



A Review of the Ethiopian Dairy Sector



By

**Zelalem YILMA
Emmannuelle GUERNEBLEICH
Ameha SEBSIBE**

Edited by

Rudolf Fombad

FAO Sub Regional Office for Eastern Africa (FAO/SFE)

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Cover photo:

Smallholder dairy producers lined up at one milk collection center around the Selale milk shed area.

Credit: Zelalem YILMA

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Definition of Terms

<i>Arera:</i>	Defatted sour milk obtained as a by-product of traditional butter-making from Ergo (Ethiopian naturally fermented milk) and a raw material for <i>Ayib</i> (Ethiopian cottage cheese) - making.
<i>Atella:</i>	A traditional home-brewery residue.
<i>Ayib:</i>	An acid-heat coagulated cottage type soft cheese crumbly in texture made from <i>Arera</i> common in many parts of Ethiopia.
<i>Ergo:</i>	Ethiopian naturally fermented milk, which is the basis of traditional fermented milk products.
<i>Nitir kibe:</i>	A product obtained after most of the moisture content of butter is removed by cooking at high temperatures. During the cooking various spices are added to improve its flavour. The resultant product has a long shelf life at ambient temperatures.
<i>Lega kibe:</i>	Fresh butter.
<i>Besal kibe:</i>	Rancid butter.
<i>Mekakelegna kibe:</i>	Semi rancid butter.

Acronyms and Abbreviations

AADPA	Addis Ababa Dairy Producers Association
AI	Artificial Insemination
ALPPIS	Addis Livestock Production and Productivity Improvement Service
AMAE	Asella Model Agricultural Enterprise
ATEVT	Agricultural, Technical, Educational and Vocational Training
BOAM	Business Organizations and their Access to Markets
CADU	Chilalo Agricultural Development Unit
CIF	Cost, Insurance and Freight
CR	Conception Rate
CSA	Central Statistical Agency of Ethiopia
DADIS	Domestic Animal Diversity Information System
DAGRIS	Domestic Animal Genetic Resource Information System
DAs	Development Agents
DDA	Dairy Development Agency
DDE	Dairy Development Enterprise
EDB	Ethiopian Dairy Board
EIAR	Ethiopian Institute of Agricultural Research
EIBC	Ethiopian Institute of Biodiversity Conservation
EMDTI	Ethiopian Meat and Dairy Technology Institute
EPID	Extension and Project Implementation Department of the Ministry of Agriculture
FAO	Food and Agriculture Organization of the United Nations
FINNIDA	Finnish International Development Agency
FTCs	Farmers Training Centres
HARC	Holeta Agricultural Research Centre
IBC	Institute of Biodiversity Conservation
IDA	International Development Association
IFCN	International Farm Comparison Network
ILRI	International Livestock Research Institute
ITC	International Trade Centre
NAIC	National Artificial Insemination Centre
NRR	Non-Return Rate
NSPC	Number of Services per Conception
PAs	Peasant Associations
QSAE	Quality Standards Authority of Ethiopia
SARI	Southern Agricultural Research Institute
SCC	Somatic Cell Count
SDDP	Smallholder Dairy Development Project
SIDA	Swedish International Development Agency
SNV	Netherlands Development Organization

SNNPR	Southern Nations, Nationalities and Peoples Region
TVET	Technical, Educational and Vocational Training
UNICEF	The United Nations Children’s Fund
UNRRA	United Nations Relief and Rehabilitation Administration
USD	United States Dollars
WADU	Wolaita Agricultural Development Unit
WFP	World Food Program of the United Nations

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Executive summary

Ethiopia has a large livestock population, a relatively favourable climate for improved, high yielding dairy cattle breeds and regions with less animal disease-stress that make the country to have a substantial potential for dairy development. Considering such a potential, investing in development interventions to the dairy sector will contribute to poverty alleviation in the country by increasing the income of smallholder dairy producers and creating employment and transforming the existing largely subsistent type of milk production to commercial level. In 2010, a total of 2 940 million litres of milk were produced from about 9.6 million cows at national level. During the same year, dairying created an estimated 588 000 full-time on-farm jobs.

In view of such a large number of dairy cows and the important number of producers engaged in the dairy sector, the development efforts so far made have not brought a significant impact on the growth of the sector. In 2010, the average daily milk production was only 1.69 litres with average lactation length of about 180 days and mean annual milk yield per cow of 305 litres. The country is a net importer of dairy products with import values significantly exceeding export values. In five reference years, 2005–2009, export values increased from about 73 000 USD to 123 000 USD, while import values increased from about 5.6 million USD to 10.3 million USD during the same period. Although milk production generally tended to increase during the last two decades at national level, the per capita milk consumption has decreased from 26 litres per annum in 1980, to 22 litres in 1993, 19 litres in 2000 and 16 litres in 2009.

The milk marketing system is not well developed giving the large majority of smallholder milk producers, limited access to the market. In 2010, less than seven percent of the annual milk production was estimated to be marketed at national level. In 2009, there were 180 cooperatives involved in milk production and marketing in the entire nation, accounting for only 2 percent of the total number of agro-based cooperatives operating in various parts of the country. In most of the cases, existing dairy cooperatives are operating in areas that are accessible to transportation and markets. This means that a substantial amount of milk does not reach the markets and a number of producers keep on producing at a subsistence level.

The following constraints account for the poor development of the dairy sector in Ethiopia:

- lack of market outlets for milk and milk products,
- inefficient and untimely artificial insemination (AI) services and poor semen quality,
- lack of crossbreed heifers,
- shortage of feeds especially agro-industrial by-products,
- shortage of water and
- inefficient and inadequate milk processing technologies.

There is a critical shortage of animal feed in the country and when available it is expensive and of poor quality. Most producers also lack the knowledge of efficient utilization of animal feed resources. The feed shortage is also partly attributed to the shortage of land for forage

development. The absence of or weak linkages among the different actors in the dairy value chain is considered to be another important factor that negatively affects the country's dairy development. Reports on the microbiological properties of marketed milk and milk products indicate that their quality is below standards.

In addition to making development interventions in the various components (breeding, animal health, feeding, milk collection, storage, processing and distribution), it is essential to encourage the involvement of the private sector in the dairy value chain, and put an efficient and operational coordination system in place that connects the various actors in the dairy sector. The Ethiopian Dairy Board (EDB), which is under establishment, is a good initiative. This will elevate the existing subsistent type of milk production to commercial levels to the benefit of all the actors involved ranging from the individual producer and consumer to the country level.

This document gives an overview of the Ethiopian dairy sector. The major challenges of the development of the sector are highlighted and conclusion and recommendations are briefly presented.

CHAPTER 1

1.0 Introduction

Ethiopia is reported to be endowed with the largest livestock population in Africa. According to the 2010 report of the Central Statistical Agency (CSA) the cattle population was estimated at about 50.9 million. The indigenous breeds accounted for 99.19 percent, while the hybrids and pure exotic breeds were represented by 0.72 and 0.09 percent, respectively. From the total cattle population, 45.13 percent are males and 54.87 percent females. This indicates the importance of male cattle particularly oxen for draft power. However, in the crop/livestock mixed farming system, oxen work for a maximum of 100 days in a year. This means that for the rest of the year oxen compete for the meagre feed resources though unproductive. An appropriate alternative strategy needs therefore to be put in place to reserve the feed for dairy cows that produce not only milk but also replacement stock. The total estimated goat population was about 22 million with indigenous breeds accounting for 99.98 percent and hybrid and pure exotic breeds for about 0.02 percent. The male and female goat population accounted for 30.83 and 69.17 percent, respectively. The total camel population was estimated to be 807 581 with the proportion of male and female camels being 33.88 and 66.12 percent, respectively (CSA, 2010a).

In spite of such a substantial potential, the dairy sector is not developed to the expected level. The annual growth rate in milk production of 1.2 percent falls behind the annual human population growth estimated at 3 percent (GRM International BV, 2007). The traditional milk production system, which is dominated by indigenous breeds of low genetic potential for milk production, accounts for about 97 percent of the country's total annual milk production (Felleke, 2003). The low productivity of the country's livestock production system in general and the traditional sector in particular is mainly attributed to shortage of crossbred dairy cows, lack of capital by dairy producers, inadequate animal feed resources both in terms of quality and quantity, unimproved animal husbandry systems, inefficient and inadequate milk processing materials and methods, low milk production and supply to milk processing centres and poor marketing and market information systems.

Generally, a substantial amount of the country's meat and milk production is used for household subsistence consumption. Livestock especially cattle are utilized only to support farming as a source of animal power (traction) in the highlands. Though, the country's considerable potential of the livestock sector is reported to be untapped, according to the Ethiopian Revenue and Customs Authority report of 2009/2010, livestock and livestock products such as: live animals, skins and hides, meat and meat products, leather and leather products etc. were Ethiopia's fifth most important export commodities next to coffee, oil seeds, gold and chat (*Catha edulis*) (Access Capital Research, 2010). In the report, livestock and livestock products contributed to about 9.1 percent of the country's total export earnings with a value of about 182 million US Dollars.

The large livestock population, the favourable climate for improved, high yielding animal breeds and the relatively disease-free environment for livestock make Ethiopia to have a significant potential for dairy development. Considering the important prospective for smallholder income generation and employment opportunities from the high value dairy products, the development of the dairy sector can contribute immensely to poverty alleviation and improved nutrition in the country. With the present trend characterized by transition towards a market-oriented economy, the dairy sector appears to be moving towards a takeoff stage. Liberalized markets, involvement of the private sector and promotion of smallholder dairy are the main features of this stage (Ahmed *et al.*, 2004).

Putting in place a functional quality control system is an important tool to bring about improvement in the dairy sector. However, the country has no properly operational formal marketing and grading system that is geared towards matching the quality of milk and milk products to market prices. Identification of formal markets that demand standard and high quality products will help to determine market prices based on the quality and thereby enhance commercialization of the smallholder dairy sector. The approach provides an incentive for farmers to produce milk and milk products of good quality from the nutritional as well as the consumers' health perspective. This approach of availing a formal market with a price related grading system for milk has been demonstrated to be successful in many countries.

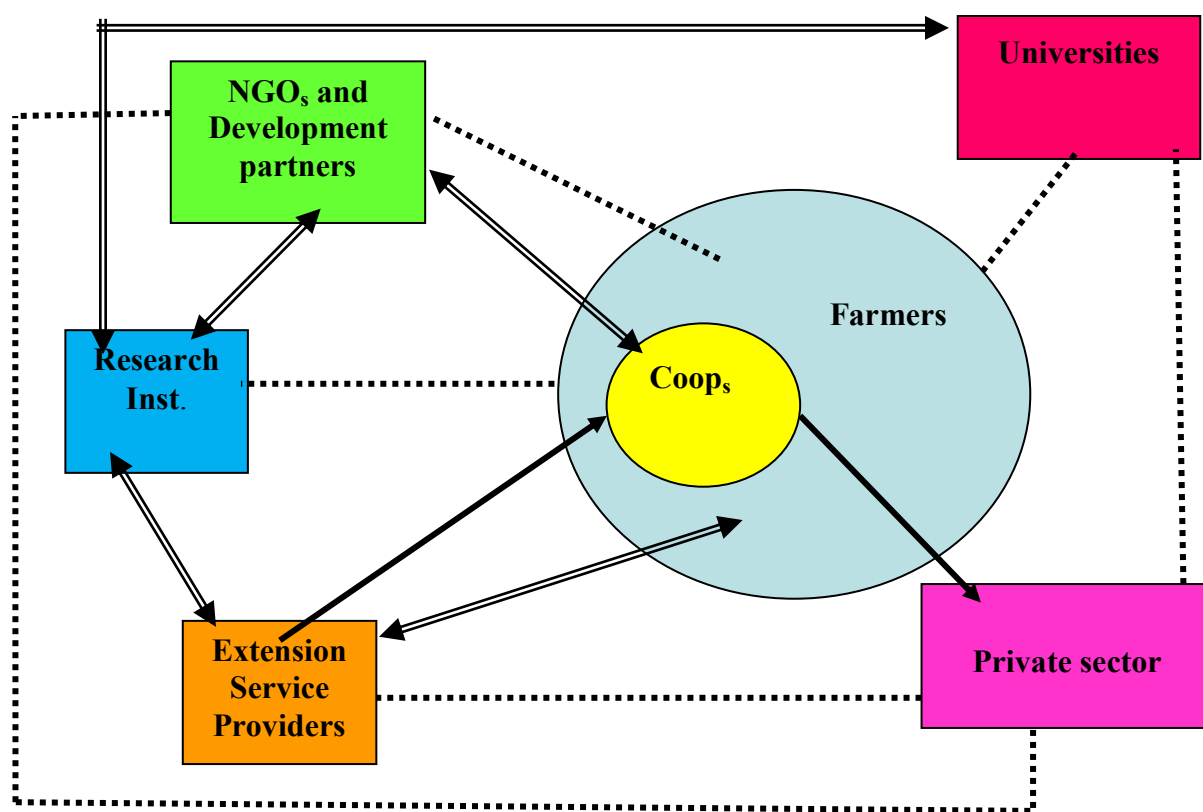
The document provides an overview of the development of the Ethiopian dairy sector that is largely based on review of available reports supported by supplementary data collected from concerned actors at federal and regional levels.

CHAPTER 2

2.0 Industry Players

There are various players (from individuals to institutions) in the dairy sector that play sundry roles at different levels. These include: farm input suppliers, producers of different scales, cooperatives and unions, extension service providers, traders, processors, distributors, industry facilitators, development partners and consumers as end users. Earlier studies (Lemma *et al.*, 2008; Yilma *et al.*, 2011), reported that weak linkages among the different actors in the dairy value chain (Figure 1) are some of the important factors that contribute to the poor development of Ethiopia's dairy sector. The list of major key past, recently completed, current and upcoming interventions in the Ethiopian dairy development is presented in Annex 1 Table 1.

Figure 1: Linkages among the various actors in the Ethiopian dairy value chain



.....	No or very weak linkage
↔	Two way and fair linkage
→	One way and moderate to weak linkage

Source: Yilma et al. (2011)

2.1. Smallholder Dairy Producers

Smallholder dairy producers dominate the dairy industry at the production and are the users of the extension services provided by various development partners. Different players are linked and interact with smallholder dairy producers at various levels based on the type of ongoing joint venture activities. The actors are: extension agents, various non-governmental and international development partners mainly Food and Agricultural Organization (FAO), Netherlands Development Organization (SNV), Land O'Lakes, Self Help, Hunde (in the central highlands), cooperatives and research and higher education institutions (Yilma *et al.*, 2011).

Smallholder producers, however, lack the required technological, organizational as well as institutional capacities. Lemma *et al.*, (2008) reported them to be less organized and distant from market outlets, lack economies of scale and institutions for risk management and face higher transaction costs. Urban and peri-urban smallholder producers are the main suppliers of raw milk to milk processors of different scales. One of the major commercial processors (Sebeta Agro Industry) has its own dairy farm but depends on outside sources for 99 percent of its raw milk intake (Haile, 2009).

2.2. Dairy Cooperatives and Unions

Cooperatives play a significant role in ensuring sustainable supply of raw milk to the dairy industry by coordinating the flow of milk from their members and assisting them by supplying the required dairy farm inputs. Emanu (2009) reported that there are 180 cooperatives engaged in milk production and marketing operating in different parts of the country. However, this number makes only 0.74 percent of the total number of agricultural and non-agricultural cooperatives (24 167) and 2 percent of agri-based cooperatives (8 985) in the country. According to the same author, there are a total of four (two each in Amhara and Oromia Regions) milk production and marketing cooperative unions that are formed by cooperatives for better marketing capability and bargaining power. Ada'a Dairy Cooperative is the most successful, while Selale and Asella Dairy Cooperative Unions are currently performing fairly well.

2.3. The Ministry of Agriculture

Dairy development in the country is undertaken by the Government represented by the Ministry of Agriculture (MoA). MoA is the government's main arm for agricultural policy formulation and technical supervision including designing strategies, preparation of programs, capacity-building, providing trainings and coordinating national agricultural development projects. The principal function of MoA is to provide technical backstopping and budgets to regional agricultural development bureaus and direct farmers support through extension services. In the livestock sector, MoA retains control of federal responsibilities in animal

disease-monitoring, vaccination campaigns and artificial insemination (AI) programs (GRM International BV, 2007).

MoA's main objective is to improve the livelihood and income of producers by increasing livestock productivity and profitability. This is done through the provision of extension services to smallholder dairy producers on different improved livestock technologies, building of technical capacity of producers, promotion of collective action (formation of cooperatives and unions), and facilitation of linkages with other national, regional and international organizations engaged in dairy research and development for further innovations. Dairy cooperatives and unions provide a regular market outlet to member and non-member smallholder producers that produce small amounts of milk daily.

2.4. Local and International Development Partners

Different national and international development partners have been involved in the development of the country's dairy sector by providing material and technical support to smallholder producers, dairy cooperatives and unions and the private sector. The major development partners currently involved in dairy development at different levels and in different dairy potential areas of the country include: SNV, Land O'Lakes, FAO, Heifers International Organization and Non-Governmental Organizations (NGOs) such as Self Help and Hunde that operate in the central highlands.

Land O'Lakes provides technical assistance to dairy farmers, producer groups and cooperatives, input suppliers and processors. The objective of this assistance is to have a competitive Ethiopian dairy industry built upon private investment that creates employment and generates income for smallholder families and provides quality products to local consumers. The key components of the technical assistance include: milk shed development, stimulation of business development, strengthening of market linkages among stakeholders and advancement of dairy industry organization.

SNV through its 'Support to Business Organizations and their Access to Markets (BOAM) program, supports the development of value chains by establishing market linkages, bringing value chain actors together, developing agro-processing activities and linking the private sector to public sector initiatives. It can also where possible work with the Dutch business community, from local producer organizations and processing companies to multinational partners. The overall aim is to increase the access of Ethiopian companies to markets. The three strategic intervention areas of the dairy industry include: milk collection centres and linkage to farmers milk packaging and quality management. Reports of research results on various aspects of the dairy sector conducted by SNV are available at <http://www.sustainable-ethiopia.com/>.

FAO is involved in dairy development activities with the major objective of raising the subsistent type of smallholder dairy production to commercial level through its 'Crop

Diversification and Marketing Development' Project. The principal activities include: distribution of crossbreed heifers to increase milk production (thereby increasing the amount of milk delivered to milk collection, processing and marketing cooperative centres), establishment of new cooperatives and upgrading the existing ones, improvement of the marketing channel through improving quality of products, the marketing system and identifying linkages between producers and consumers. FAO is also engaged in need assessment studies for future improvement interventions in areas such as actor linkages in dairy innovation system, climate change and livestock production and trade.

2.5. The Private Sector

The private sector constitutes an important part of the dairy sector. It is engaged in providing farm inputs (feed and veterinary drugs), animal health care and milk processing and storage equipment and serves as an important market outlet for milk and milk products. Commercial processors are those adopting modern technology with the majority of their output being pasteurized milk in packs of 500 ml. Currently, there are over 22 medium- and large-scale dairy processing companies in Ethiopia with nine of them operating in Addis Ababa and the rest in other major regional cities (Table 1).

Table 1: Major private dairy enterprises operating in different parts of Ethiopia

Ser. No.	Dairy enterprise	Location	Year of establishment	Daily processing capacity, (litres)	Attained average capacity, (litres)
1	Sebeta Agro Industry (Mama Dairy)	Sebeta	1998	35 000	30 000
2	Lame Dairy Processing (former DDE)	Addis Ababa	2008	60 000	30 000
3	Dire Dawa Dairy Processing Enterprise	Dire Dawa	1972	20 000	20 000
4	MB PLC (Family Milk)	Addis Ababa	2003	15 000	7 000
5	Yadeni Dairy Farm (Bora Milk)	Addis Ababa	2008	15 000	7 000
6	Ada'a Dairy Cooperative	Debre Zeit	1998	15 000	3 000
7	Lema Dairy	Debre Zeit	2004	10 000	3 000
8	Berta and Family plc	Addis Ababa	2000	9 000	6 000
9	Genesis Farm	Debre Zeit	2001	4 000	4 000
10	Holland Dairy	Debre Zeit		4 000	4 000
11	Almi Tiku Wetet (Almi Fresh Milk)	Hawassa		4 000	3 000
12	Ruth and Hirut Dairy Farm	Addis Ababa	2008	4 000	1 500
13	Abay fana Awash Agro-Industry	Adama		3 500	2 000
14	Chuye Milk and Milk Products Processing	Addis baba		3 000	1 000
15	Fantu and Family Dairy Farm	Addis Ababa		2 500	2 000
16	Zemen Milk	Mekelle		2 000	150
17	Penguin International Business plc (cheese world)	Addis Ababa		1 800	600
18	Life Milk Processing Enterprise	Sululta		1 500	1 500
19	Semit Agro Industry/Enat Milk	Mojjo			
20	Beral Milk	Addis Ababa	1991		
21	Harmonius Agro Industry	Adama			
22	Jantekel Dairy Union (Facil Milk)	Gonder		1 200	300

Source: (Current study survey result; Land O'Lakes, 2011)

2.6. Research Institutions

Dairy development research endeavours have been oriented towards genetics, husbandry, feed-resource management, animal nutrition, physiology, animal health, dairy processing technology, social economics and technology transfer. Research work has been undertaken on-station and whenever necessary followed by on-farm verifications. The Holetta Agricultural Research Centre (HARC) of the Ethiopian Institute of Agricultural Research (EIAR) serves as a centre of excellence for dairy research. The centre coordinates all dairy improvement research activities in the federal system as well as in different regional states including joint venture research activities with agricultural universities and colleges. Both federal and regional research institutions adopt and generate appropriate technologies for dairy development and are also involved in capacity building by organizing and providing trainings. They verify and demonstrate promising technologies on farms with the participation of smallholder farmers.

2.7. Higher Learning Institutions

Higher learning institutions are involved in providing long term trainings on a regular basis to high level agricultural professionals and short term trainings on request. Universities that provide long term trainings on dairy related fields include: Haramaya University, Hawassa University, Bahir Dar University, Jimma University, the Veterinary Faculty of Addis Ababa University, and the Asella Model Agricultural Enterprise (AMAE) of Adama University.

There are also 25 Agricultural Technical Educational and Vocational Training (ATEVT) Schools operating in different parts of the country that accept students who have completed tenth grade and provide them a three-year diploma program in one of five disciplines: Animal Science, Animal Health, Agricultural Cooperatives Development, Natural Resources, and Plant Science. All ATEVT schools offer Animal Science, Natural Resources and Plant Science, while a few others offer Animal Health and Agricultural Cooperatives. The ATEVT curriculum was first introduced in September 2000 by the Ministry of Agriculture and Rural Development, (MOARD) in 28 ATEVTs located across the country. In 2001, the number was reduced to 25. The 25 ATEVTs graduated the first Development Agents (DAs) in 2004. By 2008, the colleges had produced nearly 60 000 DAs (12% of them women). ATEVTs seek to produce mid-level skilled and competent agricultural DAs who will then teach farmers at Farmers Training Centres (FTCs). There are two categories of ATEVT colleges: federal and regional colleges. There are seven federal colleges (four in the large regions and three in the emerging regions) that report to and are managed by the MoA. The rest (regional colleges) are managed by the regional Bureaus of Agriculture (BoA) or the Ministry of Education through the Technical, Educational and Vocational Training (TEVT) Commission or Agency (Davis *et al.*, 2010).

2.8. Other Important Players

There are also a number of other important players that contribute to the development of the dairy sector. The National Artificial Insemination Centre (NAIC) imports semen of pure exotic breeds, produces semen from selected crossbreed bulls from its Holetta Bull Dam Farm and liquid nitrogen. NAIC distributes semen to nine sub centres (Liquid Nitrogen Plants) located in five regions, namely: Oromia (Nekemt and Asella), SNNP (Wolayta and Wolkite), Amhara (Bahir Dar and Dessie), Tigray (two sub centers in Mekelle) and Harar. NAIC also provides training on AI service provision to AI technicians as trainees and trainers. The major functions of the sub centres include: supplying AI inputs (semen, liquid nitrogen and AI equipments), providing and coordinating AI services in the respective regions. Established in 2008 at Debre Zeit, the 'Ethiopian Meat and Dairy Technology Institute' (EMDTI) provides tailor-made trainings on different aspects of dairy development. Banks and microfinance institutions are also playing an important role in the dairy development of the country. Colleges, universities, hospitals, cafes and restaurants of big enterprises can be categorized as institutional buyers of milk with most of them sourcing from collectors (Haile, 2009).

CHAPTER 3

3.0 Policy and Regulatory Environment

The policy and regulatory environment that influenced the country's dairy sector can be categorized into three distinct periods:

- **1960 - 1974** - a free market economic system and the emergence of modern commercial dairying;
- **1974 - 1991** - the socialist (Derg) regime that emphasized a centralized economic system and state farms and
- **1991 to present** - the current phase of free market and market liberalization.

The following distinct policies and regulatory environments influenced the Ethiopian dairy sector: land tenure, macroeconomic and orientation of development endeavours. The overall objective of the various policies and regulations of these successive periods that correspond to three successive political regimes have been to improve commercial dairy production in dairy potential areas of the country, through the introduction of exotic and crossbreed dairy cattle, AI technology, feed and husbandry technologies and development of a milk processing industry to supply the consumers of Addis Ababa. The policy instruments and operational procedures employed to achieve these goals varied over time based on the politico-economic philosophy of the respective political regimes (SNV, 2008). The major features of the three distinct periods are briefly presented below.

1960 – 1974:

Felleke (2003) stated that the first attempt to introduce modern dairy production in Ethiopia was made in 1947 where 300 Friesian and Brown Swiss dairy cattle were donated by the United Nations Relief and Rehabilitation Administration (UNRRA). Since then, there were a number of initiatives to develop the country's dairy sector. The major ones were: establishment of a milk processing plant at Sholla, Addis Ababa (Zegeye, 2000), introduction of exotic dairy cattle breeds by missionaries and foreign individuals and organizations, expansion of the capacity of the Sholla plant to 10,000 liters then to 30,000 liters per day, opening of milk purchasing and collection centers in Addis Ababa and up to a radius of 70 km around Addis Ababa along the main roads, limited extension service, and incentives to well off producers with the support from United Nations International Children Education Fund (UNICEF) (Staal, 1995). In 1971, the Dairy Development Agency (DDA) was established to provide guidance and assistance such as provision of extension and credit services to dairy producers to establish commercial dairy farms in areas serving the cities and townships, and improve the quality and increase the quantity of milk and milk products (Ketema, 2000; Zegeye, 2000). With the encouragement of DDA, cooperatives came into existence to undertake commercial agricultural production. Major attempts to improve smallholder dairy production were made by: Swedish International Development Agency (SIDA) supported Chilalo Agricultural Development Unit (CADU) initiated in 1967 and the Wolaita Agricultural Development Unit (WADU) funded by the International Development Association (IDA). Major achievements of these units consisted of: one cow unit dairy

development package, production of frozen cattle semen and crossbreed dairy heifers, introduction of small-scale milk processing units, introduction of AI and bull station services, popularization of improved forage cultivation and establishment of a farm with 290 dairy cattle at Wolaita Soddo currently managed by Southern Agricultural Research Institute (SARI).

1974 - 1991:

After the imperial period came the socialist regime in 1974, during which some important policies were pursued under a centralized economic system that directly or indirectly influenced the country's dairy sector. These were:

- Nationalization of land and distribution to peasants through Peasant Associations (PAs) without the right to rent, mortgage or sell. Some large farms were converted into state farms and new ones established. Land allocated to an individual could be taken over by the PAs in order to reallocate it to other families.
- Promotion of the formation of producers and service cooperatives (Staal, 1995).
- Establishment of the Dairy Development Enterprise (DDE).
- Increasing the processing capacity of the Sholla plant to 60,000 litres per day with support from the Government of Finland and the United Nations Capital Development Fund, introduction of butter oil recombination capacity, establishment of 30 collection kiosks and 16 chilling centres, and expansion of milk collection routes to 150 km around Addis Ababa.
- Fixing overvalued foreign exchange rate policy that led exports to become expensive and imports cheaper (Ketema, 2000).

As reported by Haile (2009), cooperatives suffered a loss of credibility by members and the public as they were manipulated into government and political tools rather than instruments for socio-economic development. Members who were forced to form or join the cooperatives became dissatisfied because of the lack of tangible benefits and loss of a sense of ownership with no role to play in their management. This led to the gradual fading away of the cooperatives which became non functional (Ketema, 2000). This situation led to a dramatic increase in the role of the informal market in urban milk supply and demand.

The growing importance of the informal market resulted in a major supply shift from peri-urban landholders to urban backyard producers, who purchased feed from peri-urban areas. Due to the failure of socialized agriculture and following the policy of mixed economy of 1990, producer cooperatives were reorganized by giving them the opportunity to act in a democratic manner and the right to either remain together or not. The result of this was that 95 percent of producer cooperatives disintegrated within three months of the announcement (Lirenso, 1992). Collective property was either divided among members or sold and consequently, a large number of crossbreed dairy cattle came into the hands of small private producers in the urban areas (Nigussie and Lema, 1992).

1991 – to date:

When the Ethiopian People's Revolutionary Democratic Front (EPRDF) came to power in 1991, it made several macroeconomic policy changes. Some of the major policy changes had to do with switching the fixed exchange rate system to a more market determined one. The series of devaluations of the local currency since 1992 is believed to have discouraged imports including dairy products (Haile, 2009). A new land policy was introduced in which land remained a national property but usufruct was made tenable for an indefinite period with the right to transfer to children, while selling and mortgaging remained prohibited but temporary leasing was allowed.

The formulation of the dairy development strategy focused on creating an environment for many smallholder dairy farmers to have access to markets in an attempt to stimulate producers to increase their production to meet market demands and satisfy the market (Redda, 2001). The only official body dealing with dairy policies during this period was The Dairy Development Advisory Board and had the sole task to allocate the funds generated by World Food Program (WFP) from powder milk for dairy development. Financial support used to go primarily towards forage development, expansion of veterinary and AI services, and the supply of feeds and veterinary inputs (Staal, 1995). Following the changes in policy to allow the private sector investment in dairy production, processing and marketing, several small- and medium-scale dairy processing industries were established around Addis Ababa and other urban areas. DDE retained its role as the primary actor in the dairy market.

The entrance of the private dairy processing firms particularly Sebeta Agro-Industry, in the late 1990s offered producers a better milk price as compared to that paid by DDE, thereby stimulating competition and helping the expansion of the formal market (Haile, 2009). Taking advantage of the newly created market opportunities through economic reforms, prominent dairy producers within 100 km radius of Addis Ababa formed the Addis Ababa Dairy Producers Association (AADPA) with the main objective of providing cattle feed (Haile, 2009). By the end of 1992, 90 percent of all urban dairy producers were registered. The rural cooperatives were re-established, paying particular attention to human capital, considering that the role of the government in cooperative affairs was not appreciated by the members. A new proclamation in 1998 further helped to promote cooperatives of a new kind by liberalizing them from direct government control and allowing it to only play an advisory role. Among the development projects, FINNIDA implemented the Smallholder Dairy Development Pilot Project (SDDP) with additional funding from FAO and WFP. SDDP identified marketing as the major constraint for dairy development and so organized small milk processing and marketing units to raise income and the nutritional standard of smallholder farmers through improved dairying. About 30 cooperatives were formed in the peri-urban areas of Addis Ababa. In addition, improvement in veterinary and breeding services, promotion of forage and feed production through the extension services were observed. Macroeconomic policies, changes in cooperative legislation and the openness of the manufacturing sector to private investment all resulted in positive growth in the dairy sector and bolstering in both the peri-urban areas where most development projects were located and

in rural areas where mixed farming was practiced (Haile, 2009). A summary of the status of key dairy related policy issues is given in Annex 1 Table 2.

CHAPTER 4

4.0 Characterization of the Milk Production System

4.1 Population and Distribution

Information on the size of Ethiopian livestock population is available from CSA's annual reports: the Agricultural Sample Survey and Livestock Characteristics (Private Peasant Holdings). Annual CSA surveys cover only two of the five zones in Afar Region and three of the 10 zones in the Somali Region, leaving out pastoral zones that have a substantial number of livestock. The distribution of different milk producing livestock species differs from one region to another. The total cattle population as well as milking cows is highest in the Oromia Region, estimated to be about 22.5 million (44.17 percent) and 4.4 million (45.6 percent), respectively of the total national population, while the lowest figures were found in Harari Region with a total cattle population of 45 400 (0.09 percent) and milking cows of 11 000 (0.11 percent) (Table 2). Three regions (Oromia, Amhara and SNNP) put together, account for 89.94 percent of the total cattle population and 89.55 percent of the total number of milking cows in the country. Although, the number of goats used for milk is highest in the Oromia Region, the Afar Region has the highest proportion (20.92 percent) of the total national goat population (Table 2). The number of camels used for milk production accounts for 27.67 percent of the total camel population and are exclusively found in Afar, Somalia and Oromia Regions and the Dire Dawa special administration (CSA, 2010a).

Table 2: Number of milk animals by region ('000) (2009/10)

Region	Total cattle, '000	Milking cows, '000	% of Milking cows	Total goats, '000	Milking goats, '000	% milking goats, '000	Total camel, '000	Milking camels, '000	% milking camels, '000
Tigray	3 243	593	18.3	2 621	5	0.19	32.3	-	-
Afar	500	128	25.6	961	201	20.92	218	73	33.49
Amhara	12 747	2 151	16.9	4 878	6	0.12	34.6	-	-
Oromia	22 475	4 395	19.6	7 346	319	4.34	257.3	100	38.87
Somali	591	139	23.5	1 509	73	4.84	254.8	65	25.51
Benishangul-Gumuz	422	86	20.4	336	-	-	-	-	-
SNNP	10 543	2076	19.7	4 057	52	1.28	-	-	-
Gambela	221	38	17.2	37.8	0.7	1.85	-	-	-
Harari	45.4	11	24.2	41.3	-	-	-	-	-
Dire Dawa	46.7	10.7	22.9	172.9	3	1.74	7.8	1	12.82
Ethiopia	50 884	9628	20.83	21961	660	4.41	808	240	27.67

Source: CSA (2010a)

Cow milk accounted for 95.1 percent of the total milk produced in 2009/10 from milking cows and camels in the country (Table 3). The regional differences in the distribution of the population of milk animals are also reflected in milk production. Accordingly, Oromia, Amhara and SNNP Regions accounted for 88.8 percent of the total annual milk produced from cows at national level (Table 3).

Table 3: Number of dairy animals, daily and total annual milk yield by region (2009/10)

Region	Cows			Camel		
	Number of milking cows '000'	Average daily milk yield, (litres)	Total milk yield, '000' (litres)	Number of milking camels '000'	Average daily milk yield, (litres)	Total milk yield, '000' (litres)
Tigray	592.8	1.29	155 429	-	-	-
Afar	128.0	2.64	79 739	34.0	4.66	49 276
Amhara	2 150.8	2.13	634 109	-	-	-
Oromia	4 395.3	1.50	1 308 958	64.7	-	55 297
Somale	138.6	1.60	41 318	40.4	3.66	44 116
Benishangul-Gumuz	85.5	1.25	24 220	-	-	-
SNNP	2 076.5	1.65	667 562	-	-	-
Gambela	38.4	2.11	21 616	-	-	-
Harari	11.1	2.09	4 622	-	-	-
Dire Dawa	11.1	1.48	2 643	1.1	2.89	949
Ethiopia	9 627.7	1.69	2 940 216	143. 1	5.10	150 315

Source: CSA (2010a)

CSA annual reports on livestock characteristics do not include urban, peri-urban areas and regional capitals. During this study, an attempt was made to collect relevant data from Addis Ababa and regional capitals. Data were collected on the number of milk cows and milk production from Addis Ababa and 9 regional capitals. In these 10 cities, a total of 214 879 milk cows existed in 2010 with the total number of local and crossbreed cows being 104 969 and 24 923, respectively (only data on the total number of cows were available for Hawassa). The total annual milk yield for the 10 cities was estimated to be 45.4 million litres with the contribution of local and crossbreed cows being 67.1 and 32.9 percent, respectively (Table 4).

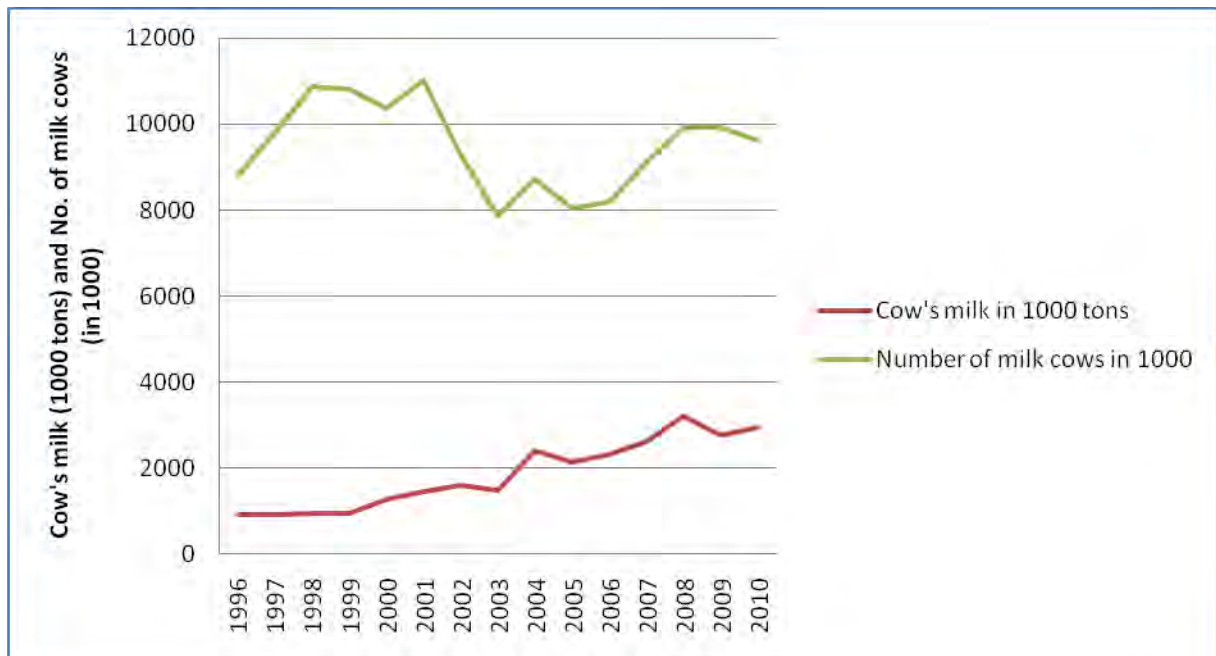
Table 4: Number of dairy animals, daily and total annual milk yield by regional capitals and Addis Ababa (2009/10)

City	Indigenous cows			Crossbred and exotic cows			Total		
	No. of milking cows	DMY/cow (litres)	TMY '000'	No. of cows	DMY/cow (litres)	TMY '000'	No. of cows	DMY/cow (litres)	TMY '000'
Mekelle	2 702	1.5	5 952	5 312	3	1 012	8 014	2.18	6 964
Asaita*	17 846	1.75	7 495	22	2.5	13	17 868	1.75	7 508
Bahir Dar	1 172	1.5	348	803	7.1	2 081	1 975	4.91	2 430
Adama	-	-	-	2 400	19	9 576	2 400	19	9 576
Jijiga	-	-	-	-	-	-	-	-	-
Asosa	7 568	1.76	1 924	-	-	-	7 568	1.76	1 924
Hawassa	-	-	-	-	-	-	84 987	1.52	31 553
Gambella	3 438	2.29	1 559	-	-	-	3 438	2.29	1 559
Harar	11 833	2	4 261	365	7.5	575	12 198	2.16	4 836
Dire Dawa	37 129	2	8 911	730	15	1 643	37 859	2.25	46 770
Addis Ababa	23 281	-	-	15 291	-	-	38 572	2.62	12 175
Total	104 969	1.61	30 450	24 923	9.02	14 900	214 879	4.04	45 350

DMY: Daily Milk Yield, TMY: Total Milk Yield

The number of milk cows at national level varied during the 15 years reference period (1996 to 2010). Generally, this number tended to increase from about 8.8 million in 1996 to 11 million in 2001 and sharply decreased to roughly 7.9 million in 2003 then increased to 9.6 million in 2010. Milk production, however, increased steadily from about 927 million litres in 1996 to 2.9 billion litres in 2010 (31.5 percent increase) (Figure 2). According to FAO (2010), the world milk production increased by 150 million tons per year following the 2002 to 2007 analysis. China, India and Pakistan accounted for about two-third of all the volume growth, while most of the remaining growth was from Brazil, Egypt, New Zealand, Turkey and USA. These eight countries accounted for approximately 85 percent of all milk volume growth from 2002 to 2007. Africa contributed to only 5 percent of the world's milk production and Ethiopia, in spite of its largest cattle population in the continent, is not among the four largest milk producing countries (Egypt, Kenya, South Africa and Sudan) (FAO, 2010). The total annual cow milk production reported for the year 2010 was approximately 2.9 billion litres which is less than each of the International Farm Comparison Network top-21 milk processors (Annex 1 Table 3).

Figure 2: Number of milking cows and cow milk production trend over 15 reference years



Source: CSA (1996 to 2010)

4.2 Milk Production Systems

Reda (2001) classified milk production systems in Ethiopia into urban, peri-urban and rural. Both urban and peri-urban systems are located around Addis Ababa and regional towns and take the advantage of the urban markets. The urban system consisted of 5 167 small, medium and large dairy farms producing about 35 million litres of milk annually. Of the total urban milk production, 73 percent is sold, 10 percent used for household consumption, 9.4 percent goes for feeding calves and 7.6 percent is processed into butter and *Ayib* (a cottage type of soft cheese crumbly in texture common in many parts of Ethiopia). Seventy one percent of the producers sell their milk directly to consumers (Reda, 2001). The peri-urban milk production system includes smallholder and commercial dairy farms in the proximity of Addis Ababa and other regional towns. This sector controls most of the country's improved dairy stock.

The rural dairy production system is part of the subsistence farming system and includes pastoralists, agro-pastoralists and mixed crop/livestock producers mainly in the highlands. The system is not market-oriented and most of the milk produced is retained for home consumption. As reported by CSA (2010b), of the total annual milk production in rural areas, 85 percent is used for household consumption, seven percent is sold, only 0.3 percent is used for wages in kind and the remaining eight percent is used for other purposes such as production of edible and cosmetic butter and *Ayib*. The level of milk surplus is determined by the demand for milk by the household and its neighbours, the

potential to produce milk in terms of the herd size, the production season and access to nearby markets. The surplus is mainly processed using traditional technologies and the processed milk products such as *Ergo*, butter, ghee and *Ayib* are usually marketed through the informal market after the households have satisfied their needs (Redda, 2001).

Based on market orientation, scale and production intensity, three major production systems can be identified: traditional smallholder; privatized state; and urban and peri-urban farms (Gebre Wold *et al.*, 2000).

The traditional smallholder system represents the rural milk production system and accounts for about 97 percent of the total national milk production and 75 percent of the commercialized milk. This sector is largely dependent on the indigenous zebu breeds of low productivity, which produce about 400–680 kg of milk/cow per lactation period. Privatized state dairy farms use grade animals (>87.5 percent exotic blood) and are concentrated within a radius of 100 km from Addis Ababa. The urban and peri-urban milk production system includes small and large private farms located in urban and peri-urban areas concentrated in the central highlands (Felleke and Gedda, 2001). This sector is commercial and mainly based on the use of grade and crossbreed animals that have the potential to produce 1120–2500 litres over 279 days lactation period. This production system is expanding in the highlands among mixed crop/livestock farms, such as those found in Selale and Holetta, and serves as the major milk supplier to the urban market (Gebre Wold *et al.*, 2000).

A study conducted to characterize dairy production systems in the Addis Ababa milk shed by the International Livestock Research Institute (ILRI) has identified seven different categories with more homogeneity within each category (Mekasha, 1999), as follows:

- i. **Traditional crop/livestock farms in rural areas:** These are small farms with four zebu cows providing very little or no specialized inputs and are located between 25 and 130 km from Addis Ababa. The farmers sell fresh milk on a daily basis to the former government owned Dairy Development Enterprise (DDE). Excess milk is sold in local markets in processed form such as butter and *Ayib*.
- ii. **Intensified dairy/crop livestock farms:** These are smallholder farms with land holding about half the size and milk production 15 percent higher compared with the traditional crop/livestock farms with similar cow numbers as in (i). They are located around Addis Ababa. Improved genotypes, artificial insemination, improved forages, concentrate feeding, housing, calf bucket feeding and early weaning are common practices.

- iii. **Crop/livestock farms with intensive cropping:** Located between 25 and 60 km from the capital, these farms are slightly more than 25 percent larger than the traditional crop/livestock farms in (i) and engage in intensive cropping with the frequent use of fertilizers. The owners provide supplementary feeds to their animals and fresh milk is directly sold with occasional processing.
- iv. **Specialized dairy farms:** These farms are located between 15 and 60 km from Addis Ababa occupying an average of about nine hectares and holding some 17 cows. Specialized inputs such as improved genotypes, artificial insemination, forage production, improved housing, concentrate feeding and veterinary care exist. The farmers sell fresh milk to local informal markets and/or to former DDE. Most farm owners have additional off-farm activities often generating more income than from livestock.
- v. **Peri-urban farms in secondary towns:** These farms are located in and around secondary towns within 25 to 50 km from Addis Ababa. Cattle graze on owned or rented land. Special inputs are linked to the type of genotype and involve artificial insemination and supplementary feeds to grazing and stall-fed roughages. These farmers, on average, own five dairy cows. The primary outlet for milk is either former DDE or local informal markets.
- vi. **Intra-urban dairy farms in Addis Ababa:** These are specialized and intensive production units based on zero grazing, purchased hay and concentrates of crossbreed and high grade cows. Annual milk production per cow is high and milk is directly sold to the local market.
- vii. **Urban dairy in secondary towns:** These are specialized dairy farms found in secondary small towns. Grazing is more important than stall feeding. Exotic blood level in the herd is high, but herd size is the smallest of all the types with an average of about two cows per farm. Milk is sold fresh to local markets and former DDE, or processed into butter and *ayib* for sale. Most farm owners have off-farm activities representing about two thirds of their income.

4.3 Dairy Cattle Breeding

An efficient, systematic and operational breeding strategy is necessary to bring about improvement in the dairy sector. Such a strategy needs to take into account selection within the local cows and crossbreeding local cows of good production potential with sires of known exotic dairy breeds. This should be accompanied by a well designed recording system. The breeding strategy should also take into consideration the agro-climatic and production system as well as socio-economic conditions of the country. Felleke *et al.* (2010) reported that the use of selected breeding bulls is not only common in the lowland areas of Ethiopia but is also effective. Bull service was first organized by MoA. It was started by the Extension and Project Implementation Department (EPID) and then has

been continued by the Animal and Fisheries Resource Department. During the bull service period, 75 percent of crossbreed bulls were distributed along with crossbreed heifers. SDDP was also engaged in the bull service through the distribution of breeding bulls to individual farmers and establishment of breeding bull stations. Breeding bulls were sourced from commercial dairy farmers in and around Addis Ababa, Asella Livestock Farm, Wolaita Jersey Bull Ranch and DDE.

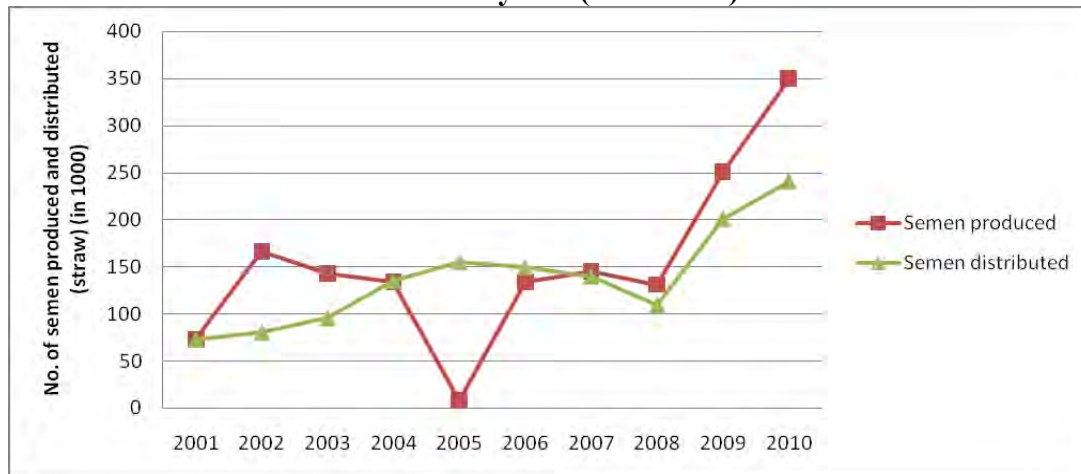
The dairy cattle breed improvement process through AI started as early as in the late 1960s with the establishment of CADU, in Asella with the assistance of SIDA and WADU funded by the International Development Association (IDA). The production of deep-frozen semen started at CADU in 1973, while CADU and WADU continued breeding crossbreed dairy cows using AI services and distributing them to farmers. During the 1970s, the government established crossbreed heifer multiplication ranches. In 1966, research centres such as Holetta, started experiments on the interaction of genetic and environment through breeding programs using sire breeds of exotic origin (Friesian, Jersey, Simmental) on dams of indigenous origin (Horo, Fogera, Boran and Barka) at different ecological zones.

4.3.1. National Artificial Insemination Centre (NAIC)

The National Artificial Insemination Centre (NAIC) was established in 1981 through the Ethio-Finnish cooperation on dairy development, which supported and equipped the NAIC in Kaliti, with the main objective to achieve an efficient and reliable artificial insemination service, and had the mandate to serve nationwide. The liquid nitrogen plant with a well equipped semen processing laboratory was installed in 1984 sourcing frozen semen from 25 Holstein and 10 Brahman bulls donated by the Cuban Government and 44 800 and 2 000 doses of Friesian and Jersey imported semen, respectively (Felleke and Gedda, 2001). Most of the semen (75.3 percent) was produced from Friesian bulls followed by Jersey bulls (10.5 percent). The Holetta bull/dam farm serves as the base for nucleus bull production, testing and rearing.

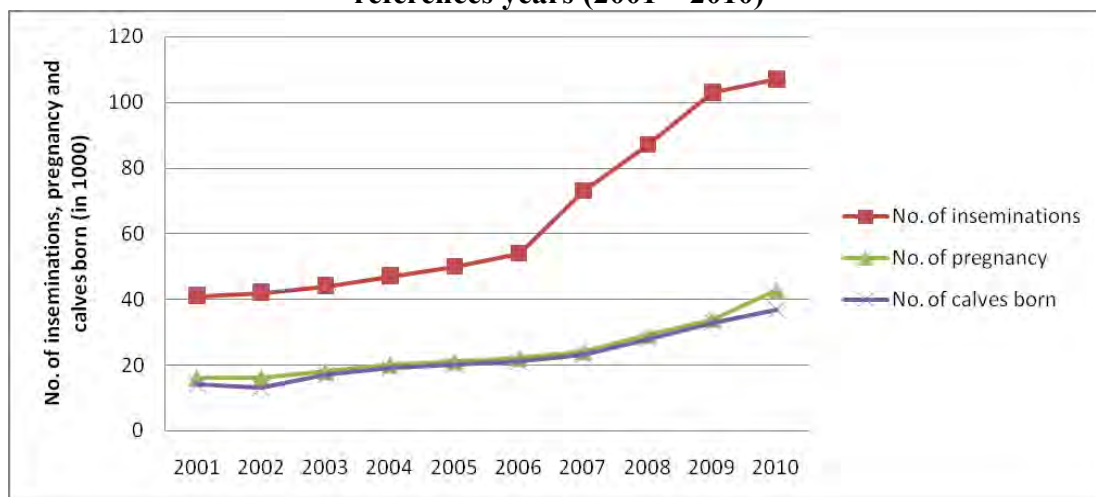
NAIC distributes semen to nine sub-centres: two in Oromia (Nekemt and Asella), two in SNNP (Wolaita and Wolkite), two in Amhara (Bahir Dar and Dessie), two in Tigray (both in Mekelle) and one in Harari (Harar). These places are selected for their strategic locations and all the semen is sent on request to the Regional Agricultural Bureaus, which are responsible for distributing liquid nitrogen and semen to sub-centres in their respective regions. Figures 3 and 4 show the number of semen produced and distributed, the numbers of inseminations, pregnancies and calves born.

Figure 3: Number of semen produced and distributed at national level during ten reference years (2001-2010)



Source: CSA (2001 to 2010)

Figure 4: Number of inseminations, pregnancies and calves born (cattle) for ten references years (2001 – 2010)



Source: CSA (2001-2010)

Information on the number of services per conception (NSPC), non-return rate (NRR) and conception rate (CR) were obtained for four regions (Tigray, Amhara, Oromia and SNNP) for the fiscal year (2008/9). Average NSPC ranged from a minimum of 1.5 in Tigray to the maximum of 3.3 in SNNPR with the overall average being 2.25 (Table 5). Non-return rate and conception rate for the four regions in question averaged 86 and about 42 percent, respectively (Table 5).

Table 5: Regional AI service efficiency (2008/09)

Region	Variable		
	Services Per Conception, NSPC	Non Return Rate, NRR (%)	Conception Rate, CR (%)
Tigray	1.5	89.3	65.6
Amhara	2.5	77	39.4
Oromia	2.8	NA	34.5
SNNP	3.3	91.7	29.5
Average	2.52	86	42.25

NSPC: Total number of inseminations per cows conceived; NRR: Proportion of cows not returned for 2nd insemination from total number of 1st inseminated cows; CR: Proportion of number of pregnant cows from total number of inseminations. Source: NAIC (2011)

According to NAIC (2011), the average on-station NSPC was 1.93 with an average minimum of 1.75 at Holetta Research Centre and 2.23 at Asella farm over a period of four years (2002/3 to 2005/6) (Table 6).

Table 6: Number of Services per Conception on three stations

Station	NSPC				Average
	2002/03	2003/04	2004/05	2005/06	
Holetta Agricultural Research Center	NA	1.5	1.85	1.9	1.75
Asella Farm	2	2.2	2.5	NA	2.23
Holetta Cattle Genetic Improvement Farm	1.7	1.8	2.18	1.83	1.88
Average	1.85	1.83	2.18	1.86	1.93

NA: Not Available, Source: NAIC (2011)

Ketema *et al.* (2010) reported an average NSPC of 1.6 and 71 percent pregnancy rate in the *Arsi* zone. Higher NSPC that varied between 2.1 and 3.0 were also reported (FAO, 2009; NAIC, 2002; Kelay, 2001) (Table 7). Ketema *et al.*, (2010) also reported NRR for first service to be slightly higher than 92 percent, 92 percent for the second service and 100 percent for the third service in the *Arsi* zone. Guaita *et al.*, (1996) and Rycroft and Bean (1992), further showed that NRR may be influenced by many factors such as herd size, skills of the technician, age of the cow, month of insemination, misidentification of the cow at subsequent service and inaccurate heat detection and recording.

Table 7: Comparison of Number of Services per Conception reported from different sources

Institutions/projects	Year	NSPC	Source
At station level			
Gobe heifer multiplication center	1992-1994	2.68	Kelay, 2001
Holota Agriculture Research Center	2002-2006	1.6	NAIC, 2002
Asella Model Agricultural Enterprise Farm	2001-2004	2.5	NAIC, 2002
Holota Bull Dam Farm	2001-2005	1.9	NAIC, 2002
At field level			
FINIDA	1984-1994	1.5	Kelay, 2002
CDMDP districts	2005-2009	2.1	FAO, 2009
National average at field level	-	2.5-3.0	NAIC, 2002

CDMDP: Crop Diversification and Marketing Development Project of FAO in the Arsi zone

4.3.2. Addis Livestock Production and Productivity Improvement Service (ALPPIS)

Recently, the private sector is getting involved in the genetic improvement of dairy cows. The ‘Addis Livestock Production and Productivity Improvement Service’ (ALPPIS) established in April 2009 by a group of experienced professionals in various disciplines of livestock development is one of the initiatives. The main objective of ALPPIS is to contribute to increased income of commercial and smallholder dairy producers by improving the production and reproductive performance of their cattle. In order to bring this into effect, ALPPIS is availing superior genetic materials (both unsexed and female sexed semen) from reputed sources abroad and is providing up-to-date information on proper management of dairy farms. ALPPIS also trains and sensitizes AI technicians and farmers on various aspects of dairy management and AI services; provides advisory and consultancy services to dairy customers that use ALPPIS services; and follows up and evaluates the performance of the semen distributed by ALPPIS. Since ALPPIS became operational, a total of about 7000 doses of semen were distributed to various users that include governmental institutions, non-governmental organizations (NGOs), cooperatives and unions, private dairy producers and AI technicians. According to ALPPIS performance evaluation, the number of services per conception so far averaged to 1.2 (ALPPIS, 2011).

ALPPIS is currently operating in and around Addis Ababa at Debre Zeit, Chanco, Holeta, Sebeta, Sululta and in other dairy potential areas of the country such as: Axum, Bahir Dar, Debre Birhan, Debre Markos, Dire Dawa, Gonder, Harar, Jimma and Mekelle. Since 2010, NAIC and prominent universities and research centres are also sourcing semen from ALPPIS.

4.4 Genetic Diversity of the Dairy Herd

Cattle in Ethiopia are kept for multiple purposes based on the production system, the production objective and scale and market orientation. In the traditional dairy production system cattle provide draft power, milk, meat, manure, hides and have different other socio-cultural values. The very few large scale dairy farms that are located around Addis Ababa and other regional major cities and a few urban and per-urban dairy farms are specialized in milk production and keep crossbreeds and pure exotic breeds (especially Holstein-Friesian).

A total of 32 cattle breeds are reported to be found in the country. The Ethiopian Institute of Biodiversity Conservation (EIBC) reported 27 cattle breeds, while Domestic Animal Diversity Information System (DADIS) managed by FAO reported 31 and Domestic Animal Genetic Resource Information System (DAGRIS) managed by ILRI reported 32 (Table 8). Although the exotic breeds like Jersey and crossbreeds are not reported, pure Jersey cows are found in Wolaiya zone managed by SARI and Ada Berga Research Station of the Holetta Agricultural Research Centre.

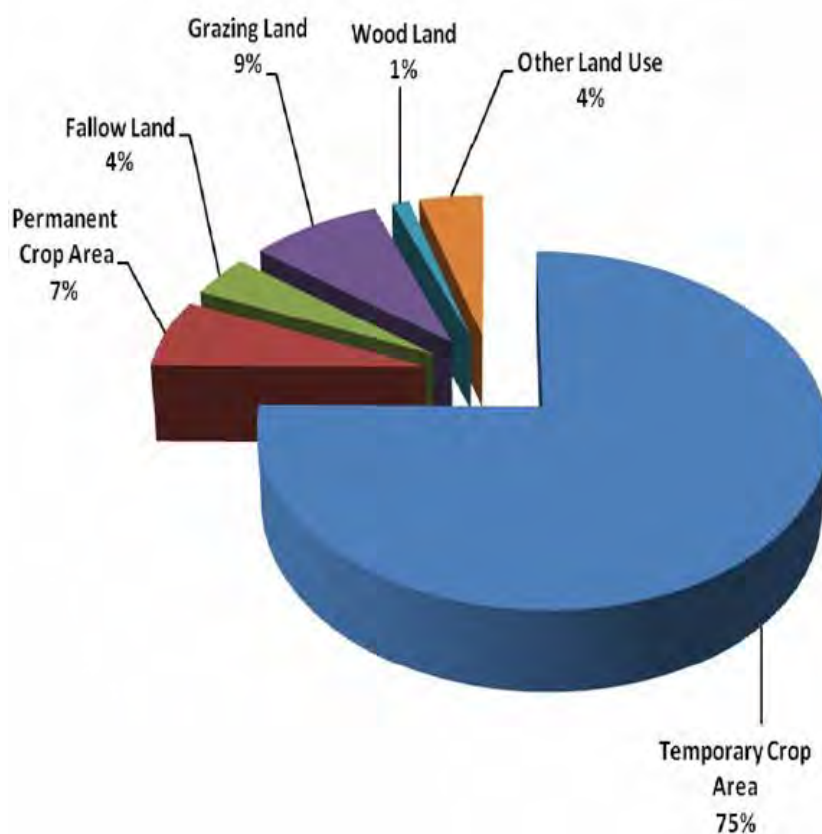
Table 8: Cattle breeds in Ethiopia from three different sources

Ser. No.	Cattle breed/strain names		
	DADIS	DAGRIS	EIBC
1	<u>Abergelle</u>	<u>Adwa</u>	Adwa
2	<u>Abigar</u>	<u>Aliab Dinka</u>	Ambo
3	<u>Abyssinian Highland Zebu</u>	<u>Ambo</u>	Arado
4	<u>Abyssinian Shorthorned Zebu</u>	<u>Anuak</u>	Arsi
5	<u>Adwa</u>	<u>Arado</u>	Bale
6	<u>Ambo</u>	<u>Arsi</u>	Barka
7	<u>Arado</u>	<u>Bale</u>	Danakil
8	<u>Arsi</u>	<u>Barka</u>	Dembia
9	<u>Bambawa</u>	<u>Danakil</u>	Boran
10	<u>Begayit</u>	<u>Dembia</u>	Fogera
11	<u>Boran</u>	<u>Ethiopian Boran</u>	Goffa
12	<u>Danakil</u>	<u>Fogera</u>	Guraghe
13	<u>Ethiopian Boran</u>	<u>Goffa</u>	Hammer
14	<u>Fogera</u>	<u>Guraghe</u>	Harar
15	<u>Goffa</u>	<u>Hammer</u>	Horro
16	<u>Gurage</u>	<u>Harar</u>	Jem-Jem
17	<u>Hammer</u>	<u>Horro</u>	Jijiga
18	<u>Harar</u>	<u>Jem-Jem</u>	Mahbere-Slassie
19	<u>Holstein-Friesian</u>	<u>Jijiga</u>	Mursi
20	<u>Horro</u>	<u>Kuri</u>	Ogaden Zebu
21	<u>Jem-Jem Zebu</u>	<u>Mahbere-Slassie</u>	Qocherie
22	<u>Jiddu</u>	<u>Murle</u>	Raya-Azebo
23	<u>Jijiga Zebu</u>	<u>Mursi</u>	Semien
24	<u>Medenece</u>	<u>Ogaden Zebu</u>	Sheko
25	<u>Mursi</u>	<u>Qocherie</u>	Smada
26	<u>Nuer</u>	<u>Raya-Azebo</u>	Nuer
27	<u>Raya-Azebo</u>	<u>Red Fulani</u>	Jidu
28	<u>Red Bororo</u>	<u>Semien</u>	
29	<u>Sheko</u>	<u>Sheko</u>	
30	<u>Smada</u>	<u>Smada</u>	
31	<u>Tigrey</u>	<u>Somali Boran</u>	
32		<u>Wegera</u>	
Total no.	31	32	27

4.5 Dairy Cattle Feeding

Livestock feeding mainly depends on grazing and browsing. In the highlands, grazing on communal lands is the common practice. This feeding method is supplemented with natural grass hay, crop residues such as straws and chaffs of cereals and pulps, and agro-industrial by-products mostly from the flour/oil industries and brewery residues. Dairy producers who keep improved dairy cows also cultivate improved forage crops such as elephant grass, oats, vetch and alfalfa to supplement grazing (CSA, 2010a). According to CSA (2010c), the total agricultural land is reported to be about 16 million hectares occupied by 12.9 million households accounting for an average of 1.23 ha per household. From the same source, out of the total agricultural land, 75 percent is used for temporary crops and seven percent for permanent crops, while grazing land accounts for nine percent, fallow land four percent, wood land one percent and the remaining four percent is used for other purposes such as land occupied by the holders' houses and/or buildings, gardens, barns, wells, ponds, etc (Figure 5).

Figure 5: Land use by type at country level



Source: CSA (2010c)

Felleke (2001) stated that 73 percent of the feed is provided from natural grazing, 14 percent from crop residues, only 0.2 percent from improved forages and the remaining 12.08 percent from other feed sources. There is a seven percent deficit in the amount of dry-matter required by the livestock. The feed supply is greatly influenced by the poor soil fertility and markedly reduced seasonal rainfall, leading to fluctuations both in terms of quantity and quality. Periodic shortfalls in feed availability, especially during the dry season, are the major constraints to livestock productivity. Even though the animals may have relatively abundant and good quality forage during the rainy season (three–five months), this situation can rapidly reverse itself in the dry season. In many parts of the highlands, feed deficits start in December–January, when the natural pastures are at their lowest quantity with respect to dry matter, nutrients, digestibility and the supply of stored crop residues is beginning to diminish. There is usually a gap of four to five months of dry season before the start of the short rains. The gap in the availability of forage between the short and long rains is not as serious as the one between the long and short rains. The second dry season, which lasts for about 150 days between October and March is therefore the critical period in a feeding system that is largely based on natural grazing pasture.

Crop residues may be the only source of feed for dairy cows over a period of one to two months (at the end of the long rains after harvests) when the natural pasture is drastically reduced. The most commonly used crop residues are: *teff*, beans and wheat straws. In a study of feed resources and nutritional management of dairy herds in urban and peri-urban dairy production systems, Mekasha (1999) reported that roadside grazing is practiced by 6.7 percent of the intra-urban dairies, while grazing pasture land is practiced by 33 percent of the large peri-urban dairy farmers. Hay is utilized by all production systems, with the exception of 40 percent of the secondary town dairy farms. There are a number of feed mills (mostly around Addis Ababa and also in different regions of the country) that are engaged in preparing and supplying balanced dairy cattle concentrate feeds. However, they are not affordable by most small-scale rural and peri-urban dairy farmers. As reported by SNV (2006), the concentrate feeds are mainly used by urban dairies. Among the non-conventional feeds, *Atella* (a traditional home brewery residue) and pulp hulls are utilized by 80 and 47 percent of the farmers, respectively. *Atella* has high crude protein (20 percent) and organic matter (97 percent) content (Mekasha, 1999).

Water constitutes about 50 to 80 percent of an animal's live weight and is an essential nutrient. Whereas an animal may lose almost all of its fat and 50 percent of its body protein and survives, the loss of 10 percent of its body water can be fatal. A 'good' supply of water (both quantity and quality) is therefore required for an animal to maximize feed intake and production. Free water intake satisfies 80 to 90 percent of a dairy cow's total

water needs. The amount of water a cow drinks depends on her size, milk yield, the quantity of dry matter consumed, temperature and relative humidity of the environment, temperature of the water, quality and availability of the water and amount of moisture in her feed (Looper and Waldner, 2007). The main sources of drinking water for livestock are rivers and streams. A substantial number of producers also use water tanks to collect and conserve rainwater from iron roofed houses.

In general, the cost of milk and milk products that are found in the market today is a reflection of the high cost of feed supplements used by the majority of dairy farms that are engaged in market-oriented milk production. This is especially true for those farms that maintain crossbreed and grade dairy cattle. The major problem is the availability of high quality forage feeds in dairy farms. Two reasons for this are: a) the introduction, promotion and expansion of improved forage production on these farms is inadequate and slow and b) the land to grow forage crops on many farms is unavailable, especially for the urban dairy producers who do not own land.

Animal feed resource utilization at regional level is summarized in Tables 9 and 10. The majority (about 94 percent) of the peasant agricultural households in Gambella Region depend on green fodder (grazing on natural pasture) for livestock feed source followed by Afar (88.25 percent) and Benshangu-Gumuz (86.63 percent) with values of (38.37 percent) in Tigray and (43.72 percent) in Ahmara Regions (Table 9). The use of crop residues and hay is the least in Gambella Region, while Tigray and Amhara Regions compensate the low proportion of green fodder use by a high proportion of crop residue and hay (Table 9).

Table 9: Proportion of animal feed resource utilization by peasant holders at regional level (2009/10)

Region	Green fodder	Crop residue	Improved feed	Hay	By-products	Others	Total
Tigray	38.37	39.17	0.35	16.86	1.62	3.62	100
Afar	88.25	6.67	0.09	1.63	0.93	2.42	100
Amhara	43.72	36.35	0.31	15.72	0.54	3.35	100
Oromia	66.65	24.80	0.11	3.22	0.91	4.3	100
Somale	80.21	18.44	-	0.53	0.29	0.53	100
Benshangul-Gumuz	86.63	7.56	0.03	1.19	0.24	4.34	100
SNNP	70.54	22.69	0.17	2.00	0.63	3.98	100
Gambella	93.92	4.03	0.28	0.03	0.63	1.12	100
Harari	38.57	47.93	1.68	3.78	6.71	1.33	100
Dire Dawa	71.51	19.73	0.24	1.42	2.94	4.16	100
Ethiopia	59.53	28.27	0.20	7.36	0.79	3.86	100

Source: CSA, (2010)

**Table 10: Animal feed practices of peasant holders – number of reporting
(holders reporting by type of feed and region)**

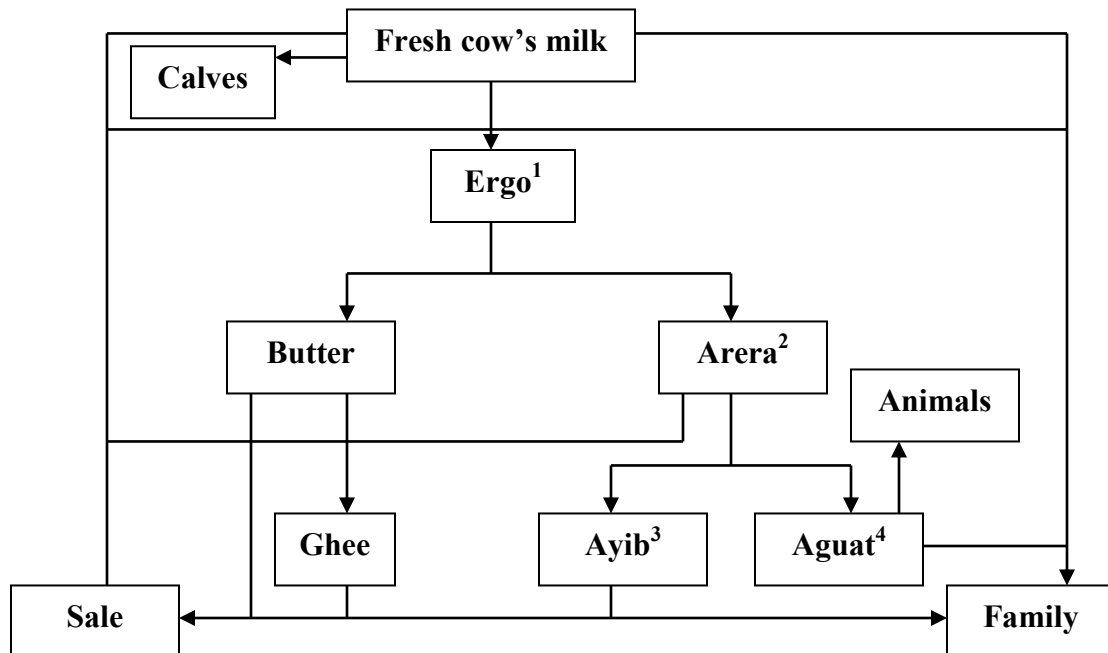
Region	Green fodder	Crop residue	Improved feed	Hay	By-products	Others
Tigray	770 841	742 233	12 133	607 788	110 776	169 386
Afar	47 418	18 374	169	3 156	1 223	4 179
Amhara	3 568 927	3 381 277	64 887	2 299 883	174 263	1 006 510
Oromia	4 887 266	4 045 671	43 515	811 687	425 793	1 384 908
Somale	147 867	91 463	-	5 255	2 302	7 550
Benshangul-Gumuz	119 247	51 183	315	11 603	2 619	27 477
SNNP	2 694 293	2 198 510	39 899	305 631	173 910	938 393
Gambella	20 860	5 044	147	21	1 874	1 549
Harari	15 511	16 765	1398	2 002	4 889	987
Dire Dawa	21 961	18 607	287	1 345	5 407	7 105
Ethiopia	12 294 191	10 569 128	162 750	4 048 369	903 056	3 548 044

Source: CSA., (2010)

4.6 Milk Utilization and Losses at the Farm Level

The importance of milk in the diet of Ethiopians differs according to the farming systems and the socio-cultural setups. In the lowlands, especially where livestock keeping is the main occupation, milk is consumed by all groups of the society. In the highlands, the rural people are sedentary farmers raising both livestock and crops, with their diet consisting mainly of cereals and legumes.

Figure 6: Flow scheme of utilization of milk and milk products in the central highlands of Ethiopia



¹Naturally fermented cow milk, ²Defatted sour milk, ³Ethiopian cottage cheese, ⁴whely

Milk is used for rearing calves and children, while the surplus is processed for *Ergo* and/or butter and *Ayib* (Figure 6). *Arrera* is used for human consumption or for *Ayib-making*. Generally, milk consumption in rural areas can be considered as a function of wealth or availability to a given household, while in urban areas it can be determined by the purchasing power of the household, the level of awareness on its nutritive value and availability.

Milk is consumed in its natural state and/or in the form of fermented (sour) milk and milk products. The milk produced on farms is used for calves, consumed by the family or sold in the local markets. In most households in the central highlands of Ethiopia where there are only local cows, the milk is just enough for the calves and there is very small amount left for family consumption and sale.

In the rural areas, only small volumes of milk are available daily at household level and to allow the milk to ferment requires that the collection should be done over a few days until a sufficient amount is available for further processing. Most people in rural areas have therefore developed a palate for sour milk and its products over generations. The relatively low pH of *Ergo*, ranging from 4.3 to 4.5 retards the growth of undesirable microorganisms, such as pathogens and spoilage bacteria, and enables its further storage (Gonfa *et al.*, 2001).

Three distinct types of butter exist in Ethiopia namely: *Lega* (Figure 7), *Mekakelegna* and *Besal*, which refer to fresh, semi-rancid and rancid, respectively, based on the degree of lypolysis it has undergone due to the age of the product. Butter is cooked at around 100°C until the moisture content is almost completely evaporated as a means to prolong its shelf-life. During the process, spices such as garlic and ginger are added to improve its flavour. The resultant product - *nitir kibie* (melted butter or ghee) can be stored for quite a long time at ambient temperature. Butter has additional functions besides its nutritional value. Women use butter as hair oil, which is assumed to have dual functions for hairdressing and to cure headaches. Ghee is added to a variety of Ethiopian traditional dishes such as: *Kitifo* (minced beef served raw or half cooked) and a variety of cereal, pulse and meat based sauces. Ghee is also consumed with coffee and tea especially when important guests are received in a home and during major holidays.

Figure 7: Fresh butter



Arrera, defatted sour milk, is a by-product of butter processing and a raw material for *Ayib* production. *Arrera* has a similar colour to *Ergo*, but its appearance is slightly smoother and its consistency thinner, although thicker than fresh milk, and has a pleasant smell and taste. *Arrera* is consumed in all parts of the country where fermented milk is produced.

Ayib – Ethiopian cottage cheese (Figure 8), made from *Arrera*, is as important as *kibe* and contributes to the overall nutrition of the people and forms part of the staple diet. *Ayib* is widely consumed as a side dish in its natural form or may be spiced with *kochikocha* (a condiment prepared from *Caps. annum*, salt and other herbs and spices). It particularly accompanies *Doro wot*, spicy chicken sauce, made in most households during major holidays. In some cases, especially during holidays, the traditional ghee (*nitir kibe*) may also be added to *Ayib*.

Figure 8: Fresh Ayib



Aguat (whey) is the liquid that remains after most of the fat and the protein in the milk has been removed during the *Ayib* making process (O'Connor, 1993). There are many uses of whey and its constituents. At farm level whey can be fed to animals or consumed

by humans. Some of the uses of whey include pig and poultry feeds, addition to bread to increase the nutritive value, fermented drinks, manufacture of alcohol and lactose, and producing whey cheese by evaporating the moisture (O'Connor, 1993).

According to CSA (2010b), of the total annual milk production at national level in 2009/10, 84.7 percent was used for household consumption, seven percent sold, 0.3 percent used to pay wages in kind and the remaining eight percent was used for other purposes such as the production of butter and *Ayib* (Ethiopian cottage cheese). The proportion of milk used on one hand for household consumption was highest in the Amhara Region (92.6 percent) followed by Tigray (91.8 percent) and SNNP (88.6 percent) with Harari (47.5 percent). The quantity of milk sold, on the other hand, was highest in Harari (47.2 percent) followed by Dire Dawa (35.7 percent) and Somali (29.7 percent) (Table 11).

Table 11: Utilization of milk at regional level (2009/10)

Region	Utilization (%)				Total
	Household consumption	Sale	Wage in kind	Others	
Tigray	91.8	1.34	0.42	6.43	100
Afar	87.29	4.69	0.3	7.72	100
Amhara	92.62	0.38	0.24	6.76	100
Oromia	86.36	6.31	0.29	7.05	100
Somali	67.79	29.68	0.17	2.36	100
Benshangule-Gumuz	63.89	0.89	0.12	35.1	100
SNNP	88.63	2.29	0.36	8.73	100
Gambella	85.13	11.15	0.44	3.28	100
Harari	47.47	47.21	-	5.32	100
Dire Dawa	63.65	35.65	0.29	0.24	100
Ethiopia	85.23	6.86	0.29	7.62	100

Generally, more milk products especially butter (36.4 percent) and *Ayib* (10.1 percent) were sold as compared to milk (6.9 percent) (Tables 12 and 13).

Table 12: Utilization of butter at regional level (2009/10)

Region	Utilization (%)				Total
	Household consumption	Sale	Wage in kind	Others	
Tigray	91.8	1.34	0.42	6.43	100
Afar	74.35	20.48	0.13	5.04	100
Amhara	59.55	38.85	0.09	1.51	100
Oromia	60.38	36.28	0.11	3.23	100
Somali	64.61	33.39	0.28	1.73	100
Benshangule-Gumuz	51.55	46.16	0.01	2.28	100
SNNP	58.43	38.51	0.42	2.64	100
Gambella	73.1	24.53	0.41	1.96	100
Harari	66.3	-	-	33.7	100
Dire Dawa	95	-	-	5	100
Total	60.77	36.36	0.23	2.64	100

Table 13: Utilization of *Ayib* (Ethiopian cottage cheese) at regional level (2009/10)

Region	Utilization (%)				Total
	Household consumption	Sale	Wage in kind	Others	
Tigray	96.95	0.31	0.38	2.36	100
Afar	88	1.25	-	10.75	100
Amhara	98.22	0.41	0.01	1.36	100
Oromia	87.65	7.58	0.06	4.71	100
Somali	100	-	-	-	100
Benshangule-Gumuz	95.37	11	0.01	3.51	100
SNNP	66.95	31.43	0.34	1.28	100
Gambella	91.68	5.74	0.55	2.03	100
Harari	-	-	-	-	-
Dire Dawa	-	-	-	-	-
Total	87.13	10.07	0.17	2.63	100

About 91 percent of the *Arera* produced at national level was consumed within the household with 4.8 percent being marketed (Table 14).

Table 14: Utilization defatted sour milk (*Arera*) at regional level (2009/10)

Region	Utilization (%)				Total
	Household consumption	Sale	Wage in kind	Others	
Tigray	90.91	-	-	9.09	100
Afar	88.21	0.43	0.34	11.02	100
Amhara	98	0.47	0.05	1.48	100
Oromia	92.49	4.54	0.01	2.96	100
Somali	92.17	7.83	-	-	100
Benshangule-Gumuz	96.64	-	-	3.36	100
SNNP	87.32	7.4	0.53	4.75	100
Gambella	98.44	0.28	1.11	0.17	100
Harari	100	-	-	-	100
Dire Dawa	-	-	-	-	-
Total	90.9	4.81	0.3	3.99	100

Source: CSA (2010)

Due to the highly perishable nature of milk coupled with mishandling practices from production up to the consumption stage, the amount produced is subject to high post harvest losses. Estimated post harvest losses of up to 40 percent of milk and its derivatives have been reported from milking to consumption (Felleke, 2003). Post harvest losses and quality deterioration are mainly attributed to mishandling in the dairy chain from farm to fork. These include:

- contamination during milking and further handling coupled with storage time and temperature before consumption,
- deliberate adulteration of milk,
- substandard handling, transportation and distribution systems,
- inefficient processing technologies,
- inadequate fresh milk outlet and
- spillage losses during milking.

According to FAO (ENA, 2004), the value of annual milk and dairy product losses due mainly to mishandling across five African and the Middle East countries (Kenya, Tanzania, Uganda, Ethiopia and Syria) was over US \$90 million. Reducing such losses and improving quality are effective ways of making more and safer milk available. This helps to improve the welfare of resource-poor dairy producers and low income consumers through increased supply in terms of volume and geographical distribution and marketing of safe and better quality milk and milk products.

4.7 Demand and Preferences for Milk and Milk products

The demand for milk and milk products is a function of several factors that include: population growth, seasonality of demand and supply, low per capita consumption and high transaction costs. The estimated growth rate of human population of three percent is not at par with that of milk production estimated at 2.1 percent. This is explained among other factors, by the population pressure that has led to people cultivating more and more land formerly used for grazing. As a result, the grazing land has been stretched beyond its capacity and consequently led to low productivity of the livestock. During the rainy season when milk production increases following a relatively increased feed availability, milk producers are faced with the problem of acute lack of milk outlets.

Generally, the demand for milk and milk products is higher in urban areas where there is high population pressure. The increasing trend of urbanization and population growth leads to the appearance and expansion of specialized medium-to-large scale dairy enterprises that collect, pasteurize, pack and distribute milk to consumers in different parts of the country.

Christians of the Ethiopian Orthodox Church that represent more than 43 percent of the population, abstain from consuming animal products including milk and milk products for about 250 days a year and the faithful do not eat anything at all until the daily service is finished at around 3:00 p.m. The longest continuous fasting period is just before the Ethiopian Easter that lasts for 55 days. The end of fasting periods and other major holidays are celebrated by consuming *Enjera* (Ethiopian kind of pancake prepared from *Teff – Eragrostis tef*). This is consumed with chicken and/or meat sauces flavoured with ghee and accompanied by *Ayib* and traditional beverages. The demand for animal products in general and that of milk and milk products in particular generally declines during fasting periods among the Orthodox Christians.

O'Connor (1992) reported that *Ergo* is mainly given to male members of the family in the highland areas, while in the lowland pastoral regions fresh milk is preferred. In addition to being served on its own, *Ergo* is consumed either spiced or naturally, as a side dish with different traditional foods, such as *Genfo* (kind of cereal based porridge), *Qinchea* (traditional dish prepared from broken wheat and barley) and *Dabbo* (traditional bread). In most cases, however, *Ergo* is not consumed by family members but reserved for further processing into products such as butter and *Ayib*, which have economic importance. When some respected guests are received in the home, *Ergo* is offered as refreshment either spiced or natural. *Arera* is preferred by women for consumption as a side dish or drink. It makes a wholesome beverage either plain or spiced in the same way as *Ergo*. It is also given to children at the age of weaning and the elderly, but is specially

considered as food for children and women in rural areas. However, when there is an abundant supply of fresh whole milk, this product can be given to calves, lactating cows and dogs (FAO, 1990).

The per capita milk consumption for Ethiopia is about 17kg, which is close to that for Africa of about 25kg, and is much lower than that recommended by World Health Organization (WHO) of 200kg, and 62.5kg by FAO (1990) as the minimum level for a balanced diet. This last figure is still much lower when compared with the world's per capita average of 100kg/year (FAO, 2010). The low demand and low prices and/or the high transaction costs incurred by producers coupled with low prices for their products do not motivate them to generate surpluses (SNV, 2008). Although milk and milk products form part of the diet of many Ethiopians, liquid milk as such, is really not part of their diet. Most people use the bulk of their milk in tea/coffee and for feeding infants or the elderly and/or infirm. They however, regularly consume other dairy products such as butter, *Ayib* and *Ergo*.

Milk production in the country has generally increased over the last 10 years from about 1.5 billion litres in 2001 to about 2.2 billion litres in 2005 and around 2.9 billion litres in 2010. This increasing trend is mostly associated with an increase in the number of cows. However, the per capita milk consumption has declined from 26kg per annum in 1980, to 22kg in 1993, 19kg in 2000 and 16kg in 2009. This is likely to be attributed to the mismatch between the growth rate of milk production and human population.

As is indicated in the Livestock Development Master Plan (GRM International BV, 2007), the high human population growth will drive up demand for quality consumer goods including milk and milk products as incomes improve. The principal demand will continue to be for liquid milk, much of which will be supplied through informal channels. In rural areas, consumption of milk and milk products is heavily influenced by livestock ownership/herding, while in urban areas the principal determinant of the consumption levels is income. Normally, the increase in demand for milk and milk products will be a function of rapidly rising human population, urbanization and increases in per capita income. In Addis Ababa, surveys of the different supermarkets reveal a variety of locally processed as well as imported milk products (fresh milk, pasteurized milk, UHT milk, cream, cheese, butter, butter-cook, butter-table, Gouda cheese, cottage cheese, mozzarella cheese, provolone cheese, cream cheese, fermented milk, and natural and flavoured yoghurt).

There is an attempt made to project the additional milk requirement to supply the growing consumer needs in Ethiopia for the coming 9-10 years. In the projection, the annual growth rate of 2.72 percent of the human population was used in the calculation

based on the report of the 2007 population census figure of 82 101 998 for 2011 (CSA, 2011). To estimate the milk production, cow milk production growth rate of 4.1 percent calculated based on the figures reported by the CSA annual report for the years 2004 to 2010 was used. Milk available for consumption is estimated based on the report of Felleke (2001) who indicated that 68 percent of the total annual milk production was to be consumed. The value recommended by FAO (1990), (62.5 kg/year/person) to be maintained for a balanced diet is considered as a target to be achieved (Table 15).

Table 15: Projected demand for milk in Ethiopia

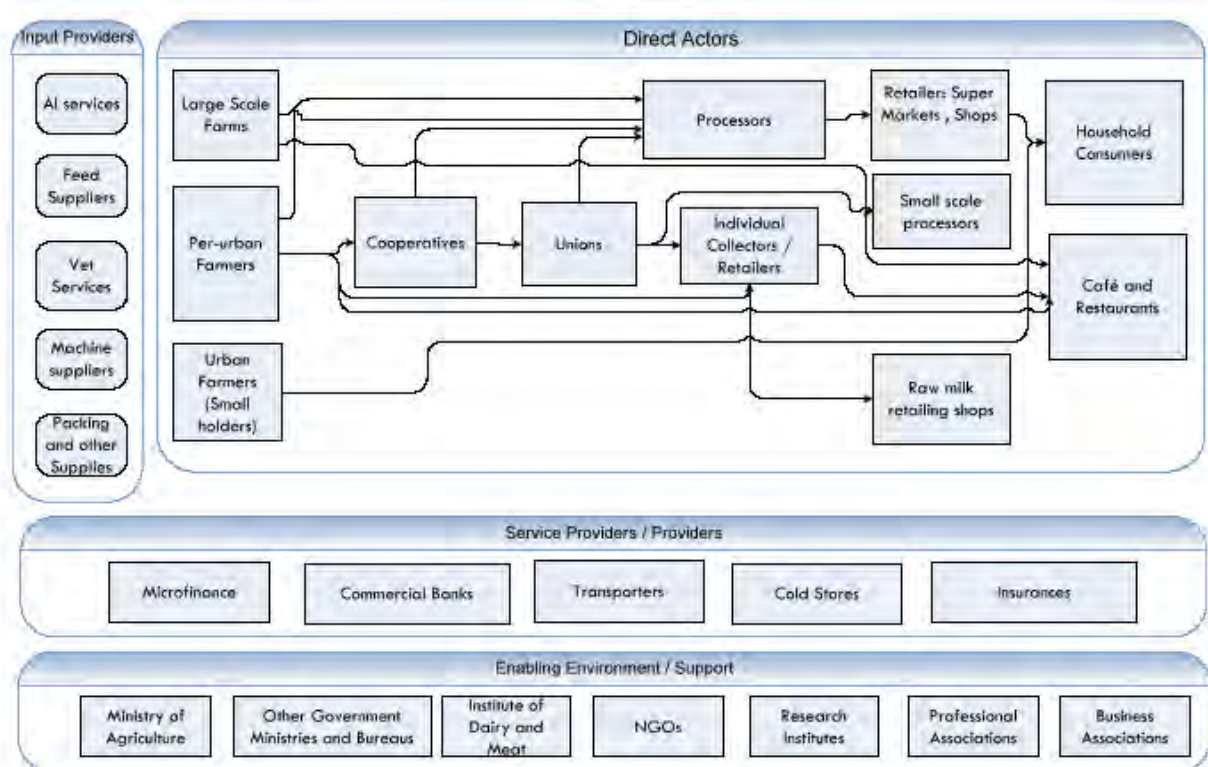
Year	Population in '000' based on current growth rate (2,27%)	Milk production, in million litres based on current growth rate, (4.1%)	Milk available for consumption (68% of the produce) in million litres	Demand for milk, in million litres based on FAO recommendation (62,5kg)	Gap between projected milk available for consumption and demand based on FAO's recommendation in million litres
2011	82 102	3 061	2 081	5 131	3 050
2012	84 335	3 186	2 166	5 271	3 105
2013	86 629	3 317	2 256	5 414	3 158
2014	88 985	3 453	2 348	5 562	3 214
2015	91 406	3 594	2 444	5 713	3 269
2016	93 892	3 742	2 545	5 868	3 323
2017	96 446	3 895	2 649	6 028	3 379
2018	99 069	4 055	2 757	6 192	3 435
2019	101 764	4 221	2 870	6 360	3 490
2020	104 532	4 394	2 988	6 533	3 545

CHAPTER 5

5.0 Analysis of the Dairy Value Chain

Kaplinsky (2000) defined value chain as “the full range of activities, which are required to bring a product or service from conception, through the intermediary phases of design, production, delivery to the final consumers, and final disposal after use. There are a number of elements that need to be considered in the value analysis of a given commodity. The major ones include: actors along the chain and their functions and linkages among themselves, governance mechanisms for the chain and roles of actors e.g. power relations and principal drivers of the chain functions, impact of upgrading products, services and processes within the chain and distribution of benefits among actors within the chain (Kaplinsky, 2000; Kaplinsky and Morris, 2001; Rich *et al.*, 2008). Jabbar (2009) stated that the analysis of a value chain encompasses wider issues than supply chain, which only shows the physical flow of goods or services from production to consumption through intermediate stages of value addition. The dairy industry value chain in Ethiopia is illustrated in Figure 9.

Figure 9: The dairy industry value chain in Ethiopia



Source: Haile, 2009.

5.1 Collection, Bulking and Transportation

Organized milk collection and processing was introduced in the country mainly in Addis Ababa in the 60s. Only one milk processing plant was functional in 1960, while processing and distribution in Addis Ababa was run by a government agency - Sholla Dairy. The agency was renamed DDA and later, DDE, but currently it has been privatized and named Sholla or '*Lame*' (Amharic for 'my cow'). The processing plant was funded by UNRRA. Milk collection points from smallholder producers were opened around Addis Ababa to feed the processing plant. Raw milk collection was further strengthened and expanded to a seven kilometre radius from the city. This arrangement attracted a substantial number of smallholder farmers that produced and delivered small amounts of milk from their indigenous cows.

The dairy plant continued to be the sole formal market that collected, processed and distributed milk and milk products to the Addis Ababa market until the country's political change in 1974. In 1979, DDA became DDE under the Ministry of State Farms. With the political change, the numerous private dairy farms were merged and nationalized and DDE became the only government processing plant that collected all the milk from these farms and its capacity grew to 60 000 litres per day. The raw milk collection was also extended to cover a distance of about 150 km from Addis. However, with the introduction of the privatization policy, DDE as well as all farms managed under DDE were sold out. DDE under the new name of Lame (Sholla), is now a private company, operating with 25 collection centres located around Addis Ababa, 13 of the centres are near Selale, five close to Holetta, and seven around Debre Birhan. At the collection points, milk is subjected to a field acidity (alcohol) test for freshness and a lactometer reading for possible adulteration (addition of water) and removal of cream. The accepted milk is transported to the nearest chilling centre, where it is cooled to temperatures below six degrees Centigrade. Milk is usually delivered to the collection centres and milk cooperatives by producers either on foot or donkey back.

The establishment of village milk marketing groups, small-scale dairy associations and cooperatives in many milk shed areas by government, local and international development partners has contributed positively to promote milk collection.

The formation of milk cooperative groups has created a new outlet for the sale of liquid milk by producers, despite the small number of farmers and quantities of milk produced. Before the formation of the cooperative groups, the households processed almost all the milk produced into butter and *Ayib*, marketing it as home-made dairy products to traders or other households in local markets. In the areas where there are operational milk

cooperatives, milk produced in the morning is sold to the milk units and that obtained in the afternoon is used for home consumption and processing of milk products.

5.2 Informal Milk Trade

Milk and milk products in Ethiopia are channelled to consumers through both formal and informal marketing systems. About 95 percent of the marketed milk at national level is channelled through the informal system. In this marketing system, milk and milk products may pass from producers to consumers directly or through one or more market agents. Producers sell the surplus milk produced to their neighbours and/or in the local markets, either as liquid milk or in the form of butter and/or *Ayib* (O'Connor, 1992). This system is characterized by no license to operate, low cost of operation, high producer prices as compared with formal market and no regulation of operation (SNV, 2008). The hygienic condition of milk and milk products channelled through this system is also poor. This is mainly due to the prevailing situation where producers have limited knowledge of dairy product handling coupled with the inadequacy of dairy infrastructure such as cooling facilities and unavailability of clean water in the production areas.

5.3 Formal Milk Trade

In the formal system, milk is collected at the cooperative or private milk collection centres and transported to processing plants. In this system, milk quality tests (principally acidity using alcohol and clot-on-boiling test, and density) are performed on delivery, thereby assuring the quality of milk. This has encouraged the producers to improve the hygiene conditions, storage and transportation of the milk in order to avoid rejection of the product on delivery to the collection centre. The formal milk market appears to be expanding during the last decade with the private sector leading the dairy processing industry in Addis Ababa and other major regional towns. However, the share of milk sold in the formal market in Ethiopia (two percent) is much less than that sold in neighbouring countries: 15 percent in Kenya and five percent in Uganda (Muriuki and Thorpe, 2001).

Although the price of the different inputs into the dairy production varies and is constantly increasing, milk producers continue to get very low amounts for their products as compared to the cost of production. It is therefore important to put a functional control mechanism in place so that producers can get what they deserve. Most farmers live in remote areas not easily accessible by road to facilitate transportation of agricultural products including milk and milk products to places with storage facilities and selling points. Transportation of fresh milk to any market will take a number of hours to reach the market. The Livestock Development Master Plan Report indicated that only a few

farmers live close to the main road system, which gives them basic access between farm and village and from the village to the market (GRM International BV, 2007).

The relatively high cost of marketing liquid milk and the risk attached to marketing perishable products play a central role in dairy production and marketing. The lack of cooling facilities, inadequate means of transport, and poor communication considerably aggravate the difficulties of collecting and preserving locally produced milk. The action of pooling of milk collection and transportation activities has the potential to mitigate the cost.

5.4. Milk Distribution and Retailing

According to CSA (2010b), only 6.8 percent of the total milk produced is marketed and milk and milk products are distributed both informally and formally. In the informal system, milk is distributed from producers to consumers (neighbours and/or in local markets) and milk products mainly in local markets. In the formal system milk is distributed by milk cooperatives and unions and the private sector. Milk collected at milk collection centres is supplied directly to consumers in the urban towns and the surplus is collected by large dairy enterprises such as Lame (Sholla), Sebeta Agro Industry (Mama) and Family Milk and transported by bulk tankers to the respective processing plants. These dairy enterprises process and pack the fresh milk collected for distribution to consumers in urban areas through agents and retailers. Homogenized, pasteurized and standardized (2.7–2.8 percent milk fat) milk packaged in half litre capacity plastic packets are distributed.

There are several factors that affect the production as well as distribution of milk and milk products. Among other factors, the unstable and low consumption levels of milk and milk products can be considered as one important factor to hamper dairy development in the country. The demand for milk and milk products declines substantially during the fasting period of the Ethiopian Orthodox Church as this population abstains from consuming animal products including milk and milk products. There is a missing link in the dairy value chain as it is difficult to justify the cause of the supply/demand mismatch. Most producers complain of the lack of market outlets for milk, especially during and shortly after the rainy season where milk production increases following the increased availability of animal feed and during fasting periods. Contrary to complains from the producers on milk surpluses, large milk processing enterprises are reported to be operating below their potential capacities mainly due to shortage of milk. Lame (Sholla) milk, the pioneer and one of the biggest dairy enterprises in the country, has a processing capacity of 60 tons/day, but has never operated at its full capacity.

There are various dairy cooperatives and unions and private dairy enterprises that are engaged in the collection, processing and distribution of milk. The Ada'a Dairy Cooperative, Selale and Asella Dairy Cooperative Unions are some of the institutions that play an important role in connecting milk producers with processors and consumers.

There are a few private enterprises involved in the production, processing and distribution of milk and milk products. Sebeta Agro-Industry, Family Milk and Lema Dairy are among the biggest ones worth mentioning. The Sebeta Agro-Industry is located some 20 km from Addis Ababa at the entrance to Sebeta town and has its own dairy farm and collects raw milk from various farms in Addis Ababa and surrounding areas (150km from Addis Ababa). It has a processing capacity of 60 tons per day. Family milk is located in Addis Ababa with a processing capacity of 15 tons per day. The Lema dairy is situated 45km South of Addis Ababa in Debre Zeit town and has a processing capacity of 10 tons of milk per day and supplies milk and milk products to Addis Ababa milk market.

5.5. Milk and Dairy Products Exports and Imports

Ethiopia is not known to export dairy products. However, some insignificant quantities of milk and butter are exported to a few countries. Butter is mainly exported to Djibouti and South Africa (targeting the Ethiopians in Diaspora), while milk is solely exported to Somalia from the South Eastern Region of the country. As indicated by SNV (2006), small quantities of cream are exported to Djibouti from Dire Dawa.

Table 16: Import and export of milk and milk products

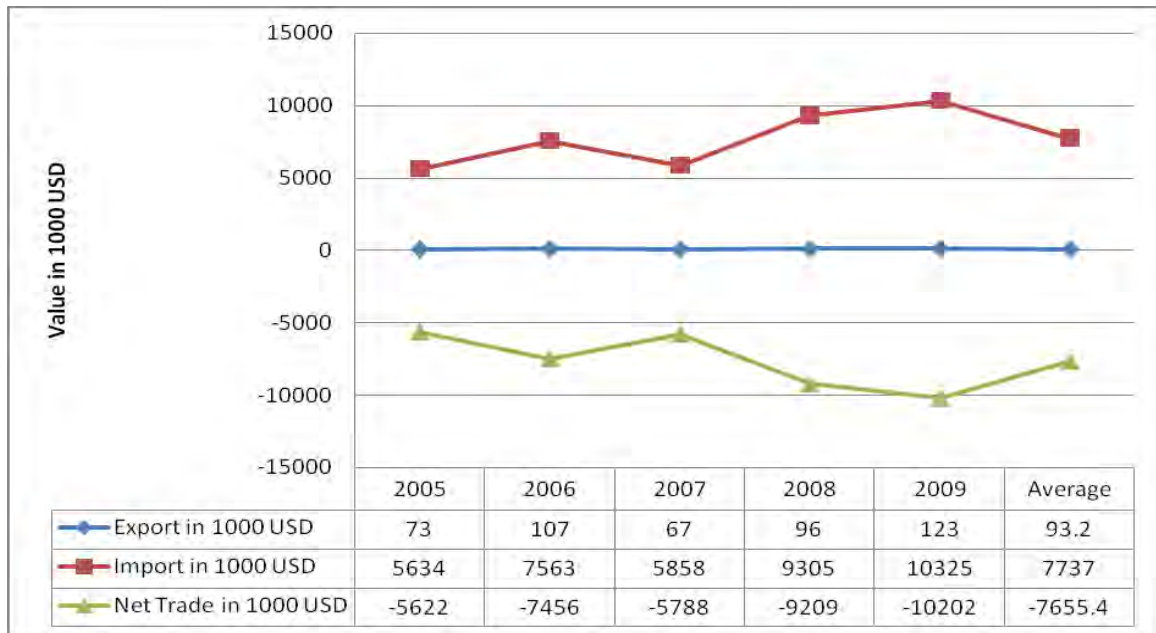
Year	Milk product	Export in value in '000' USD	Import in value in '000' USD	Net trade in value, in '000' USD
2005	Milk and cream concentrated or sweetened	61	5 393	-5 332
	Butter and other fats and oils derived from milk	12	11	1
	Cheese and curd	-	204	-204
	Milk and cream, not concentrated nor sweetened	-	14	-14
	Whey and natural milk products	-	-	-
	Buttermilk and yogurt	-	12	-12
	Sub total	73	5 634	-5 561
2006	Milk and cream concentrated or sweetened	77	7 230	-7 153
	Butter and other fats and oils derived from milk	30	41	-11
	Cheese and curd	-	260	-260
	Milk and cream, not concentrated nor sweetened	-	11	-11
	Whey and natural milk products	-	-	-
	Buttermilk and yogurt	-	21	-21
	Sub total	107	7 563	-7 456
2007	Milk and cream concentrated or sweetened	47	5 374	-5 327
	Butter and other fats and oils derived from milk	20	59	-39
	Cheese and curd	-	316	-316
	Milk and cream, not concentrated nor sweetened	-	43	-43
	Whey and natural milk products	-	37	-37
	Buttermilk and yogurt	-	26	-26
	Sub total	67	5 855	-5 788
2008	Milk and cream concentrated or sweetened	80	7745	-7 665
	Butter and other fats and oils derived from milk	16	84	-68
	Cheese and curd	-	357	-357
	Milk and cream, not concentrated nor sweetened	-	1 030	-1 030
	Whey and natural milk products	-	54	-54
	Buttermilk and yogurt	-	35	-35
	Sub total	96	9305	-9 209
2009	Milk and cream concentrated or sweetened	107	9 569	-9 462
	Butter and other fats and oils derived from milk	16	119	-103
	Cheese and curd	-	411	-411
	Milk and cream, not concentrated nor sweetened	-	128	-128
	Whey and natural milk products	-	66	-66
	Buttermilk and yogurt	-	32	-32
	Sub total	123	10 325	-10 202
	Grand total	343	38682	-29034

Source: International Trade Centre (<http://www.intracen.org/exporters/trade-statistics/>)

According to the International Trade Centre (ITC), although Ethiopia's export values generally increased from about \$73 000 in 2005 to \$123 000 in 2009, the country spent more money on importing milk and milk products from different countries as compared to export values (Table 16). The import value, which was more than \$5.6 million in 2005, also increased to \$10.3 million in 2009 (Figure 10). In the five reference years (2005 to 2009), Ethiopia exported dairy products particularly milk and butter worth

343 000 USD and imported different dairy products worth 38 682 000 USD. This means that Ethiopia is a net importer with a net trade value worth negative 29 034 000 USD. This implies that the demand for milk and milk products is increasing and the country has a long way to go in the development of its dairy sector to satisfy the domestic demand with domestic supply. Data on exported milk products in 2009/2010 and Ethiopian Custom Tariffs for imported milk and milk products are presented in Annex 1 Tables 4 and 5, respectively.

Figure 10: Milk and milk products – Export/Import (2005-2009)



CHAPTER 6

6.0 Safety of Milk and Dairy Products

6.1 The International Scenario

Food safety and quality are a growing concern all over the world particularly from human health point of view. In this respect, many countries are implementing quality control programs for all food items including animal products. In the USA, for instance, a quality milk program, dairy herd inspections and pasteurization as the critical control step is being implemented over the years (Buzby and Roberts, 1996). Milk that satisfies good hygienic conditions is necessary to produce milk products of good quality and adequate shelf life in order to provide safe food for the consumer (O'Connor, 1994). Consumers generally demand for products of consistent quality, standards, hygiene, proper presentation and ease of use. Different organizations have been working in different countries to establish quality standards to ensure the health of the consumer. Health hazards to the consumer are often grouped into microbiological, physical and chemical (FDA, 2004). Microbial criteria stipulate that specific microorganisms or toxins produced by a microorganism must not be present at all, are allowed in a limited number of samples, or be present at less than a specified number or amount in a given quantity of a food ingredient (NRC, 1985).

Different microbiological tests are used to indicate the hygienic condition during the manufacturing of a given product. A commonly used procedure to measure the sanitary quality of milk is to estimate its bacterial content. The number of bacteria in aseptically drawn milk varies from animal to animal and even from different breasts of the same animal. On average, aseptically drawn milk from healthy udders contains between 500 and 1000 bacteria ml^{-1} . High initial counts (more than 10^5 bacteria ml^{-1}) are evidence of poor production hygiene (O'Connor, 1994). Coliform count provides an indication of unsanitary production practices and/or mastitis infection. A count less than 100 Colony Forming Units (CFU)/ml is considered acceptable for milk intended to be pasteurized before consumption. Counts of 10 CFU/ml or less are achievable and desirable if raw milk will be consumed directly (Ruegg, 2003). Somatic cell count (SCC) is another indirect indicator of the microbial quality of milk. The number of somatic cells increases in response to pus-producing bacteria like *Staphylococcus aureus*, a cause of mastitis (Kleinschmit and Gompert, 2007). There shouldn't be any drug residue in milk intended for direct consumption or processing. Safety limits of somatic cells count and drug residue for raw milk employed in selected countries is presented in (Table 17). In many countries, a standard for Grade 'A' raw milk is standard plat count (SPC) of $<10 \text{ ml}^{-1}$ for milk intended for heat treatment before consumption or further processing. The microbial

safety limits for major milk products in community legislation in force by the European Commission is presented in Annex 1 Table 6.

Table 17: Commonly used safety limits of somatic cell count and drug residue for raw milk employed in selected countries

Dairy product	SCC/ml	Drug residue	Country	Source
Raw milk	$< 7.5 \times 10^5$	Absent	USA	IFCN, 2006; CDFA, 2008
Raw milk	$< 4.99 \times 10^5$	Absent	Canada	IFCN, 2006; CDFA, 2008
Raw milk	$< 4 \times 10^5$	Absent	France	IFCN, 2006; CDFA, 2008
Raw milk	$< 4 \times 10^5$	Absent	Sweden	IFCN, 2006; CDFA, 2008
Raw milk	$< 10^6$	Absent	Russian	IFCN, 2006
Raw milk	$< 6 \times 10^5$	Absent	Israel	IFCN, 2006
Raw milk	$< 4 \times 10^5$	Absent	South Africa	IFCN, 2006
Raw milk	$< 7 \times 10^5$	Absent	Brazil	IFCN, 2006
Raw milk	$< 5 \times 10^5$	Absent	China	IFCN, 2006
Raw milk	$< 2.5 \times 10^5$	Absent	Australia	IFCN, 2006

SCC: Somatic Cell Count

6.2 The Ethiopian Scenario

The Quality and Standards Authority of Ethiopia (QSAE) is the National Standards Body established in 1970 that became fully functional in 1972 for quality control. It has undergone a series of restructuring, with the latest one being in February 1998 based on the 'Proclamation No. 102/1998'. The proclamation organized the Authority to effectively promote quality management practices as one of its central objectives in addition to Standards Development, Certification, Metrology and Testing. The policy maker and governing organ of QSAE is the Standards and Certification Council whose members are appointed by the Prime Minister's Office. The members of the Council are selected from various science and technology organizations.

QSAE published the first group of 108 Ethiopian Standards (ESs) in 1973 following the consensus-based committee procedure. By 2009, QSAE had issued a total of 7 417 ESs of which 6 504 were active. These standards are used in trade and commerce, quality assurance, testing and verification of measuring instruments (QSAE, 2009). QSAE with the assistance of government has made mandatory some of the ESs as a measure to promote good health, safety, fair trade and related considerations. The current collection of ESs is mostly adopted from international standards. However, in agriculture and food fields, nationally developed/indigenous standards exist or are under development.

The implementation of or compliance with ESs is normally voluntary, however, standards that have direct influence on health, safety, etc are made compulsory. The implementation of these standards is done by the regulatory bodies, consumers and industries. This is also re-enforced by QSAE through certification of selected products

and services for which QSAE has the competence and mandate to carry out (http://www.qsae.org/web_en/About%20Us/en_aboutQSAE.htm).

According to the 2009 Catalogue of ESs , there were a total of 129 standards for milk and milk products of which 34 are concerned with specifications; 86 are on determinations and tests and nine on the code of practices, guidelines, maximum limits, general standards and requirements (QSAE, 2009). ESs requirements for a few selected products are presented in Annex 2.

Earlier research conducted in Ethiopia revealed that the microbial counts of milk and milk products produced and marketed in the country are generally much higher than the acceptable limits. Yilma (2010) in his study on the microbial properties of marketed milk and milk products sampled from 10 dairy potential areas in the country reported a similar observation and mentioned that microbial counts in samples of whole milk, *Ergo* and skim milk were particularly higher (Tables 18 and 19). According to the same author, counts of *Enterobacteriaceae* and coliform were higher than acceptable limits: *Enterobacteriaceae* <1 and coliform <10 cfu/ml for pasteurized milk and coliform <100 cfu/ml for raw milk intended for direct consumption (Council Directives 92/46/EEC, 1992). The higher count in milk could be attributed to the substandard hygienic conditions practiced during production and subsequent handling, while the high count in fermented milk products can also be partly explained by the presence of lactic acid bacteria.

Table 18: Overall bacterial and yeast and mould counts (log₁₀) per ml/g of milk and milk product samples collected from different sources (sites and producer groups)

Source	No of Obs.	TBC	<i>Enterobacteriaceae</i>	Coliform	YMC
Overall mean	630	8.35	5.10	4.53	8.32
Whole milk	135	9.10	5.49	4.58	-
Ergo	105	9.49	4.95	4.51	8.38
Butter	105	6.67	4.95	4.58	8.32
Arera	75	9.35	4.94	4.65	-
Ayib	105	7.01	4.84	4.42	8.26
Skim milk	105	9.37	5.34	4.44	-

TBC: Total Bacterial Count; YMC: Yeast and Mould Count

Table 19: Microbial count (log₁₀) per ml/g of milk and milk products categorized by sample source (producer type)

Producer	Whole milk	Ergo*	Butter	Arera	Ayib	Skim milk
<i>Total bacteria</i>						
Smallholder farmers	8.87	9.48	6.86	9.35	7.16	-
Cooperatives	9.49	9.54	6.14	-	6.51	9.25
Overall mean	9.10	9.49	6.67	9.35	7.00	9.25
<i>Enterobacteria</i>						
Smallholder farmers	5.51	4.94	4.97	4.94	4.85	-
Cooperatives	5.45	4.98	4.90	-	4.82	5.30
Overall mean	5.48	4.95	4.95	4.94	4.84	5.30
<i>Coliforms</i>						
Smallholder farmers	5.59	4.48	4.60	4.65	4.44	-
Cooperatives	4.54	4.61	4.53	-	4.37	4.37
Overall mean	4.58	4.51	4.58	4.65	4.42	4.37
<i>Yeast and mould</i>						
Smallholder farmers	-	8.39	8.34	-	8.26	-
Cooperatives	-	8.34	8.27	-	8.27	-
Overall mean	-	8.38	8.32	-	8.26	-

*Ergo refers to fermented whole milk for smallholder farmers, while it refers to fermented skim milk for cooperatives

CHAPTER 7

7.0 Dairy Production and the Environment

Globally, the livestock sector accounts for 40 percent of agricultural gross domestic product (GDP), employs 1.3 billion people and creates livelihoods for one billion of the world's poor (FAO, 2006). Livestock products provide one-third of humanity's protein intake. The cow is a highly efficient 'food processor' converting grass into healthy nutrition for humans (milk and meat). Without livestock the millions of hectares of the grasslands in the world could not be used to cultivate crops for human consumption. Growing populations and incomes, along with changing food preferences, are rapidly increasing the demand for livestock products. The global production of meat is projected to more than double from 229 million tons in 1999/01 to 465 million tons in 2050, and that of milk to grow from 580 to 1043 million tons (FAO, 2006). Livestock also play an important role in cross pollination on their path in search of feed and water. They act as a means of transportation of the seeds, which when defecated grow into pasture and their excreta are known to improve soil fertility. However, there are various negative impacts of livestock keeping on the environment depending on the production systems and objectives. Here lies the dilemma, in a nutshell: 'feeding the world versus the environmental problems' – a topic discussed at the Summit from June 25 - 27 in Edinburgh. '*Climate Change and Dairy Farming – the heat is on*' (Hemme *et al.*, 2008).

7.1 Environmental Concerns in the Dairy Sector

As indicated in the Livestock Long Shadow – environmental issues and options (FAO, 2006), livestock have a substantial impact on the world's water, land and biodiversity resources and contribute significantly to climate change. Directly and indirectly, through grazing and feed crop production, the livestock sector occupies about 30 percent of the ice-free terrestrial surface of the planet. In many situations, livestock are a major source of land based pollution, emitting nutrients and organic matter, pathogens and drug residues into rivers, lakes and coastal seas. Animals and their wastes emit gases, some of which contribute to climate change, as do land-use changes caused by demand for feed grains and grazing land.

Livestock production accounts for 70 percent of all agricultural land and 30 percent of the land surface of the planet. The expansion of livestock production is a key factor in deforestation, especially in Latin America where the greatest amount of deforestation is occurring – 70 percent of previously forest land in the Amazon is occupied by pastures. About 20 percent of the world's pastures and rangelands, with 73 percent of rangelands

in dry areas, have been degraded to some extent, mostly through overgrazing, compaction and erosion created by livestock action.

The livestock sector is a major player responsible for 18 percent of greenhouse gas emissions measured in Carbon dioxide (CO₂) equivalent. Methane and nitrous oxide are the main polluting greenhouse gases from livestock and milk production. A farm-based modelling has established that the average conventional dairy farm will produce around 900 g of CO₂ equivalent to a litre of milk produced (range 700–1500 g per litre) (Cadbury, 2008). From such a model it can be extrapolated that the production of 2 940 million litres of milk in Ethiopia in 2010 (CSA, 2010a), produced about 2 646 million kg of CO₂. Approximately 25 percent of this comes from nitrous oxide, 23 percent from carbon dioxide and the remaining 52 percent comes from methane production (Cadbury, 2008).

The sector plays a major role in increasing water usage, accounting for over eight percent of the global human water use, mostly for the irrigation of feed crops. It is probably the largest sectoral source of water pollution, contributing to eutrophication, “dead” zones in coastal areas, degradation of coral reefs, human health problems, emergence of antibiotic resistance, etc. The major sources of pollution are from animal wastes, antibiotics and hormones, chemicals from tanneries, fertilizers and pesticides used for feed crops and sediments from eroded pastures (FAO, 2006).

A survey conducted in the Borana pastoral areas, Ethiopia, summarized the most important direct and indirect effects of livestock keeping on the environment as ranked by Borana pastoralists (Table 20).

Table 20: Important direct and indirect effects of climate change in Borana pastoralists

Major effects	Rank
Deforestation	1 st
Depletion of water resources	2 nd
Overgrazing	3 rd
Trampling on grazing land	3 rd
Pollution of water	3 rd

Source: Yilma *et al.*, (2009)

7.2. Mitigation Strategies of Environmental Effects of Dairying

Overgrazing can be reduced by instituting grazing fees and by removing obstacles to mobility on common property pastures. Land degradation can be limited and reversed through soil conservation methods, silvopastoralism, better management of grazing

systems, prohibiting uncontrolled burning of land by pastoralists and controlled exclusion from sensitive areas (FAO, 2006).

Intensification, in terms of increased productivity both in livestock production and in feed crop agriculture can reduce greenhouse gas emissions from deforestation and pasture degradation (FAO, 2006). As indicated in pro-poor livestock policy initiative, the status and prospects for smallholder milk production – a global perspective, low-yield dairy systems are estimated to have higher carbon footprints per 100 kg of milk produced than high-yield systems (FAO, 2010). Capper *et al.*, (2009), in their study that compared the environmental impacts of modern dairying and dairying in 1944 in the United States also indicated that modern dairy practices require considerably fewer resources than dairying, with 21 percent of animals, 23 percent of feedstuffs, 35 percent of the water and only 10 percent of the land required to produce the same one billion kg of milk. Waste outputs were similarly reduced, with modern dairy systems producing 24 percent of the manure, 43 percent of methane (CH₄), and 56 percent of Nitrous oxide (N₂O) per billion kg of milk compared with equivalent milk from historical dairying. The carbon footprint per billion kilograms of milk produced in 2007 was 37 percent of equivalent milk production in 1944.

To fulfil the increasing requirements and demand of the population for dairy products, it is essential to adopt management practices and technologies that improve efficient productivity, allowing milk production to be increased while reducing resource use and mitigating environmental impacts.

Restoring historical losses of soil carbon through conservation tillage, cover crops, agro-forestry and other measures could sequester up to 1.3 tons of carbon per hectare per year. Again, the restoration of the desertified pastures will provide additional soil carbon. Methane emissions can be reduced through improved diets to reduce enteric fermentation, improved manure management and use of biogas, which also provide renewable energy. Nitrogen emissions can be reduced through improved diets and manure management (FAO, 2006).

Water use can be reduced by improving the efficiency of irrigation systems. Livestock's impact on erosion, sedimentation and water regulation can be addressed by measures against land degradation. Pollution can be tackled through better management of animal waste in industrial production units, better diets to improve nutrient absorption, improved manure management (including biogas) and better use of processed manure on croplands. Industrial livestock production should be decentralized to accessible croplands where wastes can be recycled without overloading soils and freshwater. Policy measures that would help in reducing water use and pollution include: full cost pricing of water (to

cover supply costs, as well as economic and environmental externalities), regulatory frameworks for limiting inputs and scale, specifying required equipment and discharge levels, zoning regulations and taxes to discourage large-scale concentrations close to cities, as well as the development of secure water rights and water markets, and participatory management of watersheds (FAO, 2006).

CHAPTER 8

8.0 Employment in the Dairy Sector

Reports by FAO (2010), estimated that some 12 to 14 percent of the world population (an estimated 750 to 900 million people) live on dairy farms or within dairy farming households. Employment and income from dairy will vary between and within production systems because of differences such as feed sources, management systems, herd sizes, form of milk disposal patterns and access to or use of technology. In Ethiopia, traditional smallholder mixed farming systems generate several times more employment but low income per unit of milk produced compared with urban and peri-urban dairy systems because of low productivity of animals in the former. In both systems, over two-third of the labour requirement is provided by children as they usually do the herding. Mostly women are involved in traditional milk processing and marketing.

Haile (2009) estimated that labour use in various dairy processing and marketing activities in different production systems and scales of operation in Ethiopia totalled an equivalent of 174 000 full-time jobs in 2004. Considering the proposition by Haile (2009) that there are 224.5 persons per 1000 litres and that 2 940 million litres of milk were produced at national level in 2010, it can be extrapolated that the dairy sector creates an estimated 1.8 million full-time jobs. According to the same author, on-farm processing and marketing generate 94 percent of the daily employment as commercial processing is still at the rudimentary stage in the country. Staal *et al.*, (2008) estimated that the urban/peri-urban system creates annually 4.4 million person days of work or 16 400 full-time jobs, while the small-scale mixed farming systems create 166 million person days of work, equivalent to 553 500 full-time jobs. Based on the estimation given by FAO (2010), the production of one million litres of milk per year on small-scale dairy farms creates approximately 200 on-farm jobs. In 2010, dairying created an estimated 588 000 full-time on-farm jobs in the country.

CHAPTER 9

9.0 Challenges

The Ethiopian dairy sector is evolving but not to the level of its potential mainly due to various challenges. Some of these are briefly discussed below.

Genetic limitation: The main problem of milk production in the country is that of the poor genetic potential of the indigenous cattle, which gives rise to low milk output. Milk production is as low as 0.5 to 2 litres per day over a lactation period of 160 to 200 days. Improving the feeding, water availability and health care of the indigenous cattle did not increase the quantity of milk per day to allow the animals to be used for commercial market-oriented milk production. The current specialized dairy breeds are a result of a long period of selection program. If improvement of the local Ethiopian breeds for milk production is targeted, then it is important to have a well designed selection program in place for a few selected promising breeds.

Inadequate animal feed resources: The primary constraints to increased milk production under all dairy production systems are inadequate feed resources, poor pasture development and the ever increasing feed prices. Farmers tend to keep cattle at stocking rates that far exceed the carrying capacity of their grazing lands. This has resulted in degraded pastures and eroded soils. Stock numbers are not normally reduced in the dry season leading to grazing lands becoming progressively overgrazed. In the dominating crop/livestock production system, producers supplement the feeding of their dairy cows with crop residues and farm by-products from their farms. In some cases, during the dry season, these feedstuffs can be the only feeds available to the animals. However, the improvement of the utilization of these feedstuffs through physical and chemical processing methods to increase the availability of nutrients is only practiced on a limited number of farms.

Limited access and high cost of dairy heifers/cows: The improved crossbreed, grade and pure exotic dairy cattle are usually in short supply and when available, the high cost is a major problem. The few government crossbreed heifer multiplication centres that used to distribute in-calf crossbreed heifers to producers at reasonable prices have been sold after the introduction of the privatization policy. Prices of crossbreed cows and heifers are now unaffordable by the poor and the average smallholder farmers that would have liked to engage in the dairy business.

Absence of an operational breeding strategy and policy: The absence of effective breeding programs is a major constraint to the dairy development. The AI service has been inefficient for different reasons in rural areas where smallholder farmers

predominate. As reported by Shiferaw *et al.*, (2003), some of these reasons include: inappropriate infrastructure, managerial and financial constraints, inefficient heat detection and improper timing of insemination, embryonic death and very small number of AI technicians compared with the number of cows in a given area. Hiskias *et al.*, (2010) indicated that the Ministry of Agriculture assigns one AI technician to serve farmers of one district. However, taking into consideration the number of dairy producers, the number of female cattle of reproductive age, and the required facilities (logistics) available to AI technicians, it is practically impossible for an AI technician to satisfy the demands of all the producers in a given district. Consequently, the general productivity of the dairy herd kept by smallholder producers is very low. In spite of its sizeable livestock resources and the accompanied benefits that the country is supposed to derive from the industry, Ethiopia does not have a functional breeding policy. Most of the cattle breeding activities have been executed under strategies set by various individual organizations/institutions. Furthermore, the current conducive policy for investment opportunities is not supported by an operational breeding policy that determines the type of genetic material to be brought into the country in order to achieve the targeted genetic improvement in the different farming systems and agro-ecologies.

Inadequate veterinary service provision: The prevalence of various animal diseases, tick borne diseases, internal parasites and infectious diseases affect dairy development programs in varying scales, depending on ecological zones and management levels. The animal health services provided are inadequate; the cost of drugs and ascaricides is very high, while the diagnostic services are not readily available to the dairy farmer. This is partly attributed to the insufficient budget allocated to veterinary services (GRM International BV, 2007). Lema *et al.*, (2000) reported an overall disease occurrence of 46.8 and 33.6 percent in urban and peri-urban dairying in the central highlands, respectively. The same authors also reported the overall disease prevalence rates of 20.8, 13.1 and 10.7 percent during the dry, short rainy and long rainy seasons, respectively with an overall annual mortality rate of 4.2 percent.

Weak linkages between research, extension service providers and technology users: Weak linkages between research, extension, and technology users are one of the critical factors that have hindered dairy development in the country. This weakness stems partially from the absence of sound linkage policies in the agricultural knowledge generation and transfer systems.

Inadequate extension and training service: Effective and adequate extension services and advice on animal nutrition and feeding management, reproduction, hygiene, farm management and dairy production efficiency are not always available to the dairy farmer.

A shift towards a developed dairy industry requires more support from advisory services and more effective links with research services.

Milk market related constraints: There are no promotional activities being carried out by various government offices to portray milk as a highly nutritious and essential food for the health of the nation. There are also no price regulatory mechanisms in place that can make such an important food item easily available and affordable to a large segment of the population. As earlier mentioned, there are no functional quality control and payment systems in the country.

Limited availability of credit to the dairy farmer: Many farmers are aware of the existence of improved technologies that can offer them higher returns as compared with their conventional practices. However, most of the poor farmers do not have the financial means required to make the initial investment and acquire the associated technological inputs. Financial support or credit facilities to smallholder farmers who intend to enter into commercial dairy farming are very much limited. The importance of establishing credit facilities is a crucial step to the country's dairy sector as indicated in the livestock development master plan (GRM International BV, 2007).

Unavailability of land: The problem of inadequate feed is as a result of the limited land available for pasture establishment, especially in the productive highland zones that have a potential for dairy development. In Amhara Region, for instance, nearly all the land suitable for cultivation is already in use, while in Oromia land is scarce in many areas. The scarcity of land is becoming a critical problem in many parts of Ethiopia, in certain localities an estimated 50 percent of the population have a problem of land scarcity. If land degradation is not halted and reversed in some areas of the country, it could become extremely difficult to expand dairy production, as there would be less and less land that could be used for grazing and growing fodder crops. In the traditional sector, land becomes a constraint to milk production as a result of overstocking. In urban and peri-urban dairying, lack of grazing land is often a limiting factor. The intensification of the dairy industry by using fewer numbers of improved dairy cows with increased productivity per cow should be a strategy to be followed.

CHAPTER 10

10.0 Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis

The Ethiopian dairy sector is complex. This stems from the diverse agro-climatic conditions, production systems and socio-economic situation. The agro-climatic conditions range from arid to highland areas. The production system is dominantly subsistent (both mixed crop/livestock and pastoral) with a substantial role of the urban, peri-urban and commercial production systems. Dairy sector actors are from diverse socio-economic setups (from rural smallholder subsistence producers to commercial large-scale dairy enterprises). Milk utilization is also under the influence of the diverse socio-cultural situation. The SWOT analysis is not specific to the aforementioned diversities neither exhaustive. It focuses on key general issues of the country's dairy sector based on the contents of this document.

Strengths

Current situation	Appropriate measures to build on
Milk production and consumption culture	Development interventions can build on the existing experiences
Employment creation	Improve policy enabling environment and technical capacity; access to the required resources and services

Weaknesses

Current situation	Appropriate measures to correct
Low milk production	Efficient extension service provision on dairy husbandry practices
Lack of capital	Access to credit
Poor quality milk	Efficient and functional quality control system; the required technical skill and dairy infrastructure; quality based payment system
Shortage of skilled/trained manpower	Capacity building of existing teaching and training centers; producing sufficient professionals at different levels and streams of dairying
Difficulty to get land for dairy operation	Conducive policy enabling environment
Feed shortage (quality and quantity)	Improved feed production, conservation and utilization; use of adapted improved forage crops
Dominant rain based agricultural	Alternative use of water sources (harvesting rain water, ground water, irrigation)
Incidence of diseases of economic importance	Efficient dairy cattle disease prevention and control system
Small proportion of marketed milk and dominance of the informal market	Promote cooperative action; improve dairy infrastructure; improve linkage among the key actors; reliable, up-to-date & consistent market information system
Low level of per capita milk consumption	Promotional work on the benefits of quality milk and milk products; increase distribution; pricing system

Opportunities

Current situation	Appropriate measures to exploit
Large diversity and population of cattle	Selection of cows of better productivity and improve productivity through crossbreeding
Existence of conducive environmental conditions for dairy development	Maximize the use conducive mid altitude and highland areas for keeping specialized dairy cows and cultivation of improved forage crops
Relatively cheap farm labor	Improve technical knowledge
Increasing interest in investing in the sector	Conducive policy environment
Increasing population, urbanization and income and trend towards consuming more animal products	Increase diversity, improve quantity , quality and distribution of dairy products

Threats

Current situation	Appropriate measures to avert
Supply and demand mismatch due to seasonal, spatial and cultural factors	Shelf-stable products such as powder milk to transfer the excess from time and place of high production to that of low production
Unreliable climatic condition	Alternative use of water sources (harvesting rain water, ground water, irrigation); early warning system; climate change adaptation and mitigation mechanism
Illegally imported milk products	Policy support to domestic products; efficient import controlling system
Urban dairy farm organic waste	Efficient urban dairy farm organic waste disposal system; alternative use of urban dairy farm organic waste; moving large urban farms to appropriate places in peri-urban areas

11.0 Conclusion and Recommendations

11.1 Conclusion

Dairying constitutes an important part of the Ethiopian smallholder crop/livestock mixed farming system. The country is known to have the highest number of cattle in Africa, making it one of the biggest potential producers of milk and milk products in the continent. Despite this advantage, the industry is plagued with a number of constraints and the country remains a net importer of milk and milk products. The farmers are poorly organized into cooperatives and unions, while their products are sold at sub optimal prices.

The poor infrastructure network, inadequate provision of veterinary services and lack of continuous supply of animal feeds throughout the year are among some of the challenges faced by farmers in the field. There is need for the government and its international development partners to invest in the dairy industry and transform the activity into a lucrative business, which will contribute to the GDP of the country through exportation

of processed milk and milk products. Locally, the livelihoods of households will increase through increased consumption of milk and milk products under good hygienic conditions and appropriate value for their products, which will enable the farmers to purchase farm inputs and other household needs.

The government and the related development partners should work with the population to overcome the constraints and commercialize the sector to internationally recognized standards.

11.2 Recommendations

After reviewing the retrospective and current situations of the Ethiopian Dairy sector, it might be appropriate to consider the following: research, development, policy and crosscutting issues in order to make improvement interventions for the development of the dairy industry.

Research issues:

- Improving the use of pasture through appropriate grazing land management systems.
- Testing and using technologies to speed up genetic progress such as Multiple Ovulation and Embryo Transfer (MOET).
- Developing milk processing and preservation technologies appropriate to the various major agro-ecological zones of the country.
- Promoting HACCP program at farm-level to assure dairy farm safety. Realization of HACCP requires a critical multidisciplinary review of the existing management processes, the establishment of limits through identification of critical control points, the use of routine surveillance procedures, effective record keeping and documentation of standard procedures.

Development issues:

- Cultivation of improved forage crops suitable for the different agro-ecological zones and farming systems with accompanied technologies should be encouraged. Such forages that are nutritionally superior and yield more biomass per unit area as compared to tropical natural pasture can increase dairy farm income through increased milk yield. Smallholder farmers can reduce wastage and cost of feed and increase its intake by livestock through the use of electric or petrol driven choppers where appropriate. Promotion of efficient use of alternative feed sources such as silage, hay, crop and vegetable by-products and local beverage by-products is also essential.

- Training selected farmers as Trained Farmer Artificial Inseminators (TFAIs) will reduce the critical shortage of AI technicians.
- Information on innovations can be transferred through the production and distribution of extension bulletins and leaflets.
- Encouraging and supporting an efficient and operational public and private dairy extension and advisory service provision such as: dairy farm input provision, technology transfer and producer-research-private sector linkage.

Policy issues:

- Policies on dairy should be comprehensive and focused on ensuring increased milk production. These should include: appropriate strategies on breeding (selection and cross-breeding), improved feed utilization systems and adequate veterinary services. The policies should establish an appropriate marketing infrastructure to ensure milk collection, processing, storage, and distribution, the quality of products. A functional payment system based on quality should be implemented. The introduction of this system of payment in other countries showed an improvement in both quality and quantity produced and supplied to milk collection centres and dairies. The pricing should aim at motivating milk producers to increase their efforts in hygienic milking practices and handling of raw milk.
- The need to establish dairy advisory services at national level is important to make improvements on the various components of the dairy value chain. Institutions and Organizations such as the MoA, EIAR, QSAE, and EMDTI are vital in providing services.
- The establishment of central laboratories will determine the quality of milk supplied by various producers at different levels of Central Laboratories and should supply data on milk quality to milk collection centres and dairy factories who should accordingly adjust their purchasing prices of raw milk based on quality. It important to establish standard quality control laboratories for mandatory provision of quality certification and inspection services.
- Policies on land usage should take livestock development into account, land for grazing, cultivation of improved forage crops and agro-forestry. Institute control system to limit herd size (stock) as a preventive measure of land degradation through overgrazing by overstocking; this can be achieved through breed improvement to increase productivity per unit animal but keeping fewer numbers of high producing animals.
- There is need to create conducive environments for the establishment of feed processing plants, provide assistance and put a functional feed quality control system in place. Promotion of the establishment of forage banks in areas where rainfall and feed availability are not reliable is necessary.

- Putting in place appropriate and operational control and prevention strategies for dairy cattle diseases of economic importance. The private sector should be motivated to get involved in the manufacturing and distribution of veterinary drugs.
- The provision of credit facilities and insurance for dairy farms should be encouraged and promoted.

Crosscutting issues:

- There is a need to reinforce early warning systems on the scarcity of feeds on rangelands (surveillance and monitoring) and to give owners of livestock timely advice on mitigating the impact of drought.
- Organizing smallholder milk producers into dairy cooperative groups and subsequently into dairy unions is an appropriate strategy worth up scaling to increase milk production, the volume of milk consumed and marketed, and commercializing the subsistent type of smallholder milk production system. It has been proven in many countries that such a collective action facilitates dairy farm inputs and easily links producers to processors and distributors, creating “Business Hubs” at the levels union will help to provide all the required services and inputs (animal feed storage and formulation unit, AI and animal health services, milk chilling and processing facilities, mini milk quality control laboratory and credit facilities) in one place. Cooperative unions need to be better organized and work together so that they can optimize their potentials and be able to exploit the available market outlets.
- Incorporate synchronized breeding in the breeding strategy to make use of the comparative advantage of seasonal feed availability. Public and/or private crossbreed heifer multiplication centres should be expanded throughout the country. Access to such centres should be promoted by putting in place local market structures and credit facilities for use by farmers, community based breeding schemes should be promoted. Establish and promote bull breeding schemes and facilitate the involvement of the private sector in AI service provision.
- Increasing milk consumption through creating awareness on the nutritional value of milk and milk products and promoting school milk feeding scheme especially at kindergarten and primary school levels.
- The development of infrastructure such as roads and cooling facilities is important for the dairy industry.

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Annex 1

Table 1. Summary of major past, recently completed, current and pending key interventions in the Ethiopian dairy sector

Key Actor/project	Intervention
Past	
United Nations Relief and Rehabilitation Administration (UNRRA).	Introduction of 300 Friesian and Brown Swiss dairy cattle in 1947
The Ethiopian Government Government of Finland The United Nations Capital Development Fund	Increasing the processing capacity of the Sholla plant to 60,000 liters per day, introduction of butter oil recombination capacity, establishment of 30 collection kiosks and 16 chilling centers, and expansion of milk collection routes to 150 km around Addis Ababa.
The Ethiopian Government/MoA	Establishment of a milk processing plant at Sholla
The Ethiopian Government/MoA	Establishment of the Dairy Development Agency (DDA) in 1971 to provide guidance and assistance (extension and credit services, establishment of commercial dairy farms, improve quality and increase quantity of milk and milk products, cooperative formation for commercial agricultural production)
The Ethiopian Government/MoA	Establishment of the Dairy Development Enterprise (DDE)
Swedish International Development Agency (SIDA) supported Chilalo Agricultural Development Unit (CADU) initiated in 1967 and	Major achievements of these units consisted of: one cow unit dairy development package, production of frozen cattle semen and crossbreed dairy heifers, introduction of small-scale milk processing units, introduction of AI and bull station services, popularization of improved forage cultivation and.
Wolaita Agricultural Development Unit (WADU) funded by the International Development Association (IDA).	Establishment of a farm with 290 dairy cattle at Wolaita Soddo
FINNIDA implemented the Smallholder Dairy Development Pilot Project (SDDP) with additional funding from FAO and WFP	Organization of small milk processing and marketing units Formation of 30 cooperatives in the peri-urban areas of Addis Ababa Improved veterinary and breeding services, promotion of forage and feed production
Recently completed	
Land O'Lakes (Lo'L) – Ethiopian Dairy Development Project	Milk Value Chain
Netherlands Development Organization (SNV) – Business Organizations and their Access to Markets (BOAM)	Milk Value Chain through its 'Support to Business Organizations and their Access to Markets (BOAM) program
Improving Productivity and Market Success (IPMS)	Milk Value Chain
Existing (with their past and current intervention)	
The Ethiopian Government/MoA	Provision of structured extension services
Ethiopian Meat and Dairy Technology Institute (EMDTI) (MoA)	Provision of tailor-made trainings on different aspects of dairy development
National Artificial Insemination Centre (NAIC) (MoA)	Importation, production and distribution of semen to its nine sub centers Capacity building - training
Federal and regional Agricultural Research Institutions with the Holetta Agricultural Research Centre (HARC) of the Ethiopian Institute of Agricultural Research (EIAR) being the centre of excellence for dairy research	Adoption and generation of appropriate technologies for dairy development Capacity building by organizing and providing trainings Verification and demonstration of promising technologies on farms with the participation of smallholder farmers
Agricultural Universities, Colleges and Schools	Provision of long to medium term trainings on a regular basis to high level agricultural professionals Capacity building – tailor made short term trainings
National Veterinary Institute (NVI)	Production and distribution of veterinary vaccines and drugs
Medium- to large-scale private milk processors with the Sebeta Agro-Industry (Mama) being the pioneer	Production, collection, processing and distribution Offered producers a better milk price as compared to that paid by DDE, thereby stimulating competition and helping the expansion of the formal market
FAO Sub Regional Office for East Africa and Country Office	Milk Value chain through the 'Crop Diversification and Marketing Development' Project Need assessment studies
Primary Dairy Cooperatives and Dairy Cooperative Unions	Access to milk market outlet and dairy farm inputs to smallholder producers Link producers with processors

Addis Livestock Production and Productivity Improvement Service (ALPPIS)	Importation of unsexed and female sexed semen, distribution, follow-up, capacity building (training)
Upcoming	
Livestock Growth Project (AGP)	Dairy Value Chain
East Africa Dairy Development (EADD)	Dairy Value Chain
Market-led Innovation and Learning for Dairy Development (MIDD)	Dairy Value Chain
Livestock and Irrigation Value-Chains for Ethiopian Smallholders (LIVES)	Dairy Value Chain
The Private Sector	Dairy Value Chain

Table 2: Status of key policy issues relevant to dairy

	Issues	Position		Issues	Position
Policy and strategy issues			Dairy and related acts		
a	Agricultural Policy	In place	a	Dairy Regulation	Draft
b	Livestock Development Policy	Draft	b	Dairy Industry act	In place
c	Livestock Research Policy	In place	c	Public Health act	In place
d	Dairy Development Policy	Draft	d	Cooperative Statute	In place
e	Livestock Master Plan	In-preparation	e	Regulations enforcement	Draft
f	Dairy Development Master Plan	In-preparation	f	Standard enforcement	In place
g	Ruminant Livestock Dev. Strategy	Draft	g	Veterinary surgeons act	Draft
h	Cattle Milk Research Strategy	In place	h	Pharmacy and positions act	-
i	Animal Health Research Strategy	In place	i	Land act	In place
j	Animal Feeds and Nutrition Strategy	In place	j	Factories act	-
Standards			k	Companies act	-
a	HACCP	In place	l	Animal Diseases act	In place
b	Codex Alimentarius	In place			
c	Standard Acts	In place			
d	Local Standards	Draft			

Source: SNV (2008)

Table 3: International Farm Comparison Network Top-21 milk processors list 2011

Rank	Company name	Country	Dairy Processing plant main location	Milk intake in mill. t	Market share in % of world milk production
1	Fonterra	New Zealand	International	20.5	3.0%
2	Dairy Farmers of America	USA	USA	17.1	2.5%
3	Nestle	Switzerland	International	14.9	2.2%
4	Dean Foods	USA	USA	11.8	1.7%
5	Royal Friesland Campina	The Netherlands	The Netherlands	10.3	1.5%
6	Lactalis	France	International	10.2	1.5%
7	Arla Foods	Denmark/Sweden	Denmark/Sweden	8.7	1.3%
8	Danone	France	International	8.0	1.2%
9	California Dairies Inc.	USA	USA	7.7	1.1%
10	Kraft Foods	USA	International	7.5	1.1%
11	Nordmilch & Humana (DMK)	Germany	Germany	6.7	1.0%
12	Saputo	Canada/USA	Canada/USA	6.2	0.9%
13	Land O'Lakes Inc.	USA	USA	5.8	0.9%
14	Sodiaal & Entremont Alliance	France	France	4.2	0.6%
15	Mengnui Group	China	China	3.8	0.6%
16	Parmalat	Italy	International	3.7	0.6%
17	Yili Group	China	China	3.7	0.5%
18	Amul	India	India	3.4	0.5%
19	Northwest Dairy Association	USA	USA	3.3	0.5%
20	Schreiber Foods Inc.	USA	USA	3.3	0.5%
21	Murray Goulburn	Australia	Australia	3.2	0.5%
Sum top 21				163.9	24%

Source: IFCN (2011) – IFCN analysis is based on the IFCN Dairy Report 2010 and additional analysis and estimates. Data represent in most cases the year 2009 or 2010. Explanation: Milk intake represents milk volume collected, commodity purchase (in milk equivalents) and subsidiaries in other countries. Milk intake figures in milk, tons. In some cases recalculated from liter (1 liter = 1.033 kg). Comments: Amul (India): milk with high fat content. Nordmilch and Humana merged in 2010 and created new company Deutsches Milchkontor (DMK). Sodiaal and Ehtremont alliance merged in 2011. Fonterra and Nestle incl. 50% of milk intake of Dairy Partners America (DPA) each. In some cases: double-counting of milk intake possible (companies purchase milk/dairy ingredients from each other).

Table 4: Values and percentage shares of exported milk products in year 2009/2010

Exports by commodity (fiscal year 2009/2010)							
Rank	Major commodities	Value in 1000 USD	Share (%)	Rank	Major commodities	Value in 1000 USD	Share (%)
1	Coffee	528307	26.4	16	Others	11777	0.6
2	Oil seeds	358515	17.4	17	Cotton	10612	0.5
3	Gold	281389	14.1	18	Cereals	4801	0.2
4	Chat	209525	10.5	19	Anima Fodder	4658	0.2
5	Flowers	170195	8.5	20	Fruits	4224	0.2
6	Pulses	130100	6.5	21	Food	3031	0.2
7	Live animals	90740	4.5	22	Scrap Metal	2451	0.1
8	Skins	39739	2.0	23	Natural Honey	1889	0.1
9	Meat & Meat Products	33999	1.7	24	Beverage	1685	0.1
10	Vegetables	27242	1.4	25	Bees Wax	1599	0.1
11	Textile & Garments	22861	1.1	26	Animal Products	892	0.04
12	Spices	18568	0.9	27	Tea	882	0.04
13	Leather & leather products	15760	0.8	28	Hides	880	0.04
14	Mineral products	12363	0.7	29	Flour	762	0.04
15	Natural gum	12682	0.6				
Total						2003130	100

Source: Ethiopian Revenue and Customs Authority Cited by SNV (2008)

Table 5: Ethiopian custom tariffs for imported milk and milk products (2007)

CUSTOMS tariff No	Description of Dairy Products	Duty rate (%)	VAT (%)	WHT (%)	Sur tax (%)	special Permission
04011000	Milk and cream of =<1% fat, not concentrated or sweetened	30	0	3	10	MOH
04012000	Milk and cream of >1% but =<6% fat, not concentrated or sweetened	30	0	3	10	MOH
04013000	Milk and cream of >6% fat, not concentrated or sweetened	30	0	3	10	MOH
04021000	Milk and cream in solid forms of =<1.5% fat	20	0	3	10	MOH
04022100	Milk and cream in solid forms of >1.5% fat, unsweetened	20	0	3	10	MOH
04022900	Milk and cream in solid forms of >1.5% fat, sweetened	20	0	3	10	MOH
04022910	---When imported in bulk by food manufacturing industries	10	15	3	10	Not required
04022990	---Other	20	15	3	10	Not required
04029100	Concentrated milk and cream, unsweetened (excl. in solid form)	20	0	3	10	MOH
04029900	Sweetened milk and cream (excl. in solid form)	20	0	3	10	MOH
04031000	Yogurt	30	15	3	10	MOH
04039000	Buttermilk, curdled milk and cream, etc (excl. yogurt)	30	15	3	10	MOH
04041000	WHEY & MODIFIED WHEY, WHETHER OR NOT CONCENTRTD OR CONTNG SWEETENING MATTER	30	15	3	10	MOH
04049000	Products consisting of natural milk constituents, nes	30	15	3	10	MOH
04051000	Butter	30	15	3	10	MOH
04052000	Dairy spreads	30	15	3	10	MOH
04059000	Fats and oils derived from milk (excl. butter and dairy spreads)	30	15	3	10	MOH
04061000	Fresh (un-ripened or uncured)cheese, including whey cheese and curd	30	15	3	10	MOH
04062000	Grated or powdered cheese	30	15	3	10	MOH
04063000	Processed cheese, not grated or powdered	30	15	3	10	MOH
04064000	Blue-veined cheese	30	15	3	10	MOH
04069000	Cheese, nes	30	15	3	10	MOH

Source: SNV (2008)

Table 6: Microbiological safety limits for major milk products in community legislation in force by the European Commission

Milk product	Microorganism	Maximum limit (cfu/ml or g)
Raw cow's milk intended for processing	Total bacteria	10^5
	<i>Staphylococcus aureus</i>	2×10^3
Raw cow's milk intended for direct human consumption	<i>Salmonella</i>	Absent in 25g
	<i>S. aureus</i>	5×10^2
	Total bacteria	5×10^4
Pasteurized drinking milk	Pathogenic microorganisms	Absent in 25g
	Coliforms	5
	Total bacteria	5×10^5
UHT milk and sterilized milk	Total bacteria	100
Cheese made from raw and thermized milk	<i>Listeria monocytogenes</i>	Absent in 1g hard cheese or in 25g other cheese varieties
	<i>Salmonella</i>	Absent in 1g
	<i>S. aureus</i>	10^4
	<i>E. coli</i>	10^5
Soft cheese made from heat treated milk	<i>L. monocytogenes</i>	Absent in 25g
	<i>Salmonella</i>	Absent in 1g
	<i>S. aureus</i>	10^3
	<i>E. coli</i>	10^3
	Coliforms	10^5
Fresh cheese	<i>L. monocytogenes</i>	Absent in 25g
	<i>Salmonella</i>	Absent in 1g
	<i>S. aureus</i>	100
Butter	<i>L. monocytogenes</i>	Absent in 25g
	<i>Salmonella</i>	Absent in 1g
	Coliforms	10
Powdered milk and milk based products	<i>L. monocytogenes</i>	Absent in 1g
	<i>Salmonella</i>	Absent in 1g
	<i>S. aureus</i>	100
	Coliforms	10
Frozen milk based products	<i>L. monocytogenes</i>	Absent in 1g
	<i>Salmonella</i>	Absent in 1g
	<i>S. aureus</i>	100
	Coliforms	100
	Total bacteria	10^5
Liquid milk based products	<i>L. monocytogenes</i>	Absent in 1g
	<i>Salmonella</i>	Absent in 1g
	Coliforms	5

Source: Council Directives 92/46 EEC (1992)

Annex 2

Instances of Ethiopian standards (requirements) for a few selected milk products

Butter - Reference number: ES3461:2009

Requirements

Characteristics	Requirements	Method of test
Butter fat, min, % by mass (unsalted butter)	82.0	ES ISO 3727, ES ISO 17189
Butter fat, min, % by mass (salted butter)	80.0	ES ISO 3727, ES ISO 17189
Moisture, max, % by mass	16.0	ES ISO 3727, ES ISO 8851-1, ES ISO 8851-2
Milk Solids-Non-Fat, max, % by mass	2.0	ES ISO 3727, ES 8851-1
Salt, NaCl, max, % by mass	2.5	ES ISO 1738, ES ISO 15648

Microbial limits

Microorganism	Maximum limit	Method of Test
Total plate count	1000000/ml	ES ISO 6610
E. coli	Absent/ml	ES ISO AA866-1, ES ISO AA866-2
Salmonella	Absent/25ml	ES ISO 6785
Molds and Yeasts	10/ml	ES ISO 6611

Cream - Reference number: ES3466:2009

Essential composition and quality of pasteurized cream

Designation	Milk fat content	Methods of test
Cream*, min, % by mass (m/m)	18	ES ISO 2450
Half-cream, min, % (m/m)	10	ES ISO 2450
Whipping and whipped cream, max, % by mass	18	ES ISO 2450
Heavy whipping cream, min, % by mass	28	ES ISO 2450
Heavy cream, min, % by mass	35	ES ISO 2450
Bouble cream, min, % by mass	45	ES ISO 2450

*The work cream shall not be designated to any product that contains less than 10% milk fat

Microbial limits

Microorganism	Maximum limit	Method of test
Total plate count	100000/ml	ES ISO 6610
Coliform	Absent/ml	ES ISO 5541-1
E. coli	Absent/ml	ES ISO 11866, ES ISO 11866-2
Molds and Yeasts	10/ml	ES ISO 6611

Pasteurized liquid milk

Requirements

Characteristics	Requirements	Method of test
Fat content, whole milk, min, % by mass	3.5	ES ISO 1211, ES ISO 2442
Fat content, Fat reduced milk, % by mass	1.5-3.5	ES ISO 1211, ES ISO 2442
Fat content, low fat milk, % by mass	0.5-1.5	ES ISO 1211, ES ISO 2442
Protein, min, % by mass	3.20	ES ISO 5542, ES ISO 8968-5, ES ISO 8968-1
Total solids, min, % by mass	12.80	ES ISO 6731
Phosphatase test	Negative	ES ISO 3356
Antibiotics	None	ES3473
Pesticide residues	See 13557	ES ISO 3890-1, ES ISO 3890-2
Salmonella	Nil	ES ISO 6785
Freezing point	0.525-0.550	ES ISO 5764

Microbial limits

Microorganisms/groups of microorganisms	Requirement
Total plate count	
Very good quality	<50000 per ml
Good quality	50000 – 100000 per ml
Fecal coliforms	Nil per ml
Non fecal coliforms	<10 per ml