream, social benefit, environmental benefit.	MADDO Dairies Ltd	Key informant interviews	Checklist	Business Canvas Model
b) What is the organization of the cooperatives under MADDO dairies ltd in terms of milk procurement?	the internal organization of cooperatives, Active members, actions to increase membership, production volumes, and quality management	MADDO Dairies	Semi-structured interview	Checklist	Adapted MIDCA
		Farmer groups Farmer group leaders	FGD/ Semi-structured interview,	Checklist	organizational analysis tool-table
c) What are the socio-economic outcomes of MADDO Dairies Ltd.'s activities in the region?	Socio-economic outcomes: incomes, livelihoods, employment, wealth. Food Security, food access people, profit, planet, prosperity & partnerships	Secondary Data	Desk Study	Literature Review	Theory of change, Sustainability profile.
		Farmer producer groups	FGD	Checklist	
		MADDO Dairies Ltd, DVOs, district production department, DDA, Project team	KII	Checklist	

3.8 Research amidst Covid 19

At the beginning of this research, a total lockdown was announced in Uganda where this study was conducted, there was no inter-district movement, and the transport was shut down. But in the face of all this, the study had to go on given the deadlines. Moreover, I was not able to travel back home to conduct this research personally given the rising covid 19 cases at that time. My approach to this research was using focus group discussions and key informant interviews which seemed quite complex given the situation at hand. Nevertheless, this study was still carried out successfully with the possible options were fully utilized to ensure that rich, adequate, and credible information was obtained to build this study.

3.9 Strategies to overcome Covid 19 Limitations

The Covid situation was a hindrance but the study was still effective and rich information was collected. The following strategies were adopted.

- The research assistant approached local authorities to allow him to conduct the research and travel to different districts amidst the covid situation and was exceptionally allowed to and given a travel permit on condition that he observed the SOPs.
- Working with a research assistant to help carry out the Focus Group Discussions, key informant interviews, and a survey. This research assistant was taken through the research proposal and guided through the checklists.
- All the FGDs and key informant interviews were done online using zoom where I was able to directly engage the respondents personally with the help of the research assistant who helped to mobilize and reach out to the respondents and ensure their connection to the online meetings using his laptop and internet connection.
- The research assistant also helped continue the discussion when there were internet disruptions, and I would join the meeting again when the internet connection stabilized.
- Purposive sampling was used while choosing who attends the FGD and KII while putting into consideration their ability to give or contribute towards having relevant information needed to build this study.
- Having FGDs in an open area or big space and ensuring that the 1,5 meters distance was adhered to.
- All participants were required to wear face masks during the meetings.
- Online focus Group Discussion meetings and interviews were recorded to avoid missing out on key information.

Chapter 4: Findings

This chapter presents findings from the field research. The data presented in this chapter was collected using a mixture of methods including semi-structured interviews, focus group discussions, and a survey. Qualitative data was collected using FDGs and Key informant interviews. The survey involved 30 respondents who were also part of the Focus Group Discussion, the survey was incorporated to establish the quantitative data. The results were presented appropriately using tables, figures, graphs, narrative form, and models were developed to give a clear analysis as indicated this is the section.

Profile of respondents

The participants of this study were from the Greater Masaka region. They included dairy chain actors: farmers, milk traders, milk retailers and wholesalers, milk collection centres attendants, milk processors, and the chain supporters: dairy extension workers from the district local government and production department, DDA, and financial institutions in this region. The study was participatory in that the respondents were requested to look into bottlenecks in the dairy chain in this region and also give their opinions in form of solutions to the identified bottlenecks.

4.1 Case study of MADDO Dairies Limited

This represents data obtained from key informant consultations with MADDO Dairies Ltd. It was mentioned that MADDO originated from a cow project that was started in 1993. This was after the catholic church asked heifer international to extend their services to Masaka after it was highly inflicted by AIDs. Between 1993 to 1996, they were only able to receive 3 cows, and therefore this project started with 3 farmers. Father Peter who is the current Managing Director of MADDO Dairies Ltd joined MADDO Caritas in 1995 and had an in-depth discussion with the country director of the heifer international project and in 1996, they received 12 more cows from them.

In the following years as the farmers, took on the cows and practiced dairy farming, they didn't have a market for their milk and there was low milk consumption as milk was only bought for children and the sick. With the farmers complaining about the market for their milk, the idea of establishing a processing facility was conceived. Therefore in 2003, they thought that it would be better to add value to what the farmers were producing, and on 18th June 2003, a mini dairy was started using a loan from Bothar Ireland. They started with a pasteurizer and a packaging machine. In the first months, MADDO Dairies Ltd was receiving 350 litres of milk daily and was currently receiving over 2000 litres of milk daily. Their first products were chocolate flavoured milk and later started making strawberry, vanilla, and chocolate flavoured yoghurt and in the same year 2003, MADDO Dairies was registered as a separate entity from MADDO Caritas.

MADDO Dairies Ltd is a social business a has over time provided extension support to not only project farmers, but also other farmers regardless of their religious background in the region to foster agriculture development and currently serves over 2200 project farmers.

4.2 Milk Market Trends

These are the views and opinions of different key informants engaged in the interviews regarding milk market trends. In the interviews, it was mentioned that the biggest milk producers in the greater Masaka region are Sembabule, Lyantonde, and Rakai. They rear the indigenous cattle majorly that produce low milk volumes and normally keep more than 30 herds of cattle. These areas produce surplus milk which goes to dairy corporations. The low milk-producing districts are Kalungu, Masaka, Lwengo, and farmers in this region keep an average of 2 cows and mainly sell their milk to neighbors and small kiosks contributing majorly to the informal dairy chains.

The respondents further mentioned that historically, comparing Uganda to Kenya, Kenya from way back made it statutory that milk had to go through cooperatives since many whites settled there before independence which was not the case in Uganda as cooperatives are a recent development in Uganda. By the time of independence, there was either one or no milk cooperative in Uganda.

In the earlier days in the greater Masaka region, it was presumed that only children had to take milk, yet it was the main meal in the milk sheds of Uganda whereas for the case of Kenya, milk was compulsory in schools, and it had to be processed because it was easy to pick diseases from raw milk consumption. Therefore, much as Kenya has had a system of cooperatives for a long time, Uganda is still adopting and trying to embrace the system of cooperatives and processed milk.

In the 1980s, Uganda used to buy processed milk from Kenya however with modernization, Ugandans are now adapting to buying processed milk for example from supermarkets. A collaboration between the production department and DDA, capacity building, and improved technology and infrastructure can further reduce the informal segment greatly by formalizing the informal dairy chains.

It is important to formalize the dairy value chain in the region because there is no certainty that the milk sold in the informal chain is disease-free and not contaminated to ensure food safety, however, in homesteads, farmers will always take raw milk.

4.3 Informal verses formal milk markets

In the interviews with key informants, it was mentioned that the informal is not fully informal in the sense that DDA regulates the raw milk market to ensure that there is access to safe and quality milk on the market. Traders selling raw milk are registered, premises are inspected, and follow minimum operating standards for selling raw milk as stipulated by DDA. There is low investment in processing facilities currently that limits milk absorption into the formal segments and there are very few cottage industries. One of the interviewees' said, "to grow the informal chain there is a need to invest in the milk processing and cold chain, the processing is not only done by the Ugandan market but also the international market and growing the formal milk chain cannot be done easily as it is a continuous process and effort from all the stakeholders."

In 2015, there was an amendment to ban the sale of unpackaged milk and the government plans to attract more investors into the milk processing industry so that processed milk is readily available and affordable. It was further emphasized in the interviews that there is a need to sensitize the informal chain actors to engage in the formal chain by showing them massive opportunities in specializing in milk transportation, selling processed milk products from various processors, exporting processed milk, and milk products. And engaging them in a cost-benefit analysis to show that it is more profitable to trade in the formal chain as compared to the informal chain.

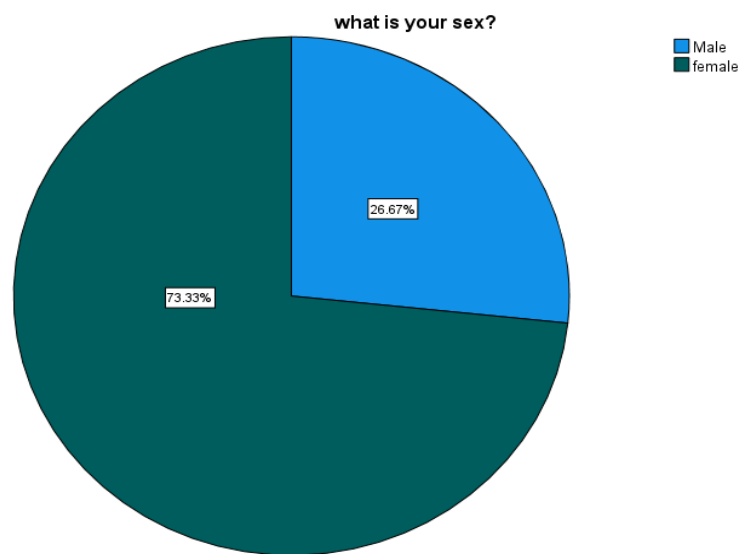
4.4 General characteristics of Farmers involved in the study (Survey and FGD).

A survey was carried out amongst the focus group discussion participants to establish the qualitative data on the gender of farmers, age, number of cows kept, and milk production volumes in this region.

4.4.1 Gender of farmers

Amongst the respondents engaged in this study, the survey results revealed that the majority of the dairy farmers were women 73.33% and the men were 26.67% as seen in figure 9

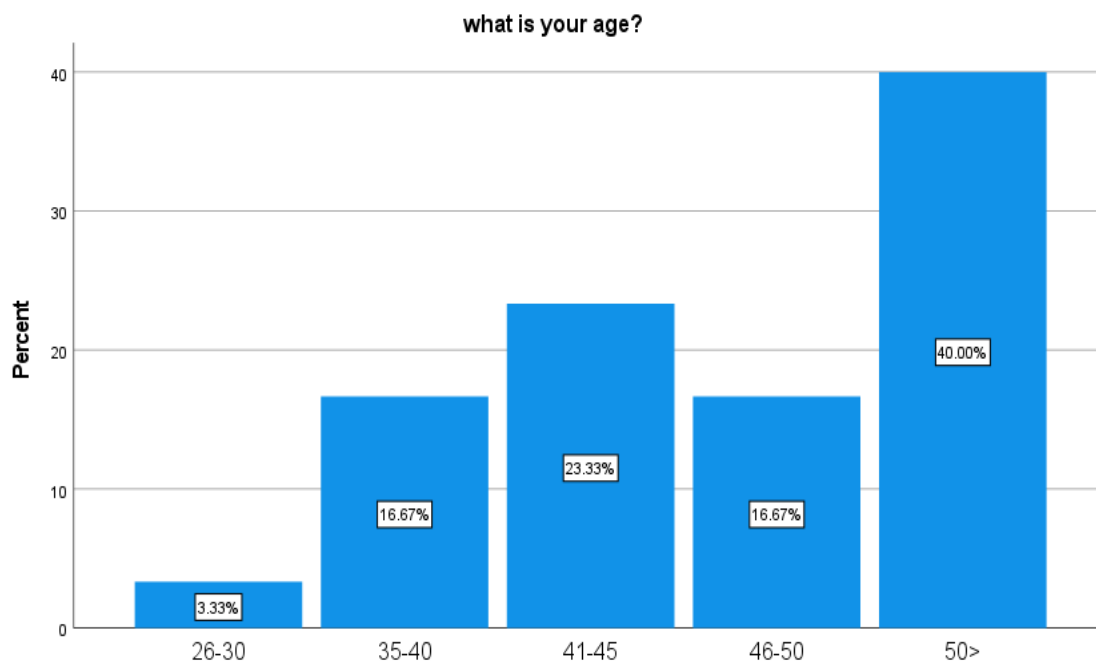
Figure 9: Sex of the respondents



4.4.2 Age of the dairy farmers

The survey revealed that the majority of the dairy farmers involved in this study were 50 years and above 40%, 16.67% of the respondents were between 46 and 50 years, 23.33% of the respondents were 41-45 years, 16.67% of the respondents were between 35-40 years and 3.33% of the respondents were between 26-30 years as seen in figure 10. Farmers between 26-40 years are regarded as youthful farmers.

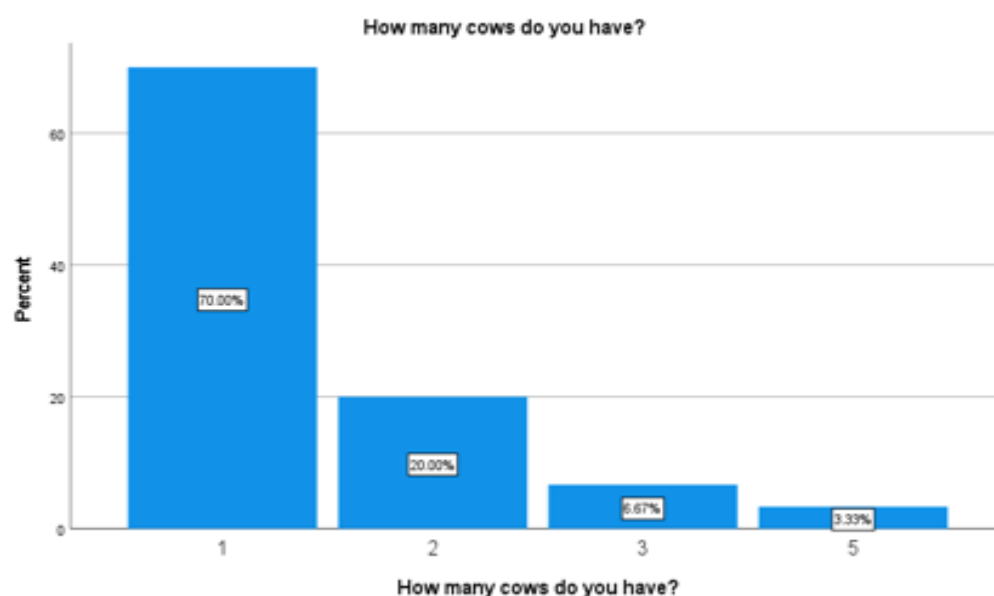
Figure 10: Age of farmers



4.4.3 Number of cows kept by farmers

The survey revealed that the majority of the respondents, 70% keep only one cow, 20% of the respondents keep 2 cows, 6.61% keep 3 cows, and 3.33% keep 5 cows as seen in figure 11.

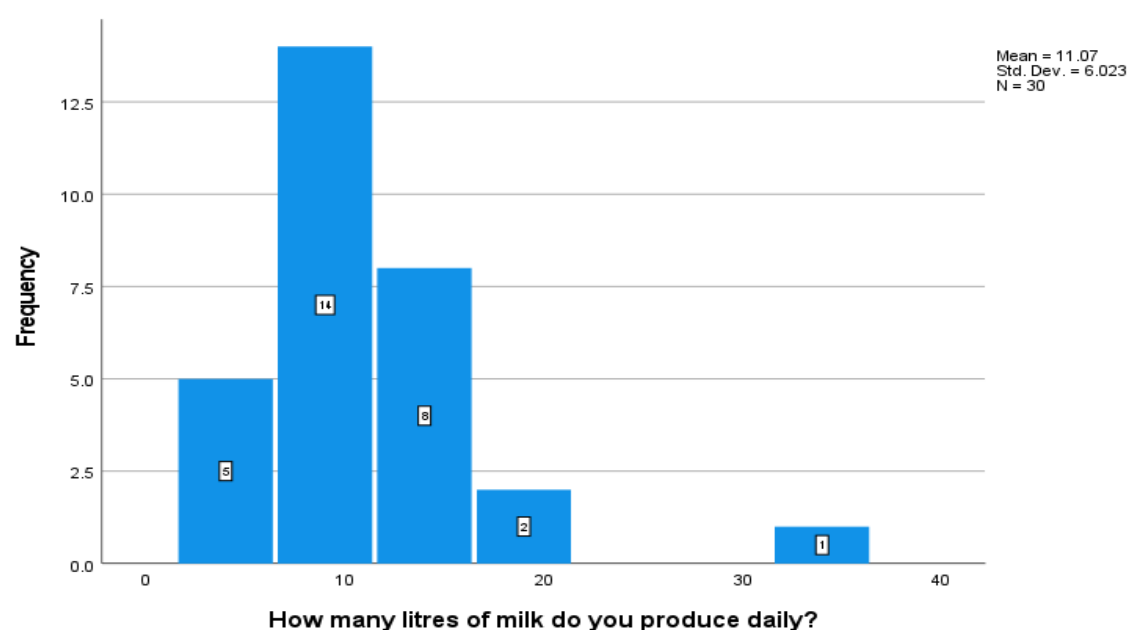
Figure 11: Number of cows per household



4.4.4 Milk production

The study revealed that the majority of the respondents 46% produce about 10 litres of milk daily, 16% of the respondents produce about 5 litres of milk daily, 26% of respondents produce about 15 litres of milk daily, 6.7% of the respondents produce 20 litres of milk daily and only 3.33% of the respondent produces about 35 litres of milk daily. The average milk production per cow daily is 11.07 litres as seen in figure 12.

Figure 12: Litres of milk produced daily



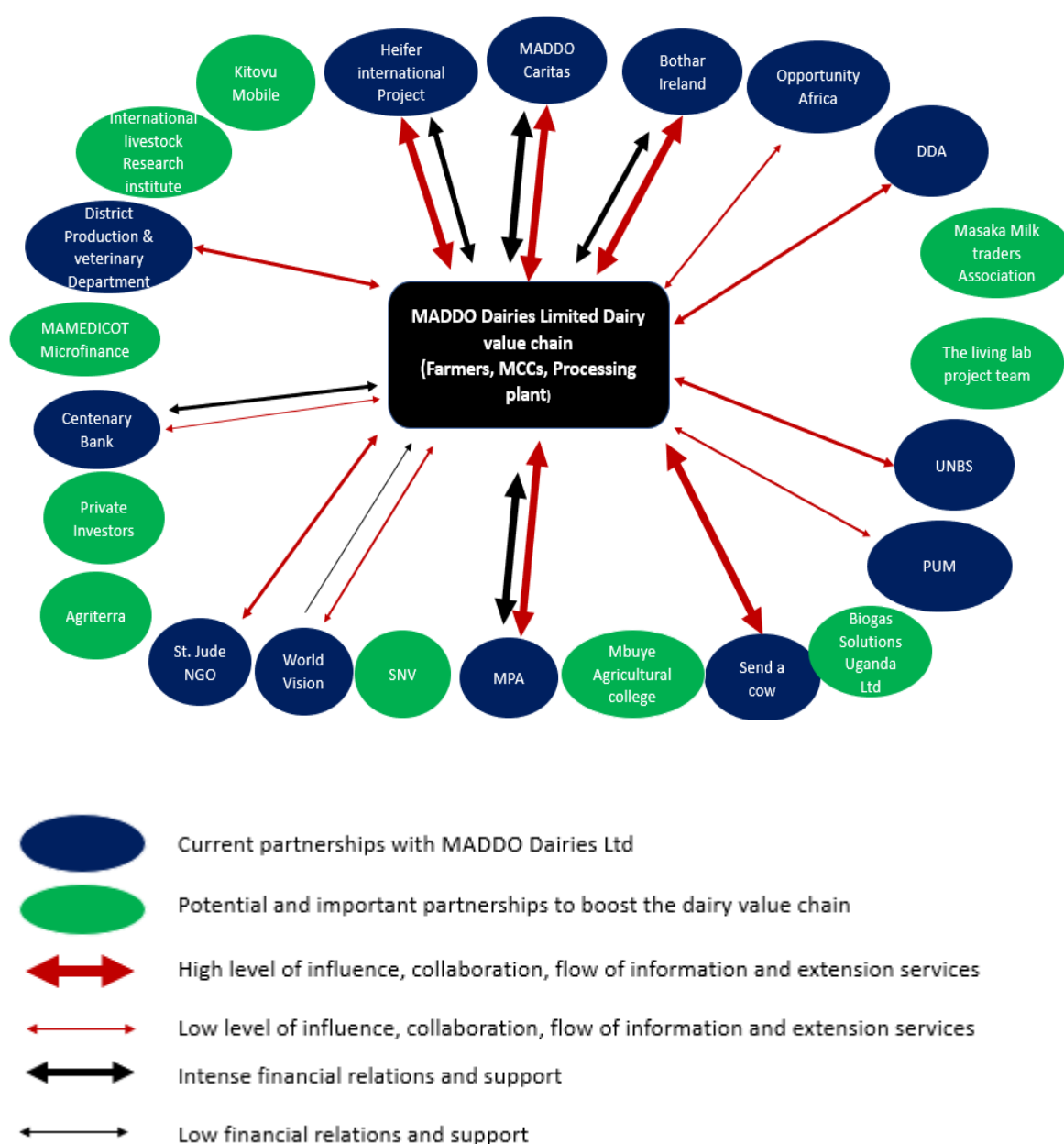
4.5 Stakeholder Analysis

This covers the stakeholders' roles and interests Functions, Actors, Supporters, chain relations, value share analysis, SWOT analysis, and gender roles in the greater Masaka Dairy value chain.

4.5.1 Stakeholders' roles, functions, and chain relations.

The data used in the radian institutiogramme reflects the views and opinions of different key informants. Figure 13 demonstrates the collaborations and partnerships between MADDO Dairies Ltd and the other organization in developing the dairy value chain in the region and also potential partnerships that could yield further development of the food systems in the region.

Figure 13: Radian institutiogramme showing collaborations and partnerships between MADDO Dairies and several organizations and potential partners.



From the radian institutiogramme, figure 13 MADDO Dairies Ltd has established several partnerships with NGOs, government bodies, and financial institutions. It has strong and intense collaborations with MADDO Caritas as a development organization because MADDO Dairies Ltd was established to create

a market for the milk produced by project farmers and therefore receives a lot of financial and extension support from MADDO Caritas as a mother organization.

There is a high level of collaboration and information flow between MADDO Dairies and the Heifer international project. Through heifer international, MADDO was able to give out cows to farmers to promote dairy farming in the region and the project farmers received several pieces of training such as animal nutrition and animal welfare to increase milk production.

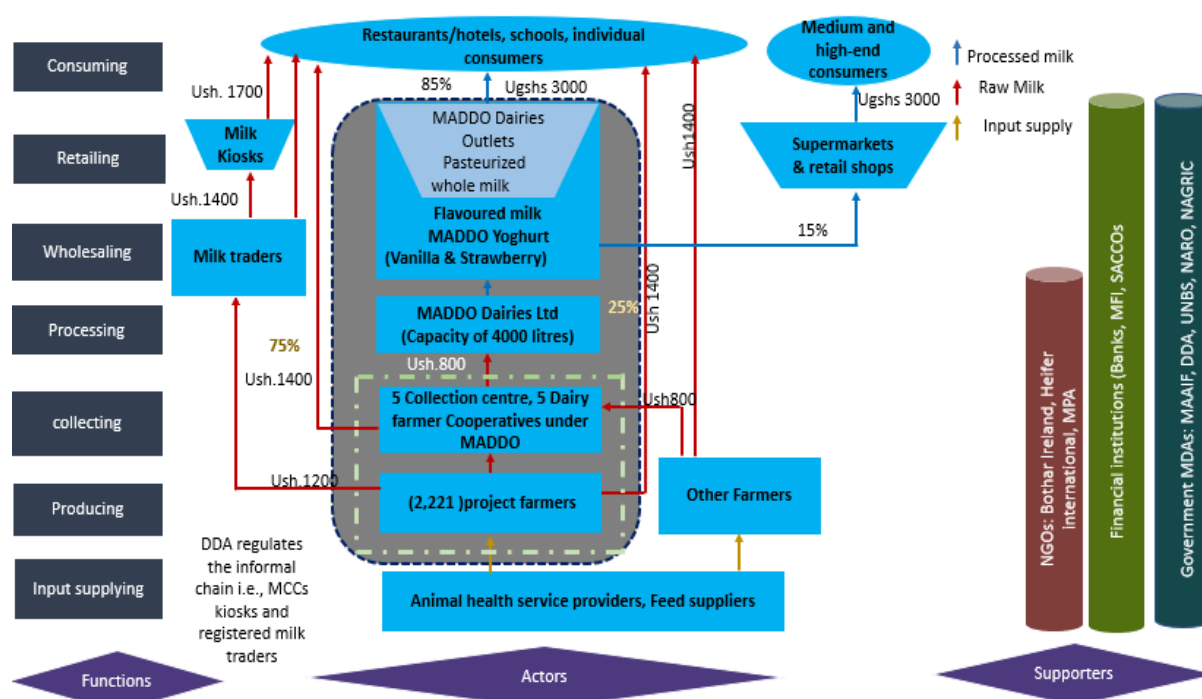
With financial support from Bothar Ireland and heifer international, MADDO Dairies Ltd has established MCCs in the region and has over time received extension services from them and there is a good relation and information flow with these organizations.

MADDO Dairies Ltd has a relationship with DDA, a government regulatory body that enforces milk quality in the region and sets standard operating procedures, it provides pieces of training on good milk handling practices in the region to MCCs, farmers, traders. And also provides training on animal nutrition and sometimes gives fodder seeds to farmers to increase milk production in the region. The district Production and veterinary department have a strong collaboration with MADDO Dairies Ltd. It provides extension services to dairy farmers and market information dissemination. St. Jude NGO provides community training on pasture production and feed conservation and collaborates with MADDO Dairies to reach out to the project farmers. Send a cow project through the church of Uganda Partners with MADDO Dairies to extend cows to farmers in the region and also provide extension services. Senior experts in the Netherlands, world Vision, and opportunity Africa provide extension services to the MADDO Dairy value chain. World vision extends financial support to the MADDO Dairies as well. The respondents in the interviews mentioned that to further strengthen the dairy value chain in the region interviewees mentioned that MADDO Dairies needs to develop more partnerships with organizations such as Agriterro, SNV, Kitovu Mobile, international livestock research institute, MAMEDICOT, Masaka Milk traders Association, Private investors, and Biogas Solutions Uganda Limited and Mbuye Agricultural College.

4.5.2 The MADDO Dairies Limited dairy value chain

The food systems of the greater Masaka region where MADDO Dairies is embedded is organized in a way that there are over 2200 project farmers organized through farmer groups that make up cooperatives that are under the supervision of MADDO Dairies Ltd. There are also other independent dairy farmers mostly small-scale and very few large-scale farmers. The farmers get farm inputs from different farm input shops in the region but also get assistance from NGOs such as Bothar Ireland, Heifer international to mention but a few. They also receive extension support from MADDO Dairies Ltd and the district local government. The project farmers supply milk to the MCCs and those who are distant from the MCCs have pickup points for milk bulking and later milk is transported to the MCCs using a motor bike, but transport costs are met by the farmers. However, as seen in figure 14. Farmers don't supply all the milk produced to MADDO, they sell some directly to neighbours, kiosks, and traders, and restaurants in the region. Traders buy milk from the farmers and sell it to milk retailers, hotels, restaurants. The MCCs receive milk not only from project farmers but also other farmers in the region as long as it meets their quality requirements. The MCCs sell raw milk to local residents as well as milk retailers and grocery stores. MCCs sell raw milk to cover their daily operating costs, and the remaining is taken to MADDO processing plant to be processed into pasteurized milk and yoghurt. The milk products are supplied to schools mostly, supermarkets, and retail shops in the region and Kampala where they have a niche market.

Figure 14: Showing MADDO Dairies Ltd chain map



4.5.3 Value share Analysis of the Dairy value chain

The production expenses were examined in the focus group discussion with farmers, and an agreement was reached after the survey was completed to further validate the data.

Table 11: production cost per month/cow from the survey

How many cows do you have? * what is your production cost per month? Crosstabulation													
Count		what is your production cost per month?											Total
		10000	20000	30000	40000	45000	50000	60000	66000	70000	80000	300000	
How many cows do you have?	1	2	4	7	1	1	2	1	0	0	3	0	21
	2	0	0	1	1	0	0	2	1	1	0	0	6
	3	0	1	0	0	0	0	1	0	0	0	0	2
	5	0	0	0	0	0	0	0	0	0	0	1	1
Total		2	5	8	2	1	2	4	1	1	3	1	30

According to the survey, it was revealed that farmers that keep one cow incur between shs.10,000 and shs.60,000 as production costs, farmers that keep 2 cows, incur between shs.30,000 and shs.70,000 as production costs, farmers that keep 3 cows, incur between shs.20,000 and shs.60,000, farmers that keep 5 cows incur Ush. 300,000 as production costs per month as seen in table 11. These were estimated production costs per cow per month for each cow without putting into consideration fixed costs and lactation days.

I. Gross margin for Dairy cow per month in the greater Masaka Uganda

In the focus group discussion held with dairy farmers, the following production costs were stated and agreed upon with farmers as the average cost of production of a cow per month as seen in table 12.

Table 12: showing a breakdown of production costs per cow/month. 1 Ush=4000 euros.

Variable costs	Cost per unit and opportunity cost In (Ush)	Total units required	Total (Ush) in the dry season	Total (Ush) in the wet season
Feeds Concentrates / dairy meal	Ush.1400/kg	25kgs in the dry season 15kgs in the wet season	35,000	21,000
Feeds/forage/silage Home grown Pasture/roadside pasture/Community pasture Banana Peelings Stover	Opportunity cost		60,000	30,000
Water Rainwater, well and Borehole	Opportunity cost in the dry season. Opportunity cost in the wet season		20,000	10,000
Animal Health/Acaricide/spray	6,000		6,000	6000
Animal Veterinary costs	70,000		50,000	50,000
Labour Family labour Hired labour	(Opportunity cost)		60,000	40,000
Total cost per month			231,000	157,000

N.B: The opportunity cost of input is equal to the income obtained by using the input in the best alternative way.

- ❖ The cost of family labour is equal to the cash payments the farmer would have made for hiring labourers.
- ❖ The cost of feeds is equal cost the farmer would have incurred to buy fodder/silage and stover
- ❖ Estimates were used for opportunity costs.
- ❖ Some costs such as costs on concentrates feed, water reduce during the wet season.

In table 12, farmers incur Ush.35,000 on concentrates (Dairy meal) during the dry season and Ush. During the wet season. most of the farmers feed the cows with homegrown pasture, roadside pasture, community pasture, banana peelings, and stover and the opportunity cost for this is Ush. 60,000 in the dry season and Ush. 30,000 for the wet season. Farmers also do not spend on the water as they mostly use rainwater, water from wells and boreholes to feed their cows but the opportunity cost for water is Ush.20,000 in the dry season and Ush.10,000 in the wet season given that water is readily available in the wet season. They also spend averagely 6000 on animal health including spraying,

Ush.50,000 on veterinary expenses, and most farmers use family labour, the opportunity cost for family labour is Ush.60,000 in the dry season and Ush. 40,000 in the wet season. The total cost of production per month/ cow in the dry season is Ush.231,000 and Ush. 157,000 in the wet season.

Cost of production per litre of milk produced/year/cow

Average lactation days in a year	180 days
Average calving intervals	403 days
Average milk production/ cow	10 litres per day

Table 13: Average production cost per cow/year

Average milk production	Per year
Total milk production /cow /year Lactation days*average milk production/cow/day	1,800 litres
Total production cost per cow/year in the dry season Production cost month/cow=231,000*6months (180 lactation days)	Ush.1,386,000
Total production cost per cow/year in the wet season Production cost/month/cow=157,000*6months	Ush. 942,000
Cost of production per litre of milk in the dry season	Ush. 1,386,000/1800 litres Ush. 770
Cost of production per litre of milk in the wet season	Ush.942,000/1800 litres Ush.523

Cost Analysis for a trader/month

Table 14: variable costs of a trader/ litre of milk

Variable costs	(Ush)	Total cost (Ush) dry season	Total Cost (Ush) wet season
Milk purchases *4,500 litres	1,200/litre dry season	5,400,000	
	700/litre wet season		3,150,000
Transport	300,000	300,000	200,000
Total		5,700,000	3,350,000

Variable cost per each litre cost of milk =Ush.5,700,000/4,500 litres=Ush. 1,270 in the dry season, 3.350,000/4500 =Ush. 744

Cost Analysis for a retailer per month

Table 15: Variable costs of a retailer/ litre of milk

Variable costs	(Ush)	Total cost (Ush) dry season	Total Cost (Ush) wet season
Milk purchases 1,500 litres /month	1400/litre dry season	2,100,000	
	1000/litre wet season		1,500,000

<u>Operating costs</u>		250,000	250,000
Rent	150,000		
Utilities	50,000		
Labour	50,000		
Total variable costs		2,350,000	1,750,000

Variable cost for each litre of milk during the dry season: Ush. 2,350,000/1,500 litres =Ush. 1,567
during the wet season: Ush. 1,750,000/1500 litres=Ush. 1,167

Cost Analysis for a processing plant per week

Table 16: Variable costs of a processor/ litre of milk processed

Variable costs	(Ush)	Total Cost (Ush) dry season	Total cost Wet season
Milk purchases *2000 litres	1200/litre dry season	2,400,000	
	800/litre wet season		1,600,000
<u>Operating costs</u>			
Utilities	200,000	700,000	700,000
Labour	400,000		
Transport	200,000		
Others	200,000	200,000	200,000
Total		3,300,000	2,500,000

Variable cost for each litre of processed milk: Ush.3,300,000/2000 litres processed weekly in the dry season =Ush. 1,650. Wet season: Ush. 2,500,000/2000= Ush. 1,250.

Value Shares of actors in the Milk Value Chain,

Uganda (Ush per kg milk (1 € = Ush 4,000)

Dry season

Table 17: showing value share in the greater Masaka dairy chain during the dry season

Chain Actor	Variable Costs (Ush)	Revenue (in Ush)	Gross Income (in Ush)	Added Value	Gross Margin (in %)	Value Shares
Selling directly to Neighbours						
Farmer	770	1400	630	1400	45%	100%
Neighbours						
Marketing through a trader						
Farmer	770	1200	430	1200	35.8%	85.7%
Trader	1270	1400	130	200	9.3%	14.3%
Marketing Milk through a trader and a retailer						
Farmer	770	1200	430	1200	35.8%	63.5%
Trader	1270	1400	130	200	9.3%	14.3%
Retailer	1567	1800	233	400	12.9%	22.2%

Marketing Milk through MADDO Dairies Ltd						
Farmer	870	1200	330	1200	40%	40%
MADDO Dairies	1,650	3000	1350	1800	45%	60%

As seen in table 17, during the dry season the milk prices go up, when a farmer sells milk directly to neighbours, he sells each litre of milk at Ush.1400, spends Ush.770 as variable costs for producing each litre of milk, and gets 100% value share. When a farmer markets through a trader, a trader pays Ushs.1200 for each litre from the farmer and the trader sells each litre of milk at Ush.140, the variable costs of a trader are Ush.1270. in this case, a trader gets Ush. 14.3% market share and a farmer gets 85.7% value share. Marketing through a trader and a retailer, a farmer sells each litre of milk at Ush.1200 to a trader, the trader then sells each litre of milk to a retailer at Ush.1,400 then the retailer sells each litre of milk at Ush.1,800 the retailer's variable cost for each litre of milk purchased is Ush.1567. The farmer, therefore, gets 63.5% as value share, a trader gets Ush. 14.3% and a retailer gets Ush.22.2% as value share. Marketing through cooperative under MADDO, the farmer spends an extra Ush.100 per litre of milk. MADDO buys each litre of milk from a farmer at Ush.1200 and MADDO Dairies Ltd sells each litre of processed milk at Ush.3000. The variable cost of processing each litre of milk is Ush.1670. Therefore, a farmer gets 40% value share and MADDO gets 60% value share.

Wet season

Table 18: Showing the value share in the greater Masaka region during the wet season

Chain Actor	Variable Costs	Revenue (in Ush)	Gross Income (in Ush)	Added Value	Gross Margin (in %)	Value Shares
Selling directly to Neighbours						
Farmer	523	1000	477	1000	47.7%	100%
Neighbour						
Marketing through a trader						
Farmer	523	700	177	700	25.2%	70%
Trader	744	1000	256	300	25.6%	30%
Marketing Milk through a trader and a retailer						
Farmer	523	700	177	700	25.2%	53.3%
Trader	744	1000	256	300	25.6%	30%
Retailer	1167	1200	33	200	3%	16.7%
Marketing Milk through MADDO Dairies						
Farmer	523	800	277	800	34.7%	28.6%
MADDO Dairies	1250	2800	1550	2000	55.3%	71.4%

As seen in table 18, during the wet season, the milk prices drop due to increased milk production, a farmer sells each litre of milk at Ush.1000 to neighbors, the variable cost of producing each litre of milk is Ush.523 and the farmer gets a value share of 100%. Marketing through a trader, a trader buys each litre of milk at Ush.700 from a farmer and the variable cost for each litre of milk purchased is Ush.744. The trader then sells each litre of milk at Ush.900 to a retailer. The retailer incurs Ush. 1167

as variable costs for each litre of milk and sells a litre of milk to the final consumer at Ush.1200. In this scenario, the farmer gets a value share of 53.3%, a trader gets 30% as a value share, and a retailer. Marketing through MADD0 Dairies Ltd, a farmer sells each litre of milk at Ush.800 and incurs extra Ush. 100 for transport of each litre of milk. MADD0 then sells each litre of processed milk at Ush.3000 and the variable cost of producing each litre of milk is Ush.1250, therefore, a farmer gets 26.7% as a value share whereas MADD0 Dairies Ltd gets 73.3% as value share.

4.5.4 Gender roles in the greater Masaka Dairy Value chain

In the focus group discussions, the participants mentioned that women are engaged in dairy farming as they are prioritized and given cows from MADD0 Dairies Ltd. Most of the strong and organized cooperatives with VSLAs are dominated and led by women. Women sell milk and keep the proceeds from their husbands to take care of their families because when the men get the money from milk payments, they most of the time waste in drinking alcohol and even get themselves, second wives. Both men and women take decisions in a home, but men dominate. Men sell milk in the morning because they have to wake up early, milk the cows at around 5.00 am, and take the milk to the pick-up points as women stay home to take care of the home and clean the milking utensils. Women, therefore, sell milk in the evening after milking the cows and mostly to neighbours especially those who are distant from the milk collection centres. The men oversee the milk proceeds in the morning and women oversee the milk proceeds in the evening which they use to take care of their homes.

Dairy farming for women-dominated homes is hard work and therefore employ farm workers to help them on the farms given the water shortage encumbrances in the region. In the FGD, it was mentioned that in some homesteads where men dominate decision making, men may decide to sell milk wherever they want without leaving any home consumption and even use the money for their own benefit without putting into consideration family needs.

4.6 Robustness, reliability and the resilience of the greater Masaka Dairy food system.

The data collected in this section represents the dairy value chain governance at different levels of the value chain from Production, milk trading, milk collection, processing, wholesaling and retailing to consumption covering the robustness, reliability and resilience of the dairy value. The results in the milk production, Milk trading and milk collection functions were collected using FGDs whereas results from the milk processing and wholesaling/retailing functions were collected using key informant interviews.

4.6.1 Robustness, reliability and resilience of the wholesaling and retailing function.

The key aspects of governance in the wholesaling and retailing function are highlighted in bold in table 19 Milk wholesalers and retailers obtain raw milk from farmers, traders, and MADD0 Milk collection centres, as well as processed milk from milk processors. They sell raw milk for Ush. 1,500-1,800 per litre and processed milk for Ush. 3,000 per litre, as well as self-processed milk products like ghee and “Bongo”-fermented milk. Because of the high turnover of raw milk, milk is cheaper during the wet season and more expensive during the dry season, milk retailers find trading informal chains more profitable than trading in the formal segment. When it comes to milk quality, farmers deliver milk to the kiosks in metallic cans and jerrycans, but usually in cans. The retailer checks the milk for adulteration with a lactometer at the kiosk's milk reception. Milk is stored in freezers and refrigerators. The DDA establishes the SOPs. DDA and UNBS conduct inspections. Milk wholesalers and retailers receive training from DDA on good milk handling and hygiene to ensure that the milk quality is maintained.

Table 19: Governance of the greater Masaka Dairy value chain at the wholesaling and retailing function.

Wholesaling and Retailing					
Robustness of the DVC		Reliability of the policy environment		Resilient innovation systems	
Organization, Productivity, volumes and prices	Milk Quality	Regulations	Incentives	Innovation services	Capacity building
•Milk wholesalers and retailers source milk from farmers, traders, Milk collection centres, and milk processors. •Most of the wholesalers and retailers of milk in the region sell raw milk, processed milk from MADDO Dairies Ltd, Fresh Dairy, Lato milk but predominately sell raw milk. •Raw milk is sold between Ush.1,500-1,800 per litre depending on the season and processed milk is sold at Ush.3,000 per litre. •Milk retailers buy milk from farmers between Ush 900-1200 depending on the season and processing companies such as MADDO sells to traders Ush.2,700 per litre of milk. •They also sell self-processed milk products such ghee and “Bongo”-fermented milk.	•Milk is brought to the kiosks by farmers using metallic cans and jerrycans but mostly in cans. •At the reception of milk at kiosks, the retailer checks the milk with a lactometer for adulteration. •The milk is kept in	•Before a milk wholesaler/retailer is given a license he/she must have clean selling premises and equipment to keep the milk chilled. •DDA gives trading licenses to Milk kiosks and shops. •Before DDA issues a license to a milk wholesaler or retailer, it visits the premises to check how hygienic the place is, if it is found to be good, the retailer is given a license regardless of whether you are selling raw milk, processed milk, or both. •DDA also does spot checks on these premises to ensure	•Most consumers especially breastfeeding mothers prefer raw milk because it is assumed that processed milk has a lot of chemicals given the long shelf life. •There is high demand for MADDO yoghurt. •Processed milk is normally bought by the educated and working-class category. It is rare for a farmer to buy processed milk. •For the processed milk category, most consumers like the	•Milk wholesalers have built good relationships with farmers and traders who supply them milk over time to ensure that they receive good quality milk from them. •Some wholesalers source milk from southwestern Uganda because it is	•Milk wholesalers and retailers receive training from DDA on good milk handling and hygiene to ensure that the milk quality is maintained. The retailers are trained twice a year.

•A kg of ghee is sold at Ush 18,000-20,000 and a litre of fermented milk is sold at Ush. 3000. •The milk retailers find trading informal chains more profitable than trading in the formal segment. •Raw milk has a short shelf life and has to be sold within two days, retailers have to ensure that they get adequate market for the milk in a short while otherwise they make losses from milk spoilage, yet processed milk has a longer shelf life and can be sold within 2 weeks hence leverage for quality and duration. •Milk is cheaper during the wet season and more expensive during the dry season.	- freezers and fridges. •The SOPs are set by the DDA. •Inspections are done by DDA and UNBS.	- that good hygiene is maintained always. •DDA sets the standard operating guidelines for milk wholesalers and retailers. •If DDA visits their premises and they are found not to meet the standard operating procedures, the premises are closed down. •Milk retailers with a freezer pay shs.30,000 to DDA for a license every year. •Milk wholesalers with a cooler at the business premises pay shs,70,000 to DDA per yea	yoghurt more compared to the pasteurized milk. •The benefit of selling raw milk is that it has a long shelf life while raw milk has a short shelf like i.e.1-2 days. •Processed milk is more expensive compared the raw milk. •Consumers claim that raw tastes better and fresher compared to processed milk.	- cheaper there. •Some of the milk retailers process milk into ghee and bongo-fermented milk.	
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4.6.2 Robustness, reliability and resilience of the Milk processing function.

The important features of governance at MADD0's milk processing function are shown in bold in table 20. MADD0 began with a capacity of 350 litres and grew to a capacity of 4000 litres before closing for renovation and growth. Since January 2021, it has been closed. Due to a mechanical breakdown, the old processing plant is currently not operating. The new facility is now under development and is expected to operate in September 2021. It will have a capacity of 10,000 litres. MADD0's milk products are sold to schools, stores, and supermarkets in the wider Masaka and Kampala areas. It is unable to obtain a consistent supply of milk from milk collection centers. During the dry season, MADD0 Dairies sources milk from the southwestern region. Before being received at the factory, the milk is inspected. DDA and UNBS conduct routine inspections at the processing plant to ensure that the stated guidelines are followed. MADD0 is eligible for tax breaks and holds a DDA license. MADD0 distributes the majority of its processed products to schools and Kampala because pasteurized milk is not widely accepted and consumed in the Masaka region. DDA and UNBS provide training to MADD0 Dairies Ltd.

Table 20: Governance of the greater Masaka Dairy value chain at the Milk processing function

Milk Processing					
Robustness of the DVC		Reliability of the policy environment		Resilient innovation systems	
Organization, volumes and price	Milk Quality	Regulations	Incentives	Innovation services	Capacity Building
•MADDO Dairies was established in 2003 and started with at a capacity of 350 litres and was at a capacity of 4000 litres before it closed for renovation and expansion. It has been closed since January 2021. •The old processing plant is not operational at the moment due to the mechanical breakdown of machinery. •The New plant will have a capacity of 10,000 litres and will be re-opened in September 2021. •Milk is received from the 5 collection centres established under MADDO Dairies Ltd. •MADDO Dairies Ltd procures about 2000 litres of milk for the process plant when it is fully functional. •Milk is processed into pasteurized milk and yoghurt with chocolate and strawberry flavors.	•Milk collected at the MCCs is brought to the processing plant using cooling trucks to maintain milk quality in transit. •The milk is again checked before the reception at the plant. •Milk is collected from the MCCs to the processing plant averagely every 3 days depending on the season. •The critical control points are in transit and storage at the processing plant. •There are 4 coolers at processing plant	•A milk processor follows standard guidelines: quality management systems, good manufacturing procedures, standard operating guidelines, ISO systems. •DDA and UNBS do routine checks at the processing plant to ensure compliance of the set guidelines.	•MADDO is getting tax incentives and has a DDA license to operate. •Currently, MADDO Dairies Ltd is selling raw milk because of the mechanical breakdown of the old plant. •However, the construction of the new plant is under way, and hope to reopen to process milk in August 2021. •The processing plant is also motivated to sell raw milk because of its high demand and to keep the MCCs fully function as they await the reopening of the new plant.	•MADDO Dairies Ltd makes pasteurized milk and yoghurt with chocolate and straw berry flavors. •The future additional products for MADDO Dairies Ltd are ice cream and cupped yoghurt. •MADDO is looking into partnerships to make UHT milk and cheese. •MADDO is currently selling its products in the greater Masaka region and Kampala- schools, hospitals, supermarkets, shops. •Because pasteurized milk is not embraced and consumed in Masaka region, MADDO sells most of its processed products to schools and Kampala.	•MADDO Dairies Ltd receives trainings from DDA and UNBS. •Through MADDO, DDA trains farmers and gives them good quality fodder seeds.

•The milk products processed by MADDO are sold to schools, shops, supermarkets in the greater Masaka region and Kampala. •It does not have a steady milk supply of milk from milk collection centres. •MADDO Dairies sources milk from southwestern region especially in the dry season.	to keep the milk fresh. •The critical control points at the processing plant are Pasteurization, sterilization.		•MADDO organizes farmers' competitions and gives awards to farmers that have increased production and quality.	•MADDO plans to establish a hub of services at every collection centre where farmers can access facilities on credit such as artificial insemination, treatment, and feeds.	
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4.6.3 Robustness, reliability and resilience of the Milk collecting function

Key elements of governance are made bold in table 21, MADDO Dairies operates five collecting centres: Kawulu in Kalungu, Kagologolo in Bukomasimbi, Kirimya in Masaka, Makondo in Lwengo, and Kyotera in Kyotera. Cans that are loaned to producer groups are used to transport milk to the collecting centers. Under the cooperative umbrella, milk is received from many producer groups. All farmers in the region can supply milk to the MCCs as long as it is of excellent quality. Every day, the MCCs collect roughly 2000 litres of milk. MCCs have agreements with MADDO Dairies Ltd, the processing plant, to supply milk. MADDO receives very small volumes of milk from MCCs, and the majority of it is sold directly to customers and traders in the region. The MCCs' operating guidelines are determined by DDA and MADDO Dairies Ltd. Every time milk is brought to the MCC before receiving it, it is tested. To maintain quality, the milk is kept in MCC coolers with capacities ranging from 2000 to 3000 litres. Milk collecting centres sell milk to MADDO Dairies Ltd, as well as customers and traders, for immediate cash to keep their operations afloat in the face of strong raw milk demand. Because MCCs reject poor milk, most farmers and traders turn to the informal market, where there are less regulations. More so, farmers are not rewarded for high milk quality by MCCs.

Table 21: Governance of the greater Masaka Dairy value chain at the Milk collecting function.

MCCs					
Productivity, Organization, volumes, and price	Milk Quality	Regulations	Incentives	Innovation services	Capacity Building
•MADDO Dairies has 5 collection centres located at Kawulu in Kalungu, Kagologolo in Bukomasimbi, Kirimya in Masaka, Makondo in Lwengo and Kyotera. •The MCCs collect about 2000 litres of milk daily. •MCCs don't have contracts with farmers regarding milk supply. •MCCs have contracts with MADDO Dairies, the processing plant to supply the milk. •Very small volumes of milk are sold to MADDO from the MCCs, and a bigger portion is directly sold to consumers and traders in the region. •MADDO Dairies Ltd is currently undergoing renovation and expansion, so it is selling raw milk at the moment. •The need for cash payments to run the MCCs operational expenses, MCCs sell raw milk they wait for payments from MADDO Dairies.	•DDA and MADDO Dairies Ltd set the standard guidelines for the MCCs to operate. •The milk inspections are carried out by the MCC attendants •Spot checks are conducted at the MCCs by DDA to see whether the stipulated guidelines are followed. •Milk tests are done every time the milk is brought to the MCC before the reception. •Before milk is accepted at the MCCs, it is checked for adulteration and alcohol tests to establish abnormal milk from sick cows. •They check for mastitis and water content and sometimes temperature to check if the milk wasn't heated before being brought to the MCC. •Alcohol tests are conducted to check for the mineral balance of the milk and also detect abnormalities in the milk such as	•DDA works with UNBS District health inspectors to ensure compliance with the SOPs. •DDA does routine checks and follows ups in case there was a deviation.	•Milk collection centres sell milk to MADDO Dairies Ltd and also consumers and traders for quick cash to sustain the operations of MCCs and high demand for raw milk. •Because MCCs reject substandard milk, most farmers and traders' resort to the informal segment	•MCCs are managed by a committee selected by farmer groups. •The committee constitutes of the chairperson, secretary, and treasurer, and audited members who open the account through which payments are made. •In the Dairy value chain, the MCCs deal with farmers, farmer groups, traders, and consumers. •MCCs receive milk every day from farmers and sometimes traders. •Traders buy milk from the MCCs to sell in their small kiosks and outlets. •Consumers who stay close to the MCCs buy milk for home consumption from them. •The MCCs are supported by MADDO Dairies Ltd since they are put in place to collect milk	•MCCs are trained on good milk handling Practices by DDA and MADDO Dairies Ltd. •They are trained quarterly.

•Milk is transported to the collection centres using cans that are given to producer groups on a loan basis •Milk is received from different producer groups under the cooperative umbrella •Payments are made between a fortnight and a month but mostly monthly. •The MCCs are self-sustainable from the milk sales. •The MCCs receive milk from all farmers in the region as long as its good quality milk.	- colostrum, milk from animals in late lactation, milk from animals suffering from mastitis. •Milk is checked before being accepted at various pick-up points and again checked at MCCs before the reception. •MCCs don't accept milk that has stayed overnight because of quality concerns. •To Maintain quality, the milk is stored in the coolers of the MCCs that have a capacity of between 2000- 3000 litres. •Milk that doesn't meet the required standards is rejected at the MCCs. •Milk is transported in metallic cans from different groups to the MCCs. •The critical control points of the MCCs are storage and reception.		- where there are no stringent standards. •MCCs don't give rewards to farmers for good milk quality.	- from different dairy farmers in the region. •The Managing director of the processing plant monitors the MCCs. •Through MCCs the farmers are able to have a ready market for their milk. •MCCs provide quality milk for processing for the processing plant. •MCCs serve all community members as long as their milk meets the quality standards. •The milk brought to the MCCs from farmer groups is recorded in the passbook, noting down how many litres each member has supplied per day to easy the payment process.	
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4.6.4 Robustness, reliability and resilience of the Milk trading function.

The key aspects of chain governance at the milk trading function are made explicit in bold in table 22 and they include: Milk is sourced from the Sembabule, Lyantonde, Rakai, Kalungu, and Gomba cattle corridors in greater Masaka. To ensure milk quality, establish a consistent milk price, improve trade ties, and avoid default from fraudulent milk traders, some traders have formed an association. Small-scale farmers' milk is not purchased by traders since they prefer to bulk large volumes at the farm. Initially, the traders used bicycles to deliver milk from farms to selling places; later, they upgraded to motorbikes, and now the majority of them have cars that transport milk. Traders prefer to sell in the informal market since the milk prices are higher and payments are made more promptly. During the dry season, mobilizing milk is difficult and costly. During the rainy season, there is so much excess milk that most milk collection centers can't handle it due of inadequate infrastructure, thus they end up pouring it, despite having current contracts with farmers to pick up their milk. Poor road

network, during the rainy season, most roads are inaccessible due to flooding. Before the milk is accepted, traders check for adulteration and conduct alcohol tests at the farm, but this is not always done. Traders purchase milk from trustworthy farms. DDA is tough on milk traders when it comes to milk handling, confiscating substandard milk, thus traders try to maintain quality milk as much as possible. Milk is typically transported in cans, and sometimes use jerrycans. Brookside dairies and DDA provide milk handling training to traders. DDA used to train them frequently, but due to covid19, they haven't done so in almost a year. Most traders are afraid to attend DDA trainings since it is harsh on traders who sell substandard milk.

Table 22: Governance of the greater Masaka Dairy value chain at the Milk trading function

Milk traders					
Robustness of the DVC		Reliability Policy environment		Resilient innovation systems	
Organization, Productivity, volume and prices	Milk quality	Regulations	Incentives	Innovation services	Capacity Building
•Milk is sourced by milk traders from the greater Masaka Cattle corridors of Sembabule, Lyantonde, Rakai, Kalungu and Gomba. •Some traders are organized in an association to maintain milk quality, have a unified milk price, promote trade relations and avoid default from fraudulent milk traders. •The traders' association has over 500 members. •The traders don't buy milk from small scale farmers as they prefer to bulk large volumes at the farm. •In the informal chain, the traders sell milk to kiosks, dairy shops, and consumers whereas in the formal segment, they supply milk to MADDO Dairies sometimes Pearl Dairies, and Brookside Dairies. •The traders started by transporting milk from the farms to selling points using bicycles, they later upgraded to motorbikes and now most of them have vehicles that transport milk.	•Traders check for adulteration and also conduct alcohol tests at the farm before the milk is accepted but not all the time. •Traders buy milk from trusted farmers. •To ensure milk quality, they go to the farms very early in the morning when the farmers are still milking to witness the hygiene and also avoid adulteration, so they collect the milk in its fresh state. •The critical points for traders are the farm, in transit and the outlets	•DDA partners with other government bodies such as the District health inspector, DVOs and UNBS and do spot checks on the roads to ensure that the standard guidelines are followed.	•Traders motivate famers to sell to them milk by giving them advance payments between two weeks and a month. •Traders plan on awarding farmers who supply them consistently with good quality milk in the future with t-shirts, milk cans, and bigger advances. •Traders are prompted to trade in the informal	•Traders deal with mainly farmers, a few milk processors, milk wholesalers, retailers, and consumers in the region. •Traders have established good relationships with farmers by prompt payments whoever some farmers who do not deal with traders under the association encountered fraudulent traders. •Traders supply milk to kiosks and other outlets and collect the money the next day.	•Traders get training on milk handling from Brookside dairies and DDA. •DDA used to train them often but because of covid19, it has been over a year when they last

• Traders prefer to sell in the informal mainly because of the better milk prices compared to the informal as well as prompt payments. • During the dry season, traders buy milk from farmers between Ush 1,100-1,200, and during the wet season, the price ranges from Ush.500-700. • Milk is sold in the informal chain at Us.1400 per litre and Ush. 1000 per litre in the formal chain. • The traders find the milk business profitable • Some farmers sell substandard milk to traders which get spoilt before it is being sold hence a big loss to the traders. • Some farmers don't honour the agreements they have with traders and sell milk to other traders, yet they have received advance payments from them. • It is hard and expensive to mobilize milk during the dry season. • During the wet season, there is a lot of surplus milk that most milk collection centres cannot accommodate the large volume because of low capacity, and they end up pouring the milk, yet they have existing contracts with farmers to pick up their milk. • Poor road network, most roads are impassable during the wet season as they flood.	where they supply the milk. • DDA is very tough on milk traders regarding milk handling as they confiscate substandard milk, so traders try as much as they can to keep quality milk. • Traders do their best to maintain milk quality in the region by doing background checks on the farmers to find out if they adulterate milk before dealing with them. • Traders who are not maintaining milk quality and adulterating milk face disciplinary committee and are banned from the association and warn counterparts not to deal with them. • Milk is mostly transported in cans and sometimes in jerrycans.	• If the traders are found to be non-compliant, they are confined for a maximum of 6 months, pay fines of up to shs.500,000, and are given strong warnings.	segment of prompt cash payments. • Traders can sell big volumes because they have undesignated markets unlike when they deal with processing plants, they can only supply limited volumes because of the limited capacity of the plants. • Traders get better prices in the informal segment unlike the formal where they are offered the low prices in both wet and dry seasons. • There is high demand for raw milk in the region.	• Traders are given support by Processing plants that offer training services on milk handling. • With DDA in the picture, most traders are prompted to sell quality milk and follow the standard guidelines. • Traders have contracts with farmers to enhance sustainable milk supply. • The traders also have contracts with the processing plants they supply. i.e Brookside and Pearl dairies. • Most traders get information about milk prices and trends through their association leaders and fellow traders since they supply milk to different markets daily.	trained them. • Because DDA is tough with traders who sell substandard milk, most traders are scared to attend trainings it provides.
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4.6.5 Robustness, reliability and resilience of the Milk production function

In bold are the key elements of chain governance at the production function in table 23. Farmers usually keep 1-3 cows, but usually only one, due to a lack of area for farming and the difficulty in maintaining more cows. In Sembabule, Lyantonde, Rakai, and Gomba, large-scale and medium-scale farmers predominate. Small-scale farmers predominate in Lwengo, Kyotera, and Masaka, yet better breeds are maintained. Due to low milk volumes, the majority of small-scale producers sell directly to consumers. The cow produces roughly 15 litres per day when it is well-nourished and has just given birth, and between 8-10 litres per day on dry days. A farmer produces 10 litres of milk per cow each day on average. Local breeds such as Ankole cows produce 5-6 litres of milk each day for farmers who keep them. Normally, one litre is kept for personal consumption and for feeding the calf, and the rest is sold. Apart from dairy farming, the majority of the farmers keep pigs, poultry, and have banana and coffee plantations. The pickup point is normally 1 km away, while the collection centers are roughly 4 km away. Farmers are paid every two weeks to a month, while payments from MCCs can take up to a month. However, they receive timely payments from neighbors and traders. Before the milk is carried to the pick-up locations and MCCs, each farmer is given a lactometer to examine the milk; however, when selling directly to neighbors, the milk is not checked. DDA provides clear guidelines for milk quality demands through MCCs. DDA does not reach farmers; it only reaches MCCs. The accepted milk is collected in a group milk can and sent to the MCC. The majority of farmers are driven to trade in the informal sector by prompt payments, better pricing, and a lack of rules. Farmers who are distant from collection centers sell milk produced in the evening to the informal sector since their groups do not have a plan to transport milk to the collection centers in the evening. As a result, farmers sell milk to their neighbors. Most farmer groups want to have a milk supply contract with MADDO Dairies Ltd to ensure price stability, volume, and consistent payments, as well as to secure advance payments. However, some farmers are hesitant to get into a milk supply contract because they are unsure that they will be able to meet the contract's obligations, particularly the milk volume requirements, given the seasonality of milk and the fact that they have a small herd of cows. MADDO Dairies extension personnel and District extension officers, NAADS, provide extension to farmers. Extension workers used to train once a week and invite group leaders for training once a month before Covid 19.

Table 23: Governance of the greater Masaka Dairy value chain at the Milk production function

Milk production					
Robustness of the DVC		Reliability policy environment		Resilient innovation systems	
Organization, Productivity, volume, and price	Milk quality	Regulations	Incentives	Innovation services	Capacity building
•Farmers keep between 1-3 cows but mostly 1 cow because of limited land for farming and can't afford to take care of more cows. •Large-scale and medium-scale farmers are predominant in Sembabule, Lyantonde, Rakai, Gomba. •Small scale farmers are predominant in Lwengo, Kyotera, and Masaka mainly but keep improved breeds. •Most of the small-scale farmers because of low milk volumes, sell directly to consumers. •A farmer's production costs are feeding, treatment, water, farm labour and spends averagely 100,000 on production per month. •When the cow is well fed and has just given birth, it produces about 15 litres	•Every farmer is given a lactometer to check the milk before it is brought to the pick-up points and MCCs, however when selling directly to neighbors, the milk is not checked. •The farmers mainly check for milk purity, adulteration and observe hygiene at the farm and pickup points. •The other tests are carried out at the MCCs.	•The quality milk standards and compliance are enforced at milk pick-up points and MCCs. •Alcohol and purity tests are conducted before milk reception at pickup points and MCCs. •Milk that does not meet the standard requirement is rejected. •Most farmers prefer to sell directly to	•Most farmers are motivated to trade in the informal chain because of prompt payments, better prices, and limited or no regulations. •In the informal Farmers don't have to pay transport costs as they sell directly to consumers unlike in the formal segment. •In the informal segment, there are no standards and checks, anyone can sell milk unlike in the formal segment. •The district local government gives some incentives to farmers such as silage cutters. •Farmers are motivated to sell in	•Farmers have good relationships with the chain actors. •Farmers deal with neighbors, traders, retailers, and consumers. •Some farmers have milk outlets where they supply their milk. •The farmers are supported by MADDO Dairies, the district local government, and several NGOs in the region. •Through the relationships with chain supporters, farmers have improved their farming skills, productivity, market access, access to market information, veterinary services, and group formation. •Most groups want to have a milk supply contract with MADDO Dairies Ltd to ensure price stability, volumes, stable payments and also use it as an opportunity to secure advance payments. •Some farmers are not comfortable with having milk supply contracts because they are not sure that they can keep the contract terms especially milk volumes given the seasonality of milk and the fact that they rear very few cows.	•Farmers receive training from MADDO Dairies extension staff and District extension officers, NAADS. •Before Covid 19, extension workers would train once a week and invite group leaders for training once a month. •There are 2 veterinary personals per subcounty facilitated by the government to extend extension services. •Farmers under the cow project have contracts with MADDO to take good care of the cows, train 4 other farmers and give a

per day and towards the dry days, it produces between 8-10 litres per day. On average a farmer produces 10 litres of milk per cow per day. • Sometimes because of poor feeding of the cows, a cow gives utmost 10 litres of milk per day for the improved breeds. • Farmers who keep the local breeds such as Ankole cows, each cow produces 5-6 litres of milk per day. • Normally one litre is left for home consumption, litres for feeding the calf, and the rest of the milk is sold. • Farmers sell a litre of milk to the MCCs at an average of shs.1000 and to neighbors and other traders at averagely Ush. 1200 • Most farmers find dairy farming profitable, and it is a big source of livelihood. • Apart from dairy farming, most of the farmers are engaged in piggyery, poultry, have banana plantations as well as coffee plantations.	• Milk is inspection is carried out at the pickup locations every day before it is transported to the MCCs. • DDA through the MCCs gives standard guidelines of the milk quality expectations. • DDA doesn't reach the farmers, only stops at the MCCs. • To ensure milk quality milk is transported to MCCs using metallic cans • To ensure hygiene, cows are Milked in a clean environment, the cow's	consumers because there are no standards in the informal segment, they adulterate the milk to increase the volumes in order to make more sales. • Farmers are required to deliver milk if the milking cow is not on any treatment or after two weeks when treatment is completed. • Milk quality checks are done at the Pickup points and MCCs. • After the milk is	the informal segment because of need of cash payments to run their farms and take care of their families. • Famers who are distant from collection centres sell milk produced in the evening to the informal segment because there is no arrangement within their groups to transport milk to the collection centres, farmers end up selling the milk to the neighbors. • Some farmers get frustrated by the stringent standards at the MCCs and end up trading in the informal segment. • There is high demand for milk which motivates dairy farmers. • Dairy farming is profitable as most farmers are able to	• Market Information is passed on to farmers through different cooperative and group leaders using an app. • Local government links farmers to markets by giving keeping them updates with market information and trends and also buy milk from farmers at a better price. • MADD0 is developing an online system amidst Covid where they can meet group leaders on zoom so that they can monitor new and existing farmers and provide extension services. • Some Farmer groups have VSLAs where members can save and access loans in times of emergency i.e., to treat their sick animals. • Because of the VSLAs many farmers remain loyal to the members and attracts new farmers to join them. • The farmers are looking forward to establishing relationships with MFIs in the region to further strengthen the VSLs. • Some farmers would have wanted to process of the milk into ghee to increase their incomes but the milk from improved breeds has low fat content i.e., a farmer would need 20 litres of milk to make 1 kg of ghee. • 153 biogas plants have been constructed for different farmers. • Government through operation wealth creation also supplies heifers to famers and supports artificial insemination.	heifer to a new farmer. • On spot training are carried out if a veterinary doctor is called upon treat a sick animal. • Trainings are done on animal nutrition, animal health, hygiene and modern technology. • They are trained once every quarter but because of Covid, they last received training in 2019. • Farmers receive training on how to maintain milk quality, hygiene, sustainable farming, better feeding, group dynamics such as record keeping. • Training of farmers is demand driven and some famers don't embrace the extension workers.
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•Milk is most of the time bulked at a pickup point and later taken to the MCCs. •The distance to the Pickup point is usually 1 km and about 4 km to the collection centres. •Farmers are paid between 2 weeks and a month though sometimes the payments delay for over a month through the MCCs however they get prompt payments from neighbors and traders. •However, sometimes it is a consensus, farmers request to be paid after a month. •Farmers are paid through the bank by MADDO Dairies and also receive cash from direct milk sales to neighbors and kiosks. Farmers deliver milk to the collection centres using bicycles or by foot.	under is cleaned and milk is collected in a clean metallic tin. •The milk is sieved and immediately taken to the pickup point where several quality checks are carried out before it is accepted. •The accepted milk is put in the group collection milk Can and is transported to the MCC. •For groups that are close to the MCCs, each farmer delivers milk individually and it is tested before reception	collected and checked at the pickup points, it is given to one farmer with a bicycle or motorcycle to deliver it at the MCC. •When farmers trade in the informal segment, the quality aspect is most of the time ignored because no one monitors the milk quality. i.e neighbors can't run quality tests.	meet their daily needs and expenses. •No incentives and awards are given for quality milk at Pick up points and MCCs. •Giving awards for quality such as motorbikes, heifers, cash would motivate them to increase productivity and enhance quality. •Long distances to the collection centres are also a disincentive to farmers. •Because of low prices, farmers are forced to supply more milk elsewhere in search for better prices and sell very little to MCCs.	•To boost breeding, a new programme is being designed by the government called-community livestock breeding where nucleus farms as a source of breeding and will be a free service. •Farmers are requested to open accounts in the bank, and they are paid through the bank. •To ensure peace and equality in the home over decision-making and money from the sale of milk, every family has to open an account with both the husband and wife as signatories for easy access to finances, accountability, and planning. •The district production department has trained extension staff in master's studies and now has 5 Ph.D. holders. •Under the production department, they have developed mineral blocks for feeding the cows which is a combination of calliandra, molasses, cassava which can sustain a cow in the dry season, with just on block a day. •Under the same department, they have developed super Napier grass since Napier grass was being infected with diseases, so they are multiplying and supplying the super Napier grass and distributing it to farmers to improving feeding. •The same department has also developed the sweet potato silage and promoting hay making technologies.	•If farmers are organized in cooperatives, it is easy to train and monitor them. •Farmers have to be trained in group dynamics, communication skills and building relationships to further strengthen the farmer groups and cooperatives. •Farmers are also trained on water harvesting mechanisms to have enough water for home use and farming. •They are trained in milk handling practices, to check the milk quality and make sure that their milk is not contaminated. •Farmers in deep villages don't easily access extension services.
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4.6.7 Survey results on Chain governance.

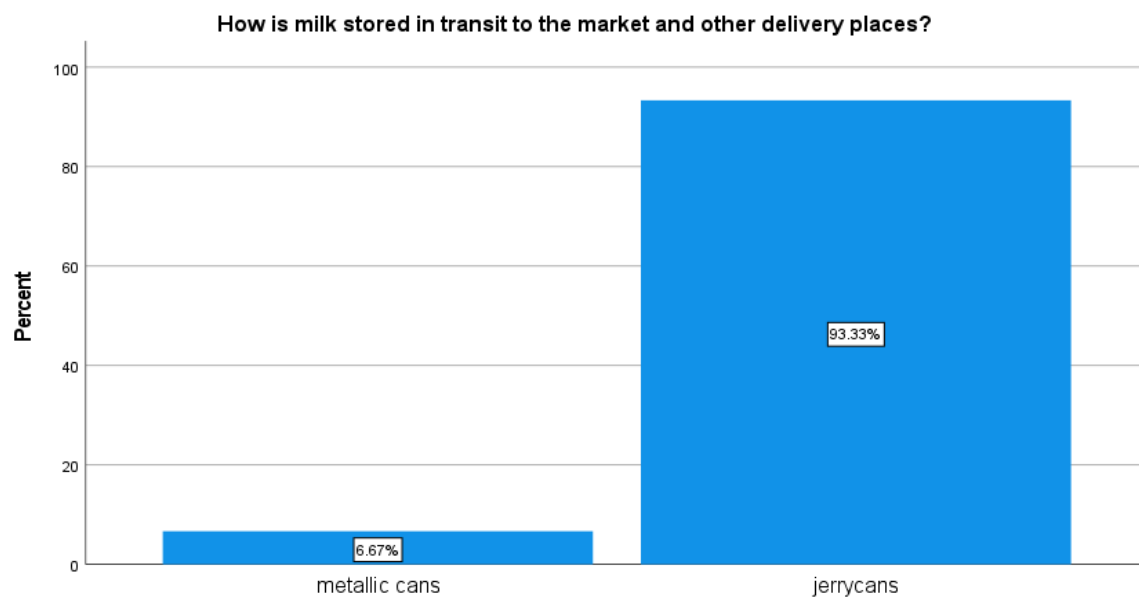
After engaging farmers in a focus group discussion as seen in tables above, a survey was carried out amongst the farmers to tackle quantitative elements of robustness, reliability and resilience of the greater Masaka Food systems.

a) Robustness: Milk quality

Milk storage in transit

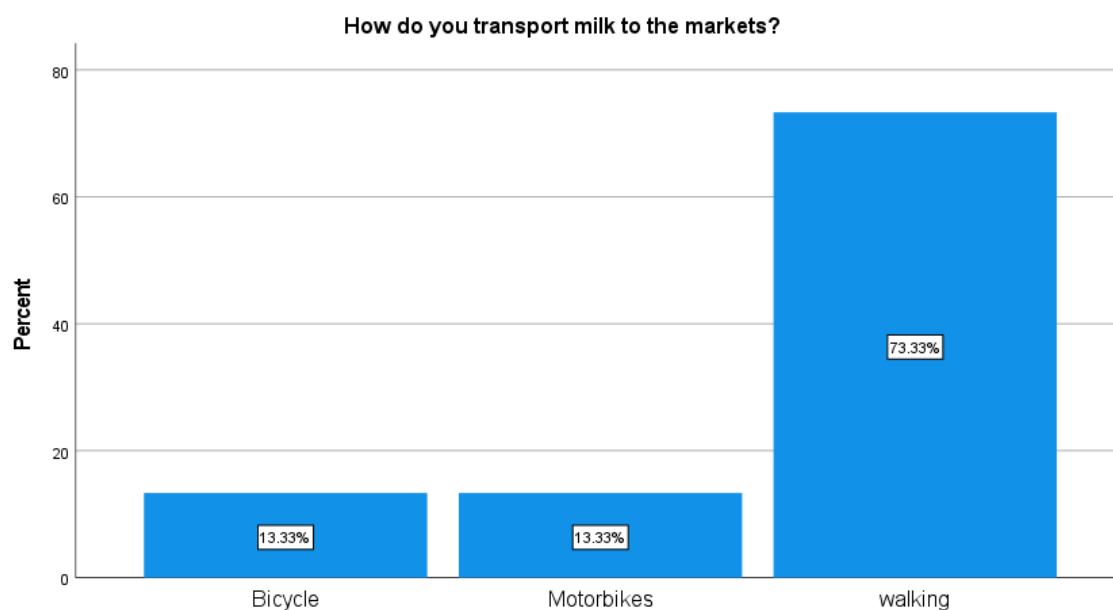
The survey revealed that 93.3% of the respondents' store milk in jerry cans while in transit to milk pickup points and MCCs whereas only 6.67% used metallic cans as seen in figure 15.

Figure 15: milk storage in transit



Milk Transportation.

Figure 16: Milk Transportation

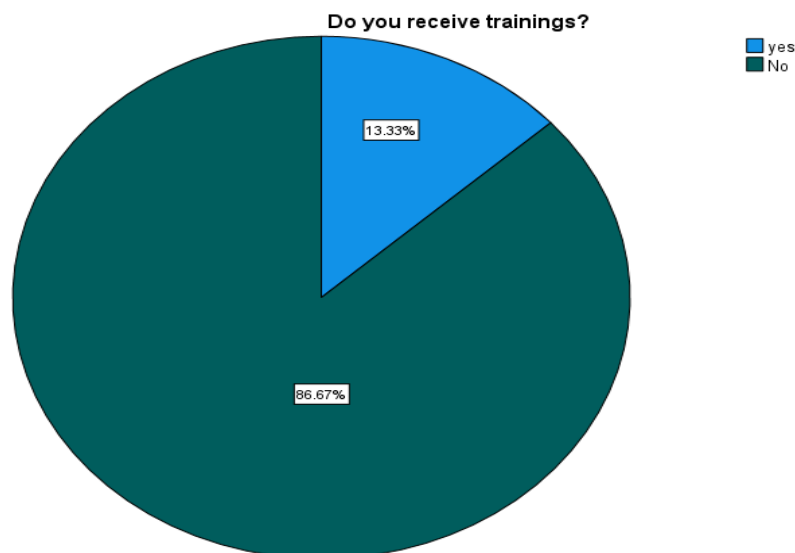


According to the survey, the Majority of the respondents 73.33% transport milk to the milk pickup points and MCCs by walking, 13.3% use motorbikes, and 13.3% use bicycles as seen in figure 16.

b) Resilient innovation systems: Capacity building of farmers

The survey revealed that 86.67% of the respondents do not receive training and this was attributed to the covid situation at the moment whereas only 13.33% of the respondents received training as seen in figure 17.

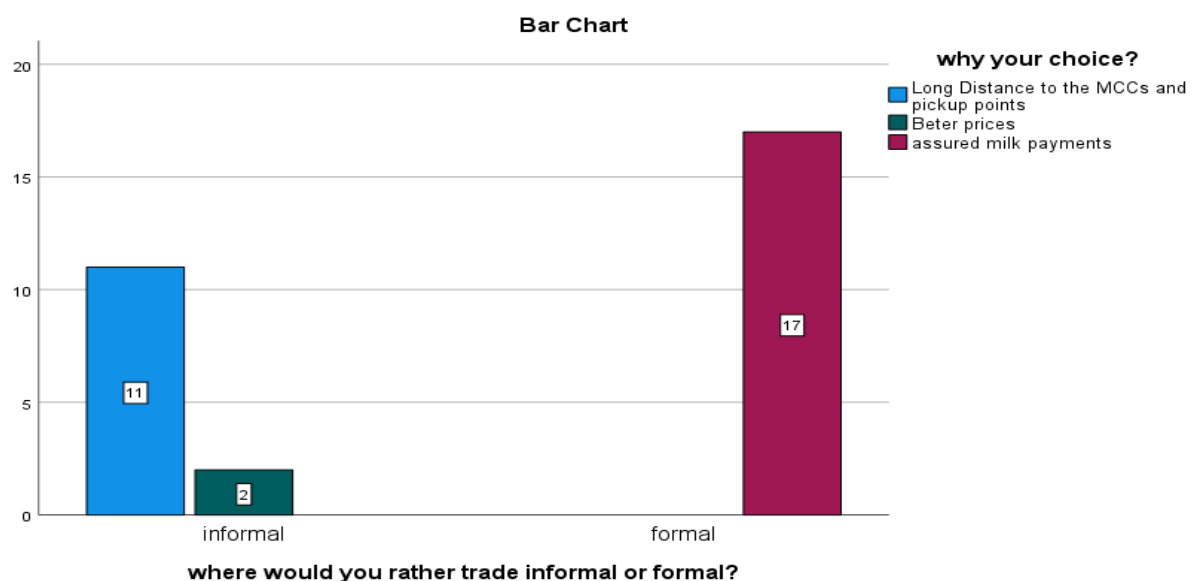
Figure 17: Training and capacity building of farmers



c) Reliability of innovation system: incentives to trade in formal vs informal chains

According to the survey as seen in figure 18, majority 56.67% of the respondents' trade in the formal chain because of assured milk payments from MADD0 Dairies Ltd compared to milk traders, 36.7% of the respondents' trade in the informal chain because of the long distance to the MCCs and 6.66% trade in the informal chain because of price.

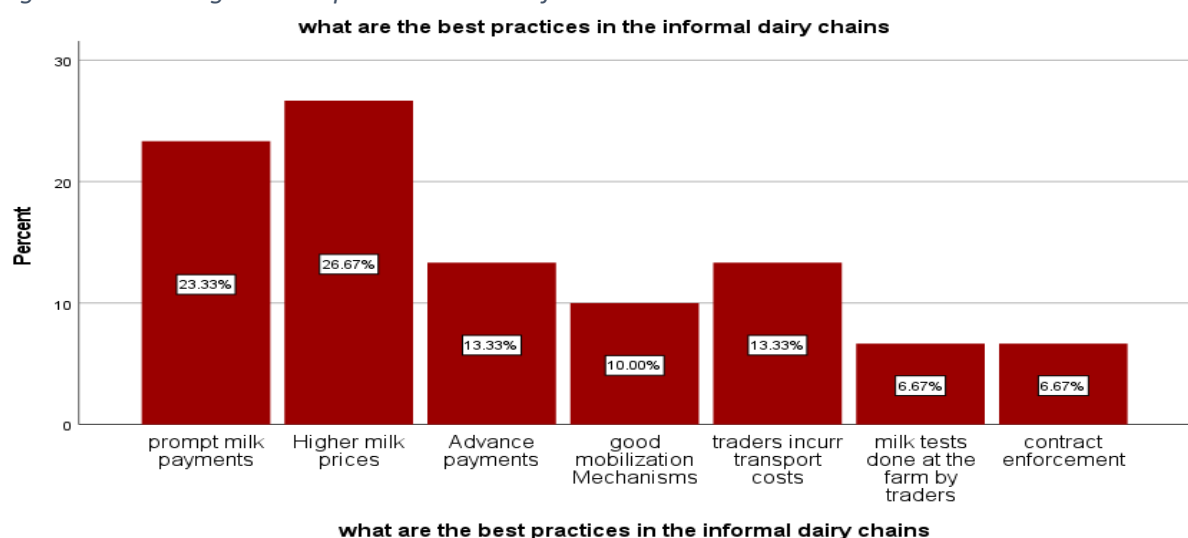
Figure 18: reason for trading in the formal chain



4.7 Best practices in the informal chains

From the FGD with farmers, regarding the best practices in the informal chain, Farmers were requested to brainstorm the best practices they have noticed in the informal chains that they have not seen or could like to see in the formal chain, and by show of hands, they were requested to choose the most significant factors, 26% of the respondents agreed to higher prices, followed by prompt milk payments which were agreed to by 23.33% of the respondents, 13.33% of the respondents agreed on advance payments, still 13% of the respondents stated that traders incur transport costs, 6.67% of the respondents mentioned that milk tests are done at the farms by traders and 6.67% of the respondents mentioned that there is contract enforcement.

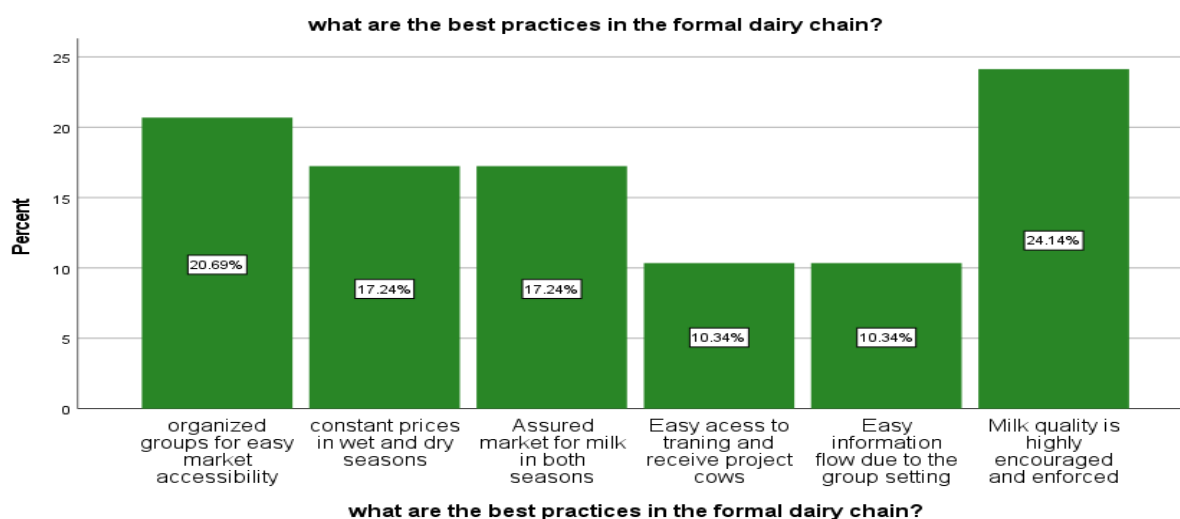
Figure 19: showing the best practices in the informal chains



4.7.1 Best practices in the formal dairy chain

In the FGDs, farmers mentioned that there good practices in the formal chain, the most predominant (22.4%) of the respondents mentioned that milk quality is highly encouraged and enforced, 20.69% mentioned that farmers are organized in groups for easy market accessibility, 17.24% mentioned that there are constant prices both in the dry and wet seasons, 17.24% also mentioned that there is assured market for the milk in both seasons, 10.34 % of the respondents mentioned that there is easy access to training and project cows and 10.34% of the respondents mentioned that there is easy information flow due to the group setting.

Figure 20: Showing beat pactices in the formal chain



4.8 Performance of MADDO Dairies Limited

4.8.1 MADDO Dairies Ltd.'s current Business Model

The performance of MADDO Dairies was assessed using the business canvas model. The details in the business canvas model below were obtained using key informant interviews. It shows MADDO Dairies Ltd.'s current Key partners, value proposition, supply relations, Key activities, customer/supply segments, channels, key resources, cost structure, and revenue streams.

Table 24: MADDO Dairies Current Business model

<u>KEY PARTNERS</u>	<u>VALUE PROPOSITION</u>	<u>SUPPLY RELATIONSHIPS</u>
➤ Heifer International ➤ Bothar Ireland ➤ Opportunity Africa in England ➤ Senior experts in the Netherlands ➤ Send a cow ➤ Microfinancing partners Africa ➤ World vision ➤ St. Jude NGO ➤ DDA ➤ UNBS ➤ District Veterinary officers ➤ Farmers ➤ Milk collection centres ➤ Milk Traders ➤ Centenary Bank ➤ Milk wholesalers and retailers.	➤ MADDO Dairies is a social business, it caters to the social aspects of people in the greater Masaka region by training farmers in sustainable agriculture, livestock management, environmental conservation, vegetable management to improve livelihoods. ➤ VISION: To establish the dairy in profitability position that will sustain it to provide quality milk products ➤ MISSION: To produce high quality milk products for improved health among the populace. ➤ OBJECTIVES: -To provide reliable market for farmers' milk & produce high quality milk products -To provide employment to the youth in the area -To improve the welfare of the community - To make profits that sustains the Dairy.	➤ MADDO gives farmers a living loan of a cow and the farmer has to pay back with a heifer which is then given to another farmer. ➤ MADDO has agreements with farmers and are signed upon reception of a heifer; stating that they will take good care of the cow, give back a heifer, and train 4 other farmers. ➤ Farmers are given good quality metallic cans to enhance milk quality at pickup points, the cans are given on a loan basis and farmers pay back from the milk sales at the MCCs. ➤ MADDO does not enforce that the project famers sell milk to them. Therefore, they don't have supply contracts with farmers in place. ➤ MADDO has meetings with farmer group representatives once every month. ➤ MADDO Dairies has a trust-based relationship with farmers.

<u>KEY ACTIVITIES</u> ➤ MADDO Dairies Ltd is a key player in the region as it is engaged in milk production, collection, and processing, and marketing. ➤ MADDO Dairies provides services to dairy farmers through the cow project by offering them heifers and extension services. ➤ They train farmers on nutrition and hygiene, good milk handling practices, proper feeding practices, and how to grow fodder and in hay and silage making and sustainable agriculture. ➤ Farmers are given high-quality metallic cans on a loan basis to ensure high milk quality.	<u>CUSTOMER / SUPPLIER SEGMENTS</u> ➤ MADDO Dairies Ltd supplies its milk products in places where it has a niche market in the greater Masaka region and Kampala. ➤ Currently, they are selling raw milk until machinery at the new processing plant is fully installed and ready to reopen. ➤ There is high demand for raw milk in the region. ➤ Farmer groups supply milk to MADDO Dairies Ltd through different MCCs. ➤ MADDO Dairies Ltd mainly procures milk from the project farmers through the established MCCs. ➤ Sometimes in the dry season, they Procure milk from the southwestern region. ➤ Currently 80% of the raw milk received at the processing plant is processed and sold as yoghurt, 15% in raw form whereas 5% is sold as pasteurized milk.	<u>CHANNELS</u> ➤ MADDO products are found in retail shops, supermarkets, schools, hotels, hospitals, and individual consumers. ➤ MADDO Dairies Ltd supplies its products in the greater Masaka region where it has a niche market i.e. mainly schools and Kampala since raw milk has more demand in the region. ➤ Milk supplies are organized from farmer groups who collect milk at pick-up points and then it is brought to various MCCs then finally brought to the processing plant. ➤ Has good relations with farmers groups and passes on market information to the farmers through farmer groups and cooperative leaders.
<u>KEY RESOURCES</u> ➤ MADDO Dairies Ltd is a company limited by guarantee ➤ It has over 2200 trained project farmers. ➤ Initially started with a processing plant with a capacity of 4,000 litres of milk daily ➤ A new processing plant with a capacity of 10,000litres per day will soon be open and has milk coolers.	<u>COST STRUCTURE</u> ➤ MADDO Dairies was using a diesel boiler to run the processing plant but it was not found to be cost-effective and is now switching to a biomass boiler that uses firewood. ➤ When at full production capacity, MADDO Dairies Ltd is able to cover its current liabilities.	<u>REVENUE STREAMS</u> ➤ MADDO gets revenue from milk processing, collection, and selling of processed milk and raw milk. ➤ Biogas installation is also a source of revenue. ➤ Farmers are asked to open accounts in the bank through which they are paid.

➤ The business premises are on 2 acres of land. ➤ Has 5 milk collection centres ➤ 3 Milk cooling trucks. ➤ At first MADDO Dairies Ltd employed permanent 32 employees but due to Covid 19 and mechanical breakdown of the old plant, it now employees 15 staff. ➤ MADDO has a forest on 185 acres. And total fixed assets are worth 1.4 billion Ugandan shillings.	➤ Limited working capital hence causing delays in paying the farmers. ➤ The new plant has been constructed using revenues from the plant and partly using loans.	
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4.8.2 Organization of cooperatives under MADDO Dairies Ltd

Using focus group discussions, data about the organization of the cooperatives under MADDO Dairies Ltd was collected and is summarized in the table 25, it entails the membership and organization of cooperatives/ farmer groups, production, and collection of milk within the cooperatives, their financial management, what motivates the farmers to be loyal to MADDO Dairies Ltd, challenges within the cooperatives and what can be done to strengthen the cooperatives and improve the loyalty of members.

Table 25: showing the organization of cooperatives under MADDO Dairies Ltd.

Organization of cooperatives	
Membership and organization	❖ Most groups have existed for over 15 years. ❖ There about 2221 project farmers under MADDO ❖ Farmers are encouraged and empowered by MADDO to organize themselves in producer groups. ❖ Farmers organize themselves in a group and MADDO extension staff help them come up with a constitution and goal. ❖ The farmer group should have a common goal, a constitution and set objectives agreed upon by members. ❖ Farmers are asked to develop an action plan before they are taken by MADDO and trained. ❖ Farmers are asked to choose leaders who monitor group activities in order to achieve their common goals. ❖ Farmers under MADDO are encouraged to sell collectively. ❖ Famers are organized in groups of 35-50 members ❖ A group of 35 members most of the time has about 14 to 20 active members. ❖ Farmers are brought together by common interest which is dairy farming and then register their group with MADDO Dairies Ltd. ❖ Members are registered in different farmers groups. ❖ There are 5 cooperatives where the farmer groups belong to. ❖ The cooperatives run and manage the MCCs. ❖ Every cooperative has between 5 to 8 farmer groups. ❖ Averagely every cooperative has about 150 members. ❖ Each farmer group has a committee has involves the chairperson, treasurer, secretary, and the trainer of trainers who is in charge of training other farmers. ❖ Before a farmer receives a cow, he ought to have received training on feeding, hygiene and farm management and then signs an agreement with MADDO to properly manage the cow and give back a heifer. ❖ To be a member and be given a cow, a farmer has to first build shelter for the cow, plant fodder to feed the cow and be extremely hygienic. ❖ Then a representative from MADDO inspects the home to confirm that the famer is ready for the cow. ❖ Farmers make contributions of Ush.150,000 for a heifer and Ush.300,000 for a cow to enhance a spirit of ownership and full responsibility of the cows. ❖ Upon approval of the premises, then a farmer receives the cow. ❖ Members are mostly active when the cows are producing milk and less active when the cows are dry. ❖ Most farmer groups have very few active members. ❖ Women dominate in the most active farmer groups. ❖ Other famers are drawn to these groups under MADDO because of the trainings they get, benefits thy see members get, market for their milk, the cow project and the VSLAs hence that is how they attract new members.

	❖ Group leaders are trained by MADDO on management skills, respect and training skills, so that they can train other members. ❖ MADDO Extension staff monitor different groups quarterly, check their records and progress. ❖ MADDO creates awareness about the benefits of belonging to farmer groups under them by doing cost benefit comparisons with unorganized farmers. ❖ Farmers in different farmer groups collect milk jointly at pick up points send it to MCCs. ❖ There are no recruitment activities to enlarge the number of group members however MADDO Dairies limited gives farmers heifers who later join the groups.
Production and collection	❖ Project farmers rear Holstein Friesian cows that are given to them under the cow project. ❖ Most farmer groups started with six cows and the members kept increasing hence the growth of the groups. ❖ All members practice zero grazing ❖ Most farmers keep one cow and averagely 2 cows. ❖ Farmers keep few cows because of limited land and can't afford to feed more cows. ❖ A cow is given to a farmer as a living loan and the farmer pays back with a heifer which is given to another who also joins the group. ❖ The farmer who receives a cow is required to train 4 other farmers in the region. ❖ When a cow has just given birth, it produces 15- 20 litres of milk daily. ❖ However, some give about 10 litres per day because of poor feeding. ❖ Some farmers produce as low as 5-6 litres per cow. ❖ For some groups are closer to the MCCs, each individual member takes the milk to the MCC. ❖ MADDO doesn't enforce that farmers sell their milk to it. ❖ For farmer groups are distant from the MCCs, collect milk jointly at pick up points send it to MCCs. ❖ At the pickup points, farmer groups collect between 50 -100 litres of milk daily. ❖ Milk is collected and transported in metallic cans with a capacity of 150 litres. ❖ For famers close to the MCCs deliver milk in jerrycans individually. ❖ Some farmers on their way to pick up points and MCCs sell their milk to traders and consumers they find on their way. ❖ Some farmer groups that are very far from the MCCs have collapsed because long distance and high costs of transport. ❖ Very small volumes are sold to the MCCs as most of the milk finds its way in the informal segment for better prices and prompt payments. ❖
Financial Management	❖ Farmers are paid after one month and sometimes payment delay up to two months. ❖ Most of the farmers request to be paid at the end of the month though the payments delay sometimes. ❖ They requested to be paid at the end of the month so that they can get a wholesome figure to invest in other projects at the end of the month. ❖ Some farmer groups have organized VSLAs to cater for uncertainties such as treatment of the cow and meet other family obligations in case of delayed milk payments. ❖ The VSLAs have all community members even those who are not engaged in dairy farming.

	❖ They save every month after receiving their payments from MADDO Dairies Ltd. ❖ There are shares which are bought by each member. ❖ Each share goes for shs.20,000 and a member can buy up to 5 shares. ❖ The farmer groups have opened accounts in banks where they keep their savings and are open to establish more relationships with microfinance institutions since they have accumulated enough savings. ❖ Most farmers borrow from the VSLAs between 1 -3 million shillings at an interest rate of 10% for members and nonmembers pay interest of 15%. ❖ Farmers avoid talking loans from financial institutions because of high interest rate. ❖ The loan term ranges from one month to 3 months. ❖ However, many farmers groups don't have VSLAs.
Services- what motivates them to be loyal to MADDO Dairies Ltd.	❖ Because they belong to cooperatives under MADDO, they get training from MADDO and the district local government. ❖ They get training on animal feeding, hygiene, animal welfare. ❖ They also get training on group dynamics such as record keeping. ❖ Farmers are given cows and only pay a service fee of shs.300,000 for a cow and only shs.150,000 for a heifer which is way cheaper than buying a heifer on their own which would cost them about Ush. 1,200,000 ❖ They are given biogas which improves their homesteads. ❖ Easily market their milk especially those who are far away from the trading centres. ❖ Most of the farmers can earn income through dairy farming and take good care of their families. ❖ Most farmers have built decent homes. ❖ Educated their children ❖ Most farmers have started up other income-generating activities such as piggery, poultry from milk revenues they get from MADDO. ❖ Improved nutrition from milk as a good source of protein ❖ Most farmers are loyal to the agreed terms with MADDDO because it is affiliated with the church and most of the members are believers.
Challenges within the cooperatives	❖ They don't have a contract with MADDO Dairies Ltd to supply the milk. Some groups want the contract because it will help them negotiate a good price, motivate them to increase the milk volumes they supply, improve payments and it will enable them to request advance payments. ❖ However, some farmer groups don't embrace contracts because they cannot meet the contract terms such as volumes especially when the cows are dry and during the dry season. ❖ Sometimes the milk payments delay. ❖ Low milk prices paid at the MCCs make them trade in the informal segment. i.e. milk prices elsewhere are Ush.1,400 per litre yet MADDO pays only shs.1200 per litre. ❖ Some farmers within the groups adulterate milk to increase volumes which affects milk quality. ❖ Stringent regulations at the MCCs even when farmers have been careful to follow the standard procedures, their milk is rejected hence forcing them to rather sell to the informal segment. ❖ Poor governance of the farmer groups leading to the collapse of many. ❖ There is a challenge of poor leadership of farmer groups as the leaders forget their roles. ❖ Most of the cooperative members are illiterate hence hard to mobilize and organize. ❖ Long distances to the MCCs. ❖ Farmers pay for transportation to the MCCs which eats up their profits, farmers pay between shs.180,000 to 240,000 as transport costs per month.

What can be done to strengthen the cooperatives and improve the loyalty of members	❖ Give them better milk prices. ❖ train them group leadership dynamics to strengthen them. ❖ Train them more on milk handling and reduce stringent milk tests that MCCs because they feel bad when their milk is rejected after they have taken caution to keep the milk quality standards. ❖ Make the milk payments prompt. ❖ Provide more training on group dynamics. ❖ Give them water harvesting systems to improve water supply on the farms especially during the dry season. ❖ Be given affordable insemination as the current one is expensive and, in most cases, ineffective. It currently costs shs.50,000. ❖ Give them a solution to help them have their cows produce heifers since most of their cows give birth to males. ❖ Increase extension services such as vaccination of the animals. ❖ Engage the government to reduce the price of feeds such as maize as its expensive because of high exportation. ❖ Farmers requested to be given quality-based payments and awards to motivate them. ❖ Farmers in distant locations from the MCCs would want MADD0 to collect milk from their farms or pick-up points
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4.8.3 Impact of MADDO Dairies Ltd in the greater Masaka Region

From the key informant interviews and focus group discussions, table 26 shows responses about the impact of MADDO Dairies Ltd in the greater Masaka region.

Table 26: Impact of MADDO Dairies Ltd

Impact of MADDO Dairies Ltd in the greater Masaka region	
Results from Focus Group Discussions	Results from Key informant interviews
• Farmers are trained on sustainable dairy practices and good milk handling practices. • Farmers are given cows to promote dairy farming in the region as a source of livelihood and take care of their families. • Farmers have been able to construct decent homes through the cow project. • Farmers ably educate their children through revenues from milk sales. • Farmers are able to start up other income-generating activities from revenues from dairy, the activities include poultry, piggery. • Improved Nutrition through milk intake as a good source of proteins. • Manure through dairy farming is used as fertilizer which has increased production of other farm productions such as coffee plantations and banana plantations • Farmers are given biogas plants which improve the standards of living for a home. • MADDO is the first and only processing plant in the region that has contributed to the development. • Easy access to cheap and affordable food.	• Farmers are given cows to promote dairy farming in the region irrespective of their religious background. • A milk processing plant (MADDO Dairies Ltd) was put in place to add value to the milk produced by farmers and also provide a constant market for the milk. • MADDO Dairies Ltd, trains farmers in sustainable agriculture, livestock management, environment conservation, and vegetable management. • They also teach farmers how to use and construct biogas and have so far constructed 153 biogas plants in different homes. • MADDO teaches farmers nutrition and hygiene to improve health and save money that would have been used for treatment. • Milk quality is key, farmers are being trained on how to handle milk. • 5 collection centres have been set up to help farmers have easy access to the market. • Farmers are trained on better feeding to increase milk production. • Farmers are trained on hay making and silage for the dry season. • Farmers are given cans to manage milk quality while in transit to the MCCs. • Farmers are taught water harvesting mechanisms to help out in the dry season. • There is improved literacy as farmers can afford to take their children to school. • Linking farmers to the market • MADDO Dairies provides employment opportunities in agriculture i.e., dairy, at MCCs, the processing plant. • Teaching farmers on sustainable energy conservation such as using energy conserving stoves to reduce deforestation that leads to climate change. • MADDO collaborates with the government to enhance garbage recycling. • Fosters tree planting in the region

Chapter 5: Discussion

According to the problem statement of this study, despite the efforts to curb the informal chain in the greater Masaka Region, MADDO Dairies Ltd is experiencing low milk procurement attributed to the prevalence and competition from the informal milk chains in the region as a result of side-selling of most of the farmers. This chapter unveils a discussion in relation to the existing literature and the findings as well as the deeper analysis of the findings from the different incorporated data sources and their implication relating to the problem statement.

5.1 Stakeholder Analysis

MADDO Dairies Ltd has been a key player in the development of the dairy value chain in the greater Masaka region. This was reflected in the key informant interviews as most of them upheld MADDO for its efforts to alleviate poverty in the region through promoting dairy farming and providing extension services. The role of MADDO Dairies Ltd as an influential stakeholder in the greater Masaka region was undeniable as even in the focus group discussion with farmers who emphasized that almost all the cows they have, were got through the MADDO cow project, the farmer groups are organized with the support from MADDO and the establishment of different MCCs and the processing plant. In addition, the farmers in the FGDs mentioned that they get training in several aspects that include animal welfare, feeding, sustainable agriculture. The survey also confirmed that indeed the majority of the farmers were happy with the services provided by MADDO Dairies Ltd.

5.2 Stakeholders and chain relations

Through key informant interviews with several partners with MADDO Dairies, they confirmed their partnership and collaboration with MADDO Dairies in developing the dairy value chain in this region. The different supporters include MADDO Caritas, the mother development organization, several NGOs such as the heifer international project, Bothar Ireland, opportunity Africa, PUM, St. Jude, World Vision, and Send a cow, Microfinancing partners Africa. Government bodies such as DDA, UNBS, the district local government have been very vital, supportive, and strongly collaborated with MADDO Dairies Ltd to develop the chain. Financial institutions such as Centenary bank provide savings services to the project farmers as the farmers are paid through their bank accounts. In the FGDs farmers also confirmed that they received support from the supportive stakeholders through extension services and farm inputs. Furthermore, when we engaged the interviewees about potential partnerships to further strengthen and develop the dairy value chain, they highlighted potential supporters to collaborate with MADDO Dairies such as SNV, Agriterra, private investors, Mbuye Agricultural college, MAMEDICOT Microfinance, Biogas solutions Uganda, international livestock research institute, Kitovu Mobile. The dairy value chain actors are input suppliers, dairy farmers, milk traders, the only milk processor in the region (MADDO Dairies Ltd, milk wholesalers, retailers, and consumers. A potential vital actor to collaborate with MADDO Dairies to spark off the growth of the dairy sector is the Masaka Milk traders Association. The role of various potential stakeholders through literature review was indeed in line with the views of different key informants that their collaboration with MADDO Dairies Ltd would help strengthen and upgrade the dairy value chain in the region.

Table 27: potential stakeholders and their roles according to key informant interviews.

Potential partners	Role in the dairy value chain
The living lab project team	To coordinate stakeholder meetings and link MADDO Dairies to potential dairy value chain supporters to facilitate value chain development.
Agriterra	Provides business development services to ambitious cooperatives and farmer groups through assisting them with advice and training hence making the cooperatives bankable and creating real farmer-led organizations. They Improve extension services to farmer members and enhance government dialogues. The training offered to farmers covers a full range of services such as

	Management and organization, financial management, governance, business development, lobby, and advocacy.
MAMEDICOT	A microfinance with over 5 branches in the greater Masaka mainly working with farmers. It has strong collaborations with Rabo Bank foundation Netherlands, they receive funding. With the funds from Rabo Bank, they extend loans at a low-interest rate and investing in projects that help farmers. Some of the projects include digitalizing banking for farmers so that they can access financial services and credit online. They give credit to farmers to purchase farm inputs, better feeds, farm machinery, and improved breeds. They link farmers to partners and potential markets in the region both nationally and internationally by linking farmers to organizations such as SNV Uganda, Biogas Association Uganda, international livestock organization, and the local government. MAMEDICOT compared to other financial institutions offers a grace period of 3-4 months to farmers. They also have an agricultural loan guarantee scheme as an insurance cover in case of uncertainties in agriculture. They also partner with the Agriculture Business initiative (ABI) which offsets half of the principle in case of uncertainties caused by climate change, pests, and diseases. And they look forward to partnering with MADDO Dairies Ltd to further develop the dairy value chain in the region.
SNV	SNV is working to make value chains and food systems more accessible, efficient, and diversified, as well as nutrition- and climate-smart, to ensure that people have access to affordable food and the opportunity to switch to healthy diets. SNV employs market-based strategies to improve systems by launching and strengthening agricultural markets in specific commodities. Using tried tools and approaches to addressing the root causes of why markets fail to meet the needs of people living in poverty, such as using a food systems lens to identify key bottlenecks, developing inclusive business models, working with public-private partnerships, and launching innovative finance. This strategy aids farmers in sustainably producing more food, while also providing jobs at all stages of the value chain and putting women and youth at the forefront of development. SNV also helps farmers and markets to be more climate resilient. It aids farmers and agribusinesses in expanding their operations by collaborating with financial institutions to make finance available on reasonable terms and by providing technical assistance to farmers and agribusinesses.
Masaka Traders Association	This association draws together milk traders in the greater Masaka region with over 500 members and has existed for 5 years. This association involves milk transporters, wholesalers, and retailers. This association aims to maintain milk quality in the region, have better milk prices, promote good trade relations of milk and deal with fraudulent milk traders. This association is fully registered. A partnership with MADDO Dairies can further the dairy value chain in the region.
Private investors	There is a need to persuade private investors to put in place a breeding centre, pasture farms to address some of the challenges of farmers in the region.

Kitovu Mobile	This is a Christian-based organization in Masaka that gives heifers to individual youth and freezers to sell milk in different outlets/ markets. Milk produced from the project cows is brought to the freezers that are in different locations with attendants. Through Kitovu mobile, the youth, orphans, and farmers can improve their livelihood. A collaboration with MADDO Dairies limited would bring these farmers together, improve milk collection, access to extension services to upgrade the dairy food system in the region.
Biogas solutions Uganda Limited (BSUL)	BSUL is a private business limited by guarantee that was founded by HIVOS, the ministry of foreign affairs Netherlands, and SNV as a joint venture. The Africa Biogas Partnership Program II (ABPP II) was implemented in five African countries, with BSUL serving as the national implementation agency in Uganda. BSUL is delivering on its promise of providing clean, dependable, and inexpensive biogas solutions for climate-smart agriculture, cooking, and lighting, local employment, family health/sanitation, and deforestation reduction.
International livestock research institute (ILRI)	The International Livestock Research Institute (ILRI) envisions a world where everyone has enough food and livelihood options to reach their full potential, and its mission is to improve food and nutritional security while also reducing poverty in developing countries by researching on efficient, safe, and sustainable livestock management, ensuring better lives through livestock. Its goal is to collaborate, create, test, modify, and promote science-based strategies that improve people's lives through livestock while remaining sustainable and scalable. To persuade decision-makers from farms to boardrooms and parliaments that wiser policies and larger livestock investments can offer major socioeconomic, health, and environmental benefits in collaboration with partners. Partnership with ILRI would boost dairy development in the region.
Mbuye Agricultural college	Offers agricultural courses: National certificate in Agriculture, Animal husbandry, crop production, and other related courses to improve skills and knowledge of dairy farmers in the region.

5.3 The MADDO Dairies Value chain

Project farmers produce an average of 10 litres of milk daily per cow and some even less because of poor feeding of the animals. Farmer groups collectively supply the milk through milk pickup points and those close to the MCCs supply milk to the milk collection centres directly. Important to note is that the farmers don't sell all the milk produced to the MCCs, as they sell some directly to neighbours, kiosks and traders as well. From the problem statement of this research: despite the efforts to curb the informal chain in the greater Masaka Region, MADDO Dairies limited is experiencing low milk procurement attributed to the prevalence and competition from the informal milk chains in the region as a result of side-selling of most of the farmers. What is striking to note is that with the effort to develop the dairy value chain in this region, even the MCCs sell raw milk to consumers directly and milk retailers in the region after farmers have supplied them with milk. According to the interview with DDA, the informal chains are regulated and have to follow certain SOPs hence there is improved quality of raw milk sold there since they take the milk regulations seriously. However, when the processing plant is fully functional, there is insufficient milk for processing and end up outsourcing milk from south western Uganda. This implies that not only farmers participate in side-selling but also MCCs are involved. MCCs sell raw milk in order to cover their daily operational costs such as fuel for the generator, rent, and other utilities. This is done because of delayed payments from MADDO Dairies Ltd attributed to liquidity constraints given the ongoing construction of a bigger plant. This suggests

serious value chain development strategies from production and collection have to be incorporated to support the new processing plant that will have a capacity of 10,000 litres compared to the old one that had a capacity of 4,000 litres.

At consumption, there is high demand for raw milk compared to processed milk, MADDO Dairies' niche market is schools and mostly distribute the processed milk to Kampala and a few supermarkets and retail shops. According to interviews, respondents mentioned that consumers in the greater Masaka region are just beginning to embrace milk consumption as they originally did not incorporate milk in their diet, more so, in an interview with milk retailers, they mentioned that processed milk is not so much embraced in the region because consumers find it more expensive and believe there are unhealthy chemicals added to increase its shelf life. In addition to this, they mentioned that processed milk is mostly bought by the educated, average income earners and busy people who want ready to drink milk. This implies that serious efforts need to be put in place to sensitize the communities about the benefits of taking processed milk especially in regard to food safety. This will not only improve food safety in the region but also increase demand for processed milk that will contribute to the development and growth of MADDO Dairies Ltd.

5.4 Gender roles in the greater Masaka Dairy Value chain

In the focus group discussions, the participants mentioned that women are engaged in dairy farming as they are prioritized and given cows from MADDO Dairies Ltd, this was undoubtedly confirmed from the survey where the majority of the respondents 73.33% were indeed women engaged in dairy farming in the region this agrees with Makoni et al., (2014), that about 80% of the population, the majority of who are women, is engaged in agriculture. This is also in line with Agriterra₇ (2012)₈ that NGO and government efforts are increasingly assisting women in owning pure dairy breeds managed on zero grazing farms. This is especially useful for farmers with small plots of land. In the key informant interviews, it was mentioned that both women and youth are prioritized when giving out cows however through the survey it was established that very few youths are engaged in dairy farming as the majority of the respondents (40%) were 50 years and above and only 3.33% (26-35 years), 16.67% were aged 35-40 years implying that majority of the farmers in this region are elderly and very few youths are engaged in dairy farming.

Men sell milk in the morning because they have to wake up early, milk the cows at around 5.00 am and take the milk to the pick-up points as women stay home to take care of the home and clean the milking utensils, this is in line with the FAO, (2017) that men are the ones that deliver milk at the collection centres in the wee hours of the morning because of long distances to the pickup points and safety-related concerns of women.

In the interviews, most respondents mentioned that in some homesteads where men dominate decision making, men may decide to sell milk wherever they want without leaving any for home consumption and even use the money for his benefit without putting into consideration family needs however from the key informant interviews it was emphasized that to manage the issues of transparency in a family MADDO Dairies Ltd, ensures that every family under the MADDO project opens a bank account with both husband and wife as signatories for easy accountability, access, and planning for milk proceeds.

5.5 Robustness, Reliability and Resilience of the greater Masaka Dairy food systems

5.5.1 Robustness of the Dairy food systems

Zooming in to this subject matter it covers the organization, productivity, volumes prices, and milk quality of the entire value chain from producers, traders, milk processors, milk wholesalers, and retailers and consumers.

a) Milk Production

In a focus group discussion with farmers, they mentioned that most of them keep 1 cow per household with an average of 2 cows. This was in agreement with the findings from the survey that revealed that the majority of the respondents 70% keep only one cow, 20% of the respondents keep 2 cows, 6.61% keep 3 cows, and 3.33%. This was further affirmed by key informants who mentioned that most farmers in the region practice zero- grazing with most of them rearing mostly one cow, this is in line with Makoni et al., (2014) Peri-Urban farmers keep mostly 1 exotic cow under zero grazing. Furthermore, this is confirmed by Arnaoudov, et., al (2017) that Smallholder farmers who rely on rain-fed natural pastures provide the majority of the milk in Uganda. During the dry season, pasture quantity and quality fall dramatically, and palatable species are overgrazed. This means that, due to a lack of grazing area and the impossibility to sustain and maintain more than one cow, most farmers in this region practice zero grazing and keep only one cow hence explaining the reason for low milk production.

b) Milk volumes

The survey revealed that the majority of the respondents 46% produce about 10 litres of milk daily, 16% of the respondents produce about 5 litres of milk daily, 26% of respondents produce about 15 litres of milk daily, 6.7% of the respondents produce 20 litres of milk daily and only 3.33% of the respondent produces about 35 litres of milk daily. The average milk production daily is 11.07 litres. This corresponds with the discussion with farmers in the FGD, they mentioned that when the cow is well fed and has just given birth, it produces about 15 litres per day and towards the dry days, it produces between 8-10 litres per day. On average a farmer produces 10 litres of milk per cow per day. Sometimes because of poor feeding of the cows, a cow gives the utmost 10 litres of milk per day for the improved breeds. While engaging with key informants in an interview they acknowledged that farmers produce an average of 10 litres of milk per cow as a result of poor feeding. This is affirmed by (Arnaoudov, et al., 2017) that the central region has the highest milk productivity of about 9.8 liters per cow/week and a higher population of the more productive exotic and crossbreeds. This implies that the greater Masaka is one of the central region areas that have high milk production though with a constraint of poor animal feeding.

c) Milk Collection and transportation

In a discussion with farmers, they mentioned that they deliver milk to the collection centres and pick up points using bicycles or by foot and this was clearly confirmed in the survey as it revealed that the majority of the respondents 73.33% transport milk to the milk pickup points and MCCs by walking, 13.3% use motorbikes, and 13.3% use bicycles. This agrees with the Makoni et al., 2014 that cows are milked twice a day, and the milk is sold to neighbors or vendors, or delivered to a milk chilling centres by foot or bicycle, some farmers own motorbikes or pick-up trucks which they often pool milk with neighbours and transport the milk in metal churns to the MCC or informal selling points. This implies that farmers typically walk between 1 and 4 kilometers to bring milk to MCCs and pickup points, posing a barrier to the development of a robust dairy value chain in this region.

d) Milk Quality

Looking at the milk quality of the entire dairy value chain from production to consumption, at production farmers mentioned in the FGD that every farmer that supplies milk to MADDO Dairies Ltd is given a lactometer to check the milk before it is brought to the pick-up points and MCCs, however when selling directly to neighbors, the milk is not checked.

The farmers mainly check for milk purity, adulteration and observe hygiene at the farm and pickup points and this was also confirmed by Key informants that farmers are trained on milk handling and how to carry out milk tests at the farm and pick up points before it is transported to the MCCs. The farmers in the FGD further mentioned that MADDO Dairies under the supervision of DDA Ltd sets the guidelines of operation which are enforced through MCCs and pickup points however the farmers

mentioned that DDA does not reach out to train the farmers on the good milk handling practices as they only stop at the MCCs. This signifies that, in addition to training MCCs on milk handling, DDA should reach out to farmers and promote better milk handling procedures from the farm level through trainings.

In the FGD with farmers, they mentioned that milk is transported to the MCCs using metallic cans which was seconded by the key informants that farmers are given metallic cans on a loan basis to transport milk from the pickup points to the MCCs. This was as well observed while conducting the focus group discussion with one of the farmer groups as one of the farmers who owns a motor bike loaded a can with milk at the pickup point and transported it to the MCC. Differing from this, the survey revealed that majority of the farmers 93.3% transport milk to the pickup points using jerry cans mainly because of the small volumes produced by each farmer and only 6.67% transport milk to the pickup points and MCCs using metallic cans. Farmers who mostly transport milk to the MCCs using jerry cans directly are the ones that are close to MCCs and do not need combined effort at pickup points to transport milk to the MCCs. But most farmers bring milk to the pickup points in jerrycans which is then tested before reception and transferred to the combined 150 litres metallic can at the pickup points. Milk wholesalers and retailers mentioned that milk is brought to the kiosks by farmers using metallic cans and jerrycans but mostly in cans. This implies that, despite the fact that DDA and MADD O Dairies Ltd prohibit the use of jerrycans to transport milk to collection centers, most farmers do so due to small milk volumes produced, and while MCCs do not reject milk supplied to them on the same basis, the quality of the milk is compromised as a result.

In interviews with MCCs, they mentioned that milk quality checks are conducted before milk is accepted at the MCCs, it is checked for adulteration and alcohol tests to establish abnormal milk from sick cows and also check the temperature to confirm that the milk was not heated before it was brought to the MCC. They indeed stated that DDA and MADD O Dairies Ltd set the standard guidelines for the MCCs to operate, and it was confirmed in an interview with DDA and MADD O Dairies Ltd that they collaborate to ensure that the set guidelines are followed at MCCs as DDA conducts spot checks. Moreover, in the survey the farmers stated that milk checks are only done in the formal segments, when farmers trade in the informal segment i.e. sell to neighbours, they don't conduct any milk check hence triggering food safety concerns, this is emphasized by Ekou, (2014) the informal milk chain is mostly comprised of middlemen even beyond the reach of DDA operators and they are driven by prices and not quality. Engaging the traders in FGD, they mentioned that they check for adulteration and also conduct alcohol tests at the farm before the milk is accepted and to ensure milk quality, but they do not do this all the time, they go to the farms very early in the morning when the farmers are still milking to witness the hygiene and also avoid adulteration, so they collect the milk in its fresh state and mainly buy milk from trusted farmers. The traders emphasized that DDA is very tough on them regarding milk handling as they confiscate substandard milk, so traders try as much as they can to keep quality milk and this was indeed affirmed in an interview with DDA that it is tough on stubborn milk traders who do not comply with the set guidelines attract penalties such as a fine of Ush.500,000, imprisonment of up to 6 months and warning letter. On the other hand, Wozemba and Nsanja, (2008) states that farmers send milk to a "pick-up station" set up by a trader, transporter, or his agent in aluminium cans or plastic jerrycans and during milk reception, there is very little quality control. Before the milk is accepted, simple quality tests such as physical appearance and lactometer reading can be performed. However, in many circumstances, quality checks are not performed, and milk may be approved even if it is adulterated with water or contains physical impurities like straw, hair, manure, or flies.

5.5.2 Reliability Policy environment

a) Regulations

The quality milk standards and compliance are enforced at milk pick-up points and MCCs and this was confirmed by MCCs and interview with MADD O Dairies Ltd, however, farmers in the FGD mentioned

that the standard guidelines at the MCCs are so stringent that their milk is rejected even when they have done their best to follow the SOPS, this encourages them to trade in the informal chain where there are no regulations, the quality aspect is most of the time ignored because no one monitors the milk quality. i.e. neighbors can't run quality tests.

While engaging DDA and DVOs in interviews, they both mentioned that DDA partners with other government bodies such as the District health inspector, DVOs and UNBS and do spot checks on the roads to ensure that the standard guidelines are followed and was obviously mentioned in the FGD with traders that DDA and District inspection personnel's do check on the roads and confiscate substandard milk. The MCCs also mentioned that DDA works with UNBS, District health inspectors to ensure compliance with the SOPS at the MCCs and DDA does routine checks and follows ups in case there was a deviation, this was in clearly affirmed in interviews with DDA and DVOs.

With the MADDO milk processing plant, in an interview with DDA, they stated that MADDO follows standard guidelines that include quality management systems, good manufacturing procedures, standard operating guidelines, ISO systems and this was affirmed by MADDO Dairies Ltd as DDA and UNBS do routine checks at the processing plant to ensure compliance of the set guidelines.

Looking at the wholesaling and retailing segment, the raw and processed milk sellers are licensed and regulated by DDA. In an interview with milk retailers, the mentioned that they sell both processed and raw milk and is supposed to only operate with a license from DDA. Before a license given to them, they must observe some guidelines such as must have clean selling premises and equipment to keep the milk chilled and inspection is done to confirm this before a license is given out and also does spot check at the premises. This was particularly affirmed in an interview with DDA that mentioned that the informal is not fully informal in the sense that DDA regulates the raw milk market to ensure that there is access to safe and quality milk on milk on the market as traders selling raw milk are registered, premises are inspected, and follow minimum operating standards for selling raw milk as stipulated by DDA. On the other hand, DDA does not fully regulate the informal chain, it only ensures that the premises where milk is sold are hygienic and have chilling systems but doesn't look into the deeper aspects of quality milk such as checks done by the traders before receiving the milk, its source, adulteration, selling diseased milk to mention but a few, whereas comparing to the formal chain under MADDO Dairies all these aspects are put into consideration and enforced.

DDA clearly stated that it regulates the informal chain as well through providing operating licenses to raw milk traders and encouraging them to follow the set SOPS and which was also confirmed by milk wholesalers and retailers in the region in the interviews. This relates to Balikowa, (2011) that DDA registers and inspects all facilities and equipment used to handle, process, and market milk and milk products throughout the country in order to ease the enforcement and monitoring of standards and quality and also encourages dairy processors and traders to receive training in Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Points (HACCP), and ISO certification standards.

b) Incentives

In the greater Masaka Dairy Value chain, farmers in the FGD mentioned that most farmers are motivated to trade in the informal chain because of prompt payments, better prices, and limited or no regulations need of cash payments to run their farms and take care of their families. However, in the survey, it was revealed that farmers would rather trade in the formal chain (MADDO Dairies Ltd) because of assured payments even when they take longer than expected sometimes.

In the informal segment, farmers don't have to pay transport costs as they sell directly to consumers and traders collect milk directly from the farm unlike in the formal segment where farmers have to foot transport expenses. In the FGD with farmers they further stressed that there are no incentives and awards given for quality milk at Pick up points and MCCs and the long distances to the collection centres

are a disincentive to farmers. More so, because of low prices, farmers are forced to supply more milk elsewhere in search for better prices and sell very little to MCCs.

In a FGD with traders, they mentioned that they motivate farmers to sell to their milk by giving them advance payments between two weeks and a month and give them prompt payments.

It should be noted that traders mentioned that they are prompted to trade in the informal segment of prompt cash payments unlike when they supply to processing plants, they have to wait for two weeks or more to receive their payments, yet they have to sustain milk supplies and pay farmers promptly. Traders further pointed out that they sell milk in the informal segment mainly because they have undesignated markets and can sell milk to several traders and consumers unlike when they deal with processing plants, they can only supply limited volumes because of the limited capacity of the plants. Apart from this, traders get better prices in the informal segment unlike the formal (processing plants) where they are offered the same price in both wet and dry seasons. Besides this, their biggest incentive is that there is a massive demand for raw milk in the region.

While engaging farmers in a FGD, they strained the fact that they do not receive any incentives for quality milk and good volumes, in other words, there are no quality based incentives they receive from MADDO Dairies Ltd, this was acknowledged in the interviews as the respondents mentioned that they do not have any quality-based incentive for the farmers and majorly concentrated on training the farmers, and incentives from quality milk are something they would want to look in to in the future. However, there was a differing opinion as one of the respondents in the interviews mentioned that MADDO Dairies organizes farmers' competitions and gives awards to farmers that have increased production and quality, this was not in line with the survey findings as all farmers agreed to not receiving any kind of awards regarding quality and production.

5.5.3 Resilient innovation systems

a) Innovation services

At the production level in the dairy value chain, through the relationships with chain supporters, farmers have improved their farming skills, productivity, market access, access to market information, veterinary services, and group formation, in addition, the district local government gives some farm inputs to farmers such as silage cutters. Paramount to mention is that MADDO is developing an online system amidst Covid where they can meet group leaders on zoom so that they can monitor new and existing farmers and provide extension services. Comparing this to the organized traders in the region, in the FGD, they stated that they get information about milk prices and trends through their association leaders and fellow traders since they supply milk to different markets daily.

In a FGD, farmers highlighted that they do not have running contracts with MADDO Dairies Ltd to supply milk, most farmers would like to have a milk supply contract with MADDO Dairies Ltd to ensure price stability, supply bigger volumes, stable payments, and also use it as an opportunity to secure advance payments however other farmers disagreed saying that they are not comfortable with having milk supply contracts because they are not sure that they can keep to the contract terms especially milk volumes given the seasonality of milk and the fact that they rear very few cows. Comparing this to traders in the region that participate in the informal segment, in the FGD, they mentioned that they have contracts with farmers to enhance sustainable milk supply in all seasons.

Some Farmer groups that are well established and organized have VSLAs where members can save and access loans in times of emergency i.e., to treat their sick animals. This strengthens the farmer groups and they remain loyal to the members and attract new farmers to join them however most farmer groups that were engaged mentioned that they do not have internally organized VSLAs because of weak leadership and these groups were not as strong and active as the groups with VSLAs.

Under the production department, they have developed mineral blocks for feeding the cows which is a combination of calliandra, molasses, cassava which can sustain a cow in the dry season, with just on block a day. More so, they have developed super Napier grass since Napier grass was being infected with diseases, so they are multiplying and supplying the super Napier grass and distributing it to farmers to improving feeding and have also developed the sweet potato silage and promoting hay making technologies in the region. However, their efforts are frustrated by limited finance to support these innovations and reach out to many farmers in the area.

When MCCs were engaged, they mentioned that they are managed by a committee selected by farmers that constitutes of the chairperson, secretary, and treasurer and audited members who open the account through which payments are made to the other members. In the Dairy value chain, the MCCs deal with farmers, farmer groups, traders, and consumers and receive milk daily from farmers and sometimes traders, this was affirmed by traders in a focus group discussion as they mentioned that they used to supply milk to MADDO Dairies Ltd but were later restrained because of delayed milk payments. In addition to this, traders buy raw milk from the MCCs to sell in their small kiosks and outlets and this was further confirmed in an interview with a milk retailer who said that they buy bulk volumes of milk from the MCCs and consumers who stay close to the MCCs buy milk for home consumption from MCCs as well. However, in an interview with MADDO they mentioned that all milk collected at MCCs is taken to the processing plant when they are fully functional. Conversely to this, in an interview with another respondent, it was mentioned that MCCs are encouraged to sell raw milk in order to meet their daily expenditures such as utilities, rent since payments from MADDO Dairies Ltd delay to pay then yet they have to buy fuel daily to operate the generator to keep the milk chilled since the rural areas where they are located have no electricity connections yet. Important to emphasize is that MCCs serve all community members as long as their milk meets the quality standards.

b) Capacity building

In the FGDs with farmers, they mentioned that they receive training from MADDO Dairies extension staff and District extension officers, NAADS. They used to be trained once every quarter but because of Covid, they last received training in 2019. This was in line with the findings from the as it revealed that 86.67% of the respondents do not receive training and this was attributed to the covid situation at the moment whereas only 13.33% of the respondents received. In an interview with District veterinary officers, they stated that there are 2 veterinary personals per subcounty facilitated by the government to extend extension services before the Covid pandemic and MADDO Dairies similarly said that before Covid 19, extension workers would train once a week and invite group leaders for training once a month. The MADDO Dairies Ltd and Local government extension workers did mention that amidst the pandemic, on spot trainings are carried out, if a veterinary doctor is called upon treat a sick animal. Trainings are done on animal nutrition, animal health, hygiene and modern farming technology. It is worth noting that, training of farmers is demand driven and some famers don't embrace the extension workers but in the discussion with farmers, they did mention that farmer in deep villages don't easily access extension services because of long distances and the poor road networks. Nevertheless, in the interview with extension staff, stated that If farmers are organized in cooperatives, it is easy to train and monitor them unlike unorganized farmers.

In a discussion with traders, they mentioned that they get training on milk handling from Brookside dairies and DDA.DDA used to train them often but because of covid19, it has been over a year when they last trained them. This was consistent with an interview with DDA that Covid 19 has slowed down plans to reach out to the chain actors in areas of training and monitoring. Even so, the traders stated that because DDA is tough with traders who sell substandard milk, most traders are scared to attend trainings it provides. MCCs are trained on good milk handling Practices by DDA and MADDO Dairies Ltd periodically, this was still affected by Covid 19.

MADDO Dairies Ltd as a processing plant also receives trainings from DDA and UNBS. DDA has been involved in training and advising on the establishment of the new 10,000 Litres capacity processing plant. Looking at the milk wholesalers and retailers in the region, they receive training from DDA on good milk handling and hygiene to ensure that the milk quality is maintained, and the retailers are trained twice a year.

5.6 Swot Analysis of the greater Masaka Dairy Value chain

Through the different key informant interviews, data on the strengths, weaknesses, opportunities, and threats of the dairy sector in the greater Masaka region was collected as shown in table 28. The data represented in this table is the opinion of different key informants.

Table 28: SWOT of the greater Masaka dairy sector

Strength • Zero grazing and small-scale farming have been practiced for over 30 years in the region • It is cheaper to produce milk compared to other animal proteins • Longer shelf life of processed milk products. • The increasing number of milk producers. • Availability of established MCCs in the region. • Access to improved dairy breeds. • there are over 45 extension workers in the greater Masaka region	Weaknesses • Seasonality of milk production • Poor and inadequate animal feeding • The delayed conception of dairy animals • Overuse of antibiotics and drugs which intoxicates the milk • Few dairy farmers compared to south western Uganda. • Low adoption of improved dairy practices. • Failure of farmers to fully unite
Opportunities • The economy of the country is expanding, creating a favourable climate for dairy production and commercialization. • Growing population. • The dairy sector is dominated by the informal segment therefore there is an opportunity in investing in value addition. • Growing middle-income earners. • No many milk processors in the region, MADDO Dairies Ltd is the only milk processor. • Increasing modernization and Urbanization of Masaka • Surplus milk can be converted to powder • Increased demand for milk in the region. • Ugandan milk and milk products are competitive on the national and international levels.	Threats • Covid 19 • Climate change • Reduction of arable land due to increased population • Pandemic diseases such as tick-borne disease, brucellosis, foot, and mouth disease. • Substandard drugs on the market • Increased overhead costs attributed to expensive treatment • Road systems in a poor condition • Limited land space to practice dairy farming as a result of the growing population and urbanization.

Source: Respondent interviews

5.8 Best Governance Practices in the informal chains compared to formal chain

With a combination of key informants' interviews and focus group discussions, table 29, shows the best practices in the informal dairy chain as compared to the MADDO Dairies value chain.

Table 29: Best governance practices in the informal chains vs formal chain

Informal Chain	Formal Chain
✓ Prompt milk payments	✓ Delayed milk payment
✓ Higher milk prices	✓ Lower milk prices
✓ Traders have contracts with dairy farmers.	✓ No contracts and the few that are there are not enforced
✓ Traders pay farmers in advance for the milk at farmgate	✓ Farmers have to wait for a month or more before payment.
✓ Traders have an association that is fully registered and do a background check before recruiting a new member	✓ Farmer groups and cooperatives are not registered and there are weak group dynamics
✓ They deploy brokers to mobilize and identify good milk farmers who can buy good volumes and high milk quality from	✓ No mobilization mechanisms of milk apart from the group setting
✓ Milk is tested by traders for adulteration and alcohol at the farm before it is accepted	✓ Milk is tested at pick points and MCCs
✓ Traders incur transport costs	✓ Farmers incur transport costs to the pickup point and MCCs.

According to Agriterro, (2012), farmers in the central region, obviously enjoy the benefits of being closer to the main market Kampala and Entebbe where they can market their milk directly to the consumer at higher prices and 90% of the milk produced in Uganda goes through the informal chain no wonder there are good practices that encourage farmers and traders to trade in this chain. As seen in table 29, the best practices in the informal milk chains are prompt payments and comparing it to the formal chain milk payments delay but farmers emphasized that even when the milk payments delay sometimes, they are very sure that it will be paid. In the informal chain, organized traders have contracts with dairy farmers to supply them with milk however in the formal chain, MADDU Dairies Ltd has no milk supply contracts with farmers. In the informal chain, organized traders pay farmers in advance for the milk at farmgate whereas, in the formal chain, farmers have to wait for a month or more before payment. More so, in the informal chain, organized traders have an association that is fully registered and do a background check before recruiting a new member whereas farmer groups and cooperatives in the formal chain are not registered, there are weak group dynamics and there are no mobilization mechanisms of milk apart from the group setting. In the informal chain, traders incur transport costs while in the formal chain, farmers incur transport costs to the Pickup points and MCCs.

5.8.1 Best governance practices in the formal chain compared to the informal chain

As seen in table 30, without a doubt, MADDO Dairies Ltd has solid governance practices that have enhanced the growth of the dairy value chain in the region compared to the formal chain. They include: Farmers are organized in groups to enhance milk volumes and easily have access to the Market whereas farmers in the informal chain are not organized and traders mainly deal with big farmers while ignoring small holder farmers, Milk prices remain favourable in the dry and wet season in the formal chain while prices fluctuate, in the wet season traders buy milk cheaply hence affecting the income of the farmers, in the formal chain, there are MCCs that provide assured market to the farmers in all seasons unlike in the informal chain where there are no milk collection points. Traders have to collect milk at the farms and in times of the rainy season, when the roads are impassable, farmers get stranded with their milk in the informal segment. In the formal chain, there are assured milk payments from MADDO Dairies Ltd and a high level of trust as MADDO is a Christian based organization however in the informal chain, there is a high level of default from traders hence the main reason the traders association was formed to deal with fraudulent milk traders, Farmers receive cows and training to practice sustainable dairy farming, on the other hand in the informal chain, farmers rarely receive training since they are not organized in groups. Additionally, in the informal chain, there is information flow attributed to the group setting however in the informal chain, there is limited information flow on market trends and prices. Without a doubt, in the formal chain milk quality is highly encouraged and enforced whereas, in the informal chain, there is minimum milk quality enforcement.

Table 30: Best governance practices in the formal chain vs the informal chain.

Formal chain under MADDO Dairies Ltd	Informal chain
Farmers are organized in groups to enhance milk volumes and easily have access to the Market.	Farmers are not organized, and traders mainly deal with big farmers while leaving out smallholder farmers.
Milk prices remain favourable in the dry and wet seasons.	Prices fluctuate, in the wet season, traders buy milk cheaply hence affecting the income of the farmers.
There are MCCs that provide assured market to the farmers in all seasons.	No milk collection points, the traders have to collect milk at the farms and in times of the rainy season, when the roads are impassable, farmers get stranded with their milk.
There are assured milk payments from MADDO Dairies Ltd and a high level of trust as MADDO is a Christian-based organization.	There is a high level of default from traders hence the main reason the traders 'association was formed to deal with fraudulent milk traders
Farmers receive cows and training to practice sustainable dairy farming	Farmers rarely receive training since they are not organized in groups.
There is information flow attributed to the group setting.	There is limited information flow on market trends and prices.
Milk quality is highly encouraged and enforced	Minimum milk quality enforcement.

5.9 Performance of MADDO Dairies Ltd

5.9.1 MADDO Dairies current Business model:

a) Supply and Customer Segments

MADDO Dairies Ltd mainly procures milk from the project farmers through the established MCCs but also during the dry season and in times of milk scarcity, they Procure milk from the southwestern region through traders and the cooling trucks. MADDO Dairies Ltd supplies its milk products in places where it has a niche market in the greater Masaka region and Kampala because there is a higher demand for raw milk in the region compared to processed milk. Currently, they are selling raw milk until machinery at the new processing plant is fully installed and ready to reopen. Organized farmer groups and MCCs both sell raw milk directly to consumers and traders leaving the processing plant with fewer volumes, this implies that despite the efforts to develop the dairy value chain, the processing plant suffers low milk procurement which would not be an issue if all the milk farmers produced was supplied to MCCs and all the milk collected at the MCCs was supplied to the processing for processing and increasing marketing strategies to ensure that the local community embraces the processed milk products.

b) Supply relations

Farmers sign agreements with MADDO when they receive a heifer, guaranteeing that they will take good care of the cow, return a heifer, and train four additional farmers. MADDO Dairies, on the other hand, does not have milk supply contracts with farmers, suggesting that farmers are not obligated to sell milk to MADDO Dairies and can trade in any segment they prefer. In an interview with MADDO Dairies, it was stated that because MADDO Dairies is a social business that cares about the well-being of the community at large, it is difficult to compel farmers to supply all of the milk produced to them because a farmer cannot refuse to sell milk to a neighbor simply because they must supply all of the milk to the MCCs. MADDO Dairies, in particular, caters to the nutrition of families in the greater Masaka region, which is one of the reasons the cow project was started in the first place: to provide farmers and their families with easy access to adequate nutrition through milk proteins. Farmers were expected to feed their family first and then sell the remaining milk, but during a focus group discussion, farmers stated that they only retain 1-2 litres for home consumption, and the remainder is sold to either the formal or informal milk chain. This implies that farmers and MADDO Dairies need to nature a contractual relationship that favours both the farmers and also supports sustainable milk supplies to the plant.

MADDO has contracts with MCCs to supply milk, and MADDO Dairies Ltd collects an agreed amount of milk twice a week, according to interviews, but when the MCCs were questioned about this, they said they sell raw milk and only send the surplus to the processing plant, implying that the chain has weak governance, necessitating the adoption of strategic chain upgrading strategies.

Farmers are given good quality metallic cans to enhance milk quality at pickup points, the cans are given on a loan basis. Farmers pay back from the milk sales at the MCCs. MADDO has meetings with farmer group representatives once every month to enhance information dissemination in various producer groups.

c) Cost structure

MADDO Dairies Ltd can meet its current liabilities when operating at full capacity, and the new plant was built partially with plant income and partly with loans. MADDO Dairies Ltd formerly utilized a diesel boiler to power the processing plant, but it was found to be inefficient, therefore the company is now transitioning to a biomass boiler that runs on firewood, which will be used at the new facility. MADDO Dairies is currently experiencing internal difficulties due to a lack of working capital, which is causing farmers to receive delayed milk payments and MCCs selling raw milk. MADDO Dairies is looking for ways to stabilize its liquidity constraints as a result of the ongoing construction of an enhanced milk processing unit.

5.2 Organization of cooperatives Under MADDO Dairies Ltd

a) Membership and organization

In a discussion with project farmers under MADDO Dairies Ltd, they mentioned that the groups have existed for over 15 years and in an interview with MADDO Dairies Ltd, they stated that they work with about 2221 farmers. They are encouraged and empowered by MADDO to organize themselves in producer groups, have a common goal, a constitution, and set objectives agreed upon by members and choose leaders. This was confirmed when MADDO Dairies was engaged in the organization of farmers. Farmers are organized in groups of 35-50 members however very few members are active in the group i.e. a group of 35 members has only about 14 to 20 members, active in a way that they can supply milk to MADDO Dairies. They are not able to supply milk when the cows are dry and resume when the cows give birth and there are 5 cooperatives under which the farmer groups exist.

b) Production and collection

Project farmers stated that they rear Holstein Friesian cows that are given to them under the cow project and in an interview with MADDO, this was affirmed as they mentioned that most farmer groups started with six cows and the members kept increasing hence the growth of the groups. All members practice zero grazing and keep one cow and averagely 2 cows, farmers said in a discussion with them, this was confirmed in the survey, it revealed the majority of the farmers 70% keep only one cow. For some groups that are closer to the MCCs, each member takes the milk to the MCC however MADDO doesn't enforce that farmers sell their milk to it. For farmer groups that are distant from the MCCs, collect milk jointly at pick up points send it to MCCs however Some farmers on their way to pick up points and MCCs sell their milk to traders and consumers they find on their way hence Very small volumes are sold to the MCCs as most of the milk finds its way in the informal segment for better prices and prompt payments.

c) Financial management

Farmers stated that they are paid after one month and that payments can take up to two months. However, when MADDO Dairies was engaged, they stated that farmers are paid every fortnight, though some farmers request to be paid at the end of the month, but that payments can take up to two months due to liquidity issues. Some farmers opt to sell milk in the informal market for quick cash to meet their daily expenses due to delayed milk payments. This allows them to take care of their families and farms. Some farmers affirmed that they requested to be paid at the end of the month so that they can get a wholesome figure to invest in other projects at the end of the month. Payment priority is given to farmers who supply significant milk volumes, according to the interviews, to maintain a good working relationship with the farmers. It's no surprise that MADDO Dairies stated in the interview that they want to increase milk output among farmers by stressing improved nutrition so that farmers can offer huge volumes to MCCs.

Farmers have VSLAs, and the few that exist are dominated by women, and they assist farmers in dealing with uncertainties such as cow treatment and meeting other family obligations in the event of delayed milk payments. Since they have gathered enough savings and are paid milk payments through the bank, the farmer groups have opened accounts in banks where they deposit their funds and are eager to establishing new relationships with microfinance institutions. However, because most farmer groups are weak and on the point of collapsing due to poor leadership and group dynamics, only a few have this form of organization.

5.3 Food systems outcomes and sustainability

The food systems outcomes of the MADDO Dairy value and impact are shown in table 31 using the theory of change from inputs, activities, output, outcomes of the activities and finally the impact on people, planet, profit, prosperity and partnerships.

Table 31: Impact of MADDO Dairies Ltd in the greater Masaka region.

Inputs	Activities	Output	Outcome	Impact
The cow project	•Farmers are given Holstein Friesian cows •To be a good candidate for a cow, a farmer has to first build a shelter for the cow and be extremely hygienic at home •The farmers are trained on cow nutrition, welfare, and quality in order to have maximum production.	•An individual farmer is able to train 4 other farmers. •Trained dairy farmers.	•Over 800 cows have been given out to farmers. •Increased milk production per cow i.e., 10-15 litres of milk per day. •Improved nutrition of many families as milk is a rich source of proteins •Increased income of farmers.	•Growth of the dairy sector in the region. •Source of living for many farmers. •Most Farmers have been able to educate their children through milk sales. •Contributing to food security. •Reduced unemployment.
Facilitating &organizing dairy farmers in groups-cooperatives	•Farmers are empowered and encouraged to join producer groups. •Farmers are helped to develop an action plan, constitution, and a common goal to unite farmers in a producer group. •Farmer groups are trained on group leadership and dynamics. •They are then required to choose leaders i.e., Chairperson, Secretary,	•Over 2200 registered project farmers. •5-8 farmer groups per cooperative. •5 cooperatives in the region.	•Easy access to market for their milk, i.e., MCCs. •Easy access to training. •Development of VSLAs. •Easy market information dissemination. •Better cooperation of the farmer-members. •Reduction of transport cost.	•Overcoming production and marketing constraints. •Easy access to finances and farm inputs •Linking farmers to markets. •Increased income.

	•treasurer to keep on track the group activities in order to achieve their goals. •Registration of project farmers.			
Milk collection centres	•5 milk collection centres have been set under each cooperative	• 5 milk collection centres in Kalungu, Bukomasimbi, Masaka, Kyotera and Lwengo districts. • Each milk collection centre has a capacity of 2000-3000 litres.	•Increased access to quality of milk. •Easy milk collection and bulking.	•Contributing to food safety and security. •Creating employment opportunities.
MADDO Dairies Ltd processing plant	•Construction of the first milk processing plant in 2003 with a capacity of 4000 litres daily. •A new processing plant with a capacity of 10,000 litres construction underway.	•MADDO Dairies Ltd is the first and only dairy processing plant in the region.	•Increased quality of processed milk. •Increased market and income of dairy farmers.	•Contributing to food security in the region. •Creating employment opportunities in the region. •Improved standards of living.
Biogas initiative	•Construction of biogas in farmers homes. •Training farmers on how to use the biogas.	•153 biogas plants installed in different home steads	•Improved standards of living •Reduced deforestation	•Improved livelihood of the farmers. •Contributing to SGD 7 access to affordable and clean energy. •Reduction of greenhouse gas emissions contributing to reducing climate change.
Promotion of a sustainable agriculture/	•Training on sustainable agricultural practices.	•Over 2200 farmers •practicing sustainable dairy •production for quality milk •supply.	•High adoption of sustainable agriculture. • Households empowered to	•Increased milk production and Reduction of greenhouse gas emissions. •Improved livelihood.

climate smart dairy.	•Involvement of chain supporters to the promotion of sustainable and climate smart production. •Zero grazing and pasture conservation. •Keeping improved dairy breeds. •Reducing wastage through circular agriculture.	•At least 90% of trained farmers have gained knowledge and skills in sustainable agriculture. •At least one demonstration farm established per parish •	effectively practice sustainable agro-economic activities.	•Increased income
•Training and capacity building	•Organize trainings for the dairy farmers on: Group dynamic, Leadership Training, Animal Husbandry, Forage Production, Farm Management, Manure Management, Nutrition, Hygiene, Quality Management System and Water harvesting mechanisms. •Participating farmers go for at least 1 study tour/exchange visit to research institutions or agricultural shows per parish	•2 trainings per group per month. •Trainers of trainers of each group trained once every month and disseminate the information to other members. •At least one workshop on agricultural systems held each year per parish •At least 100 farmers trained per parish. •	•Improved health, farmers save on the medical bill •High quality milk. •Improved dairy farming through training.	•Empowered farmers with skills and knowledge. •Consistent production of milk throughout the year •Improved livelihood
•Enhanced access to resources and linkage to other stakeholders and chain supporters	•Established partnership and linkages with chain supporters such as DDA, the district local government, and several NGOs. •Farmers receive trainings, financial and extension support from the chain supporters. •Established linkages with agric. research institutions.	•Easy access to farm inputs. •Improved farming skills. •Improved information flow within the chain.	•Increased milk production. •Improved milk quality.	•Better relationship between input suppliers and dairy farmers. •Improved farming skills. •Improved livelihoods. •Food security.

•Women and youth inclusion and empowerment.	•Youth and women are given heifers hence engaging them in dairy farming. •Youth and women are employed at different milk collection centres and market MADDQ Dairies products. •Training on leadership, Financial literacy and Savings	•Involvement of youth and women in dairy farming, leaders in the farmer groups	• inclusion of women and youth in the farmer groups.	•Empowered women in leadership and involvement in decision making.
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5.3.1 Sustainability profile

From the analysis in table 32 the following sustainability profile was derived showing the impact of MADDO Dairies on people, planet, profit, prosperity, and partnerships.

Table 32: impact on MADDO Dairies Ltd on people, planet, profit, prosperity, and partnerships

People	✓ Improved livelihoods ✓ Women and youth employment ✓ Skilled & empowered dairy farmers ✓ Good relations with stakeholders ✓ Improved food security ✓ Farmers can afford to educate their children ✓ Increased access to affordable food ✓ Improved Nutrition ✓ Gives cows to farmers irrespective of religion ✓ improved social relations
Planet	✓ Reduction in GHG emissions ✓ Circularity-Garbage recycling ✓ Biodiversity of the soil ✓ Increased crop yield and farm productivity from the use of manure ✓ Most farmers have been given biogas plants to reduce deforestation ✓ Tree planting project ✓ Training in sustainable agriculture
Profit	✓ Increased incomes of farmers ✓ Increased market share ✓ Started up other income-generating activities from the milk sales
Prosperity	✓ MADDO is the 1st and only milk processing plant in the region ✓ Linking farmers to markets ✓ Improved coffee production in the region. ✓ Fostering Dairy development in the region by giving out heifers to smallholder farmers ✓ Farmers have access to training on-farm management, hygiene, livestock management ✓ Equal opportunities for all stakeholders
Partnership	✓ Partnerships with chain actors, NGOs, financial institutions, and government

5.4 Reflection Trajectory

This research was carried out with the main objective of comparing informal and formal Dairy chains, assessing MADD0 Dairies Ltd.'s impact on the Dairy food systems, advising it on the best practices in the informal chains and chain upgrading strategies. This study involved almost all the dairy stakeholders in the greater Masaka region that included dairy farmers, milk traders, MCCs operators, MADD0 Dairies, the first and only processing plant in the region, milk wholesalers and retailers, government bodies such as the district production department, local government District veterinary officers, extension workers, dairy experts, financial institutions and DDA the dairy regulatory body. The greater Masaka region was the area of study with MADD0 Dairies Ltd as the case study.

This research was carried out with the help of the research assistant because I was not able to travel back to Uganda given the growing covid cases then and more so, at the beginning of this field study, a tough lockdown was announced, where all transport means were shut down and inter-district movement was prohibited, and curfew time was until 5. pm. This implied that the study would take longer than anticipated and it would be extremely complex to collect data. In the face of all this, I had device ways to make sure that the research was carried out and rich, credible, and reliable data had to be collected and meet my deadlines.

Looking into the planned data collection tools, I had planned to use FGDs with farmer groups, traders, then key informant interviews with MADD0, government bodies, financial institutions, and dairy experts in the region. Checklists were developed and discussed with the research assistant to prepare for the field study. I had not planned to use a survey, but with all this shortcoming, I realized that I would not get enough time to collect all the information I needed from the farmers during the FGD especially the quantitative data, so I devised a questionnaire that would be answered by the farmers during the FGD with the help of the research assistant.

With Covid 19 as the biggest barrier to this study, the research assistant had to get an exceptional travel permit from the authorities to travel to the area of study and work closely with the local leaders in the region to permit his movement and engage the community members. Farmer group members that participated in the FGDs were selected purposively with the help MADD0 staff, local leaders with interest in farmer groups that were well organized and committed to supplying MADD0, with milk, farmer groups that are located in distant places from the MCCs, and farmer groups that belong to cooperatives but stopped supplying milk to MADD0 Dairies. Each FGD had 10 farmers, and these were organized with the help of the research assistant. The discussions happened online using zoom that was enabled on the research assistant's laptop and I was able to directly discuss and interact with the participants at length in regard to the research questions. During the meeting with the farmers, the research assistant guided the members on filling the questionnaire because it was in English and most of the farmers would not readily read or write in English. To avoid putting the participants at risk of spreading covid 19, the meetings were held outdoors, and 1.5 metres distance was maintained during the meeting, they had to keep their face masks and a hand sanitizer was provided for the participants. With this approach, we were able to have rich information from the FGDs because FGDs were complemented with a survey. More so, the survey enabled all the participants views to be easily assembled. All meetings were recorded, and notes were taken and for data analysis. Key informant interviews were held with other group leaders that did not attend the FGDs to increase the credibility of the data gathered.

For the traders, the research assistant had to approach them at their evening meeting place after they have finished their milk sales and supplies of the day, and still a zoom meeting was set up where I directly engaged them on the research topics and the meeting was recorded and notes were taken.

Key informant interviews were also conducted through Zoom, with me directly engaging the participants and taking notes and all the meetings were recorded. Since he had a travel permit, the research assistant had to travel to several offices and homes of key respondents because most of them

did not have a reliable internet connection. During the meetings, the Covid 19 SOPs were observed. i.e. social distance was maintained, and both had to wear a face mask unless talking. In the scenarios where there was a poor network, the research assistant would come in since I have shared and discussed with him the checklists.

The recordings from the Zoom meetings were carefully listened to, and all of the data was compiled into pre-formatted templates (i.e. Word documents designed to enter qualitative data in various sections based on established categories). During the FGDs and KIIs, data was collected in notebooks with participants to supplement collected data. The quantitative data was analyzed using SPSS version 28 and qualitative analysis was done to uncover emergent themes that clarified the study topics. The research findings were presentation to the commissioners who gave feedback, rectification of some of the data and provided possible recommendations to the identified constraints.

This research approach was effective, especially during Uganda's difficult times; rich, reliable data was acquired with the specified tools, as all of the research questions were thoroughly addressed, comparisons were made, and triangulation was performed, as shown in the discussion chapter.

Chapter 6: Conclusion

This chapter looks back at the main research questions: “What is the governance of the Dairy value chain in the greater Masaka region? and what is the performance of MADDO Dairies Ltd in upgrading the dairy food system in the greater Masaka region?” The findings from the literature review, Key informant interviews, focus group discussions and the survey provide in-depth analysis as seen in the findings and discussion chapters. Therefore, this chapter answers the main research questions conclusively.

6.1 Governance of the Dairy value chain in the Masaka region

6.1.1 Stakeholder Analysis

Because it is the first and only dairy processing plant in the region, MADDO Dairies Ltd has played a significant role in the development of the dairy value chain in the greater Masaka region, according to this study. It has formed various partnerships and collaborations with government NGOs and financial institutions to assist its dairy activities. Several farmers have received cows as part of the cow initiative, and MCCs have been established in the area to connect them to the market. Farmers have access to extension services through MADDO's many affiliations and partnerships. However, it was stressed that collaborating with other significant dairy partners and strengthening the existing partnerships will help the MADDO Dairies value chain thrive even further. Women dominate dairy farming in this region and practice zero grazing and majority of whom are 50 years and above with very few youths engaged in farming because of rural-urban migration in search of better jobs.

6.1.2 Robustness, Reliability and Resilience of the greater Masaka dairy value chain dairy value

Farmers in the greater Masaka region keep an average of two cows under the peri-urban pastoral system characterized by poor feeding resulting in low milk production of the reared Friesian Holstein cows hence practicing zero-grazing. This is due to a shortage of grazing land and the inability to nourish and maintain more than one cow. Farmers produce an average of 10 litres of milk per cow per day, with some producing significantly less due to poor animal nutrition. Farmers supply milk to MCCs collectively, but some of it is sold directly to customers. MCCs also sell raw milk to local customers and stores in order to meet their daily operating costs while MADDO Dairies payments are delayed. The raw milk segment is regulated by the DDA, and dealers who meet the DDA's requirements are granted operating licenses meaning that there are quality milk checks in the informal chain. As a result of side selling by farmers and MCCs, MADDO Dairies Ltd has a low milk supply even when it is fully operational. This implies that MADDO Dairies receives less milk supply for processing because of poor governance of the dairy value chain in the region, as well as low milk production due to improper nutrition of the cows.

MADDO Dairies Ltd mostly obtains milk from project farmers through established MCCs, but they also obtain milk from the southwestern region through traders and cooling trucks during the dry season and during times of milk scarcity. Because raw milk is in more demand in the region than processed milk, MADDO Dairies Ltd supplies its milk products in places where it has a niche market, such as the greater Masaka region towns and Kampala. They are now selling raw milk until the new processing plant's machinery is fully built and ready to reopen.

When it comes to consumption, raw milk has a higher demand than processed milk. MADDO Dairies' niche market is schools, and they largely distribute processed milk to Kampala and a few supermarkets and retail shops hence there is low demand for MADDO Dairies processed milk products in the region. This means that considerable efforts must be made to educate communities about the benefits of drinking processed milk, particularly in terms of food safety. This will not only improve food safety in the region, but it will also raise demand for processed milk, which will help MADDO Dairies Ltd flourish and grow. Therefore, with the effort to develop the dairy value chain in the region, there are

substantial chain governance discrepancies in milk production, farmer groups organization, collection criteria at the MCCs hence the need to strengthen governance of this chain for further development.

6.1.3 Best governance Practices in the informal dairy value chains

The study findings revealed the best governance practices in the informal chain that MADDO Dairies can adopt to develop the dairy value chain in the greater Masaka region are, prompt payments, competitive milk prices, actors in the informal chain such as organized traders have contracts with dairy farmers to supply them with milk, strong milk collection, and mobilization mechanisms advance milk payments, fully registered associations by milk traders and traders incur transport to the market.

6.2 Performance of MADDO Dairies Ltd in Upgrading the dairy food systems

6.2.1 MADDO Dairies Ltd current business model

MADDO Dairies Ltd has the potential to cover its current liabilities when running at full capacity, according to this research, and the new plant was developed partly with plant income and partly with loans. MADDO Dairies Ltd on the other hand, is currently experiencing liquidity issues and thus lacks sufficient working capital, owing to the ongoing construction of the processing plant, which they hope to open before the end of the year. As a result of the liquidity issues, farmers are receiving delayed milk payments and MCCs are selling raw milk. MADDO Dairies is seeking measures to relieve its cash flow problems. MADDO Dairies Ltd formerly utilized a diesel boiler to power the processing plant, but it was found to be inefficient, therefore the company is now transitioning to a biomass boiler that runs on firewood, which will be used at the new facility to manage costs. Though there have been partnerships with NGOs and government bodies, there is still need to develop new partnerships and strengthen the existing ones.

6.2.2 Organization of cooperatives Under MADDO Dairies Ltd

MADDO Dairies Ltd has around 2200 project farmers who are organized in producer groups and work in a cooperative framework, according to this research findings. MADDO organizes and monitors these groups, and the majority of them have been around for more than 15 years. They must have a common goal, a constitution, and set objectives that are agreed upon by all members, as well as choose leaders. However, the majority of the farmers' groups were poorly organized and on the verge of collapsing due to a lack of active members in relation to registered members. This was attributed to the poor leadership of leaders, a lack of cohesiveness, bad group dynamics, poor record keeping and a failure to maintain the cows given to them, resulting in low milk production, as well as a lack of enough training and supervision by MADDO Dairies Ltd. VSLAs are established by a few farmer groups, most of which are dominated by women, and they help farmers deal with issues like cow treatment and meeting other family obligations in the event of delayed milk payments. Only a few farmer groups have this type of structure because most farmer organizations are weak and on the verge of collapse owing to poor leadership and group dynamics.

6.2.3 Food systems outcomes and sustainability

MADDO Dairies Ltd has, without doubt, impacted the greater Masaka region positively by developing the dairy sector through giving cows to farmers, facilitating the organization of farmers into producer groups, the establishment of milk collection centres, the bigas initiatives, promotion of sustainable agriculture training and capacity building and establishment of the first and only processing plant in the region that provide a ready market for the milk produced by dairy farmers in the region. Over 2,200 farmers are organized farmer groups and cooperatives, over 800 cows have been given to farmers in the region over time. This has led to increased income of the farmers, development of the dairy sector in the region, reduced unemployment, increased access to safe and affordable food, linking farmers to markets, and reduction of greenhouse gas emissions through practicing climate-smart dairy.

Chapter 7: Recommendations

This chapter contributes to answering the main objective of this study which is to compare the informal and formal Dairy chains, assess MADDO Dairies Ltd.'s impact on the Dairy food systems, advise it on the best practices in the informal chains and chain upgrading strategies. This study in particular was participatory in nature, in that participants were engaged to identify bottlenecks and give responding solutions.

7.1. Recommendations for developing the entire dairy value chain

Table 33 shows the identified constraints and responding recommendations of the entire chain from production, milk collection, processing, wholesaling, and retailing, and consuming.

Table 33: constraints and recommendations in the greater Masaka dairy value chain across the entire dairy value chain.

Functions	Constraints	Recommendations
Consuming	☐ Low consumption of processed dairy products	➤ Build Strong partnerships between the MADDO, DDA, District local government to enhance the formalization of the informal dairy value chains. ➤ Increase capacity building about the formalization of the milk chains and milk safety concerns. ➤ Need for a cold chain from MADDO to delivery points to maintain the milk quality in transit ➤ Exploit the local market fully to encourage the local community to embrace processed milk. ➤
Wholesaling/retailing	☐ Informal market that isn't fully regulated.	
Processing	☐ Low milk procurement ☐ Few MADDO processed milk products on the market ☐ Limited processing capacity ☐ Mechanical breakdown of machines at the old processing plant. ☐ Milk processing has been at a standstill since January 2021. ☐	➤ Increased capacity building and advanced technology ➤ Increased marketing of MADDO processed products ➤ Public-private partnerships to increase the production line.
Collection MCCs (cooperatives)-farmer groups	☐ Weak group dynamics and governance ☐ Long distances to the collection centres ☐ Increased farmer groups disintegration ☐ Low prices of milk at MCCs compared to informal	➤ Improve leadership of cooperatives and farmer groups through training on group dynamics ➤ Register and further empower cooperatives. ➤ Improve contract enforcement in cooperatives (contract farming)

	❑ No cold chain from the farm to the MCCs ❑ Delayed milk payments ❑ Limited training by DDA on milk handling on farm level ❑ No awards for milk quality and production ❑ Poor quality milk ❑ Limited processing capacity to accommodate all the milk in the region. ❑ No means of transport for milk produced in the evening. ❑ Weak farmer group loyalty to supply	➤ Improve milk payments- prompt payments ➤ Offer competitive milk prices ➤ Increased monitoring of existing cooperatives and empowerment ➤ Increased awareness and training on milk quality standards ➤ Incentives to good performing farmers ➤ Establish more collection centres in the villages. ➤ Establishment of a revolving fund to sustain farmers in times of financial need. ➤ Create a hub of services at MCCs ➤ Introduce quality-based payments.
Production	❑ poor animal feeding especially in the dry season ❑ Long conception periods ❑ Low milk production ❑ Inadequate farm management skills ❑ Inadequate access to high-quality animal breeds ❑ Artificial insemination is not effective most times and is very expensive ❑ Limited grazing land for growing pasture and fodder ❑ No techniques of preserving the available fodder ❑ Most farmers don't know how to calculate feed ratios and dry matter balancing. ❑ Poor record-keeping ❑ Low youth inclusion	➤ Farmer exposure visits i.e., western Uganda and lead farmers in the region. ➤ Increased training on fodder conservation especially for dry seasons, feeding, pest control. ➤ Better Breeds-Start up a breeding centre in the region ➤ Improve artificial insemination services and have affordable artificial insemination. ➤ Public-private partnerships with financial institutions, other government bodies, and NGOs to improve the capacity building of farmers. ➤ Adopt backyard gardening of limited land. ➤ Encourage farmers with big pieces of land to venture into pasture production. ➤ Increase access to vaccination of dairy cows. ➤ Persuade private investors to put in place pasture farms and breeding centres. ➤ Establish a water harvesting system to cater for the dry season water scarcity ➤ Increase extension services. ➤ Award good performing farmers. ➤ Extending support and skills for youth to participate in agriculture. ➤

7.2 Recommendations to MADDO Dairies limited

This section elaborates on the chain upgrading strategies that MADDO Dairies can adopt to develop the greater Masaka food systems.

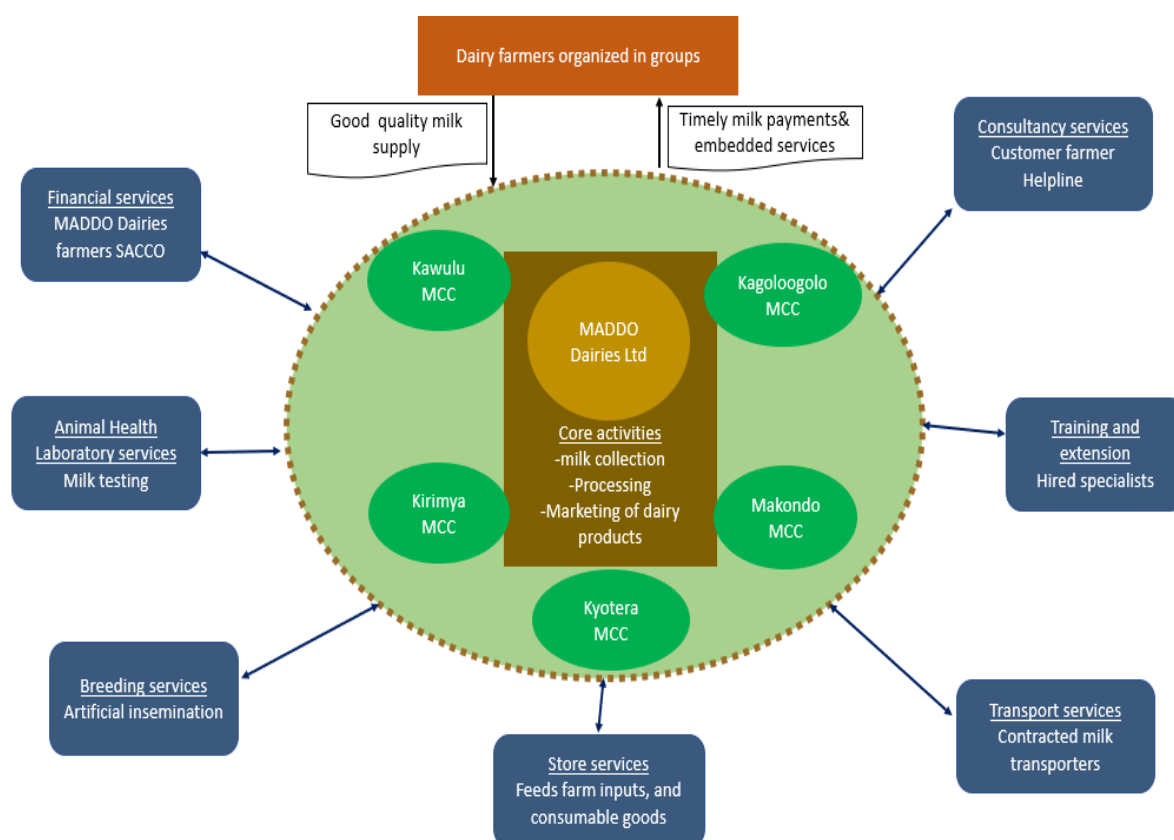
7.2.1 Best governance practices in the informal chain

Prompt milk payments, offering farmers competitive milk prices, putting in place and enforcing contracts with farmers, adoption of strong milk collection and mobilization mechanisms, advance milk payments, fully registered cooperatives, incurring transport costs are among the recommended best practices that MADDO Dairies can learn from the informal chains in order to develop the greater Masaka food systems, according to this study.

7.2.2 Recommended MADDO Dairies Ltd business Hub Arrangement

A dairy hub is one innovative approach developed to address weak farmer groups and commitment/loyalty to supply milk. The established MADDO MCCs become a centre of agribusiness centres that support and attract a network of businesses delivering inputs and services at subsidized costs to farmers that supply milk to MADDO Dairies specifically. A hub is therefore a cluster from which farmers are able to get inputs and services at a favourable cost through economies of scale in the hub setting. The services would include financial services, Animal health, and laboratory services, breeding services, agrovet stores, transport services, training and extension services, and consultancy services. This would increase the farmers' commitment and loyalty to supply milk to MADDO, increase milk production because of easy access to farm inputs and services as these services would only be tailored to farmers that supply milk to different MADDO Milk collection centres. This would reduce the instances of farmers side selling.

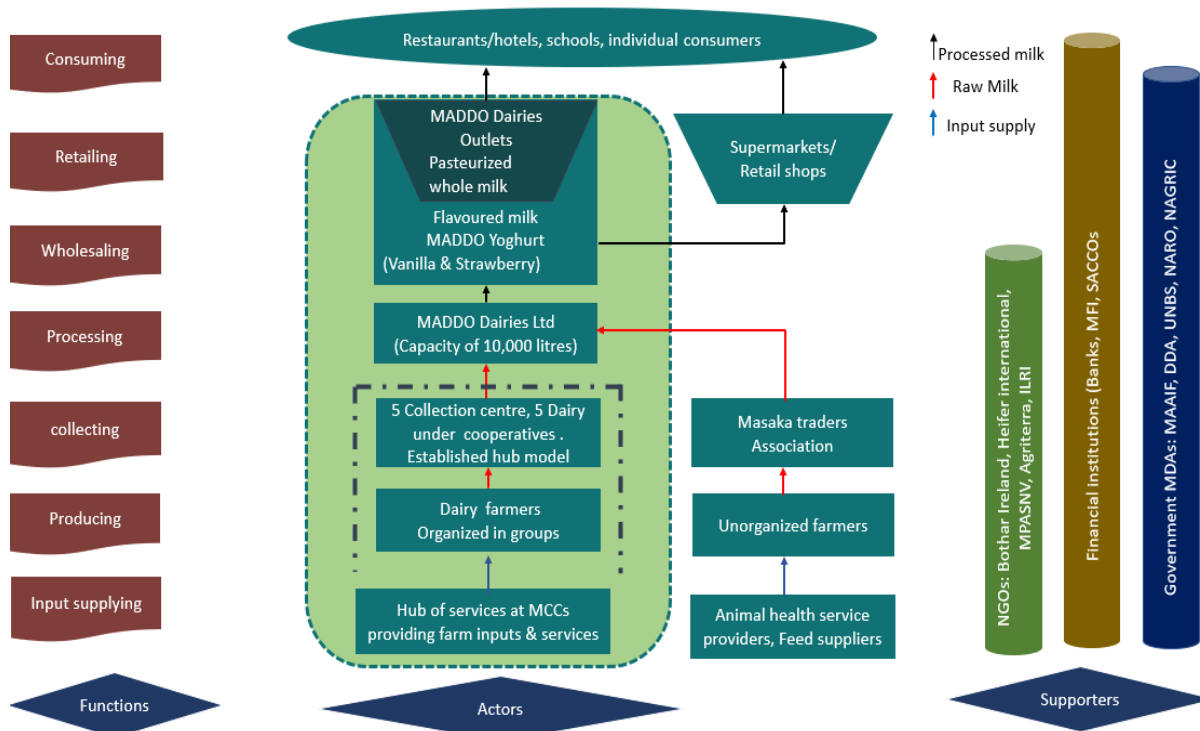
Figure 21: Recommended MADDO Dairies Ltd business hub



7.2.3 Recommended MADDO Dairies Chain map.

The recommended dairy value chain for MADDO Dairies Ltd would entail an incorporated dairy hub model, where farmers organized in different farmers groups have access to farm input facilities at different milk collection centres. The MCCs would be managed by the cooperative leaders who would ensure that only quality milk is received from farmers. All the milk received would be transported to the milk processing plant where it would be processed into various milk products, then distributed through MADDO outlets, supermarkets, and retail shops. Consumers would only look up for the processed milk products sold at the outlets other than buying raw milk from the MCCs and the farmers. MADDO Dairies would establish a strong partnership with Masaka milk traders' association which would help mobilize milk from farmers in hard-to-reach areas and very distant places. These traders would supply all the collected milk to the processing plant, and this would be enforced through contract enforcement with these farmers. MADDO Dairies would have to increase its partnership base with various NGOs such as Agriterra, SNV to mention but a few, and government bodies to establish and develop this value chain. This involves MADDO Dairies Ltd managing the entire chain from input supply, producing, collection, processing, and marketing the processed milk products.

Figure 22: recommended MADDO Dairies value chain



7.2.4 Recommended Business model Canvas for MADDO Dairies Ltd

Using the business canvas model, it highlights MADDO Dairies, key partners, value proposition, supply relations, key activities, customer/supply segments, channels, key resources, cost structure, and revenue streams. In black is the current situation and in red is the recommended situation as seen in table 34.

Table 34:current business canvas model and the recommendations.

KEY PARTNERS	VALUE PROPOSITION	SUPPLY RELATIONSHIPS
➤ Heifer International ➤ Bothar Ireland ➤ Opportunity Africa in England ➤ Senior experts in the Netherlands ➤ Send a cow ➤ Microfinancing partners Africa ➤ World vision ➤ St. Jude NGO ➤ DDA ➤ UNBS ➤ District Veterinary officers ➤ Farmers ➤ Milk collection centres ➤ Milk Traders ➤ Centenary Bank ➤ Milk wholesalers and retailers. ➤ International Livestock research institute ➤ SNV ➤ Agriterra ➤ The Living lab project team ➤ Biogas association Uganda ➤ International livestock organization ➤ District production department ➤ Kitovu Mobile ➤ Private investors ➤ MAMIDECOT Microfinance	➤ MADDO Dairies is a social business, it caters to the social aspects of people in the greater Masaka region by training farmers in sustainable agriculture, livestock management, environmental conservation, vegetable management to improve livelihoods. ➤ VISION: To establish the dairy in profitability position that will sustain it to provide quality milk products ➤ MISSION: To produce high-quality milk products for improved health among the populace. ➤ OBJECTIVES: -To provide a reliable market for farmers' milk & produce high-quality milk products -To provide employment to the youth in the area -To improve the welfare of the community - To make profits that sustains the Dairy. ➤ The core values are teamwork, accountability, time management, Equity and quality assurance.	➤ MADDO gives farmers a living loan of a cow and the farmer has to pay back with a heifer which is then given to another farmer. ➤ MADDO has agreements with farmers and is signed upon reception of a heifer; stating that it they will take good care of the cow, give back a heifer, and train 4 other farmers. ➤ Farmers are given good quality metallic cans to enhance milk quality at pickup points, the cans are given on a loan basis, and farmers pay back from the milk sales at the MCCs. ➤ MADDO does not enforce that the project famers sell milk to them. Therefore, they don't have supply contracts with farmers in place. ➤ MADDO has meetings with farmer group representatives once every month. ➤ MADDO Dairies has a trust-based relationship with farmers. ➤ Enforce contractual milk supply with farmer groups, traders, and MCCs. ➤ Establish the hub model at different MCCs to enhance the loyalty and commitment of dairy farmers. ➤ Introduce quality-based payments to prompt farmers to supply high-quality milk to the MCCs. ➤ Enforcement of VSLAs in each farmer group.

<u>KEY ACTIVITIES</u> ➤ MADDO Dairies Ltd is a key player in the region as it is engaged in milk production, collection, and processing and marketing. ➤ MADDO Dairies provides services to dairy farmers through the cow project by offering them heifers and extension services. ➤ They train farmers on nutrition and hygiene, good milk handling practices, proper feeding practices and how to grow fodder and in hay and silage making and sustainable agriculture. ➤ Farmers are given high-quality metallic cans on a loan basis to ensure high milk quality.	<u>CUSTOMER / SUPPLIER SEGMENTS</u> ➤ MADDO Dairies Ltd supplies its milk products in places where it has a niche market in the greater Masaka region and Kampala. ➤ Currently, they are selling raw milk until machinery at the new processing plant is fully installed and ready to reopen. ➤ There is high demand for raw milk in the region. ➤ Farmer groups supply milk to MADDO Dairies Ltd through different MCCs. ➤ MADDO Dairies Ltd mainly procures milk from the project farmers through the established MCCs. ➤ Sometimes in the dry season, they Procure milk from the southwestern region. ➤ Currently 80% of the raw milk received at the processing plant is processed and sold as yoghurt, 15% in raw form whereas 5% is sold as pasteurized milk. ➤ Establish a relationship with Masaka Milk traders Association. ➤ MADDO Dairies Ltd to engage only in the sell and marketing of processed dairy products.	➤ Give awards and incentives to farmers for high milk production and quality. i.e. silage cutters, motorbikes, discounts on the cost of input facilities. ➤ Regular meeting and monitoring of farmer groups. ➤ Better supply chain integration. ➤ Improved linkages and trustworthy interactions between chain actors to reduce transaction costs and improve milk quality and safety. <u>CHANNELS</u> ➤ MADDO products are found in retail shops, supermarkets, schools, hotels, and individual consumers. ➤ MADDO Dairies Ltd supplies its products in the greater Masaka region where it has a niche market i.e. mainly schools and Kampala since raw milk has more demand in the region. ➤ Milk supplies are organized from farmer groups who collect milk at pick-up points and then it is brought to various MCCs then finally brought to the processing plant. ➤ Has good relations with farmers groups and passes on market information to the farmers through farmer groups and cooperative leaders. ➤ Take advantage of the local market and local consumption of processed milk products through aggressive marketing and capacity building to enhance sales and marketing activities.
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		➤ Invest in the cold chain locally to enable easy distribution of processed milk products.
<u>KEY RESOURCES</u> ➤ MADDO Dairies Ltd is a company limited by guarantee ➤ It has over 2200 trained project farmers. ➤ Initially started with a processing plant with a capacity of 4,000 litres of milk daily ➤ A new processing plant with a capacity of 10,000litres per day will soon be open and has milk coolers. ➤ The business premises are on 2 acres of land. ➤ Has 5 milk collection centres ➤ 3 Milk cooling trucks. ➤ At first MADDO Dairies Ltd employed permanent 32 employees but due to Covid 19 and mechanical breakdown of the old plant, it now employees 15 staff. ➤ MADDO has a forest on 185 acres. And total fixed assets are worth 1.4 billion Ugandan shillings. ➤ Increase the number of milk collection centres especially in remote areas. ➤ Increase the number of farmers organized in groups through increased recruiting and mobilization mechanisms. ➤ Have the processing plant up and running and increase the machinery capacity. ➤ Increase the human resource base and train them to manage MADDO Core activities hence capacity building.	<u>COST STRUCTURE</u> ➤ MADDO Dairies was using a diesel boiler to run the processing plant but it was not found to be cost effective and is now switching to a biomass boiler which uses firewood. ➤ When at full production capacity, MADDO Dairies Ltd is able to cover its current liabilities. ➤ Limited working capital hence causing delays in paying the farmers. ➤ The new plant has been constructed using revenues from the plant and partly using loans. ➤ Public private partnerships to enhance resource mobilization. ➤ Improve internal financial management through accountability and transparency and have audit reviews.	<u>REVENUE STREAMS</u> ➤ MADDO gets revenue from milk processing, collection and selling of processed milk and raw milk. ➤ Biogas installation is also a source of revenue. ➤ Farmers are asked to open accounts in the bank through which they are paid.

7.3 Recommendations to the Living Lab project team

The living lab project's core purpose is to ensure affordable and quality milk supply in the food system of Greater Masaka, through the living lab, it is hoped that there will be Increased volumes of quality milk in the MADDO dairy value chain. Therefore, based on the findings of this study, the following are the recommendations for a living lab team towards upgrading the dairy value chain in the greater Masaka region:

Facilitate chain actors' interactions through organizing stakeholder meetings to enhance knowledge sharing and information dissemination.

Facilitate organization and strengthening of farmer groups through linking farmers to developmental organizations such as Agriterra that Provide business development services to ambitious cooperatives and farmer groups through assisting them with advice and training hence making the cooperatives bankable and creating real farmer-led organizations.

Linking farmers with educational institutions as Mbuye Agricultural Institute in order to train more farmers in dairy aspects in order to enhance animal health and nutrition and boost milk production.

Participate in the promotion of sustainable dairy production through organizing farmer trainings and chain actors on climate-smart agriculture, animal nutrition, and animal welfare to realize increased milk production in the area.

Establish public-private partnerships between MADDO Dairies Ltd with government bodies and NGOs in order to facilitate and support the new and ongoing dairy projects in the greater Masaka region.

Promote and support consumer awareness by disseminating information on the consumption of high-quality processed milk and by establishing and strengthening partnerships between MADDO Dairies Ltd and other stakeholders such as the DDA, the district production department, and non-governmental organizations (NGOs) to raise consumer awareness about the benefits of processed milk.

Engage in the sensitization of informal dairy chain actors to participate in the formal dairy chain by specializing in milk transportation, selling processed milk products, exporting milk products, and a variety of other massive opportunities in the formal chain other than raw milk trade.

Persuade private investors to invest in pasture production given that most farmers have limited land for pasture production and conservation and making it available to farmers at an affordable price, invest in breeding centres given increased artificial insemination failures in the region.

Because there are over 45 extension workers in the greater Masaka region, the living lab team can facilitate a networking meeting with them and form an association with a primary goal of reaching out to farms timely and monitoring them to foster dairy development in the region hence creating sustainable dairy food systems.

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Annexes

Annex 1: MADDO Dairies Milk delivery vans of processed milk products



Annex 2: raw milk transporting tankers



Annex 3: Milk inspection and training



Annex 4: The on going construction of the new MADDO Dairies Ltd processing plant with a capacity of 10,000 litres





Annex 5: Silage making by the district production office



Annex 6: Focus group discussion checklist

Checklist for Farmers (FGD/Interviews)

Question one: What is the governance of the Dairy value chain in the greater Masaka region?

a) What are the roles and functions of various stakeholders in the dairy value chain?

Concepts (Stakeholders' roles and interests Functions, Actors, Supporters, chain relations, SWOT analysis, gender roles, Value shares and volumes, Food storage, transport & trade, food processing, food consumption)

FGD/Interview Questions

- What is your role in the chain?
- How many cows do you keep?
- How old are you?
- How many litres of milk do you produce daily?
- What is your production cost?
- How do you access the market?
- How do you get information about prices and any other changes in the market trends?
- Who do you sell the milk to?
- How many litres of milk do you sell?
- How many litres remain for home consumption?
- How much do you sell the milk? (to neighbors, traders, MCC, other consumers?)
- How do you transport milk to the markets?
- Is dairy profitable to you as farmer?
- Where would you rather trade, informal or formal chain?
- Why your choice?
- Who are the actors that you work with in the chain?
- Who supports you in the chain?
- What kind of support do you get if any?
- How is the milk stored in transit to the market or other delivery places?
- What means of transport are used to deliver milk to different customer segments?
- Do you do any processing of the milk on the side?
- What milk products do you make?
- What are the strengths, weaknesses, opportunities, and threats in the dairy in this region?

b) What is the robustness, reliability and resilience of the greater Masaka Dairy food systems?

concepts Robustness: vertical & horizontal alliances quality management systems.

Reliability: Standards & regulations, incentives, Resilience: innovation linkages, capacity building.

Robustness of DVC

Milk Quality

- Is the milk quality checked in formal/informal chain?
- Who does the quality inspections?
- How often is milk inspection carried out?
- Who sets the rules and the standards?
- What quality tests are conducted?
- What quality management systems are in place?
- Is the milk checked at reception?
- What storage do you use for transporting milk from the farmer to the selling points?
- How do you enhance trust among chain actors?

Reliability Policy Environment

- What milk quality systems are in place in formal/informal chains?
- Who ensures compliance of the milk quality system in both informal and informal chains?
- Why is quality ignored most times in the informal chain?

- What regulations favour you in the informal chain/ formal chain?
- What are the stipulated quality standards of milk processors?
- Do you have any standards in the informal market?
- What are the required milk standards for a transporter, wholesaler/retailer?
- What policies support the existence of the informal chain?
- What incentives are encouraging you to trade in the informal/ formal chain?
- What other factors are influencing the existence of the informal chain?
- Are there awards given for maintaining certain milk quality standards?
- What are the awards/ incentives given in both chains if any?

Resilient innovation System

Innovation services

- Who are the actors that you deal with in the chain?
- What relationship do you have with the other actors?
- Who are the supporters in the chain?
- What relationship do you have with the supporters?
- What are the benefits of these relationships?
- What institutional arrangements do you have with the supporters?

Capacity Building

- Do you receive trainings?
- What kind of trainings do you receive?
- Who provides the trainings?
- How often are you trained?
 - Governance- trainings with the cooperatives
 - Who supports and coordinates these trainings?
 - Public private partnerships that foster innovations among actors
- How many times do you provide the training, weekly, monthly, yearly?
- What topics do you train about?
- Do you work with MADDO Dairies and the cooperatives under MADDO?
- What relationship do you have with them?

2c) What are the best practices in the formal chain compared to the informal chain that MADDO Dairies can adopt? Concepts (Milk markets, Comparison of the informal and formal milk channels, best practices in informal chains)

- Where would you rather trade formal or informal markets?
- What is the profitability in informal compared to the formal chain?
- What is being done well in the informal chains that you want to see in the formal?
- What is in the informal that you would want to see in the formal chain?
- Informal chain: What motivates you to trade in the informal chain?
- What regulations are in the informal chain compared to the formal?
- What incentives are informal chains compared to the formal chain?
- What is the profitability in the informal compared to the formal chain?
- What other socio-economic factors influence trading in the informal chain?
- What challenges are you experiencing in the formal chain that drive you to trade in the informal chain?

- Why are milk consumers buying from the informal chain and not so much from the formal chain?
- What recommendations do you have for MADDO to grow the formal chain?
- What incentives would motivate you to trade in the formal chain?
- What would motivate the consumers to buy from the formal chain?

(Cooperative leaders)2b) what is the organization of cooperatives under MADDO Dairies Limited in terms of milk procurement?

Organization of cooperatives	
	Membership
	❖ What is the internal organization of the cooperatives? ❖ How many members are active out of the total registered? ❖ Are members certified? ❖ What actions are being taken to increase membership?
	Production
	❖ How many average cows does each member have? ❖ How many litres of milk to do collect daily as a cooperative? ❖ How many litres of milk are sold to MADDO? ❖ What percentage is sold to MADDO? ❖ Why don't you sell all the milk you produce to MADDO? ❖ How many litres are sold to other channels? ❖ Which other channels do you sell to? ❖ Why do you sell to other channels? ❖ What quality management system do you have in place to ensure that quality is maintained? ❖ How much are you paid for each litre sold to MADDO? ❖ How often are you paid?
	Services
	❖ What services and benefits do you get from belonging to cooperatives under MADDO? ❖ Are you satisfied with the services being provided? ❖ Do you have a contract with MADDO Dairies? ❖ What gaps do you realize in the cooperatives? ❖ What can be done to improve your loyalty and service delivery?
	Financial Management
	❖ How often do MADDO Dairies make payments for milk procured? Daily, weekly, monthly? ❖ Are your financial needs covered by the cooperative? ❖ Do you have access to financial institutions and banks? ❖ Do you have VSLAs? ❖ How are they performing? ❖ What is your long-term goal as a cooperative? ❖ What do you want to achieve as a cooperative? ❖ What internal challenges are you experiencing? ❖ What are your recommendations to MADDO Dairies to sustain and further grow the cooperatives?

2c) What are socio economic outcomes of MADDO Dairies Ltd in the region?

- How have MADDO Dairies Ltd/NGO impacted your community in terms of:
 - livelihood (food, shelter, clothing)?
 - Food access and affordability?
 - Food safety and nutrition?
 - Production of milk and distribution?
- How has it impacted your lives as farmers and creating employment?
- What benefits do you get from belonging to these cooperatives?
- What is MADDO Dairies Ltd.'s Impact on people, planet, profitability, partnerships, and prosperity?

Annex 7: FGD/ interview with traders checklist

Trader/ transporter/wholesaler/retailer checklist

Question one: What is the governance of the Dairy value chain in the greater Masaka region?

c) What are the roles and functions of various stakeholders in the dairy value chain?

Concepts (Stakeholders' roles and interests Functions, Actors, Supporters, chain relations, SWOT analysis, gender roles, Value shares and volumes, Food storage, transport & trade, food processing, food consumption)

- What is your role in the chain?
- How old are you?
- How many litres of milk you purchase a day?
- How do you transport milk from the farm to the selling points?
- How do you access the market?
- How do you get information about prices and any other changes in the market trends?
- Who do you sell the milk to?
- What are your transaction costs?
- How many litres of milk do you sell?
- How much do you sell the milk? (to neighbors, traders, MCC, other consumers?)
- How do you transport milk to the markets?
- Is milk profitable to you as a trader?
- Where would you rather trade, informal or formal chain?
- Why your choice?
- Who are the actors that you work with in the chain?
- Who supports you in the chain?
- What kind of support do you get if any?
- How is the milk stored in transit to the market or other delivery places?
- What means of transport are used to deliver milk to different customer segments?
- Do you do any processing of the milk on the side?
- What milk products do you make?
- What are the strengths, weaknesses, opportunities, and threats in the dairy in this region?

d) What is the robustness, reliability and resilience of the greater Masaka Dairy food systems?

concepts Robustness: vertical & horizontal alliances quality management systems.

Reliability: Standards & regulations, incentives, Resilience: innovation linkages, capacity building.

Robustness of DVC

- Where do you supply the milk products?
- Where do you source the milk?
- How much milk is procured daily?
- How much do you buy per litre of milk?
- What products do you make out of this milk?
- Who do you sell this milk to?
- What is your profitability?
- Do you have steady supply of milk?
- Who are your priority customers?
- Who do you buy milk from?
- How much is the milk/ litre from each supplier of raw milk?
- How much is the milk from processors?
- What milk (raw/ processed) do customers prefer to buy?
- What are the reasons for the customers selection of milk type?
- Who do you sell milk to and at how much?
- What are transaction costs in both formal /informal chains?
- What are the payment systems in formal/informal?
- What is your profitability when you trade in formal/informal?

Reliability Policy Environment

- What milk quality systems are in place in formal/informal chains?
- Who ensures compliance of the milk quality system in both informal and informal chains?
- Why is quality ignored most times in the informal chain?
- What regulations favour you in the informal chain/ formal chain?
- What are the stipulated quality standards of milk processors?
- Do you have any standards in the informal market?
- What are the required milk standards for a transporter, wholesaler/retailer?
- What policies support the existence of the informal chain?
- What incentives are encouraging you to trade in the informal/ formal chain?
- What other factors are influencing the existence of the informal chain?
- Are there awards given for maintaining certain milk quality standards?
- What are the awards/ incentives given in both chains if any?

Resilient innovation System

- Who are the actors that you deal with in the chain?
- What relationship do you have with the other actors?
- Who are the supporters in the chain?
- What relationship do you have with the supporters?
- What are the benefits of these relationships?
- What institutional arrangements do you have with the supporters?

- Do you receive trainings?
- What kind of trainings do you receive?
- Who provides the trainings?
- How often are you trained?

2c) What are the best practices in the formal chain compared to the informal chain that MADDO Dairies can adopt? Concepts (Milk markets, Comparison of the informal and formal milk channels, best practices in informal chains)

- Where would you rather trade formal or informal markets?
- What is the profitability in informal compared to the formal chain?
- What advice would you give to MADDO to upgrade the formal chain?
- What is being done well in the informal chains that you want to see in the formal?
- What is in the informal that you would want to see in the formal chain?
- Informal chain: What motivates you to trade in the informal chain?
- What regulations are in the informal chain compared to the formal?
- What incentives are informal chains compared to the formal chain?
- What is the profitability in the informal compared to the formal chain?
- What other socio-economic factors influence trading in the informal chain?
- What challenges are you experiencing in the formal chain that drive you to trade in the informal chain?
- Why are milk consumers buying from the informal chain and not so much from the formal chain?
- What recommendations do you have for MADDO to grow the formal chain?
- What incentives would motivate you to trade in the formal chain?
- What would motivate the consumers to buy from the formal chain?
-

Annex 8: Checklist for MADDO Dairies Ltd staff

MADDO Dairies Checklist

Checklist for Farmers (men, women, youth)

Question one: What is the governance of the Dairy value chain in the greater Masaka region?

e) What are the roles and functions of various stakeholders in the dairy value chain?

Concepts (Stakeholders' roles and interests Functions, Actors, Supporters, chain relations, SWOT analysis, gender roles, Value shares and volumes, Food storage, transport & trade, food processing, food consumption)

- What is your role in the chain?
- For how long has MADDO Dairies existed?
- What is your processing capacity?
- How many litres of milk do you purchase daily?
- How is milk transported from the farm to the processing plant?
- What Products do you make from the milk?
- How do you access the market?
- How do you get information about prices and any other changes in the market trends?
- Who do you sell the milk products to? Who are your customers?
- What are your transaction costs?

- How is the milk stored in transit to the processing plant and to the market?
- How many litres of milk do you sell daily to your end customers?
- Who are the actors that you work with in the chain?
- Who supports you in the chain?
- What are the strengths, weaknesses, opportunities, and threats in the dairy in this region?

What is the robustness, reliability and resilience of the greater Masaka Dairy food systems?

concepts Robustness: vertical & horizontal alliances quality management systems.

Reliability: Standards & regulations, incentives, Resilience: innovation linkages, capacity building.

Robustness of DVC

- Where do you supply the milk products?
- Where do you source the milk?
- How much milk is procured daily?
- How much do you buy per litre of milk?
- What products do you make out of this milk?
- Who do you sell this milk to?
- What is your profitability and value share?
- Do you have steady supply of milk?
- What is your value share?

MCCs under MADDO Dairies

- How much volumes are collected daily?
- Do you have contracts with the suppliers and the people you supply to?
- Who do you sell the milk to formal/ informal?
- What are the reasons for selling to either chains?
- Where is the milk sourced?
- How is the payment daily/weekly/ monthly?
- What is your profitability?

Quality

- Is the milk quality checked?
- Who does the quality inspections?
- How often is milk inspection carried out?
- Who sets the rules and the standards?
- What quality tests are conducted?
- What quality management systems are in place?
- Is the milk checked at reception?
- What storage do you use for transporting milk from the farmer to the selling points?
- What are the critical control points? (More care is taken to avoid contamination and ensure quality?)

Reliability Policy Environment

Regulations

- What milk quality systems are in place in formal/informal chains?
- Who ensures compliance of the milk quality system in both informal and informal chains?
- Why is quality ignored most times in the informal chain?

- What regulations favour you in the informal chain/ formal chain?
- What are the stipulated quality standards of milk processors?
- Do you have any standards in the informal market?
- What are the required milk standards for a transporter, wholesaler/retailer?
- What policies support the existence of the informal chain?

Incentives

- What incentives are encouraging you to trade in the formal chain?
- What other factors are influencing the existence of the informal chain?
- Are there awards given for maintaining certain milk quality standards?
- What are the awards/ incentives given in both chains if any?

Reliability Policy Environment

Innovation services

- Who are the actors that you deal with in the chain?
- What relationship do you have with the other actors?
- Who are the supporters in the chain?
- What relationship do you have with the supporters?
- What are the benefits of these relationships?
- What institutional arrangements do you have with the supporters?
- Do you have contracts with the suppliers?
- What innovations have been introduced by chain actors/supporters?
- How does market information flow in the informal/ formal chain?

Capacity Building

- Do you receive trainings?
- What kind of trainings do you receive?
- Who provides the trainings?
- How often are you trained?
- Do you train the farmers/ traders?
- What kind of training do you offer?

2a) What is the current business model of MADD0 Dairies Ltd?

<u>KEY PARTNERS</u> ➤ Who are your key partners? ➤ Who are your suppliers? ➤ What support do you get from your key partners? ➤ What activities do your partners perform? ➤ What key partnerships has MADDO Dairies Ltd established to upgrade the dairy value chain in the region?	<u>VALUE PROPOSITION</u> ➤ What products and services do you offer? ➤ What customer needs are you satisfying? ➤ How do customers access your product?	<u>CUSTOMER RELATIONSHIPS</u> ➤ Do you have contract with your customers/suppliers? ➤ Do have open days for customers to visit your farm? ➤ Do you have any training or workshops for your customers/suppliers? ➤ What kind of relationship do you have with your suppliers and customers? ➤
<u>KEY ACTIVITIES</u> ➤ What are the main activities of this organization? ➤ What income generating activities sustain the organization? ➤ How do these activities contribute to the dairy development in the area?	<u>CUSTOMER SEGMENTS</u> ➤ How many products are you producing? ➤ What group of customers are you targeting?	<u>CHANNELS</u> ➤ How do customers access your products? ➤ How do you communicate with your customers? ➤ What are your marketing strategies? ➤ What is the most efficient way of reaching your customers?
<u>KEY RESOURCES</u> ➤ Do you have a brand name? ➤ How many permanent employees do you have (Males and females)? ➤ How many part-time employees do you have (Males and females)? ➤ How do you finance your business? ➤ What is the size of your land? ➤ What other physical infrastructures do you have apart from land? ➤ What are your fixed assets and what is their net worth?	<u>COST STRUCTURE</u> ➤ What are the average production costs incurred in milk processing? ➤ What are the sales and marketing costs? ➤ Are you profitable? ➤ What are your monthly profits? ➤ Do your profits sustain the business? ➤ Do you source money elsewhere to facilitate the daily running of the enterprise? ➤ Which activities are most expensive for the enterprise? ➤ What are your monthly expenses? ➤ How often do you pay milk suppliers? (cooperatives)	<u>REVENUE STREAMS</u> ➤ What is the price of each milk product produced? ➤ What is the method of payment? ➤ What are the other sources of revenue? ➤ Are the revenue sources sustainable for the organization?

2b) What is the organization of the cooperatives under MADDO Dairies Ltd?

- What is the Internal organization of cooperatives?
- How many active members?
- How does the management increase membership (recruitments)?
- How many litres of milk do you supply to MADDO Dairies Ltd daily as a cooperative?
- What quality management system do you have in place to ensure that quality is maintained?
- Do you have contracts with the farmers?
- What internal challenges are you experiencing?
- How do you access finances to cover your financial needs for the farmers?
- How often do MADDO Dairies make payments for milk procured? Daily, weekly, monthly?
- Do you have a contract with MADDO Dairies?
- Do you have plans to further strengthen these cooperatives?

2c) What are socio economic outcomes of MADDO Dairies Ltd in the region?

- How have MADDO Dairies Ltd/NGO impacted the community in terms of:
 - livelihood (food, shelter, clothing)?
 - Food access and affordability?
 - Food safety and nutrition?
 - Production of milk and distribution?
- How has it impacted your lives of farmers and creating employment?
- What benefits do farmers get from belonging to these cooperatives?
- What is MADDO Dairies Ltd.'s Impact on people, planet, profitability, partnerships, and prosperity?

Annex 9: Checklist for financial institutions

Checklist Financial institutions

- What is your role in the dairy chain?
- Do you have facilities for farmers, traders and processors?
- What challenges do you experience with working with farmers/cooperatives?
- What would be your recommendations to improve your relationship with the farmers/cooperatives?
- What business solutions would you recommend to the farmers, traders, MADDO?
- Are there possible partnerships can improve your service delivery to this segment?
- What would you propose to improve this segment's access to finance?
- What products would best suit cooperatives (farmer producer groups)?
-

Annex 10: Checklist Production department, DVO,

DVO/ Production/District extension officers Checklist

- What is your role and functions in the dairy chain?
- What are the strengths, weaknesses, opportunities and threats in the dairy value chain?
- What incentives has the government put in place to grow the formal chain in the region?
- What quality measures and standards are in place to improve milk quality?

- Who are the chain actors and supporters that you partner with to ensure that quality is adhered to?
- Who does the milk quality checks?
- Why is the informal chain thriving compared to the formal chain in this region?
- Is there something that MADDO Dairies can learn from the informal chain in order to upgrade the formal chain?
- What partnerships would reduce the informal milk chain in the region?
- What would be your recommendations to MADDO Dairies Ltd to reduce the informal chain and have a sustainable dairy value chain?
- What has been the impact of MADDO Dairies Ltd and NGO on this community and the dairy sector? (In terms of livelihoods, food security, and other socio-economic impacts)

Milk Quality

- What quality management systems are in place?
- Is the milk quality checked in formal/informal chain?
- What quality measures and standards has DDA put in place to improve milk quality?
- Who does the quality inspections and checks?
- How often is milk inspection carried out?
- Who sets the rules and the standards?
- What quality tests are conducted?

Regulations

- What milk quality systems are in place in formal/informal chains?
- Who ensures compliance of the milk quality system in both informal and formal chains?
- Why is quality ignored most times in the informal chain?
- What regulations favour the existence of informal chain/ formal chains?
- What are the stipulated quality standards of milk processors?
- What penalties are given to those who don't follow the standard guidelines?
- Do you have any standards in the informal market?
- What are the required milk standards/ guidelines for a transporter, wholesaler/retailer?
- What policies support the existence of the informal chain?

Incentives

- What incentives are encouraging you to trade in the informal/ formal chain?
- What other factors are influencing the existence of the informal chain?
- Are there awards given for maintaining certain milk quality standards?
- What are the awards/ incentives given in both chains if any?

Innovation services

- Who are the actors that you deal with in the chain?
- What relationship do you have with the actors?
- Who are the other supporters in the dairy chain?
- What relationship do you have with the supporters?
- What are the benefits of these relationships?
- What institutional arrangements do you have with other supporters?
- What innovations have been introduced to upgrade the dairy value chain?

- How does market information flow in the informal/ formal chain?

Capacity Building

- Do you provide trainings?
- What kind of trainings do you provide?
- Who provides the trainings?
- How often are you trained?
- How many times do you provide the training, weekly, monthly, yearly?
- What topics do you train about?
- Do you work with MADDO Dairies and the cooperatives under MADDO?
- What relationship do you have with them?
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Annex 11: DDA Officer Checklist

- What are the roles and functions of DDA in the region?
- What is the strength, weakness, opportunities, and threats of the dairy sector in the region?
- What are the interests of DDA?
- What are the reasons behind the dominance of the informal chains in the region?
- What is DDA doing to reduce the informal chain?
- What incentives has the DDA put in place to grow the formal chain in the region?
- Who are the chain actors and supporters that you partner with to ensure that quality is adhered to?
- What partnerships would reduce the informal milk chain in the region?
- Is there something that MADDO Dairies can learn from the informal chain in order to upgrade the formal chain?
- What would be your recommendations to MADDO Dairies Ltd to reduce the informal chain and have a sustainable dairy value chain?
- What has been the impact of MADDO Dairies Ltd and NGO on this community and the dairy sector? (In terms of livelihoods, food security, and other socio-economic impacts)

Milk Quality

- What quality management systems are in place?
- Is the milk quality checked in formal/informal chain?
- What quality measures and standards has DDA put in place to improve milk quality?
- Who does the quality inspections and checks?
- How often is milk inspection carried out?
- Who sets the rules and the standards?
- What quality tests are conducted?

Regulations

- What milk quality systems are in place in formal/informal chains?
- Who ensures compliance of the milk quality system in both informal and formal chains?
- Why is quality ignored most times in the informal chain?
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- What are the stipulated quality standards of milk processors?

- What penalties are given to those who don't follow the standard guidelines?
- Do you have any standards in the informal market?
- What are the required milk standards/ guidelines for a transporter, wholesaler/retailer?
- What policies support the existence of the informal chain?

Incentives

- What incentives are encouraging you to trade in the informal/ formal chain?
- What other factors are influencing the existence of the informal chain?
- Are there awards given for maintaining certain milk quality standards?
- What are the awards/ incentives given in both chains if any?

Innovation services

- Who are the actors that you deal with in the chain?
- What relationship do you have with the actors?
- Who are the other supporters in the dairy chain?
- What relationship do you have with the supporters?
- What are the benefits of these relationships?
- What institutional arrangements do you have with other supporters?
- What innovations have been introduced by DDA to upgrade the dairy value chain?
- How does market information flow in the informal/ formal chain?

Capacity Building

- Do you provide trainings?
- What kind of trainings do you provide?
- Who provides the trainings?
- How many times do you provide the training, weekly, monthly, yearly?
- What topics do you train about?
- Do you work with MADDQ Dairies and the cooperatives under MADDQ?
- What relationship do you have with them?

Annex 12: the living lab project team checklist

- What is the SWOT of the dairy sector in this area?
- Who are you partnering with in the Living lab project to improve the dairy food systems in the region? (chain actors and supporters)
- What activities will the Living lab project undertake to upgrade the dairy value chain in the region?
- What is the impact of MADDQ Dairies Ltd on the dairy value chain in the region?
- What will be the impact of your activities and partnerships in upgrading the dairy value chain?
- What recommendations do you have for MADDQ Dairies to upgrade the dairy value chain in the region?

Annex 13: chain governance analysis checklist

	Robustness of DVC		Reliability Policy Environment		Resilient innovation System	
	Productivity/volume and prices	Milk Quality	Regulations	Incentives	Innovation services	Capacity Building
Wholesaling/ Retailing	Who do you buy milk from? How much is the milk/ litre from each supplier of raw milk? How much is the milk from processors? What milk (raw/ processed) do customers prefer to buy? What are the reasons for the customers selection of milk type? Who do you sell milk to and at how much? What are transaction costs in both formal /informal chains? What are the payment systems in formal/informal? What is your profitability when you trade in formal/informal?	Is the milk quality checked in formal/informal chain? Who does the quality inspections? How often is milk inspection carried out? Who sets the rules and the standards? What quality tests are conducted? What quality management systems are in place?	What milk quality systems are in place in formal/informal chains? Who ensures compliance of the milk quality system in both informal and informal chains? Why is quality ignored most times in the informal chain? What regulations favour you in the informal chain/ formal chain? What are the stipulated quality standards of milk processors? Do you have any standards in the informal market? What are the required milk standards for a transporter, wholesaler/retailer? What policies support the existence of the informal chain?	What incentives are encouraging you to trade in the informal/ formal chain? What other factors are influencing the existence of the informal chain? Are there awards given for maintaining certain milk quality standards? What are the awards/ incentives given in both chains if any?	Who are the actors that you deal with in the chain? What relationship do you have with the other actors? Who are the supporters in the chain? What relationship do you have with the supporters? What are the benefits of these relationships? What institutional arrangements do you have with the supporters? Do you have contracts with the people you supply? What innovations have been introduced by chain actors/supporters? How does market information flow in the informal/ formal chain?	Do you receive trainings? What kind of trainings do you receive? Who provides the trainings? How often are you trained?
Milk processing	Where do you supply the milk products? Where do you source the milk? How much milk is procured daily? How much do you buy per litre of milk? What products do you make out of this milk? Who do you sell this milk to? What is your profitability? Do you have steady supply of milk?	Is the milk checked at reception? What storage do you use for transporting milk from the farmer to the selling points?				
Milk collection centres	How much volumes are collected daily? Do you have contracts with the suppliers and the people you supply to? Who do you sell the milk to formal/ informal?					

	What are the reasons for selling to either chains? Where is the milk sourced? How is the payment daily/weekly/ monthly? What is your profitability?					
Milk transporters	What are the transportation costs involved? What are the risks involved? Where do you source milk from? Who do you supply it to informal/formal? Why the choice of who you supply to? How much do you buy milk/ litre? How much do you sell to formal and informal chain? What is your profitability?					
Milk Production	What is the total cost of milk production on the farm? How many litres of each cow produce daily? How many litres do you sell and how many remain for home consumption? How much do you sell each litre of milk? What is your profitability?					