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AFRICA SUSTAINABLE LIVESTOCK 2050

Business models along the cattle dairy value chain

ETHIOPIA

Ada'a and the Sululta Districts

Ethiopian Society Of Animal Production

USAID FROM THE AMERICAN PEOPLE

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Contents

Tables

Figures

1. Introduction

By 2050 human population in Ethiopia will grow by 86 percent from the current 102 million. In that year, 76 million people will live in cities and towns vis-à-vis 19 million today. Per capita national income, currently at USD 767 per year, will almost double by 2050. These socio-economic changes will trigger demand for all livestock products to increase tremendously: between 2015 and 2050 demand for milk and beef is estimated to grow by about 5.5 million tonnes and 0.9 million tonnes or 145 and 257 percent increase, respectively, with similar or higher growth rates anticipated for the demand of other animal source foods (FAO, 2019).

The livestock sector will radically transform to respond to the increasing demands. The major policies and strategies that guide the transformation of the country and of its livestock sector include the Growth and Transformation Plan-II (2015–2020), the Agricultural Development Led Industrialization (since 1995), the Livestock Master Plan (2015–2020), and the Climate Resilient Green Economy Strategy (2015–2030). The transformation of the livestock sector, however, is anticipated to be so rapid and, to some extent, unpredictable that existing policies and strategies might become inadequate in few years' time to steer a long-term sustainable growth of livestock.

According to a recent report by FAO's Africa Sustainable Livestock 2050 project (FAO, 2019), multiple plausible futures await Ethiopia and its cattle sector, each of them having highly different impacts on society. The future will eventually depend on the interactions between known megatrends – from population growth to technology development – and unpredictable factors of which governance and the economic system are extremely critical. The scenarios convincingly show the escalation of many known challenges such as fierce competition for environmental resources, particularly land and water, structural changes in employment opportunities and the increased risks of emergence and spread of zoonotic diseases and livestock-driven antimicrobial resistance. Such risks may be managed better in some scenarios than in others; however, unpredictable outbreaks of an emerging or re-emerging infectious disease(s) will not only drastically affect the livestock sector, or one of its subsectors, but also have such negative spillover effects on society to jeopardize years of growth and development. The report pinpoints an issue that is often overlooked in livestock sector policies and strategies: the increased relevance of urban, peri-urban middle-scale and

commercial livestock operations. These entities operate closely to fast expanding and densely populated urban areas, and they will become more important as the urban population grows and is better off, demanding increasingly larger quantities of livestock products, especially beef and dairy products. It is critical that these hotspots of human-animal interaction are properly regulated, as any disease outbreak could escalate rapidly in such densely populated areas.

The Africa Sustainable Livestock 2050 (ASL2050), implemented under the umbrella of the FAO Global Health Security Programme, currently operates in four African countries: Egypt, Ethiopia, Kenya and Uganda. The Project aims to: (i) identify emerging public health challenges associated with the coming growth and transformation of the livestock sector, such as outbreak and spread of zoonotic diseases that jump the animal-human barrier; (ii) facilitate policy reforms at local level to ensure that businesses along the livestock value chains adopt good practices, with a focus on good biosecurity practices that reduce the risk of livestock-driven public health threats.

Any policy reform aimed at facilitating the adoption of good practices by actors and companies along the livestock value chain should base on an understanding of their business model. How does the trading business change if, say, livestock traders adopt good biosecurity practices? Do businesses along the livestock value chain have sufficient resources and incentives to adopt good practices? How does the adoption of good practices change the short- and long-term profitability of the business of livestock farmers, processors, traders, retailers and other actors? To answer these questions, ASL2050 in Ethiopia partnered with the Ethiopian Society of Animal Production (ESAP) to understand and document the various business models along the cattle dairy value chain nodes in two pilot (learning) districts – Ada'a and Sululta including the urban and rural administrations. Accordingly, ESAP performed an analysis of the cattle dairy businesses along the value chain, including:

- Drawing business canvasses for actors / businesses at the different nodes of dairy value chain;
- Documenting the business process models of the actors / businesses at the different nodes of dairy value chain;

- Assessing the profitability of the different businesses operating at the various nodes of dairy value chain; and
- Drafting a report presenting the business models of the actors operating at the different nodes of dairy value chain.

To this end, ESAP, in consultation with FAO and other partner institutions (service providers) working on similar issues in the other project countries, developed and used data collection tools to gather business-related information from stakeholders on the ground. These tools include (i) a semi-structured questionnaire – used for focus group discussions and individual interviews – to gather information to complete the business canvass and the business process model; (ii) an enterprise budget template, used to assess the cost structure, the revenue stream and the profitability of the livestock businesses. The service providers in the four countries cooperated and shared information among each other for effective facilitation of the common work and agreeing upon best tools for data collection to improve the quality of the outputs through cross-learning and cooperation. ASL2050 facilitated and organized biweekly virtual consultation meetings.

The main objective of this research was to identify and characterize emerging business models in the Ethiopian dairy value chain using enterprise budget, business processes and the business canvas models. A biosecurity lens was used to characterize the farms and direct value chain actors.

2. Methodology

2.1. Survey design and field data collection

The team conducted semi-structured quantitative surveys to gather business-related information from key actors along the dairy value chain in the districts of Ada'a and Sululta covering both rural and urban administrations. These actors include: (a) milk producers; (b) processors (milk collection centers / milk processing plants); (c) traders / transporters; (d) retailers.

We developed four business process models and business model canvasses of representative key actors / enterprises along the dairy value chain. They include the main elements of the business such as key activities, resources, customers, etc. An excel sheet that presents the

enterprise budget for a typical business at each node of the dairy value chain was prepared, as measure of profitability. We show data obtained from 128 value chain actors at the different nodes of the dairy value chain. They participated in focus-group discussions (FGD), as key informants, and were respondents to a rapid survey conducted in the two leading milk-producing dist4ricts. We collected data using a semi-structured questionnaire that was pretested in all locations and then adjusted based on the responses and experience for better effectiveness.

We identified respondents from the key value chain actors operating in Sululta and Ada'a districts using a purposive sampling approach particularly for collectors and processors. The team organized separate FGDs as well as in-depth discussions with key informants (both men and women) operating along the dairy value chain, i.e. producers, processors, cooperatives collectors, and retailers and service providers in the two districts. Field validation was finally conducted through visiting selected individual actors.

2.2 Sample size and composition

Given the importance of scale of operation in the study, the team aimed to select a representative sample covering key actors along the dairy value chain in the districts. At the production node, the sample covers smallholders, commercial, and urban/peri-urban dairy farms. Table 1 shows the distribution of sample households/businesses at the value chain nodes in the two districts.

Two consultation workshops were organized in January 2021 in both districts involving all the actors. The workshop aimed at collecting technical inputs. Finally, a stakeholders' validation meeting took place in Addis Ababa to validate results of the study. Participants of the validation meeting included government officials, researchers, and Non-Governmental Organizations (international and local), representatives of producers' organizations and of other private actors such as service providers, processors, and consumers.

Table 1. Distribution of sample of the different actors by district

Value chain node	FGD		Rapid survey		In-depth interviews	
	Ada'a	Sululta	Ada'a	Sululta	Ada'a	Sululta
Production	3	3	10	10	3	3

Collection / Processing	3	3	10	10	3	3
Trading /Transporting	3	3	10	10	3	3
Marketing /Sales	3	3	10	10	3	3
Total	**12**	**12**	**40**	**40**	**12**	**12**

We used the Business Model Canvas, developed by Alexander Osterwalder to describe the rationale of how an individual (person or firm) creates, captures and delivers value (Osterwalder and Pigneur, 2010). Using a common language (e.g. how, what, who and how much?), the canvas helps to characterize the core elements of a business (CIAT, 2012; Vorley et al., 2015). As a tool, the canvas facilitates dialogue between farmers, development and business actors. A business model describes how any given enterprise – large or small, informal or formal – does business, markets its products and sources inputs and finance (FAO, 2015). Few studies applied the business canvass/business process model approach in the livestock (dairy) sector (e.g., Ongkunaruk, 2015; Sijbrandij, 2016; Ramadanti et al, 2017; Nuryadi and Mulyono, 2019; Furberg and Naumburg, 2019; Indrawan, 2020).

We entered and analyzed data with Microsoft Excel and SPSS version 20. We used descriptive statistics, gross margin and measure of profitability, and profit share analyses of the value chain actors to summarize the collected data.

3. Results

3.1. The dairy sub-sector

In Ethiopia, the main dairy animals are cattle, camels and goats depending on the agro-ecology. Estimates of total cow milk production for the rural sedentary areas of the country during the reference period, was about 3.62 billion liters (CSA, 2020). The estimate for volume of milk produced from camels was about 648.15 million liters. Regarding cows' milk, 97 percent comes from indigenous breeds while the contribution of the exotic purebred and crossbred animals is not more than 3 percent per annum. This is partly because estimates by CSA exclude contributions of the commercial farms and urban farms to the national milk production. The highland mixed crop–livestock production system incorporates smallholders, urban, peri-urban, and large-scale dairy farming systems. Milk production in the highland areas exclusively focuses on producing market milk from purebred cows and long shelf life traditional products, such as butter and *ayib* from local breeds. This is mainly done by linking smallholders to terminal markets and encouraging medium and large commercial farms by strengthening the extension system for technical support and by facilitating access to credit.

As compared to the highlands, the pastoral areas are endowed with diversified dairy animals by being home to cows, camels and goats. Camel milk is a staple food of pastoral communities and is considered a whole food. Pastoralists can survive on camel milk alone for up to six months. Compared to cow milk, camel milk is rich in vitamins, minerals, proteins, and immunoglobulin; it is lower in fat and higher in lactose, potassium, iron, and vitamin C. On top of their own consumption, pastoralists sell camel milk through intermediaries in highland cities/towns, such as Addis Ababa, and export it to neighboring countries. Generally, the retail prices in Addis Ababa currently range between 25 – 35 Birr per liter with some exception that sells up to 50 Birr per liter in high-end consumer areas such as Gerji and Bole.

There are more than 50 licensed large-scale milk-processing plants in the country according data obtained from Ethiopian Meat and Dairy Industry Development Institute (EMDIDI) in 2020. Most of the processing plants operate at a quarter of their installed capacities for the lack of quality and surplus milk from smallholder and commercial farms as well as market insecurity during fasting seasons. Paradoxically, imports of long life dairy products such as

milk powder, UHT (ultrahigh temperature) milk and cheese still contribute to bridge the gap between demand and supply of milk products in terms of quality and quantity.

The dairy value chain stretches from the inputs suppliers, such as of feed and drugs, to retailers. These actors fall under the regulation and control of various government bodies, which currently are not planning and operating in an organized manner. For instance, milk processors are controlled by the Food and Drug Control Authority affiliated to Ministry of Health, retailers are controlled by Ministry of Trade, and farms by Ministry of Agriculture, while leaving collectors uncontrolled as middle-ground players between the two far ends of the long value chain. The inexistence of a dairy board has been raised as key fault in the value chain governance by a few dairy assessment reports that compare the status of the sector with that of neighboring and other countries with similar dairy development stage (Yilma et. al., 2010).

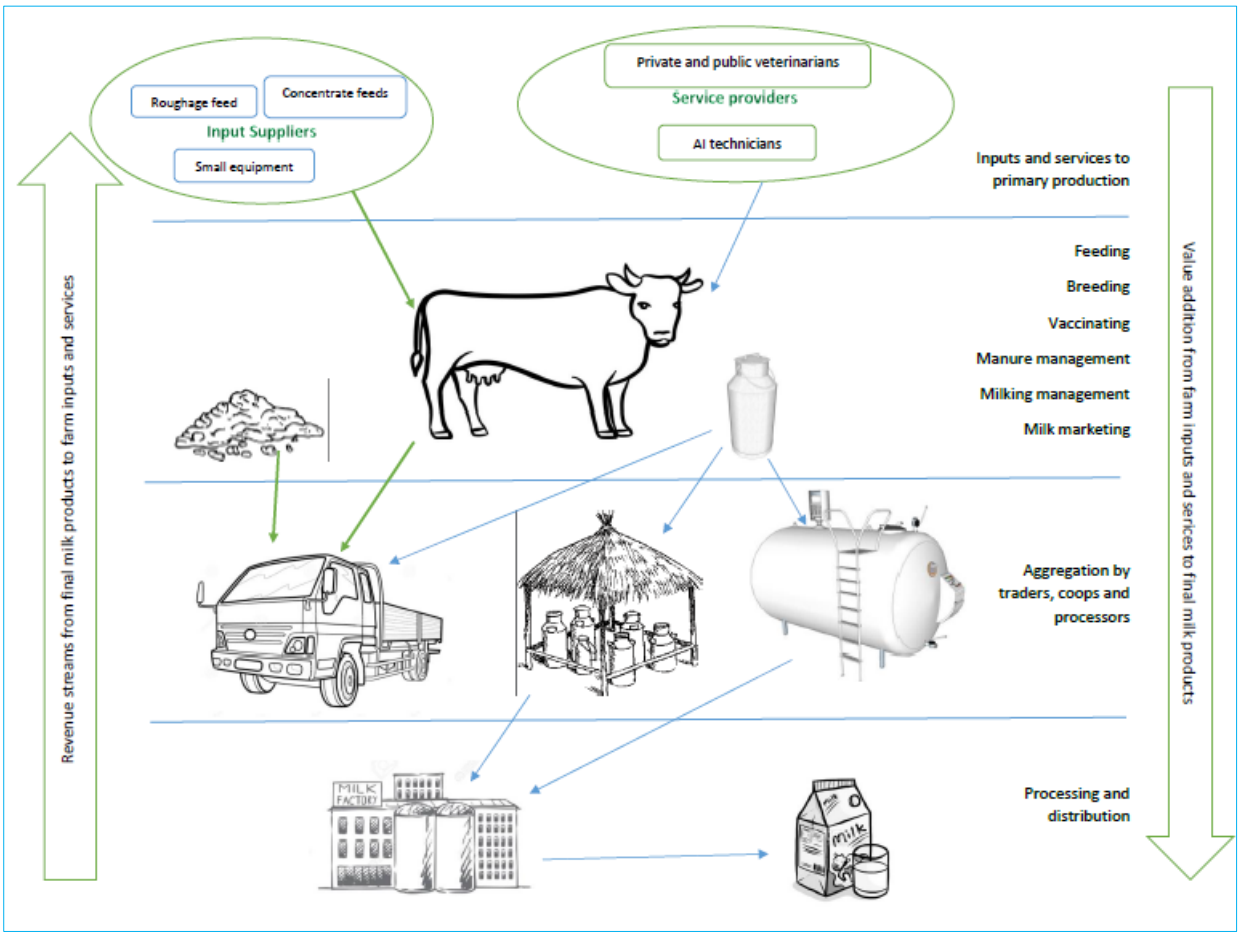


Figure 1. The dairy value chain in Ada'a and Sululta districts

Figure 1 shows the relationship between the various functions of dairy value chain in Ada'a and Sululta districts. A chain of functions such as input and services supplies, milk production,

aggregation and finally processing has been identified in the study area. Two business models have been observed as emerging function in the dairy value chain.

The first is chilling milk by cooperatives and individual milk collectors that transport milk over 400 km distance to processors, unlike the usual 100 km radius milk collection. The second is diversification of milk products to long-life milk products and functionality foods for export, unlike the conventional milk products. These two have mutually grown and deployed the use of technologies to chill milk right after collection and during transportation. The production of milk beverages using UHT milk processing technology has enabled processors to pay more for better quality milk supply. Usually about 20 percent of the collected milk is processed into UHT milk. A quality based milk payment is sensitized by the technology application at the demand side to the production function. As a result, price of good quality milk has risen by up to 30 percent, as processors are willing to pay more for better quality input to produce good quality new product for the market.

3.2. Production node

3.2.1. Characteristics of dairy production enterprises

Dairy farming systems in the two districts take the form of mixed crop-livestock, urban/peri-urban, and commercial dairy production. The first two systems usually use family labor and purchased inputs, such as concentrate feed and conserved forage. The peri-urban/urban and commercial systems include both smallholder producers and medium- and large-scale dairy farms. These systems are mainly based on the use of crossbreed, grade, or even pure exotic dairy cows, and have the potential to grow. In peri-urban and urban areas, where production is more commercially oriented, use of hired labor for a range of activities (e.g., milking, taking milk to collection centers, fetching water, cleaning stalls, taking care of animals and cutting and carrying forage / grass) is greater than in rural areas.

In Sululta, commercial dairy farming is dominant along the main asphalt road following investment facilitations in the past few decades. The area is part of Selale plateau, the largest milk shed in the country. Reports indicate that it supplies 80 percent of the milk demands of Addis Ababa city (Milk Processors Association, unpublished). Smallholder farmers also produce milk and deliver to milk collectors and processors along the main road. Their

livelihood mostly depends on production of natural pasture, hay, and milk. Communal grazing lands cover vast area of the plateau, which is not suitable for crop production due to water logging and frost problems.

Distribution of crossbred cows was highly skewed with 91.4 percent of the heads found in urban/peri-urban subsystem in both districts. Herd composition recorded from the study showed presence of local and crossbred cows, heifers, calves and bulls in the herd. According to the information gathered from FGDs, the average dairy herd size was 8 and 14 cattle per household for producers in Bishoftu town and Sululta town, respectively (Table 2). Lactating cows constitute a significant proportion of the total herd owned by the producers in both districts. The lower cattle ownership per household in Ada'a is mainly associated with land shortage and high cost and limited availability of feed resources.

Table 2. Dairy herd structure per household

		Number	
Location	**Class of animals**	**Mean**	**SD**
	Lactating cows	3.03	1.59
	Dry cows	2.08	1.14
Ada'a	Bulls	0.13	0.52
	Heifers	1.05	2.41
	Calves	1.65	1.61
	Total	**7.94**	**1.45**
	Lactating cows	5.50	5.36
	Dry cows	2.53	2.54
Sululta	Bulls	0.78	0.89
	Heifers	2.63	2.23
	Calves	2.40	2.31
	Total	**13.84**	**2.67**

Milk production per cow per day in the areas ranges from 4 to 27 liters, with a mean and standard deviation of 19.22 and 6.68, respectively (Table 3). The highest volume of milk produced per household was 250 liters, with a mean and standard deviation of 50 and 22.28 liters. The length of lactation period varies according to breed type. Lactation period ranges from 10–12 and 7–8 months for crosses and local breed cows, respectively. Crossbred cows attain peak milk yield during the first 3–4 months.

Table 3. Mean and maximum daily milk production per household

	Maximum	Mean	SD
Daily milk production per cow	27	19.22	6.68
Daily milk production per household	250	50	22.28

Manure management varies according to the production system. In rural and peri-urban production systems, dairy animals are tethered nearby farmlands or grazed on communal pasturelands to take advantage of manure to fertilize the land. Manure is also used as a source of fuel in the rural system. Use of biogas digester is rare in both areas. In the urban production system of Ada'a, manure handling represents a cost for producers – they spend extra money to dispose it from their farms. All producers that participated in the FGDs and that were visited during field survey for data collection use conventional dairy barns for housing animals. The cows are confined together on a concrete floor and tied at neck. Most farm activities are practiced in the barn including milking and feeding. The barns are completely roofed and have sufficient ventilations.

3.2.2. Land access, adequacy and ownership pattern

Land is an important asset for dairy production. In Ada'a, the majority of milk producers allocate space for their dairy cattle in the family residential compound. In contrary to the family dairy farms, micro and small enterprises involved in dairy production in Ada'a use rented shade from local administration with five years contract agreement, which is part of the government's urban agriculture promotion policy. Due to land shortage, family dairy keepers use about one-third to one-half space of their residence compound for their animals. For dairy producers living in and around Bishoftu town, a rapidly expanding urban area, there is neither land allocated for grazing, forage production nor farm expansion. As a result, dairy keepers face difficulty to increase production. Only 16 percent of the farms have separate land for the dairy farm while the rest share family living compound to keep cows in tie stall barn. Integrated income generating activities were reported from urban farms in Ada'a where poultry farming is a common means of farm diversification and horizontal integration. However, no input / output integration was observed between dairy and poultry farming in such family farms. There is high risk of biosecurity breach for the urban farms located within Bishoftu town because family members, feed suppliers, feed, veterinarians, AI technicians and visitors use the same gate without any protective clothes and sanitary measures. The

critical shortage of land for the growing human population, let alone urban animal farming, has worsened the situation.

In Sululta, dairy farmers have access to land through leasing from the government in the case of commercial farms, and through inheritance in the case of family farms. There is adequate land for barn facilities unlike in Ada'a. Specialized dairy farms are common in the area. There are different modes of land allocation for commercial farming in the area such as lease, rental from government and rental from private properties. Most family farms have separate compound to keep animals unlike in Ada'a where dairy farms share family living compounds.

3.2.3. Infrastructure and facilities

In Ada'a, almost all farms have access to all weather road and most farms are at a very close proximity to asphalt road. Access to water is adequate from the municipality-supplied tap water. There is good mobile telephone network to call veterinarians and AI technicians as well as communicate with customers. Electricity is available in all the urban farms but some rural farms face severe interruption. The floor of all houses is made of cement concrete and corrugated iron sheet roof. In all farms, the sidewalls are quarter to half open and one side of the walls is fully covered. The walls are made of mud or cement/concrete blocks. Eighty-three percent of farms do not have space for cows' exercise yard and for further expansion; 83.3 percent of family farms do not have adequate space to allocate for milking place, milk storage space, proper drainage and waste disposal. No farm has separate place for keeping the feed, for quarantine and isolating sick animals, maternity and calf pens. In all farms, feeding troughs are made of cement concrete, which is commendable for hygienic feeding of animals. Sixty-six percent of the farms use plastic bucket as water trough, while two of the farms use concrete water trough. All farms use simple barn cleaning tools.

In Sululta, most of the commercial farms are located close to the main asphalt road with few minutes' walk from all-weather tarmac road. Water source is mostly from water well in the compound. The mobile network reception is fairly good to communicate with the farm service providers as well as customers in most areas where the commercial farms are located. However, electricity is frequently interrupted and some farms have not yet been connected to the main grid.

3.3. Bulking or aggregation node

The aggregation node is of key importance in the dairy value chain, otherwise smallholder producers in rural areas travel distances to reach main road and town markets where they sell their milk to informal collectors who arbitrarily downgrade the quality and pay lower prices. Producers who live in the peri-urban/urban system nearby major towns like Bishoftu and Addis Ababa have access to better infrastructure and market information.

All commercial farms are involved in milk production, but few collect and/or process milk, and they tend to have their own marketing outlet. Commercial producers usually sign annual contracts with large processors to supply fresh milk on a daily basis by transporting it directly to the processing plant or collection center. Local collectors buy milk directly from producers and re-sell it to larger traders, to dairy processors, or directly to retailers in the urban centers. In addition, dairy processors collect fresh milk from producers through local agents and retailers. They also buy the milk at temporary collection centers located along main roads. Often, in this aggregation method, there is no control over quality and producers have limited capacity to negotiate prices.

Cooperatives and traders play a key role in Ada'a area in aggregating and bulking milk from smallholder milk producers both in urban and rural settings. The prominent cooperative is Ada'a Dairy Cooperative that has members mostly based in the peri-urban and urban areas of Bishoftu Town. The cooperative has its own milk processing plant and a feed processing plant to serve as input and output outlet for the members.

Traders play key bulking role for smallholder milk producers in providing better price per liter of milk. There are collection centers, mainly in Sululta, used as small-scale aggregation points conveniently located near dairy producers, which reduce transport cost and the risk of spoilage of milk, and most importantly provide an alternative to informal traders. Some relatively strong cooperatives have milk collection centers located near their main office on the roadside. Most cooperatives are located far away from the processing plants and do not have enough equipment to ensure proper storage and transportation. When cooperatives do not have any collection center, members bring their milk to the main office that also functions as collection center. The efficiency of milk collection is hampered by the lack of acceptable means of transportation such as refrigerated tanks, and by the high cost involved in

transportation. Lead farms and large cooperatives possess a motorized and refrigerated truck; however, their ability to reach out to remote areas is limited.

In general, rural producers are responsible for the delivery of their milk to the roadside collection and distribution node. Local traders and agents transport and distribute milk from rural villages where there is poor road infrastructure. Big cooperatives and processing plants possess proper vehicles for transporting milk to their processing facility. They collect and transport milk from producers located far away; however, they arrange with producers in the vicinity to deliver milk to their facility.

3.4. Processing node

In home processing, the daily decision on how much to process is driven by factors such as season, number of children in the household, presence of sick family member(s) and daily financial needs. Home processing is often inefficient and associated with high post-harvest losses. This appears as one of the reasons why family dairy producers prefer to sell fresh milk – when there is demand or market – rather than processing. Some of the women farmers are involved in some sort of home processing of milk. Most of the dairy products such as cottage cheese and butter found in the market are from home processing and sold through the informal channel but often with limited hygienic practices and sanitation, as well as quality requirements. Small cooperatives in Sululta area are engaged in manual semi-processing of milk, which involves the preparation of butter, cheese and curd that are then sold directly to local consumers. In rural towns, retailers also do their own semi-processing.

Commercial processors include large cooperatives and specialized and lead farms that are equipped with modern technology for the production of pasteurized milk and dairy products (e.g. yogurt and cheese). Most of the commercial processors produce pasteurized milk (2.7–2.8 percent milk fat) in 500 ml and standard-size plastic packs labelled with their company names. They also produce a number of dairy products such as butter, cheese, and yoghurt with grams plastic cups, which are distributed through their retailing agents. In addition, large dairy farms (privatized state farms) are involved in milk processing. They have their own milk processing plants, and process milk of their own production, as well as milk purchased from nearby producers. Due to the limited availability of good quality milk, on average these processors operate below capacity.

Ada'a Dairy Cooperative, Holland Dairy and Bobo Milk are strategically located in areas with high density of dairy farmers and receive milk of acceptable qualities. Some processors found outside of Ada'a, e.g. Lame Dairy (Shola Milk), Family Milk and Sebeta Agro-industry, have chilling facilities in Bishoftu town though they are located in Addis Ababa and Sebeta.

There are different types of enterprises that play the bulking and aggregating role in Sululta. Processors, milk traders and cooperatives are the main corporate type collectors while there are many individual collectors operating informally. Milk collection/aggregation node is blamed for up to 90 percent of milk adulteration according to unpublished reports of SNV and Oromia Livestock Agency.

Milk processing plants located in Sululta district collectively have less than 100 tons per shift milk processing capacity and, as a result, majority of milk passes the Addis Ababa city checkpoint as fresh. Many processors located in Addis Ababa obtain fresh milk from Sululta and the larger Selale milk shed either by direct collection or through traders. Some processors have set up chilling facilities around Sululta. Producers in this area mostly prefer supplying milk to these outlets for their fair price and shortened supply chain.

Commercial processors have the power to influence the performance of the value chain, for instance, by setting quality standards at collection centers, by determining marketed volumes and by fixing farm-gate prices for fresh milk and products. Large processors take what Ada'a Dairy Cooperative pays to farmers per liter of milk as the lowest benchmark and offer higher prices than all cooperatives, even to cooperative members. Such competition has already resulted in fewer supplier producers to the Ada'a Dairy Cooperative. Therefore, empowering cooperatives to negotiate a fair price with processors is of utmost importance.

Foreign direct investments in the dairy processing has affected the value chain in a way that it exerted a pull factor to improve volume of high quality and chilled milk. UHT milk technology is utilized by four large processors located in Addis Ababa and Dukem industry zone. This technology offers a long shelf-life fluid milk production without further cold chain requirements that addresses the national challenge of cooling facilities for long distance transportation and retail purposes.

3.5. Milk retail and distribution node

Milk retailers include supermarkets and small shops in the formal chain and small shops in the informal chain. They are involved in activities such as purchasing from processors and transporting of dairy products and selling to consumers such as urban households, hotels and restaurants and institutions in the formal chain. There are also retailers that buy raw milk from informal private collectors and sell to low-income consumers and teashops and cafés through an informal channel.

In the informal channel, raw milk and dairy products pass from producers to consumers directly or through small retail shops in nearby markets, through intermediaries with low cost of transaction but high producer price compared to formal market operations. In addition, there are only ad hoc business relationships that usually favor traders over producers. In the formal channel, pasteurized milk and other dairy products pass from processors through whole sellers to retailers and finally reach the consumers. However, the processors are also involved directly in wholesale and retailing.

3.6. Quality of milk and products

In terms of hygienic milking practices, all the respondents wash the utensils used for milking and milk handling. Commonly they wash the milking utensils with warm water and soap and then leave them to dry until milking. Almost all of the respondents in Sululta and Ada'a area pointed out that they milk their cows two times a day – morning and evening. They perform milking in the barn where the animals are sheltered. All respondents reported that they wash their hands, the milking vessels and the udder before milking. However, only few respondents use separate towels for cleaning the udder of individual cows.

Often the quality of milk is compromised due to unavailability of appropriate equipment (e.g. testing kits and thermometers) and utensils for milking and milk handling. Typically, producers use plastic containers that are difficult to clean and hence unhygienic. In most rural households, since the milk yield per cow is barely enough for the calf and there is very little amount left daily, accumulation of a sufficient amount of milk for home processing is done over a few days. Rural households that sell surplus whole milk transport it to nearby markets or to milk collection centers in jerry cans, commonly on foot, or by using donkeys, horse carts

or motorcycles. Chilling is not usually practiced at the collectors and traders level and this has direct effect on quality of the product.

The formal channel has encouraged producers to improve milk hygiene, storage and transportation practices in order to avoid rejection of the product on delivery at the collection centers. Milk collected in bulk by cooperatives and dairy enterprises is transported with refrigerated tankers to the processing facilities, where it is cooled to temperatures below 6°C. At the processing plants, quality tests such as acidity – using alcohol and clot-on boiling test, and density – using a lactometer, are performed thereby assuring the quality of milk. Other causes of post-harvest losses and quality deterioration of milk include spillage losses during milking; contamination during milking and further handling, coupled with storage time and inappropriate temperatures; deliberate adulteration of milk; insufficient technologies; and absence of shade, which affects the quality of stored milk.

3.7. Biosecurity practices

Biosecurity is defined as measures or practices designed to avoid introducing disease agents onto the premises. Disease agents can be bacteria, viruses, fungi or toxins. Observations revealed that levels of uptake of biosecurity measures on dairy farms are low – many of the recommended good practices (biosecurity measures) are not adopted particularly at production and collection nodes. In other words, practices observed are not in line with recommended good practices such as keeping the milking cow in well-ventilated and clean barn, maintaining cleanliness of the cow and milking area, washing hands with clean water and soap before handling milk, and wearing clean coveralls and gumboots while handling milk.

The level of awareness of farmers in Ada'a and Sululta about the biosecurity measures is low to medium. About 50 percent of respondent farmers practice sanitation of milking equipment, isolation of sick animals, sorting the herd by class, vaccinating animals, keeping contact information of a veterinarian for emergency, cleaning feed store, and securing water points. Moreover, workers can also identify sick animals. The practice of biosecurity measures is better in Ada'a than in Sululta. However, it can be generalized that good dairying practice is still at lower adoption level in both areas. Producers follow traditional methods of keeping their cattle healthy using their indigenous knowledge. One such practice was observed in

Ada'a where milk producers gather information about incidence of cattle diseases in neighboring districts from where they source feed such as straw and hay for their animals. This helps them to decide on changing the source of feed to avoid infections through contaminated feed. Producers reported practices of commonly treating sick animals with veterinary drugs without advice from veterinary officers. Some producers treat sick animals with medicine formulations intended for humans. Access of visitors to the farm is not restricted, barn doors are open and disinfectant footbath is not used almost at all farms. There is no isolation pen for keeping sick animals. Practice of cleaning and disinfecting equipment that has been used for sick animals before its reuse for healthy animals is not common.

The same equipment used for manure disposal is also used for transporting or delivering feed. All farms did not have isolation pens or quarantine facility for newly purchased cows. Most of the farms do not have a biosecurity plan that includes building maintenance activities (e.g. check and maintain fences, and repair holes in buildings) to keep out vermin and wild animals.

Most of the dairy producers do not have records and hence lack a means to track/monitor feedstuffs purchased from multiple locations or sources. Feed storage areas are littered with refusals/leftovers, and the feeds are prone to contamination with feces (droppings) and urine from rodents, birds, dogs, and cats. Manure handling, drainage and disposal to prevent environmental contamination are poor. However, producers cover farm water sources to prevent contamination by vermin, birds and other wildlife.

Discussions with key informants in Ada'a and Sululta revealed that milk collectors, traders, transporters, and workers in collection centers had low levels of adherence to biosecurity (good) practices. Low level of enforcement by authorities may be due to absence of appropriate regulations and controlling mechanisms. According to good practice guides, use of personal protection equipment by those handling milk is mandatory to prevent the risk of contamination. However, observations revealed low adoption by producers, milk collection workers, and transporters. Non-food grade plastic cans, buckets and jerry cans are commonly used for handling and transporting milk. The levels of hygiene, the speed of transport and careful handling during transporting milk is low. Milk filtering cloths are used repeatedly before being cleaned despite the fact that improper use of filters is well-known source of milk

contamination. Besides unhygienic handling, milk quality is also influenced by the ambient storage temperature for longer period before cooling and further processing.

Direct observations revealed unhygienic handling of containers used for transporting milk – e.g. exposing them to dust, flies and other sources of contamination. None of the actors reported disinfecting or sterilizing milk containers before or after use; many reported washing them using soap/detergent powders as the only measure to avoid contamination. Cleaning of milk containers, as practiced by the actors – rinsing with unclean water, is not sufficient to avoid microbial contamination, rather it may introduce new pathogens and spoilage organisms. Hence, most actors operate under unhygienic conditions that increase the probability of contamination e.g., ubiquitous use of untreated water for cleaning and washing equipment, utensils, feeding troughs, and containers for milking and transporting milk. While sanitary requirements are very loosely taken at collection node of the value chain, they are more visible at the processing node. This may be due to the relative stringency of regulations by the Ethiopian Food and Drug Authority that controls milk processors. Milk collectors are less addressed by the standards developing wing of the regulatory system or by the enforcement body. Milk collecting personnel wear no protective clothes, hold no health certificates and practice no sanitary measures. With regard to processors, there are facilities to take care of personnel hygiene, visitors and equipment sanitization, quality assurance system and cold chain facilities. Emerging businesses in the dairy value chain have set better standard of milk handling as they implement strict milk quality testing system that serves as pull factor with the premium prices acting as incentives. Quality based milk payments, coupled with strict milk quality and safety regulation, is believed to have a trickle-down effect on improved biosecurity measures down to the milk production node.

3.8. Technology utilization

Equipment and machinery such as milking machines, chilling tanks, lacto scans, cream separators, milk buckets, milk cans, milk churners, ear tags, lactometers and veterinary equipment are not found in most of the farms except few large farms and cooperatives. The common equipment used for dairy production include: cart, spade, broom, feeding trough, watering bucket, milking bucket, milk churners, milk collection cans, acid testers and lactometers. While few dairy technologies and equipment are available at big commercial

farms, dairying in general remained a low-level technology user in both areas. Due to lack of exposure and access to new technologies and lack of financial means, basic scientific information is not available in an organized and useful manner to dairy producers. At the production node, the use of basic technology like water tanks and biogas digester is very rare. At aggregation, plastic jerry cans / barrels are commonly used instead of aluminum cans.

Where land is not available, use of concentrate feed is higher than where farmers have the option to graze their cows on communal pasturelands. Feed mixing technology enables farmers meet their cows' requirements in terms of macro- and micronutrients. Technology sources for smallholder farmers remained a public dominated extension system with very limited coverage.

3.9. Input supply and service delivery

The inputs used at the production node include dairy cattle, manufactured feed and mineral supplements, drugs and veterinary products, and dairy equipment. Often, small producers have low access to some of such inputs due to logistical and price reasons.

Dairy producers purchase hay, crop residues, and straws from farmers and institutions and concentrate feeds from feed processing plants, agro-industrial plants, or retailers. In Ada'a, the bulk of roughage feed used in dairy production is crop residue, mainly *teff* and wheat straws available in local markets. On the other hand, private pasture, hay, crop residues and concentrates are common dairy feed resources in Sululta. The concentrate feed is commonly formulated from brans, oil seed cakes, minerals, and salt at different ratio as required. Some producers also buy formulated dairy rations from Alema Koudijs Feed Plc. and oil seed cakes from vendors. The most common feed used in both districts is wheat bran due to its cheaper cost than other forms of concentrate feeds. The proportion of mixed ration depends on the availability and price. For instance, in Ada'a, formulated ration may constitute crop residue, bran, dairy mix and oil seed cake in the proportion 10:5:1:0.5. In Sululta, on the other hand, according to results of the current study, wheat bran, brewers' grain, hay, dairy mix, bean coat are mixed in the ratio 2:1.5:1.4:1:1.

The most common water source for livestock in Ada'a is tap water but characterized by shortage and high cost. Most commercial dairy producers in Sululta own high potential water

well for their livestock. Some producers, however, complain about water shortages for dairy farm use.

In Ada'a, all dairy producers use artificial insemination (AI) for breeding, however; they have negative opinion on its effectiveness. There are different reasons for low efficiency of AI service. The majority of producers in Sululta use bull service than AI. AI service remains among the top priorities for dairying because current coverage does not meet the demand. Dairy producers get services, such as animal treatment, drugs and AI from private veterinary service via cell phone calls as and when needed.

Delivery of extension and input services by the public sector is weak and inadequate. At present, access to and availability of vaccines and other drugs is below requirements for development of a market-oriented dairy. Often, public extension services do not meet all the demand for advice of dairy producers, in particular, improved dairy processing, product development and marketing, client relationships, and business development services.

3.10. Financial services

At present, cooperatives and dairy producers have limited access to adequate credit and finance to improve their activities, and often loan offers from the formal financial sector do not meet the demand. Financial services in the peri-urban/urban system are provided usually by large cooperatives (through saving and credit schemes). Cooperatives have their own saving and credit arrangements that eases financial constraints of their members. Some private banks have started livestock insurance schemes.

3.11. Marketing and sales

In the study areas, the mean daily milk production per household was 36 and 65 liters for Ada'a and Sululta districts, respectively with the overall average of 50 liters per household. The higher daily milk volume in Sululta is associated with the type of genotypes kept. Of the total milk produced per household, about 35 and 65 percent in Ada'a and Sululta, respectively, were delivered to the market. Even though the milk volume decreases during dry season, respondents in both areas indicated that milk is sold both during the dry and wet seasons. In addition, they noted that milk price shows seasonal fluctuation due to variation in

milk supply and consumption pattern related with religious months of fasting. On average, milk price in Ada'a and Sululta was 22 and 19 Birr per liter, respectively.

Farmers sell the milk they produce through different channels including collectors/traders, cooperatives, processors and direct to local consumers. Milk price in the areas considerably vary depending upon distance from milk market, type of outlet, and season. Milk price is set mainly by buyers, while few respondents indicated sellers determine the price, especially if the product is sold to neighbors and other surrounding residents. The best prices were offered by consumer households with an average of 27 – 30 Birr per liter in Ada'a. Milk price varied between the two districts, which might be associated with differences in production and supply of milk. Moreover, large volume of milk from both areas is transported to capital city Addis Ababa and to different processors including Holland Dairy Processing industry. Participants of focus group discussions noted that price of milk was decided by traders.

In both districts, as indicated above, large volume of the milk produced per household is sold as fresh whole milk due to better demand by consumers. According to the current study, almost all of the households and milk traders were individual sellers. Sufficient support has not been accorded to form and empower dairy cooperatives by the local governments. Consequently, milk production, marketing, service, input and other support is not well organized.

4. Business process and model canvass

4.1. Business processes

4.1.1. Dairy producers

Milk producers perform a range of activities from farm inputs preparation including buying of dairy cows or procurement of other critical inputs to handling and marketing milk. Figure 2 depicts core activities in the business model of dairy producers. They execute activities such as monitoring reproductive cycles, mating/insemination, feeding, milking, health monitoring, cleaning cattle shed, dung making, calf management, etc. They store the milk in available containers, mainly plastic containers (jerry cans), and transport it to the nearest collection center or to roadsides. In the latter case, producers need to wait until collectors arrive. Some of the measures taken by producers to minimize losses and safeguard milk quality include washing and smoking of utensils and filtering of the milk whenever transferring from one container to another.

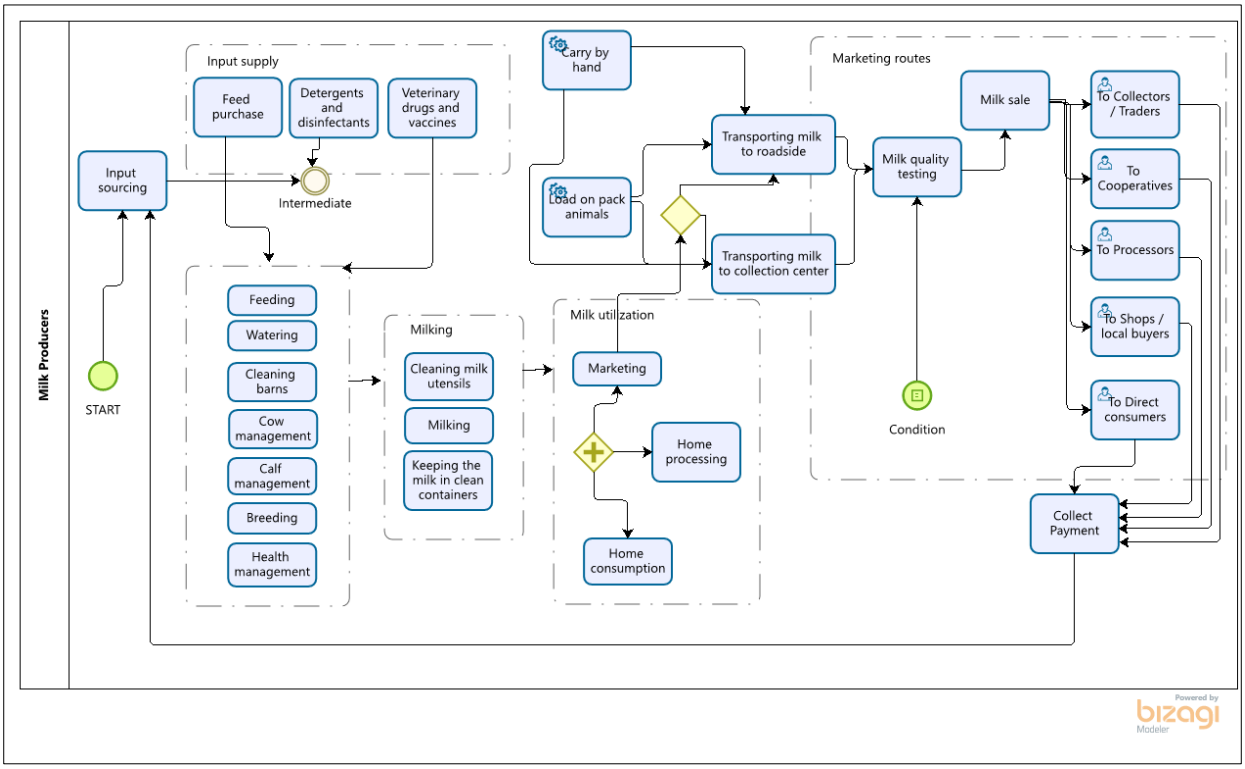


Figure 2. Business processes model for milk producers

They also attempt to control milk quality and hygiene through keeping sanitary conditions of the animals, and detect the presence of mastitis using simple devices. However, there is high level of milk contamination and quality deterioration. Milk transportation is usually done

manually (carrying by hand) or packing on donkey/horses or using public transport depending on the volume of milk. They sell the milk to formal chain actors such as raw milk collectors/traders, cooperatives, processors and direct consumers. In the informal channel, producers sale to the local consumers through home delivery and to small shops.

4.1.2. Raw milk collectors

Collectors are the actors responsible for trading the milk from producers to other actors in the chain. The activities of collectors include buying, assembling and re-selling to different chain actors (Figure 3). Formal milk collectors/ traders collect the milk from smallholder farmers and sale it to processors; or re-sell it to larger traders, or directly to retailers in the urban centers. Informal private collectors collect the milk from smallholder farmers which they re-sale to retailers such as kiosk/shops.

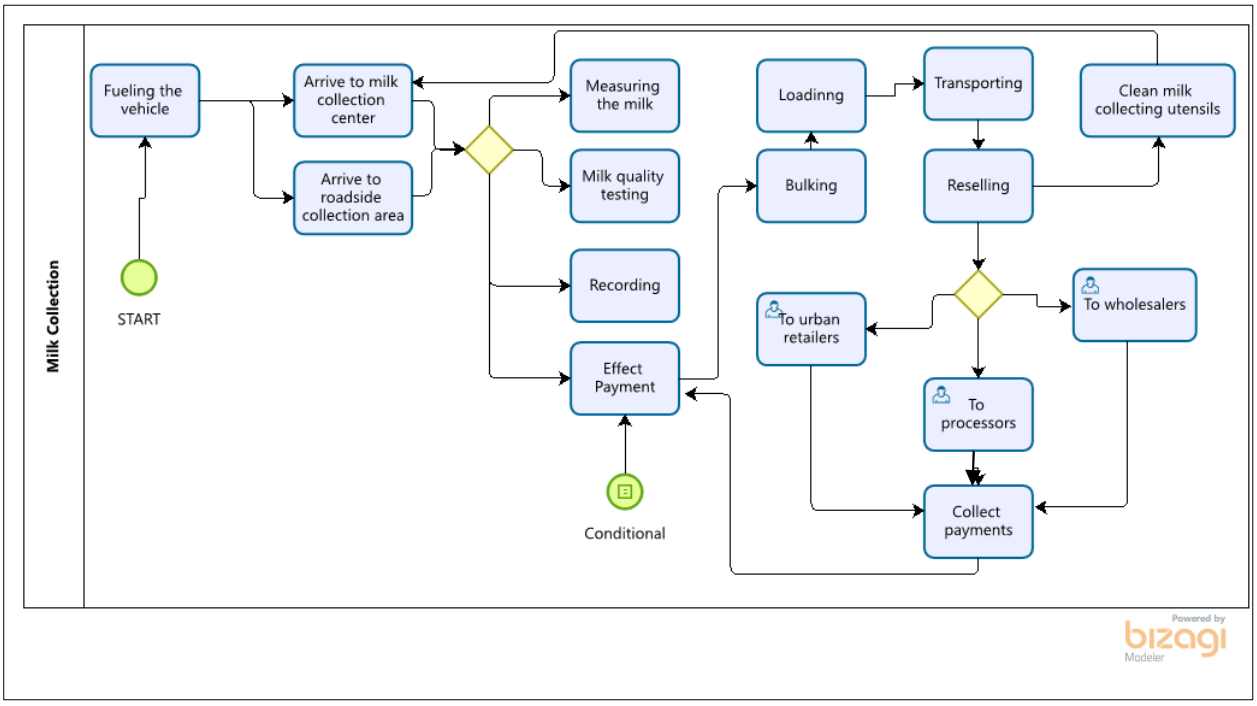


Figure 3. Business processes model for milk collectors

Cooperatives, too, are involved in activities such as collecting milk from farmers, bulking and refrigerating, and delivering to milk collection unit (Figure 4). Milk collection units are those that collect milk from farmers and formal collectors, and supply to large processing plants.

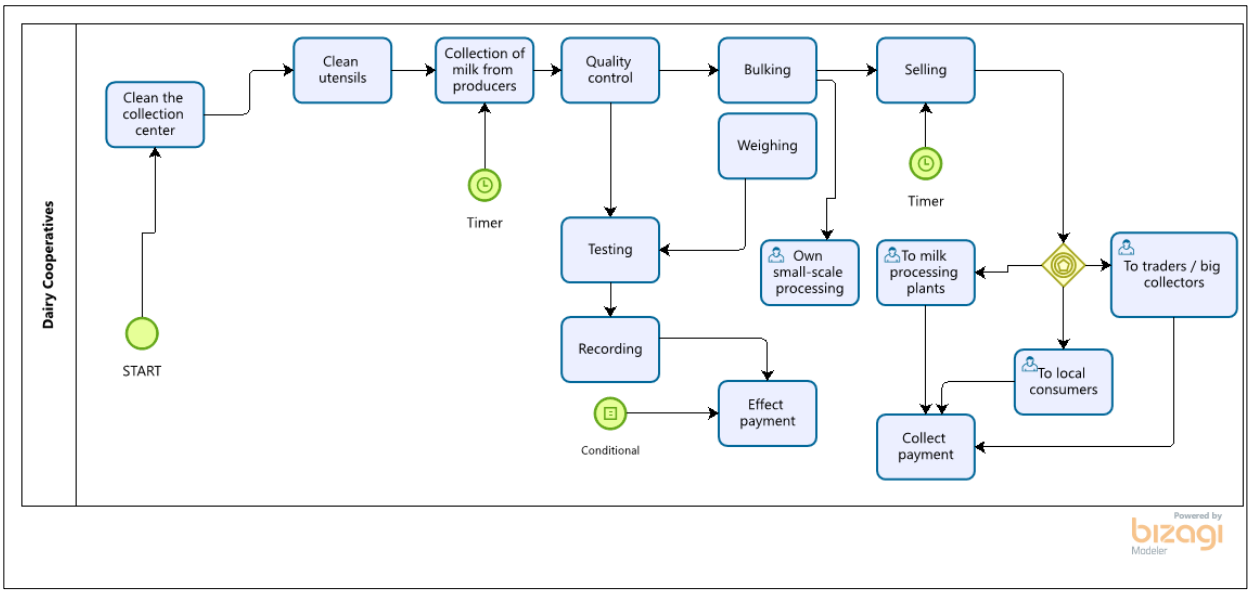


Figure 4. Business processes model for cooperatives engaged in milk collection

4.1.3. Processors

In the study areas, two types of processors were identified: small-scale processors and large processing plants. Large processing plants purchase milk in large quantity from collection units and process it into cheese, yoghurt, and defatted pasteurized milk types (Figure 5). Processing is limited to production of non-concentrated and short shelf-life products. Both large and small processors practice milk chilling, pasteurization, packaging, product processing, and quality assessment. All actors engaged in processing conduct at least one or more types of milk quality analysis (microbial contamination test and milk compositional test) both during buying and during selling.

4.1.4. Milk retailers

Retailers' involvement in the chain includes buying of milk directly from producers, collectors, and wholesalers and selling directly to consumers as depicted in Figure 6. The retailers mostly have shops and refrigeration facilities and sell the products with or without further processing. They include supermarkets and small shops in the formal chain and kiosks in the informal chain. They involve in activities such as purchasing from processors and transporting of processed milk and milk products that they sell to final consumers such as urban households, hotels and restaurants and institutions like schools and colleges in the formal channel. They also buy raw milk from informal private collectors and sell it to low income consumers and teashops and cafés through the informal channel.

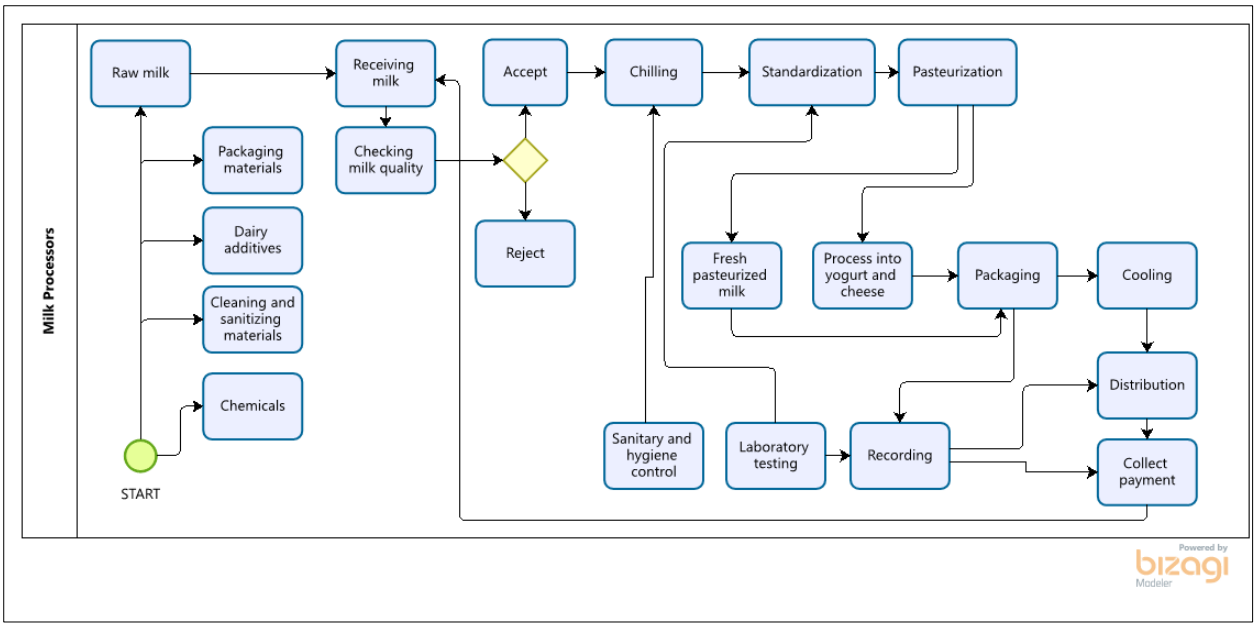


Figure 5. Business process model for milk processors

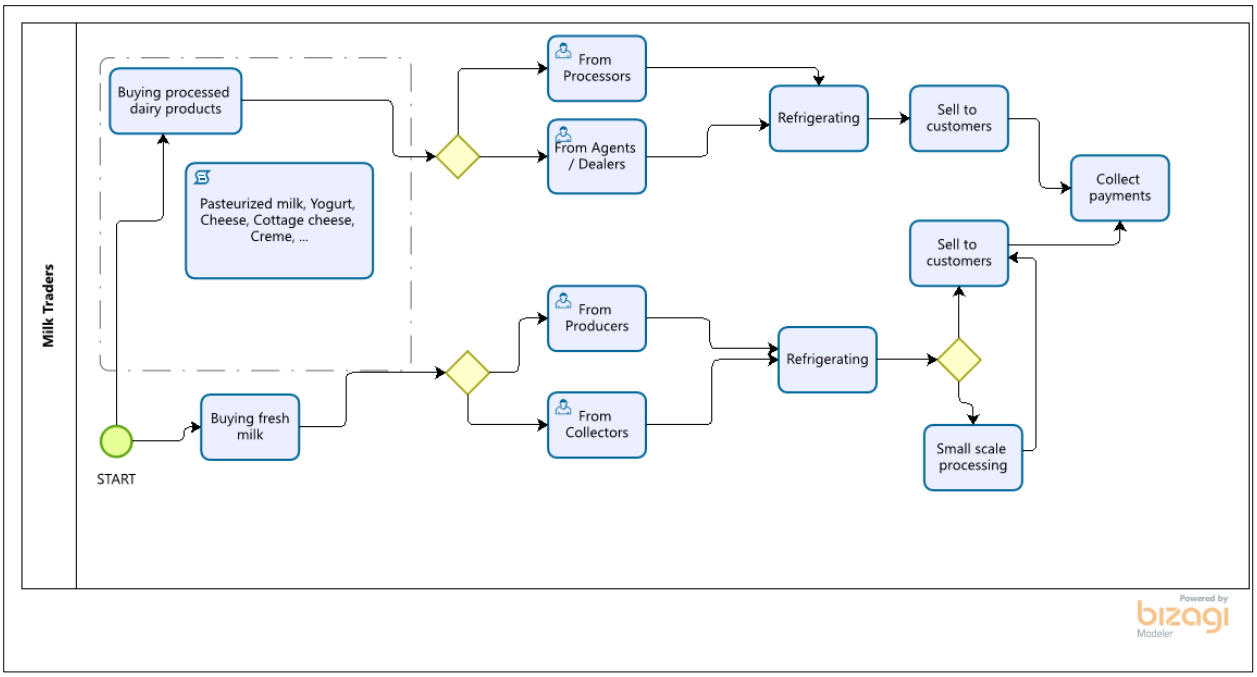


Figure 6. Business process model for milk retailers

4.2. Business model canvass for milk producers

Value proposition

This is the reason why producers choose the product or service considering the benefits or values they aim to provide to their customers. Both commercial and subsistence producers are aware of the value their customers are expecting from them. The value propositions at farm level have three dimensions based on the product they sell, i.e., milk, culled animals and

manure. With regard to the primary product, milk, "quality milk production and timely delivery" make the key value customers are looking for and the producers are striving to deliver. During major fasting seasons of the Ethiopian Orthodox Christians, milk is home-processed into traditional products such as *qibe* (cooking butter), and *ayib* (cottage cheese) for better shelf life and value on the market. Animals are culled from the farm mostly due to space limitation particularly in urban and peri-urban family farms, whereas performance and other zootechnical reasons are considered during culling animals in commercial farms. Therefore, the value propositions related to culled cattle is "conditioning". Culled cows, excess heifers and male claves for beef, breeding and/or veal are better valued on the market when conditioned for larger body conformation. Manure is one of the resources farmers benefit from selling. It leaves the farm either fresh or composted. "Composting" is the value proposition for manure destined to horticulture farms. Fresh manure for dung cake makers leaves without any further value addition.

Customer segments

Customer segments are the different groups of people or organizations to which the producers' value is intended to be delivered in the form of products and/or services. Milk producers' primary customers include milk collectors/traders, milk processors and individual milk consumers in order of importance. Milk collectors are convenient customers as they collect from the farm gate, even though they pay relatively lower prices compared to other customers. Culled animals are destined to other dairy farmers for breeding or to butchers. Butchers pay the lowest price for culled cows, male calves and excess heifers compared to other dairy farms that collect culled cows and heifers for breeding purposes. Preferred customers for manure are flower farms who pay premium prices for composted manure. Dung cake makers buy fresh dung at a very low price.

Customer relationship

Customer relationship refers to the types of relationships that a given firm establishes with a specific segment of the market – can be personal or automated – and aimed at attracting, retaining, or increasing customers. The type of relationships milk producers in Ada'a and Sululta establish with the above mentioned specific customer segments are similar. Searching for new buyers through brokers and direct contacts are the two methods used by milk

producers to expand their customer base. Discussion with the customers about their requirements helps the farmers to maintain their key customers. However, there are complaints from producers that no matter how hard they try to keep their customers, fasting season decides who stays as a reliable customer even after the fasting season is over. Yet, the higher demand than the supply at national level has obvious impact on the customer relationship whereby even an adulterated milk gets access to the formal milk market chain. This has resulted in weak customer relationship at the production and collection node of the dairy value chain in Ada'a and Sululta areas.

Channels

Channels are the way entrepreneurs communicate with the target market segment to deliver the value proposition; it includes the communication, sales, distribution, and customer service channels, both online and offline. Most milk marketing channels are either direct or indirect. In both Ada'a and Sululta, producers use both direct and indirect channels to reach the end consumers. Direct door-to-door sales and contractual one-point sales fetch the farmers a better price for their milk. However, the big volume sales with relatively lower price are recorded from the indirect channels through collectors and processors.

Key activities

Key activities refer to the most important things a producer must do to make his business – dairy production – work. In order to deliver the values proposed above, dairy producers in Ada'a and Sululta do the following key activities in their routine as measures of biosecurity and delivering quality milk to customers: feed quality monitoring, barn cleaning, personnel and equipment hygiene practices, strict animal vaccination, prompt treatment of sick cows, sorting cows based on their productivity. While these are important routines from biosecurity point of view, heat detection, mating/inseminating cows in heat, and milking cows also make part of the key activities in the farms observed during the current study.

Key resources

The most important assets required to make a commercial, family or smallholder milk production business work in the study areas include abundant labor to rear cows, availability of feed (notably mixed ration), dairy cows and input services. Producers either own, rent, or

obtain these resources from their key partners. Among the inputs used for milk production, feed costs account up to 89 percent of the cost of production.

Key partners

Key partners are the network of partners that allow the feasibility of the dairy production model and enable the optimization of the allocation of resources. Key partners in a typical dairy farming business model include input suppliers, government institutions, and non-governmental organizations. In Ada'a and Sululta districts, the major input suppliers are feed suppliers (both roughage and concentrate), and artificial insemination and veterinary service providers. The extension service wing of the public sector provides AI and veterinary services to smallholder farmers and family dairy producers. Commercial farms usually access AI and veterinary services chiefly from the private providers as the public extension system currently lacks the capacity to respond to their requirements with the kind of urgency the business demands.

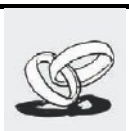
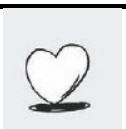
Cost structure

The block of the cost structure describes all the costs incurred to operate a dairy production business model. Cost should be minimized as it has transversal characteristics and is a determinant of the viability of a sustainable business model. Even though the costs incurred by milk producers in different production systems differ, the common ones are discussed here. Feed costs comprise up to 89 percent of the total cost of production in urban farms while the figures are lower for commercial and smallholder farmers that have access to land for grazing and/or fodder production. The second most important cost of production is recorded salary and wages preceding veterinary and AI costs. Transportation costs and utilities (water and electricity) make the lowest contribution to price buildup in milk production. The minimum set of ration ingredients and their respective prices were described by farmers as follows: dry feed (60 Birr per bale), dairy mix (1 300 Birr per quintal), wheat bran (900 Birr per quintal), wheat shorts (1 100 Birr per quintal), brewers' grain (400 Birr per quintal), and salt (900 Birr per quintal).

Revenue streams

Revenue streams for milk producers can be of two types: a bimonthly payment from milk collectors and processors and a monthly payment from direct consumers. One-time payment for milk is limited to urban farms in Ada'a where producers have their own milk shops.

Table 4. Business model canvas for milk producers

<table>
<tr>
<td rowspan="2"> 
Key Partners
• Feed suppliers and other input suppliers
• Veterinarians
• Government extension workers
• Cooperatives
• NGOs
• Customers</td>
<td> 
Key Activities
• Feed quality monitoring
• Barn cleaning, personal and equipment hygiene practices
• Vaccinations
• Proactive treatment of sick cow
• Sorting cow breeds on their productivity
• Breeding cows timely
• Milking</td>
<td rowspan="2"> 
Value Proposition
• Quality milk production with timely delivery of milk and milk products (butter, cottage cheese, yogurt, etc.)
• Conditioning culled cows, excess heifers, and male calves for beef, breeding and veal
• Manure
○ Composting for horticulture farms
○ Fresh manure for dung cake makers</td>
<td> 
Customer Relationships
• Searching for new buyers through brokers and direct contact
• Discussion with customers about their requirements</td>
<td rowspan="2"> 
Customer Segments
• Milk collectors
• Milk processors
• Individual consumers
• Dairy farmers and butchers
• Flower farmers</td>
</tr>
<tr>
<td> 
Key Resources
• Dry feed
• Dairy mix
• Wheat bran
• Brewers' grain
• Salt
• Replacement animals
• Inputs: drugs
• Milking and collection utensils
• Sanitation materials
• Labor</td>
<td> 
Channels
• Channels are direct contact and word of mouth, telephone and scheduled meeting, for all the five phases such as awareness, evaluation, purchase, delivery and after sale</td>
</tr>
<tr>
<td colspan="3"> 
Cost Structure
○ Feed costs
○ Salary and wage
○ Veterinary and breeding costs (AI/bull service)
○ Transportation
○ Utilities</td>
<td colspan="2"> 
Revenue Streams
○ Milk and milk products
○ Sale of culled animals
○ Manure</td>
</tr>
</table>

4.3. Business model canvas for milk collectors

Value proposition

Milk production and processing are value chain operations mostly located far apart for the sake of resources each needs to function, such as infrastructure, utility and land. Milk collectors in Ada'a and Sululta strive to address location disadvantage of milk producers and processors as delivering adequate volume and quality of milk on a regular basis is their key value proposition.

Customer segments

Milk processors located in Addis Ababa and the surrounding cities are the main customers of milk collectors in Sululta and Ada'a. They also serve the informal milk retailers and urban milk shops. In terms of volumes of sales, milk processors are priority customers of collectors while in terms of price, traditional milk shops are preferred customers for the collectors.

Customer relationship

Collectors sign contracts with milk processors who define the quality, volume and payment modalities of milk transactions, among other legal conditions. Bids and direct communications are mostly the means of getting new customers for collectors. However, the role of brokers was also noted in facilitating new deals between collectors and processors.

Channels

Direct channels are dominant in collectors' operations as most of the collectors directly interact with their customers. Some collectors who operate at smaller volume use indirect channels to reach their customers. This kind of model is used only for few weeks until the collector gets the trust of farmers and that of processors with whom s/he has newly established business relationship. Once trust is established such collectors use their own contracted delivery truck to collect and distribute milk.

Key activities

Collectors' key activities include milk quality testing, bulking and transporting to customers' location. Once it reaches customers, milk is tested for quality and recorded. Common platform tests such as organoleptic test, alcohol test and lactometer readings are observed and/or recorded at both the collection and delivery points. Another key activity of collectors is collection of receivables.

Key resources

Infrastructural resources such as road, electricity and water are key factors for milk collection business. Indeed, availability of the primary resource – marketable milk – is indispensable.

Key partners

The vast number of smallholder dairy producers as well as milk processors are the key partners of milk collectors. The transport service providers are also important partners for those that have no transportation vehicles.

Cost structure

Common to all collectors, milk costs take the lion's share of the cost structure followed by transportation costs. Testing and hygiene costs take very small portion of the milk collection business cost structure.

Revenue streams

A bimonthly payment from milk processors and milk shops is the only and direct revenue stream.

Table 5. Business model canvas for milk collectors

Key Partners

- Farmers
- Transport agencies
- Processors
- Retailers

Key Activities

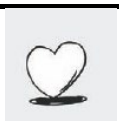
- Milk collection and quality control
- Logistics control
- Distribution
- Revenue collection

Key Resources

- Milk production potential
- Vehicle
- Milk collection utensils
- Milk chiller
- Labor

Value Proposition

- Timely and quality milk delivery
- Delivering adequate amount of milk

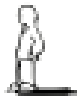


Customer Relationships

- Reach new processors with bids and les persons

Channels

- Direct contact and word of mouth, telephone and scheduled meeting,



Customer Segments

- Milk processors
- Milk shops

Cost Structure

- Milk cost
- Fuel cost
- Salary and wage
- Transportation
- Utilities
- Cleaning chemicals
- Electricity
- Cost of vehicle
- Maintenance cost

Revenue Streams

- Milk sale

4.4. Business model canvas for milk processors

Value proposition

Milk processors address the gap in the dairy consumers market through the production of shelf-stable milk and milk products. For the institutional consumer market, a diversified milk products supplied in a regular time delivery, with a flexible payment systems are the values served by the large processors.

Customer segments

The major customers of milk processors include supermarkets and minimarkets, kiosks, hotels and restaurants, institutions such as hospitals and factories in descending order of importance in terms of volume of sales.

Customer relationship

Milk processors reach new customers through bids, sales person contact and maintain their customers through market assessment of end consumers and sending out seasonal cards to customers. In addition, processors request for feedback on their new products that enter the market.

Channels

Most processors use indirect channel to market their products to end consumers, i.e., through supermarkets, hotels and institutions. Some processors have their own retail shops in town where they can directly channel their products to consumers.

Key activities

One of the key activities is the manufacture of pasteurized milk, yogurt, and cheese. The manufacturing process includes pasteurization, temperature conditioning, mixing, and coagulation. In all the stages, it is important to respect the appropriate hygienic-sanitary norms avoiding alterations in the quality of the product. The key activities to deliver the values proposed include milk sourcing management, products processing management, cold chain maintenance, and sales and marketing coordination and quality assurance. Unlike the rest of

the value chain actors, all activities listed above are key to the successful delivery of the values to the customers.

Key resources

The key resources include raw milk supply, ingredients supply for products, packaging materials, factory premises, processing machines, skilled staff, and working capital.

Key partners

These are the key partners for milk processors: milk suppliers, ingredients suppliers, packaging materials suppliers, hygiene chemicals (detergents and disinfectants) suppliers, government regulatory body (EFDA – Ethiopian Food and Drug Authority, ESA – Ethiopian Standards Authority, MoTI – Ministry of Trade and Industry, EMDIDI – Ethiopian Meat and Dairy Industry Development Institute), and NGOs (usually for supply chain support).

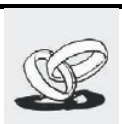
Cost structure

The main costs for a milk processor include raw milk costs, packaging and ingredients, salary and wages, transportation costs, utilities (water and electricity), hygiene and sanitary supplies.

Revenue streams

Revenue originates from the various types of dairy products sold, including pasteurized milk, yogurt (flavored, plain), cheeses (cottage, provolone, mozzarella, Gouda), cooking butter, table butter, cream, etc.

Table 6. Business model canvas for milk processors



Key Partners

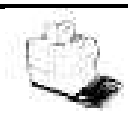
- Milk suppliers
- Ingredients suppliers
- Packaging suppliers
- Hygiene chemicals suppliers
- Government regulatory body (EFDA, ESA, MoTI, EMDIDI) and NGOs as supply chain support

Key Activities

- Milk sourcing management
- Product processing management
- Cold chain maintenance
- Sales and marketing coordination
- Quality assurance

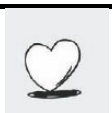
Key Resources

- Raw milk
- Ingredients for products
- Packaging materials
- Factory premises
- Processing premises
- Processing machines
- Skilled staff
- Working capital



Value Proposition

- Shelf stable milk and milk products
- Diversified milk products
- Regular and timely delivery
- Flexible payment system (postdated checks vs. cash sales)



Customer Relationships

- Reach new customers through bids
- Sales persons contact
- Market assessment of end customers
- Sending out seasonal cards

Channels

- Visit customers regularly and collect feedback
- Telephone
- Direct contact delivery and after sale

Customer Segments

- Hotels and restaurants
- Supermarkets / minimarkets
- Kiosks
- Institutions (hospitals etc.)

Cost Structure

- Raw milk costs
- Packaging materials and ingredients
- Salary and wage
- Transportation
- Utilities
- Hygiene and sanitary supplies

Revenue Streams

- Pasteurized milk
- Yogurt (flavored, plain)
- Cheese (cottage, provolone, mozzarella, Gouda)
- Cooking butter
- Table butter
- Cream

Table 7. Challenge solution matrix

Problems	Root cause	Symptoms / apparent problems	Recommended solution	Responsible bodies
Poor AI service delivery	Public extension dominated service with limited coverage and incentives	High incidence of repeat breeder; Very intermittent availability of liquid nitrogen; Unreliable semen quality and availability	Private sector engagement in AI service delivery	Private sector and enablers
Poor coverage of public veterinary service delivery	Public extension dominated service with limited coverage and incentives	The vaccination programs are irregular, and the supply of vaccine is not reliable; Ineffective vaccines that resulted in relapse of diseases (e.g. FMD) for which animals are vaccinated; Limited drugs availability; Insufficient regulation on illegal drugs that are usually of poor quality and less effective	Private sector engagement in veterinary service delivery	Private sector and enablers
High cost of production	Inadequate supply of animal feed (concentrate and fodder); Shortage of land for grazing and/or fodder production; Limitation of practices in feed preservation techniques; Inadequate forage seed supply	Feed prices are ever-increasing; Feed quality is compromised; Feed supply is not continuous	Lift the VAT on ruminant concentrate feed; Allocate land for grazing; Increase land efficiency on crop and forest land by integrating fodder species; Facilitate fodder input supply	Private sector Enablers
Lack of collective lobbying and bargaining power	Lack of functional sector association and overarching board to regulate the dairy value chain	Unregulated market, irregular policy enforcement	Strengthen dairy farmers association, processors association, cooperatives and collectors, establish the dairy board	All stakeholders of the dairy value chain

5. Enterprise budget for key dairy value chain nodes

The enterprise budget allows estimating cost and revenue of a given enterprise, and hence the profit of an enterprise. In this study, enterprise budgets were constructed for milk

production, milk collection, and milk processing nodes of the dairy value chain in Ada'a and Sululta districts.

5.1. Enterprise budget for milk producers

Milk producers are subject to fluctuating feed prices that comprise up to 89 percent of their cost of production. Feed costs are calculated as the sum of cost of roughages (hay, fodder, silage, crop by-products), concentrates (dairy mixes or a mix of wheat bran, oil seed cakes, molasses, salt, and premixes), and water. Feed transport costs are in most cases included in the feed costs. Among the feeds, roughage feeds can be considered as fixed feed costs as they do not seem to vary between milk producing and non-producing cows. On the contrary, concentrate feeds are provided in a way that high yielding cows receive more concentrates than do dry and low yielding cows. Because of lack of cost records on individual and group fed herds it was reported here as a total and annualized feed costs. Table 8 presents a case farm with 9 milking cows.

5.2. Enterprise budget for milk traders or collectors

Milk collection business functions as an aggregation and transport of a raw material that is delivered to the processing node of the value chain. It is a key function of adding value to raw milk, a perishable commodity produced by farmers distantly located from the processors or consumers. The main cost categories of milk collection enterprises include cost of raw milk and transport while fixed costs are negligible as they make use of transportation services provided by others. Table 9 shows cost and revenue structure of an average milk collection business which trades 730 000 liters of milk per year.

5.3. Enterprise budgeting for milk processors

Milk processing is a manufacturing function in the dairy value chain. The largest part of cost categories in milk processing enterprises in Ada'a and Sululta is attributed to purchase of raw milk. Fixed costs such as depreciation of buildings and machinery represent a marginal fraction compared to the variable costs such as utility and transports. Among the milk products processors supply to the market, yogurt fetches the highest profit margin as a value added popular product. Table 10 presents an enterprise budget of a processing plant with annual volume of 10 950 000 liters of milk processed.

Table 8. Enterprise budget for producers

Variable Costs	*Unit*	*Unit Price*	*Qty.*	Total / year
Male calf feed cost (0-6month)	Daily cost	7.5	365	2 738
female calf feed cost (0-6months)	Daily cost	100	365	36 500
Heifer calf feed cost (6month - 1 year)	Daily cost	116	365	42 340
Bull calf feed cost (6month - 1 year)				0
Bull feed cost (1 year and above)				0
Heifer feed cost (1 Year and above)	Daily cost	420	365	153 300
Milking cow feed Cost	Daily cost	1 360	365	496 400
Dry cow feed cost	Daily cost	350	365	127 750
Breeding fees (bull or AI service cost per year)	Month	300	12	3 600
Daily labor	Daily cost	960	365	350 400
Management labor	Daily cost	750	365	273 750
Milk marketing and hauling	Daily cost	400	365	146 000
Veterinary medicaments cost	Daily cost	41.076	365	14 993
Bedding material cost				0
Cleaning materials cost	Daily cost	50	365	18 250
Fuel and oil		-		
Electricity cost	Daily cost	10	365	3 650
Water cost	Daily cost	33	365	12 045
Barn maintenance cost	Lump sum	32 000	1	32 000
Total Variable Costs				1 713 715
Fixed Costs				
Fixed Costs				33 723
Total Costs				**1 747 438**
Returns				
Milk sales	Daily income	5 040	365	1 839 600
Calves sold	Lump sum			10 500
Cull cows sold	Number	55 000	3	165 000
Cull replacements sold				0
Cull yearlings sold				0
Manure sales	Daily income	11	365	4 015
Other income				0
Total Gross Return				**2 019 115**
Profit				**271 677**
Net Income Over Total Costs				***15%***

Table 9. Enterprise budget for traders/collectors

Particular	Unit	Unit price	Qty.	Total per year
Return				
Milk sales	Liter	22	730 000	16 060 000
Total Gross Return				16 060 000
Variable Costs				
Milk costs	Liter	17	730 000	12 410 000
Cleaning materials cost	Daily cost	50	365	18 250
Water cost	Daily cost	50	365	18 250

Electricity cost				0
Daily labor	Daily cost	450	365	164 250
Management labor	Daily cost	300	365	109 500
Milk marketing and hauling	Daily cost	1 000	365	365 000
Fuel and oil	Daily cost	1 000	365	365 000
Machinery maintenance cost	Daily cost	411	365	150 015
Other variable costs				
Total Variable Costs				***13 600 265***
Total Costs				**13 600 265**
Profit				**2 459 735**
Net Income Over Total Costs				**18%**

Table 10. Enterprise budget for milk processors

Particular	Unit	Qty	Unit Price	Total per year
Returns				
Pasteurized milk	Per year in lit	10 607 696	26	275 800 100
Yogurt	Per year in lit	159 318	48	7 647 264
Butter	Per year in kg	7 073	300	2 121 900
Cheese	Per year in kg	7 457	70	521 990
Total Gross Return				***286 091 254***
Variable Costs				
Raw milk cost	Per year in lit	10 950 000	22	240 900 000
packaging cost	Lump sum			2 288 580
Electricity cost	Per year			1 134 580
Fuel and oil	Per year	48 000	25	1 200 000
Building and maintenance cost	Lump sum			195 000
Cash interest paid	Per year	450 000	4	1 800 000
Laboratory costs	Per month	12	18 000	216 000
Salary and wages	Per head annual	32	48 688	1 558 016
Other variable costs	Per year			
Total Variable Costs				**249 292 176**
Fixed Costs				
Depreciation of buildings and machines	Per year			3 028 486
Insurance	Per year			171 035
Opportunity cost of investment				1 388 889
Total Fixed Costs				**4 588 410**
Total Costs				**253 880 586**
Profit				**32 210 668**
Net Income Over Total Costs				**13%**

5.4. Profit markup at key nodes of the value chain

We calculate the profit markup that is the percentage of net profit over total costs. In other words, we present the extra earning when costs of producing are deducted from the total earnings as a percentage of total costs. In the current study, for every Birr invested, 0.15 Birr net profit is made at production, 0.18 Birr at collection and 0.13 Birr at processing nodes of dairy value chain in Ada'a and Sululta districts (Table 11; Figure 7).

Table 11. Profit markup for actors at three dairy value chain nodes

Profit markup	Milk producer	Milk collector	Milk processor
	15%	18%	13%

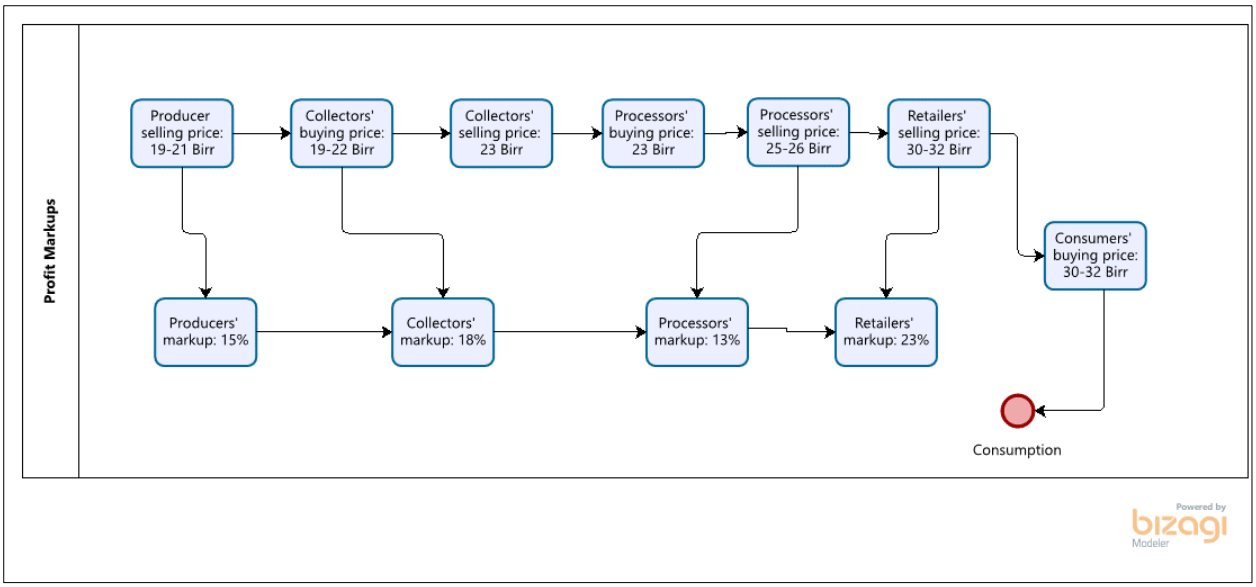


Figure 7. Price and profit markup flow at three dairy value chain nodes

6. Summary and conclusion

Milk producers engage in farm inputs preparation including buying of dairy cows or procurement of the inputs and involve in routine husbandry activities (breeding, feeding, health monitoring) and milking, handling, transporting and marketing of the milk. Milk collectors are those actors responsible for the trading of milk from producers to other actors in the chain. Main activities of the milk collectors include testing for quality; seeking information on quantity, quality, hygiene, fat content, and adulteration; buying, assembling and re-selling to different chain actors. Cooperatives are involved in activities such as collecting milk from farmers, bulking, refrigerating and delivering it to milk collection units or to processors.

Milk processors are of two types: small-scale and large-scale. Large processing plants purchase milk in large quantity from collection units and process it into cheese, yoghurt and pasteurized milk. Processers are involved in milk chilling, pasteurization, packaging, product making, quality assessment and milk standardization. They conduct milk quality analysis using microbial contamination test and milk compositional test during buying and selling.

The value propositions at farm level are “quality milk production and timely delivery”. Primary customers of milk producers are milk collectors/traders, milk processors and individual milk consumers in order of importance. Culled animals are destined to other dairy farmers for breeding or to butchers. Searching for new buyers through brokers and direct contacts are the two methods used by milk producers to expand their customer base. Discussion with the customers about their requirements helps the farmers to maintain their key customers, with whom they communicate both in person and through social media.

Key activities for the dairy production business model include undertaking feed quality monitoring, barn cleaning, personnel and equipment hygiene practices, strict vaccination, prompt treatment of sick cows, sorting cows based on their productivity as measures of biosecurity and delivering quality milk to customers. Among important assets and inputs required to operate the dairy business model, feed costs comprise the highest, up to 89 percent of the cost of production. Key partners in a typical dairy farming business model include input suppliers, government and non-government organizations. The revenue streams for milk producers are a bimonthly payment from milk collectors and processors, and a monthly payment from contracted direct sales to consumers. One-time payment for milk is limited to urban farms where producers have their own milk shops.

Delivering adequate volume and quality of milk on a regular basis is the key value proposition of collectors. They serve as market channel to a vast number of smallholder milk producers. Milk processors located in Addis Ababa and the surrounding cities are the main customers of milk collectors. They also serve the informal milk retailers and urban milk shops. In terms of volumes of sales, milk processors are priority customers of collectors while in terms of price of sales, traditional milk shops are preferred customers for the collectors. Collectors sign contracts with milk processors that define the quality, volume and payment modalities of milk transactions between processors and collectors, among other legal conditions. Bids and direct communications are mostly the means of getting new customers for collectors. However, the role of brokers is also noticed in facilitating new deals between collectors and processors.

Direct communication channels with key partners are dominant in operations of collectors. Some collectors that operate at smaller volume use indirect channels to reach their customers. Infrastructural resources such as road, electricity and water are key factors for milk collection business. The vast numbers of smallholder dairy producers are the key partners to milk collectors. The transport service providers are also important partners for those who do not have milk transportation vehicles. Common to all collectors, milk costs take the lion share of the cost structure followed by transportation costs. Testing and hygiene costs take very small portion of the milk collection business cost structure. A bimonthly payment from milk processors and milk shops is the only and direct revenue stream.

The value proposition of processors is diversified milk products supply in a regular time delivery with flexible payment systems. The major customers of milk processors include supermarkets and minimarkets, kiosks, hotels and restaurants, and institutions. Milk processors reach new customers through bids and sales person contact. They endeavor to maintain their customers through market assessment of end consumers and sending out seasonal cards to customers. In addition, processors request for feedback on their new products that enter the market. Most processors use indirect channel to market their products to end consumers, i.e. through supermarkets, hotels and institutions. Some processors have their own retail shops in town where they can directly channel their products to consumers. The key activities to deliver the values proposed include, milk sourcing

management, products processing management, cold chain maintenance, and sales and marketing coordination and quality assurance. The key resources include raw milk supply, ingredients supply for products, packaging materials, factory premises, processing machines, skilled staff, and working capital. The main costs for a milk processor include raw milk costs, packaging and ingredients, salary and wages, transportation costs, utilities (water and electricity), hygiene and sanitary supplies. Their products include pasteurized milk, yogurt (flavored, plain), cheese (cottage, provolone, mozzarella, Gouda), cooking butter, table butter, cream, etc.

In the current study, for every Birr of costs incurred, 0.15 Birr profit is made at production, 0.18 Birr at collection and 0.13 Birr at processing nodes of the dairy value chain.

We concluded that all actors along the dairy value chain maintain a profitable business but, according to our view, marginal changes in production practices could definitely improve profitability. However, for this to occur, it is necessary to create an enabling environment which allows the public and private sectors to cooperate successfully and dairy producers to improve the profitability and sustainability of their business while providing affordably-priced milk and dairy products to consumers.

7. References

CIAT. 2012. Linking Smallholders: A guide on inclusive business models. Blog. Cali, Colombia: CIAT.

CSA. 2020. Livestock sample survey 2019/20. Central Statistical Authority. Addis Ababa, Ethiopia.

FAO. 2015. Inclusive business models – Guidelines for improving linkages between producer groups and buyers of agricultural produce, by Kelly, S., Vergara, N. & Bammann, H. Rome, Italy.

FAO. 2019. The future of livestock in Ethiopia. Opportunities and challenges in the face of uncertainty, Rome. 48pp.

FAO. 2020. The future of livestock in Ethiopia. Emerging public health risks in urban and peri-urban areas, Rome. 2pp.

Furberg, M. Naumburg, A. 2019. Milk as a Service: Exploring the Concepts of Servitization and Digitalization in the Business Model of an Incumbent Manufacturing Firm. MSc. Thesis. KTH Royal Institute of Technology. Stockholm, Sweden. 97pp.

Indrawan, D. 2020. Business model canvas for animal health business using IoT application. Proceedings of the First ASEAN Business, Environment, and Technology Symposium. Advances in Economics, Business and Management Research, Series vol. 141.

Nuryadi, R.T. and Mulyono, N.B. 2019. Proposed Business Model of Dairy Cooperative to Empower Dairy Supply Chain of Dairy Cooperative. The Asian J. Technology Management, 12(3): 226–242.

Ongkunaruk, P. 2015. Business process analysis and improvement for a raw milk collection centre in Thailand. Agriculture and Agricultural Science Procedia 3, 35–39.

Osterwalder, A. and Pigneur, Y. 2010. Business Model Generation. John Wiley & Sons, Inc. Hoboken, New Jersey.

Ramadanti, A., Daryanto, A., Sukardi, D. 2017. The dairy value chain, inclusive business model, and inclusiveness improvement of southern Bandung dairy cooperative Pangalengan. J. Management & Agribusiness. 14(3). doi: http://dx.doi.org/10.17358/jma.14.3.240.

Sijbrandij, P.G. 2016. Business Models in the Dairy Value Chain: A Comparison over Geographies. MSc Thesis. Wageningen University. 76pp.

Vorley, B., Porras, I. and Amrein, A. 2015. The Indonesia Domestic Biogas Programme: can carbon financing promote sustainable agriculture? IIED and Hivos.

Yilma, Z., Emannuelle, G.B., and Ameha, S. 2011. A Review of the Ethiopian Dairy Sector. Ed. Rudolf Fombad, Food and Agriculture Organization of the United Nations, Sub Regional Office for Eastern Africa (FAO/SFE), Addis Ababa, Ethiopia, 81pp.

8. Annexes

Spreadsheet of enterprise budgets

Producers enterprise budget

Returns	**Unit**	**Qty.**	**Price**	**Total per Year**
Milk sales				
Milk premiums				
Calves sold				
Cull cows sold				
Cull replacements sold				
Cull yearlings sold				
Manure sales				
Other income				
Total Gross Return				
Variable Costs				
male calf feed cost (0-6month)				
female calf feed cost (0-6months)				
Heifer calf feed cost (6month - 1 year)				
Bull calf feed cost (6month - 1 year)				
Bull feed cost (1 year and above)				
Heifer feed cost (1 Year and above)				
Milking cow feed cost				
Dry cow feed cost				
Breeding fees (bull or AI service cost per year)				
Daily labor				
Management labor				
Milk marketing and hauling				
Veterinary medicaments cost				
Bedding material cost				
cleaning materials cost				
Fuel and oil				
Electricity cost				
water cost				
barn maintenance cost				
Machinery maintenance cost				
Cash interest paid				
Other variable costs				
Total Variable Costs				
Fixed Costs				
Depreciation of machines				
Depreciation of buildings				
Farm/Livestock insurance				
Opportunity cost of investment				
Other fixed costs				
Total Fixed Costs				

Returns	Unit	Qty.	Price	Total per Year
Total Costs				
Income Over Variable Costs				
Income Over Total Costs				

Collectors/ cooperatives Enterprise budget

Returns	Unit	Qty.	Price	total per year
Milk sales				
Milk premiums				
Other income				
Total Gross Return				
Variable Costs				
Milk costs				
cleaning materials cost				
water cost				
Electricity cost				
Daily labor				
Management labor				
Milk marketing and hauling				
Fuel and oil				
Machinery maintenance cost				
Cash interest paid				
Other variable costs				
Total Variable Costs				
Fixed Costs				
Depreciation of machines				
Depreciation of buildings				
Opportunity cost of investment				
Other fixed costs				
Total Fixed Costs				
Total Costs				
Income Over Variable Costs				
Income Over Total Costs				

Processors Enterprise budget

Returns	Unit	Qty.	Price	Total
Pasteurized milk				
Yogurt				
Butter				
Cream				
Cheese				
Other income				
Total Gross Return				
Variable Costs				
Raw milk cost				
ingredient cost				
packaging cost				
Electricity cost				
water cost				
Fuel and oil				
Building maintenance cost				
Machinery maintenance cost				
Cash interest paid				
Laboratory costs				
Salary and wages				
Other variable costs				
Total Variable Costs				
Fixed Costs				
Depreciation of machines				
Depreciation of buildings				
Insurance				
Opportunity cost of investment				
Other fixed costs				
Total Fixed Costs				
Total Costs				
Income Over Variable Costs				
Income Over Total Costs				

Traders enterprise budget

Returns	Unit	Qty.	Price	Total
Pasteurized milk				
Yogurt				
Butter				
Cream				
Cheese				
Other income				
Total Gross Return				
Variable Costs				
Cost of milk products sold				
Pasteurized milk				
Yogurt				
butter				
Cream				
cheese				
Other products				
Electricity cost				
water cost				
Fuel and oil				
Building maintenance cost				
Machinery maintenance cost				
Cash interest paid				
Salary and wages				
Other variable costs				
Total Variable Costs				
Fixed Costs				
Depreciation of machines				
Depreciation of buildings				
Insurance				
Opportunity cost of investment				
Other fixed costs				
Total Fixed Costs				
Total Costs				
Income Over Variable Costs				
Income Over Total Costs				

Questionnaire and cheek list

Milk producers questionnaire on dairy biosecurity: a value chain approach

1. Name, and contacts of respondent	
2. Gender of respondent	a) Male b) Female
3. Education level of respondent	a. Never gone to school b. Primary level c. Secondary d. Advanced Level (HSC) e. Tertiary level f. Others specify.....

4. Type of dairy animals (number)	Local	Cross breeds	High-grade
Lactating cows			
Dry cows			
Bulls			
Heifers			
Calves			
Other animals (Specify)			

Production issues

5. How many men and women are engaged in production on this farm and what do they do?		Number	Role
	Men		
	Women		

6. What equipment do you use for milking?	
7. Which disinfectants do you use before/ or after milking? (iodine, caustic soda, detergents, other)	

8. What are your main production inputs for raising cattle for diary?
Feeds

On farm/Locally produced (***at no cost)***		Bought/Purchased		
a)Type of feed	Amount in quantity *(kg, Bundles, Acres)*	Type of feed	Amount in quantity*(kg, Acres, Bundles,*	Price

Drugs, vaccines and AI

b)Type of input	Dose per year	Type of drugs	Amount in quantity	Price
AI		Vaccine		
		Drugs		
		Anthelminths		

9.	What other services do you spend on?	i. Professional services and Pay per month …… ii. Water _ and amount per month …… iii. Means of transport _and amount spent per month …… iv. Type of labor _____amount paid per month _____ v. Others (specify) _____		
10.	Which months / seasons is milk production highest and lowest?		High production	Low production
		Month		
		Amount		
11.	Give reasons for the variation in seasonal production	**Reasons for High production**	**Reasons for Low production**	
	Marketing Issues			
12.	How much milk do you produce in liters per day?	a) Liters produced _____ b) Liters sold _____ c) Liters consumed at home _____ d) Liters exchanged for other things _____		
13.	On Average what is the rate of destocking on your farm?	a) Numbers ready for sale in years _____ b) Numbers sold in year _____ c) Numbers consumed at home _____ d) No. Used for traditional ceremonies _____ e) No. exchanged for other things _____ f) Other……		
14.	What is your Farm gate milk price?	Birr per Liter		
15.	what type of container is used when selling milk			
16.	Who are the buyers of your milk a) Supermarkets b) Vendor c) Cooperatives d) Hotels/restaurants e) Shops f) Neighbors g) Butchers h) Consumer, i) Other	Buyers of milk		Buyers of culled cattle
		Location of buyers		
17.	What is the quality and safety attributes of milk and milk products most demanded by your consumers? Is there price premium for these attributes? If so how much? How do you maintain quality and safety before selling? What are quality control measures used by buyers? 18. Is there price premium for meeting these attributes? If so how much?	**Yes**	**No**	
19.	**Value Addition**			
20.	Do you add value/process your Milk/live animal?	a) Yes	**b) No**	If No, Why

21. If yes , What are the Value added Products do you produce (List them) 22. **Value Addition**	Milk value-added product		
	Cattle value added types		
23. What percent of milk production sold as Fresh whole milk Processed in to other products Consumed at home Other way of disposing milk (specify) 24. What are quality and safety attributes of milk and milk products?			
25. Are there quality and safety regulation issues by government? Are they mandatory or voluntary?			
26. Are there quality and safety regulation issues by government? Are they required or voluntary?			
Biosecurity issues 1. Is there designated entrance for visitors without contacting animals? 2. Do you keep record of visitors? 3. Do you keep feed and other products away from visitors and monitor? 4. Do you provide tire disinfectant baths or sprays for visiting vehicles? 5. Do you provide disposable boots or disinfectant footbaths for visitors at entry? 6. Do you test feed for mycotoxins? 7. Do you clean and disinfect feed delivery equipment regularly? 8. Do you provide separate working clothes for workers? 9. Are the gates and doors closed at all times? 10. Are there shrubs and other objects around barns that can hide unwanted animals? 11. Are feed and water points secured? 12. Do you have inventory of chemicals in the farm? 13. Do you clean all feed stores before restocking? 14. Are the workers trained to identify and report sick animals and unusual events? 15. Do you provide workers with specific guidelines for sanitation procedures if they have animals at home? 16. Do you have emergency contact details of a veterinarian for disease reporting? 17. Do you implement a vaccination program? 18. Do you quarantine new coming animals? 19. Do you test bulls and replacement heifers for contagious diseases before purchase? 20. Do you allocate separate places for dry, milking, calves and bulls? 21. Do you have isolation area for sick animals?		1. Yes / No 2. Yes / No 3. Yes / No 4. Yes / No 5. Yes / No 6. Yes / No 7. Yes / No 8. Yes / No 9. Yes / No 10. Yes / No 11. Yes / No 12. Yes / No 13. Yes / No 14. Yes / No 15. Yes / No 16. Yes / No 17. Yes / No 18. Yes / No 19. Yes / No 20. Yes / No 21. Yes / No	

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