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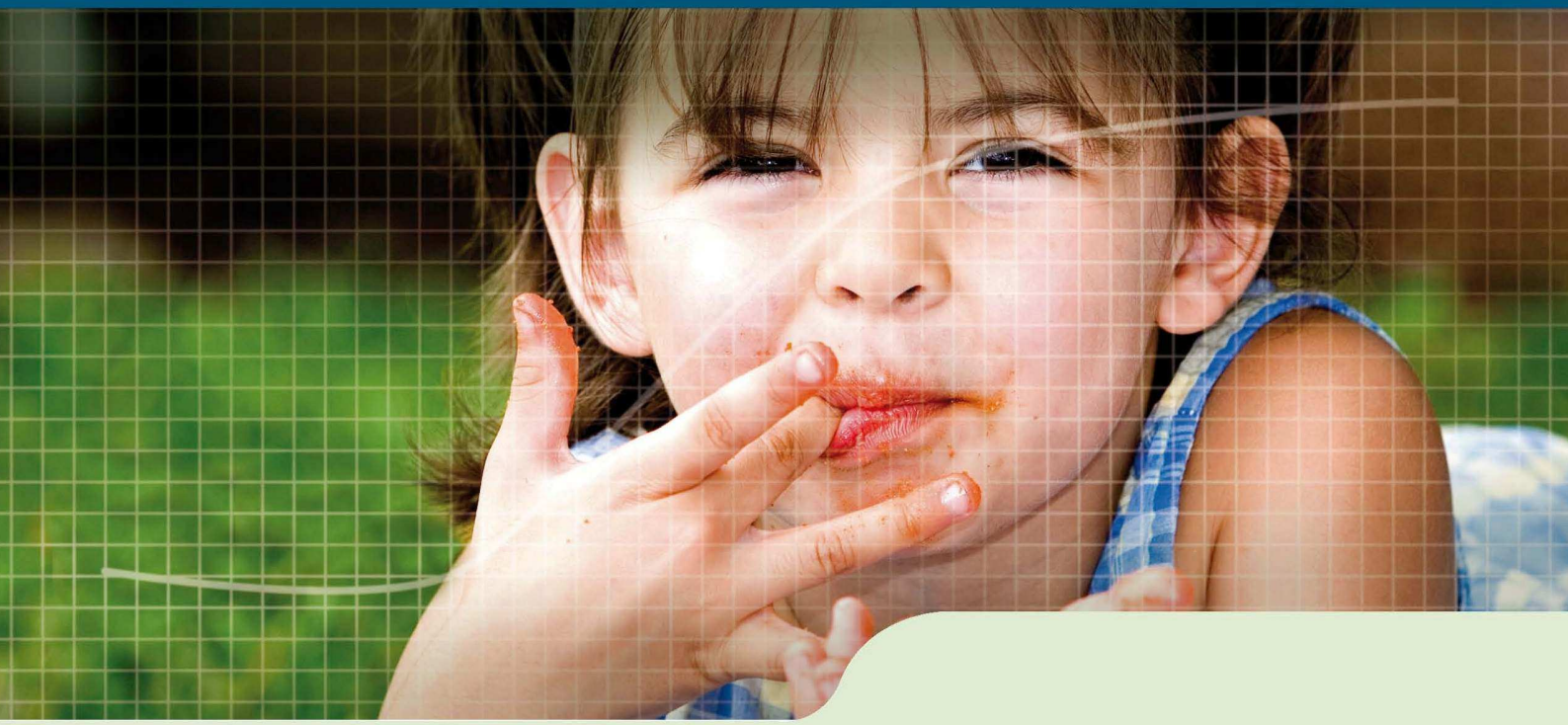

Report 339

Performance of milk collection centres in Ethiopia

Asessment of the operation of milk collection centres in the central highlands of Ethiopia (Akaki, Asela, Chancho and Holeta)

March 2010

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Colophon

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Wageningen UR Livestock Research and Central Veterinary Institute of Wageningen UR, both part of Stichting Dienst Landbouwkundig Onderzoek (DLO Foundation), together with the Department of Animal Sciences of Wageningen University comprises the Animal Sciences Group of Wageningen UR (University & Research centre).

Single numbers can be obtained from the website.

ISO 9001 certification by DNV emphasizes our quality level. All our research projects are subject to the General Conditions of the Animal Sciences Group, which have been filed with the District Court Zwolle.

Abstract
Using interviews and visual observations, this report describes various aspects of the performance of milk collection centers in four different areas of Ethiopia. Characteristics of suppliers, the collection process, hygienic measures and administration of the centers are described, differentiating between peri-urban and rural areas. A limited numbers of farms was visited to carry out visual observation of the milking.

Keywords
Milk collection centers, Ethiopia, peri-urban milk production, characteristics of suppliers, hygiene, marketing

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Summary

In 2008, two students, Elles Pronker and Tijmen Leegwater of the Van Hall Larenstein Institute of Wageningen UR carried out research activities into the performance of milk collection centres in Ethiopia. This work was part of a wider research programme into various aspect of the development of the dairy industry in Ethiopia.

Four field sites were selected, 3 in peri-urban areas near Addis Ababa, 1 in a rural area approximately 150 kms south east of Addis Ababa. A structured questionnaire for interviews of staff members of the milk collection centres was prepared, as well as a checklist for visual observation of both the situation at the milk collection centres and at the milking situation on-farm.

In rural areas, households supplying milk to the MCC own 4.7 cows on average, of which 20% are crossbreds and they supply 3.7 liters daily to the MCC.
In the peri urban areas, households supplying milk to the MCC's own 3.8 cows on average, with 60 % crossbreds and they supply on average 9.0 liters milk daily to the MCC.

Milk collection centres in peri-urban areas have a larger membership than centres in rural areas. The majority of members are male: 56% in the peri-urban areas, 79% in the rural areas. Most of the milk is delivered on foot (50%), the rest mainly using donkeys or horses.
In the rural areas, 75% of the MCC's collect milk only once a day. Evening milk delivery in the rural areas is only 8% of the daily total, whilst for the peri-urban areas this is 25%.
Most of the milk is delivered in plastic containers. All MCC use filters and 90% use lactodensimeters. In the peri-urban areas all MCC's use alcohol tests, in the rural areas this is only 12.5%.

Visual observations took place on-farm during milking. Positive aspects monitored were udder cleaning before milking (100%), washing hands before milking (94%), cleaning of equipment with hot water and detergent (app. 90%). Milking however always takes place in the holding area, with cows standing in either wet or dusty manure.

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1 Introduction, background

Ethiopia has the largest number of livestock in Africa. Despite this large number of animals, the consumption of milk is amongst the lowest in the continent. This problem is associated with among others poor access to markets and hence milk produced in the country cannot easily be marketed. Furthermore, the quantity of milk produced in the rural areas is small, because of low animal productivity. The per capita production and consumption decreased from 26 litres annually in the mid 1980s to 16 litres in 2001 (Muriuki and Thorpe, 2001).

In order to stimulate production, in Ethiopia, like in many other countries, milk collection centres are set up in various parts of the country to support the marketing of milk from small holders to the processors and retailers in the larger towns. Milk collection centres can be important links between the producers and the processing plants or the consumers. (Mukumbuta, 2006; Pandey, 2008; FAO, 2002)

In September 2007, the Animal Sciences Group of Wageningen University and Research, was invited to carry out a needs assessment on research and knowledge related issues concerning the development of the dairy sector in Ethiopia. During this assessment it was established that the performance of milk collection centres was of rather poor quality, both in terms of general managerial standards, but worries were raised specifically regarding hygiene and food safety standards(Have, van der, 2008).
The assessment led to the development of a research programme in 2008, focussing on three topics:

- the fodder supply situation and its effects on milk production
- the reasons for underinvestment in the dairy sector in Ethiopia
- the performance of milk collection centres in Ethiopia

The proposed research program was discussed with the Netherlands Agricultural Councilor and other stakeholders in the dairy sector (CG Dairy meeting[1]). The research project 'Support to the Development of the Dairy Sector in Ethiopia (BO-10-006-075(Afr.15))' was commissioned by the Netherlands Ministry of Agriculture and Food Quality and carried out by the Animal sciences Group of Wageningen University and Research Centre.
The topic on fodder has been taken on by an Ethiopian MSc. Student, and will be finalized mid 2010.
A study on the reasons for underinvestment in the dairy sector, was carried out and completed in 2008 (Bekamp, 2008).
The field research on the performance of milk collection centres was carried out by two students of Van Hal Larenstein Institute of Wageningen University, in the period september 2008-january 2009.

The aim of the research was to carry out an assessment of the performance of milk collection centres in Ethiopia. The results of the assessment will among others be fed into further policy making on dairy development in Ethiopia.

The research started with a desk study on experiences with milk collection in other countries, which was followed by fieldwork in four areas in Ethiopia.

This report mainly describes the results of the field research on the milk collection centres.
Some more general information on various aspects of operating milk collection centres is given in the appendices.

[1] Consultative Group meeting: a quarterly meeting of all stakeholders in the dairy industry, facilitated by SNV Ethiopia

2 Research questions and methodology

2.1 Research questions

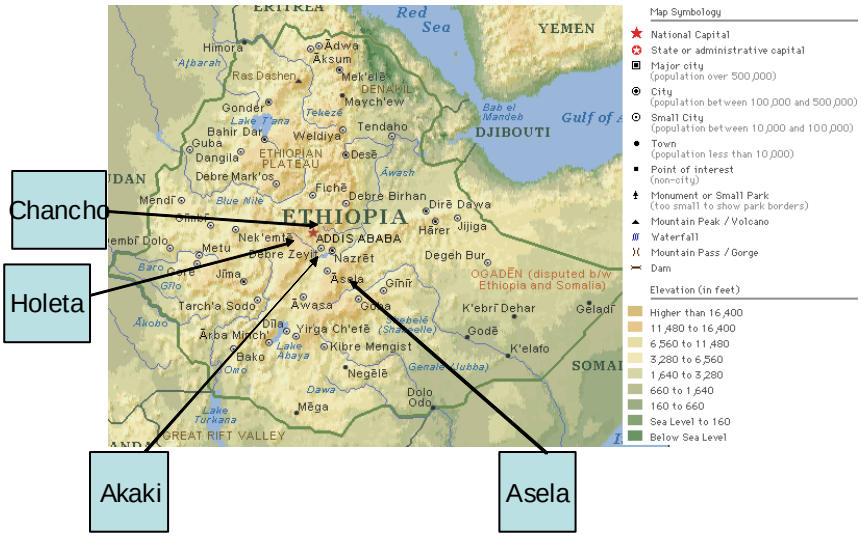
The leading research questions were:

1. *What are the criteria to assess the milk collection centres and what are the weaknesses and strong points of the milk collection centres in Ethiopia?*
   a. *How is a milk collection centre set up in Ethiopia?*
   b. *What is registered and administered at the milk collection centres?*
   c. *What are the opinions of the stakeholders about the milk collection centres?*
2. *Which improvements are needed to create a successful milk collection system in Ethiopia?*

2.2 Methodology

Two students of the Van Hall Larenstein Institute of Wageningen University carried out fieldwork in four different areas of Ethiopia. Field sites were selected, all in areas with high potential for milk production in the highlands of Ethiopia varying from 1500-3000 mts. a.s.l. Most of the milk reaching the formal dairy chain of Addis Ababa is produced in the peri-urban areas. In order to compare milk collection in peri-urban areas with milk collection in the rural areas, three research sites were selected in the peri-urban areas of Addis Ababa (Chancho, Akaki and Holeta where a total of 16 milk collection centres were part of the research) and 1 in a rural area (Asela, where eight milk collection centres were subject of research).

Map 1 Field study areas



Structured questionnaires were prepared (Appendix 1) and field tested in Debre Zeit (40 kms south of Addis Ababa).
To strengthen the research, a checklist for visual observations at the milk collection centres was used (Appendix 2). In all the field sites, the farms of a number of farmers delivering milk to the collection centres were visited, and the conditions under which milking took place were observed and assessed using a checklist (Appendix 3).

The data were analysed using Microsoft Excel, as the samples were too small for statistical analysis. Datasheets are presented in Appendix 5.

3 Brief overview of the dairy sector in Ethiopia

3.1 General overview of Ethiopia

Population
The total population of Ethiopia stands at approximately 80 million. Figures below show the breakdown of the population according to age category for the year 2008 (CIA):
0-14 years: 43.1% (male 16,932,540/female 16,818,931)
15-64 years: 54.1% (male 21,128,196/female 21,211,755)
65 years and over: 2.8% (male 979,166/female 1,183,502) (2008)
Average population growth is 3.2% per year.

Economy
Ethiopia's economy is largely based on agriculture, which accounts for almost half of GDP, 60% of exports, and 80% of total employment. The agricultural sector suffers from frequent droughts and poor cultivation practices. Coffee is critical to the Ethiopian economy with exports of some $350 million in 2006, but historically low prices have driven many farmers to supplement income from other crops and off-farm employment.

Livestock
Ethiopia has the largest livestock population in Africa, which is estimated at about 35 million tropical livestock units[2]. However, milk production is very low and is approximately 1.4 million tonnes per annum, increasing at a yearly rate of 1.2% for milk produced from indigenous stock and 3.5% for milk produced from improved stock. As human population increases at a rate of over 3% per annum and with little import of dairy products, milk consumption is decreasing. The average per capita consumption of milk is 19 kg/year and is lower than the African (27 kg a year) average, while the world average is 100 kg per capita per year.

3.2 Current situation of the dairy sector

3.2.1 Dairy production systems

Four main dairy production systems can be identified in the country:
- - a small commercial sector consisting of large private and state farms;
- - small urban/peri-urban systems raising crossbreds or both crossbreds and local cattle and having access to milk collection centres (private or cooperative);
- - smallholder mixed farming systems in the highlands using indigenous breeds;
- - pastoral/agro pastoral systems in the lowlands.

Reliable figures on the relative importance of these systems in terms of number of farms/herds, dairy population or share of milk produced are not available. However, a rough estimate indicates that currently, about 1.4 billion litres of milk is produced annually and it is estimated that 900 million litres (63.3%) is produced by rural small-scale mixed farms in the highlands, 205 million litres (14.3%) by small urban/peri-urban farms in the highlands, 320 million litres (22.4%) by pastoral/agro-pastoral producers in the lowlands and 5 million litres (less than 0.03%) by large private and state farms. (Yemesrach, 2003; Geda, 2001)

Urban milk production
One of the largest sources of milk in Addis Ababa and regional towns is from intra-urban milk producers. About 10 years ago, a total of 5167 small- medium- and large-scale dairy farmers existed in and around Addis Ababa (Region 14 Addis Ababa Agricultural Bureau survey report quoted by Azage and Alemu 1998). Total milk production from these dairy farmers was estimated to be 34.649 million litres/annum. Of this total, 73% is sold, 10% is left for household consumption, 9.4% goes to

[2] Tropical Livestock Unit, a measure used in the tropics equivalent to an animal of 250 kilograms (550 lb)

calves and 7.6 % is processed, mainly into butter and A*yib*[3] (Azage and Alemu 1998). The producers deliver milk to consumers or consumers may collect it at the producer's gate. Studies indicate that in terms of volume 71% of intra-urban producers sell milk directly to consumers (Belachew et al. 1998). Payment to producers is generally on a monthly basis. This house-to-house milk marketing system is traditional, but it poses food safety risks to consumers. The milk being marketed under this system is of questionable quality. Milk is not pasteurised and there is a possible risk of adulteration. Although, some farmers produce good quality milk, hygienic quality and composition of most milk marketed in such production systems is poor. Moreover, prices are high even when quality of the milk delivered is low. No standards, quality control mechanisms or dairy policy exist to safeguard consumers. Regional towns face the same situation and there are limited data available relating to existing milk marketing systems in regional towns. (Redda, 2002). Urban dairy farmers also experience problems with the hygienic conditions related to manure management. Unhygienic production conditions (smell, flies etc) are a cause of friction with town planners.

Peri-urban milk production
This includes smallholder and commercial dairy farmers working in the proximity of the city of Addis Ababa and other regional towns. Most of the improved dairy stock in Ethiopia is used for this type of dairy production. Until recently, formalised milk marketing of standardised and pasteurised milk to the city was monopolised by the formerly government owned Dairy Development Enterprise (DDE) which was privatised in 2008. However, contribution to the total domestic milk supply for Addis Ababa remained at only 14% (Belachew et al. 1994). The dairy processing plant of the former DDE now operates under the name of Lameh Dairies. A former large state farm has been privatized and has started milk processing, operating under the name of Sebato Agro Industries. Currently, smallholder farmers' milk marketing units (dairy cooperatives/ associations), the privatised DDE enterprises and private processors and private dairy farmers in and around Addis Ababa are supplying dairy products to the city market. There is no adequate and reliable information available on the milk-marketing situation in other regions. (Redda, 2002)

Rural milk production
This subsistence type of production is the predominant milk production system accounting for over 97% of total national milk production (Staal and Shapiro 1996). In this system, there are pocket areas where crossbred dairy stock have been and are distributed, but largely the system is based on low producing indigenous breeds of zebu cattle (Vernooij, 2009). Livestock are kept under traditional management conditions and generally obtain most of their feed from native vegetation, aftermath grazing and crop residues. (Redda, 2002). Much of the milk produced in this system is traditionally processed into butter and ayib (highlands) or consumed as liquid milk products (pastoral areas).

Constraints to production
In research carried out by the FAO, the most frequently reported constraints by farmers are poor animal breeds (92%), low milk supply (88%) and lack of feed (83%). The areas, which need technical support as identified by the respondents at the milk collection centres are packaging (68%), record keeping (100%), financial management (100%), quality control (100%), marketing (100%) and cooperative administration (100%). More than 65% reported that they are ready to pay for these services (FAO, 2008). More on this issue in 4.2.5.

3.2.2 Milk marketing

Table 1 Ethiopian livestock and livestock production potential

	Year 2004
Number of cattle	35,500,000
Butter and Ghee (Metric tons)	17,550
Butter of cow milk (MT)	1,950
Ghee from cow milk (MT)	15,600
Cheese whole cow milk (MT)	5,850
Beef and veal meat (MT)	304,000
Cow milk (fresh)(MT)	1,450,000

Source: (FAO 2004)

[3] Locally made cheese

In Ethiopia, liquid milk is marketed through both formal and informal channels. The informal channel involves direct and indirect sales to consumers. In direct transactions, producers sell their milk to final consumers at the farm gate, in their immediate neighbourhoods or in the city of Addis Ababa or nearby towns. People transport the milk on foot, by horse, by donkey or by public or private transport. Producers also sell indirectly to consumers through itinerant traders. Milk-collection centres are located within a 120 km radius of Addis Ababa, which can be considered as the peri-urban areas (Siegfried Debrah, 1991).

In scarcely populated areas, or areas where individual suppliers are far away from the dairy plant and difficult to reach, milk has to be transported over long distances. Milk collection can take place in different stages. Farmers take their milk to a milk collection point, where the milk is weighed and usually a few basic platform tests are done. From the milk collection point, milk can be transported directly to the dairy plant or to a milk collection centre where the milk is bulked and cooled and transported to a dairy processing plant. In most areas of Ethiopia, milk collection centres act also as milk collection points and are located at the main tarmac roads. In most cases, milk is transported directly in milk cans to the milk processing plant. Private parties (mainly private dairy plants) and farmers' cooperatives and/or associations operate milk collection points and milk collection centres. There are certain quality requirements for the milk deliveries at the collection centres. However, only 44% reported that the quality test is done at the time of milk delivery.

The milk deliveries are received mainly in the morning only (87%). The capacity of the mainly cooperative milk collection centres is limited in terms of quantities of milk collected, value-adding processing, geographic coverage, number of peasant associations and dairy products involved.
The main location of dairy product sales by cooperatives is the milk collection centre itself. The main buyers are rural and urban consumers in the area where the cooperatives are engaged in direct marketing of dairy products to the consumers and as such, there are no contractual arrangements and strong vertical linkage to the supermarkets, institutional users and private and/or public processing plants.
The dairy cooperative’s product offerings are limited mainly to butter, skimmed milk, yoghurt and cheese. The selling of fresh liquid milk is not very common. The major consumers purchase points for raw milk are to a neighbour dairy producer through contractual arrangement (76%).

4 Research findings

4.1 General information research locations

4.1.1 Akaki (peri urban)

Akaki is located 30 kilometres south of Addis Ababa. The climate is subtropical, with daily temperatures varying between 18 and 25 degrees and an average of 22 degrees Centigrade. The altitude (1850 to 1950 metres) contributes to this more temperate climate. In this area the average rainfall is 850 to 900 mm annually. This rainfall is divided in two periods: a short rain season from February until April and a long rainy season from June until September.

Akaki inhabitants number around 200 thousand, most of the workforce is engaged in agriculture (60 %), 30 % are factory workers and 10 % have other work. There is much industrial activity in Akaki, so the number of people involved in agriculture is relatively low in comparison to most other parts of Ethiopia. The factory wages are relatively high, as compared to agricultural salaries, resulting among others in a shortage of workers in the dairy sector.

According to the Local Government statistics, farmers in this area own 22 thousand cows of which 39.6 % are dairy cows (all crossbreds) and 61.4 % local breeds, used for draught and meat production.

Of the total milk production of Akaki 75 % is marketed through formal and the rest via informal channels. The large farms deliver their milk directly to the processing plant, by-passing the milk collection centres. The number of specialised dairy farms stands at 1071. Apart from the milk sales, farmers get additional income from selling their calves, which are sold a week after birth, for a price around 150 - 170 Birr[4].

The major crops that are fed by farmers are grain straw, hay and concentrate. Not enough fodder can be grown for self-sufficiency, so additional feeds have to be purchased. The feed problem is increasing, because in some areas land that was used to produce feed is now used by flower farms and urban encroachment. The water for irrigation and drinking water for cows comes from the river or wells.

Several non-government organisations in this area provide training to farmers. These are local organisations (either government departments or some church based assistance programmes). One international NGO, Land O' Lakes, is involved in dairy development in Ethiopia and is also active in this area. Some farming families get extra income through employment or by selling crops. The manure is used for fuel (cooking) and for house building.

4.1.2 Asela (rural)

The research in Asela was carried out in three woreda's[5] (Tiyo, Lemu Bilbilo and Sagure). These areas are located 60 km round Asela. Asela is 175 km southeast of Addis Ababa. The altitude of the area is between 2000 and 3000 metres. Because of the altitude, the average daily temperature varies from 6 to 30 ℃ . The average rainfall in the area is 800 mm a year, with a maximum of 1500 mm a year.

300,000 people live in this area, 50% of them are Muslim and 50% Christian. Ninety nine percent of the population is involved in farming on a total of 56.000 farms.

The largest dairy farm has 25 cows and the smallest only one. Out of the 324 thousand head of cattle in the area, only approximately 14.000 are crossbreds. Most farmers keep their crossbreds in a self-made barn and their local cows of the Arsi breed in the open. The crossbreds are kept in a barn to

[4] Local currency, exchange rate of 13.5 Birr for one Euro (January 2009)
[5] Smallest administrative unit (village)

protect them from the sun during hot days. Artificial insemination services do exist in the area, but semen not regularly available and cannot be relied upon.
In addition to cows farmers keep sheep (149,895), goats (25,122), horses (43,636), mules (2,437), donkeys (31,557) and poultry (145,293).

The cattle are used for different purposes, like draught, meat and milking. Most of these animals are sold to the butcher at an age of eight years at a price of 1300 Birr for an Arsi and 2000 Birr for a cross bred. Prices for young milking cows of the Arsi breed are 2500 Birr, prices for crossbreds are approximately 8000 Birr.

The main crops grown in this area are wheat, barley, teff, pea and beans. For feeding the cows, straw, green feed (like, elephant grass and alfalfa), hay, maize, rapeseed, oilcake and compound concentrates are used. There is a shortage of land in the Asela area to feed all the animals. For that purpose the farmers buy feed (concentrates, byproducts from the factories in Asela. The straw, green forage and hay come from feed markets in surrounding areas. The most common water sources for the cows are local rivers and wells. Farmers near the main road use tap water.

Some of the animals are used for milk production, in particular the crossbreds. Milk is processed either at home(40%) or taken to the milk collection centres (60%). The raw milk is processed at home in four different products: yoghurt (sour milk), butter, skimmed milk and cheese (Ayib).

The cows' manure is used for compost/fertilizer, fuel (dung cake), building material while one farmer has his own biogas installation[6]. The manure cakes are used as fuel for cooking and baking (for the preparations of one loaf of bread one needs around three dung cakes). The current price for a cake is 0.50 Birr (November 2008).

Training support in the area is provided by the FAO, Land O' Lakes and the local Ministry of Agriculture. Main topics are milk quality, dairy management and fodder production. FAO is in the process of winding up its support to this area, so in the near future the local Ministry (Agricultural and Rural office of Asela) will be responsible for these trainings. Trainings are also, but to a lesser extend, supported by organisations like Land O' Lakes and SNV (Tulu, 2008).

4.1.3 Chancho (peri-urban)

Chancho is located 45 kilometres northwest of Addis Ababa. The altitude is between 2500 and 2600 metres. The average daily temperature is about 15 degrees centigrade with a minimum of 10 degrees and a maximum of 23 degrees. The average rainfall varies between 800-1200 mm per year.

The total population of Chancho is around 30 thousand people, of whom 85% are Christian Orthodox.

85% of the income of the people is derived from farming activities. Additional income is generated from employment in industry and flower farms. One of the largest milk collectors in this area is the (cooperative) Union of Selale Dairy farmers. The milk suppliers own an average of three cows with a minimum of one cow and a maximum of fifty cows. Sixty percent of these animals are crossbreds and forty percent are local breeds. The average milk yield of a crossbred cow is about ten litres a day. Local breeds yield about four litres a day. The most important income sources of the farming families are from the sale of milk, but they also keep sheep, horses, poultry and donkeys.

Farmers training in the area is mainly provided by SNV and Land O' Lakes. The trainings focus on milk hygiene, cooperative and farm management and milk processing.

[6] The Ministry of Energy has, with the support of SNV Ethiopia, started a biogas support programme in 2008

4.1.4 Holeta (peri-urban)

Holeta is located forty kilometres north-west of Addis Ababa at an altitude of 2400 ms above sea level. Average minimum and maximum temperature in this area vary from 6 to 22 degrees centigrade. The average yearly rainfall is 1100 mm. Almost all rainfall occurs in the long rain season from June up to September.

The total population of Holeta is around 102,000 people (Orthodox Christian and Muslim).

The total number of cattle in Holeta area is around 185,000. (98 percent are local breeds and 2 percent are crossbreds). Farmers keep an average of two cows per farm. Besides, farmers keep sheep, goats, donkeys, horses, mules and chickens. But the exact number of these animals in this area was not known.
Cows mainly graze but are also fed with straw from crops, hay, concentrates and forage grown in back yards. Drinking water for the cows is coming from rivers, springs, ponds, groundwater and tap water. The average production level for the local breeds is about 2 litres per day and for crossbred cows about 5 litres a day.

4.2 Research findings milk collection centres

4.2.1 Characteristics of suppliers

Table 2 shows the differences in average characteristics of the milk suppliers (farmers supplying milk to the milk collection centre) between the rural and peri-urban areas.

Table 2 General information on milk suppliers to the milk collection centres

	Rural	Peri-urban
Average number of cows per supplier	4.7	3.8
Average number of crossbreeds per supplier	0.9	2.2
Average number of local breeds per supplier	3.7	1.4
Percentage crossbreds	20%	60%
Average milk supply per member to the MCC (l)	3.7	9.0
Average milk supply per non members to the MCC (l)	2.8	7.1
Supplied milk per cow to the MCC (l)	0.78	2.33

The milk suppliers in the rural Asela area own more cows on average, 4.7 head per household as compared to 3.8 in the peri-urban study areas. Milk suppliers in the peri-urban areas however keep more crossbreds, indicating their specialization in milk production. The largest peri-urban farm visited owns 50 cows, the smallest just one. Ownership in Asela varies from one to a maximum of 20 head. Members supply more milk per day to the collection centres than non-members, which most probably is a result of the training and other support received by members.

In the rural area, farmers keep Arsi cows and in the peri-urban areas farmers mainly use the Borana breed and Borana-Friesian crossbreds. These local breeds clearly differ in milk yield: average milk yield of Borana cows is higher than the average yield of the Arsi cows.

Most of the milk collection centres are owned and managed by cooperatives, except for the milk collection centre of Holeta town which is privately owned.
Farmers can deliver milk to a milk collection centre without being a member of the cooperative running the centre.
To become a member of a cooperative, farmers have to pay a registration fee. The amount differs per area, but membership entry fees are approximately 500 Birr annually. The cooperatives that do not have shares, require a small membership fee per year, which is around 100 Birr/year. Members' benefits are a stable milk price and a guaranteed market . Furthermore, they can get training from NGOs that work with the cooperatives. Figures 2
and 3 provide an overview of the number of members and the composition of male and female members per milk collection centre in the rural and the peri-urban areas.

Fig. 1 Membership composition in rural areas

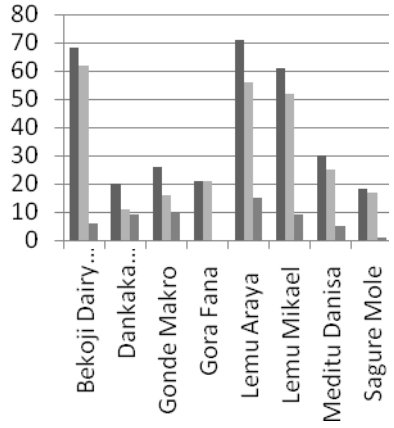
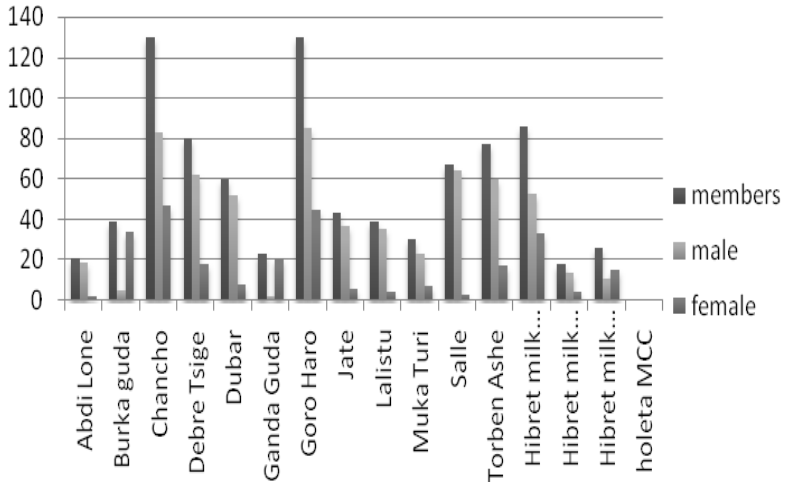


Fig. 2 Member composition in peri-urban areas



The milk collection centres in the rural area of Asela have fewer members as compared to the milk collection centres in the peri-urban areas. Rural areas are more sparsely populated, resulting in a lower number of members and suppliers per centre. Most of the members are male: in the peri-urban area 56% of the members are male and in the rural area 79% of the members are male.
Female membership is low in the peri-urban areas (figure 3) except for some areas (Chancho, Goro Haro) but rather high in a number of cooperatives at the Asela area (figure 2)

Transportation to the milk collection centres takes place in different ways. Figures 4 and 5 are pie charts of the different means of transport that the farmers use to take their milk to the milk collection centres.

Fig. 3 Means of transport to MCC in rural areas

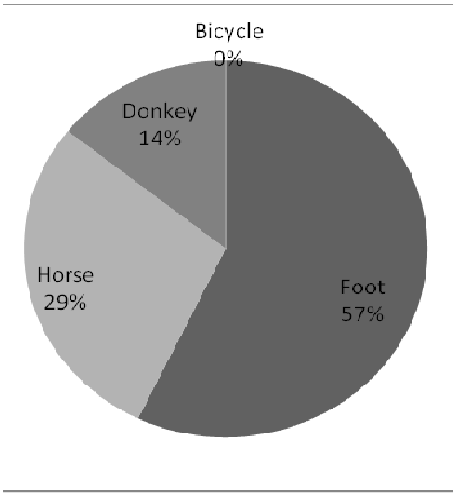
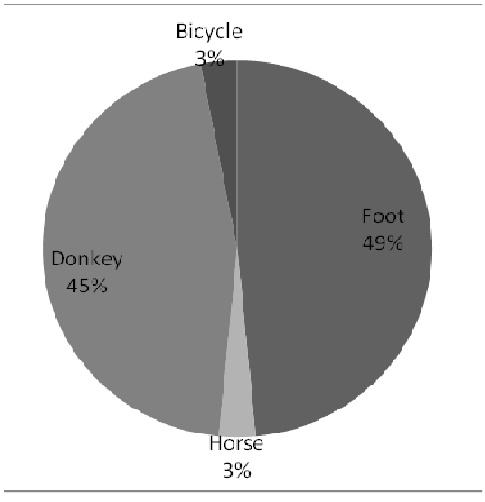


Fig. 4 Means of transport to MCC in peri-urban areas



In both the rural and urban areas the farmers bring the milk mainly on foot (app. 50%) or by horse or donkey (app. 40%). In the rural areas, sometimes bicycles are used too.

Although most farmers live within the vicinity of the milk collection centre, travel times to the milk collection centres (MCC) differ greatly. Figures 6 and 7 show the average daily travel time of famers to the milk collection centres.

The shortest travel time is two minutes and the longest travel time is two hours for a single trip. The farmers in the rural area understandably need more time for travelling to the MCC than the farmers in the more densely populated peri-urban areas.

Fig. 5 Travel time to MCC in rural area (minutes)

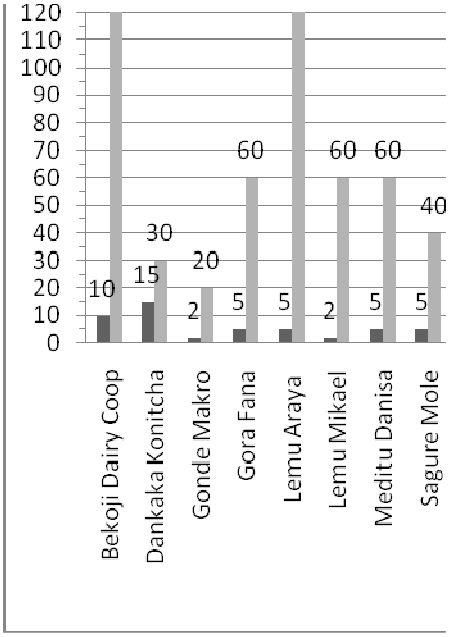
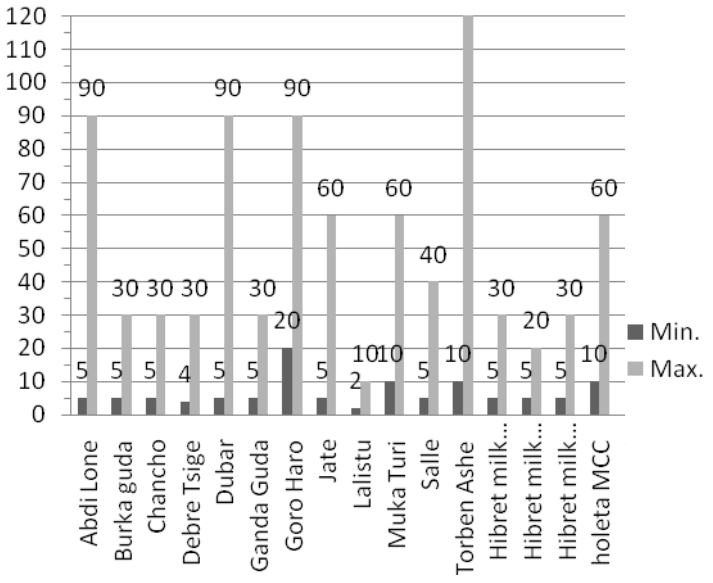


Fig. 6 Travel time to MCC in) peri-urban area (minutes)



Milk delivery twice a day can become very time consuming for some farmers in the rural areas, also resulting in higher risks for deterioration of milk quality. Ideally, travel time to the MCC should not exceed one hour for a single trip (FAO, 2002).

4.2.2 Process of milk collection

After delivery, the employees of the milk collection centres weigh the milk and do some basic milk quality tests. In Ethiopia, the testing equipment used at the milk collection centres consists of lactodensimeters, alcohol test, filter and visual observation. In figures 8 and 9 the frequency of use of each method of quality control is displayed. The lactodensimeter measures addition of water to the milk. The alcohol test gives an indication of the acidity of the milk (milk acceptable for consumption or spoilt). The filter and visual observation gives indications concerning the cleanliness of the milk. More information on hygiene in milk collection centres is given in appendix 11.

Fig. 7 Use of quality control in rural area

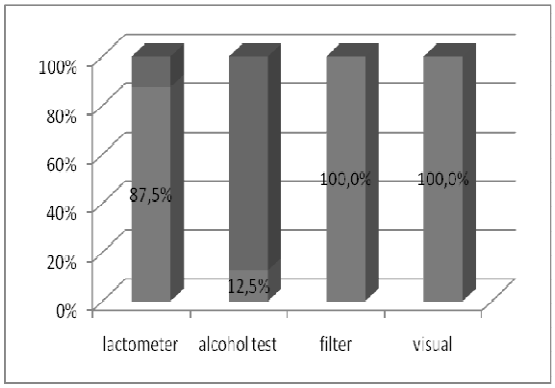
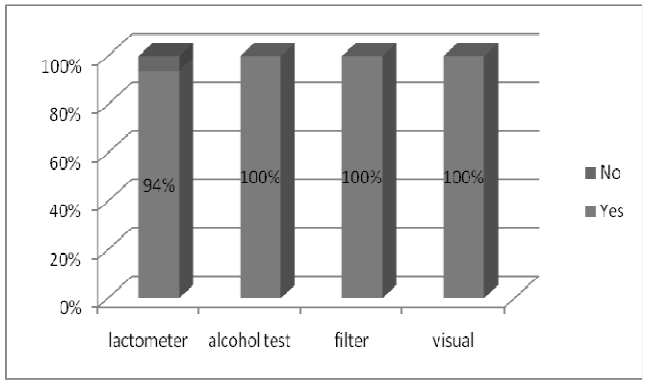


Fig. 8 Use of quality control in peri-urban areas



The figures show some differences in the use of the quality control methods between rural and peri urban areas. Quality control visually and by using filters is done at all centres. In the rural areas, there is only one centre that is using the alcohol test. Most employees in the rural areas are not familiar with the use of testing equipment and often only use filter and visual observation methods.
When the milk is sold directly to end-consumers at the MCC, the interviews show that there is hardly a felt need for quality testing, neither by employees of the milk collection centres, nor by the customers. In most cases, consumer boil the milk at home.

After collection, milk is stored either for further processing at the centre or until transport takes place to the processing plant. Only the milk collection centre in Holeta has the possibility to cool milk, the other milk collection centres do not have any cooling equipment. In these cases, fast processing or transportation to the processing plant is a must. The time from milking to cooling is often more than three hours in the peri-urban area before the milk is processed in the urban area.

Table 3 provides various statistics on the milk collection centres, differentiating between peri- urban and rural areas.

Table 3 Key data of the milk collection centres

	Peri-urban	Rural
Average amount of received daily:	817	160
The largest MCC	2200	400
The smallest MCC	250	40
Average amount milk received /employee	235	39
Average fixed costs/litre milk[7]	0.05	0.19
Average milk price for supplier (EB)	4.63	3.41
Highest milk price for supplier (EB)	5.10	4.00
Lowest milk price for supplier (EB)	4.25	2.00

Quantities of milk received per centre, vary greatly between rural and peri urban areas. Milk supply is much higher in the peri-urban areas, where more farmers have turned to commercial dairy production, using crossbreds. Furthermore, the data are influenced by sales to consumers directly at the centres: these are not included in the above figures, which provide only the amounts of milk sold to processing plant. Direct sales to consumers are higher in rural milk collection centres as compared to peri urban centres.
The largest collection centre is the privately owned one in Holeta. This collection centre also has owns a lorry that collects the milk along the main roads around Holeta.

Efficiency
Besides the fluctuations in the amount of milk received also the amount of milk processed per employee is fluctuating substantially between milk collection centres. There are on average four employees working at the centres, but the efficiency (amount of milk per employee) of operations differs greatly in all the research sites. Subsequently, the fixed costs per litre of milk (without processing costs) are lower in the peri-urban area as compared to the rural area. Labour costs constitute the biggest part of these costs.

The collection centres in the peri-urban areas deliver milk to the urban market (like Addis Ababa) where there is high demand resulting in a better milk price for the farmers than in the rural areas. In the rural areas, the infrastructure is poor, making it virtually impossible to take the milk to the urban areas.

In the peri-urban areas, prices for the milk are more stable and higher, because of the bigger and more permanent demand from the towns. The price has more than doubled in the last two years. The privately owned milk collection centre in Holeta pays the lowest price, which is most likely the result of their monopoly position and the surplus of milk in this area. The variation of prices is also larger in this area due to fluctuating seasonal demands: there is enough milk in the rainy season but insufficient amounts in the dry season.

[7] These are approximates, as it was hard to get all the financial data. The differences obviously reflect the consequences of economies of scale.

The payment for raw milk is only based on quantity, as there are no facilities to test the milk on fat and protein and to pay for quality (composition).
In the peri-urban area, most of the milk collection centres pay their suppliers every two weeks. In the rural areas, the payment is monthly for 75% of the collection centres and for 25% payment takes place every two weeks. Bi-weekly payments are on request of the farmers, monthly payment will result in longer cash shortage periods at the end of every month.

The milk collection centres collect the milk once or twice a day. In the rural areas, only 25% of the milk collection centres collect twice a day, 75% only once. In the rural areas, 8% only of total daily milk collection takes place in the evening; for the peri-urban areas, this is 25%. Farmers who live in remote areas will not be able to return home before darkness, therefore they supply in the morning only and use the evening either for home consumption of for selling to their neighbours.

4.2.3 Hygiene

The materials that are used by farmers to store and transport are mainly plastic bottles and containers. Most of these are in good condition, but never-theless difficult to clean. The milk collection centres use mainly plastic containers. Some have aluminium ones, but these are too expensive for most of the milk collection centres. Only the Selale Union of Chancho uses aluminium containers (50% of total trading capacity). In the rural areas, farmers use their own processing equipment. Traditional butter is sometimes made using wooden containers, which are difficult to clean and sterilize. Stainless steel materials that are available are usually obtained from local NGO's or the FAO.

Types of bottles to used to transport milk

After the milk has been collected from the centre, the materials that are used for quality control, measuring and storing milk are cleaned, for which soap and detergent is used. Detergent is used to disinfect the materials. The effect of detergent is best in combination with hot water. Unfortunately, not all the milk collection centres have access to hot water, leaving doubts about the effectiveness of the cleaning process. Figures 10 and 11 show pie charts with the method of cleaning that is used.

Fig. 9 Types of cleaning in rural area

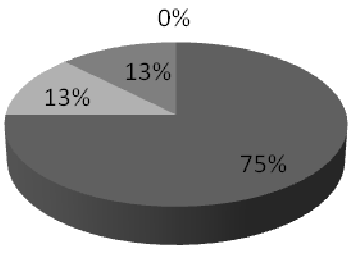
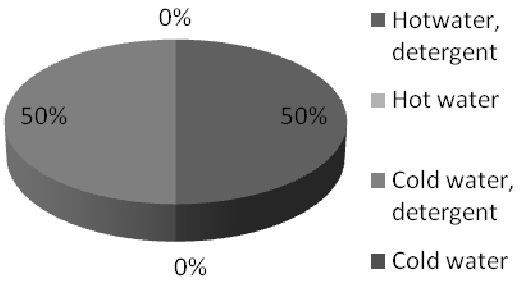


Fig. 10 Types of cleaning in peri-urban area



None of the MCC do clean with cold water only, all to them use extra measures. In the peri-urban areas, 50% of the milk collection centres do use water with detergent, whilst the other half only uses hot water. In the rural areas, 75% of the MCC use hot water with detergent, whilst 13% use hot water only and 13% use cold water with detergent. The latter method is obviously the most inefficient, since fat and greasy residues can hardly be removed in this way.

4.2.4 Finance and administration

For a good and fair payment system, and proper recording of the milk deliveries, the milk collection centres need a good system of administration. Figures 12 and 13 display five kinds of administration measures that are used. The administration records consist of a profit and loss account, which analyses the trading result of the milk collection centre. The milk record is used for an overview of the amount of milk supplied and delivered. There are two records: one for the farmers themselves and the other for the milk collection centre. The record for the farmers is showing the amount and quality of the milk delivered. The records of the milk collection centre also include the total daily amount as well as the monthly milk supplies
Thirdly, a cashbook is used for an overview of the cash inflows and outflows. Fourth is the minute book, this is a report of the visits and meetings. Finally, the salesbook records the sale of milk products and sometimes sale of fodder and/or medicine for farmers, if the centre is also trading in these commodities.

Fig. 11 Administration of MCC in rural areas

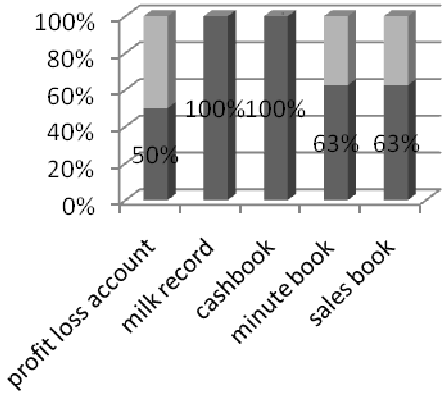
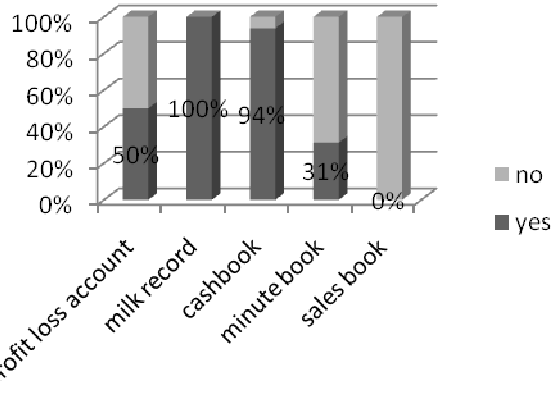


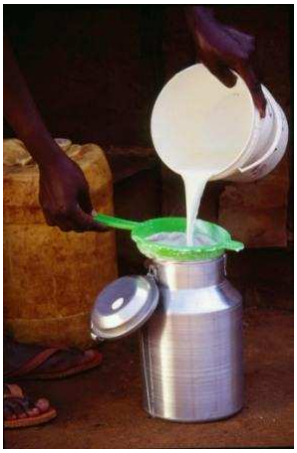
Fig. 12 Administration of MCC in peri-urban area



The figures display the use of the different records kept at the milk collection centres. In the peri-urban areas, the use of a sales record is virtually nil, because nearly all the milk is going direct to the processing plant. With the milk intake record, they have all the necessary data of the milk. In the rural areas over 60% of the centres, keep a sales book.

For account keeping, 50% of all centres use a profit and loss account and 94% use a cashbook in peri-urban areas, against 100% in the rural areas. The absence of a profit and loss account means that 50% of all centres do not have a proper analysis of their financial situation.
The milk collection centres in the rural area sell all the milk products locally, but this is a very small market with strongly fluctuating prices affecting both the income of the farmers and the milk collection centres. When there is a low demand, the farmers have to take the (skimmed) milk back home and have very little income only.

It was hard to obtain reliable data on the financial situation of the milk collection centres. As per the figures available, the profitability of the milk collection centres varies between the 700 Birr loss and 1200 Birr profit per year, on average 300 Birr/milk collection centre profit. The profit of the milk collection centre does not depend on the amount of milk supplied. The reliability of these figures is however rather questionable, given the poor administration and few possibilities to analyse the financial data.



4.2.5 Respondents' perception of problems and solution

The employees of the milk collection centres were asked to indicate the major problems, possible solutions and changes of the milk collection centre expected for the next 5 years. Their answers are summarized in table 4.

Table 4 Answers to open questions

		Rural	Peri-urban
Major problems	Market	7	8
	Low quality utensils	0	8
	Need of standards	0	7
	Education level	1	3
	Better buildings	3	2
	Short of cross breed	1	1
	AI/medicine store	3	1
Solution	Own processing plant	4	11
	Materials	0	8
	More milk	0	8
	Education	0	5
	New building	6	2
	Quality standards	0	1
Five year plans	New materials	0	7
	Better quality milk	1	6
	Forage and concentrate	3	5
	Higher milk price	1	3
	AI / medicine store	6	2
	build new MCC (at better place)	0	1
	Find new markets	5	1
	Import improved breed	3	1

The major problems mentioned are grouped into seven different issues. The main problem is the unreliability and uncertainty of the market, forcing the milk collection centre to search for other markets outside their original area of operation.

The peri-urban centres are more worried about the quality of the materials, most probably because they are more exposed to alternative competitors than the milk collection centres in the rural areas. The same difference can be seen in the need for applying quality standards: in the peri-urban areas the positive effects of applying quality standards are rated much higher than in rural areas. There is a much stronger drive with the peri urban milk collection centres towards taking processing and marketing into their own hands, as a solution to overcome the uncertainty of the markets. Discussions at some of the plants reveal doubts about the level of professionalism available to allow for such risky ventures.

Quality of building is worrying at most of the rural milk collection centres, their buildings are indeed often of poor quality, sometimes partly built of clay and difficult to clean.
In their five-year plans the collection centres in the peri-urban areas focus on better quality, which they intend to achieve by improving the feed to get better a better composition (quality in terms of fat and protein) of the milk. Furthermore, they want to have better materials (changing plastic equipment to aluminium or stainless steel). Those producers in rural areas with the ambition to produce more milk, will concentrate on obtaining better breeds in their area through AI services and import of crossbreds from other parts of the country.

4.3 Research findings of visual observations on farm

In order to get a good overview of all factors involved in hygienic dairy production, visual observations were carried out during milking on 18 farms selected at the four field sites (about four farmers per site). Milkers were observed on the application of hygiene measures before, during and after milking, ranging from hand washing, udder cleaning, water quality, cleanliness of milking area, presence of other cows/calves. See appendix 3 for the visual observation on farm checklist.

Due to the fact that time allowed for visiting only a limited number of farmers and most probably farmers with above average management were selected (by the milk collection centre staff) to be visited, results are merely an indication of what is most probably the “top end of the list of quality-suppliers” and can be summarized as follows:

Strong points:
- Almost all producers wash their hands before they start milking (94%)
- All the producers had cleaned the udder of the cow before milking (100%)
- Almost all the producers are cleaning the udder first with water (83%) and subsequently dry it with a cloth (83%).
- Almost all the materials were cleaned after milking with boiled water (83%), with detergent (94%)

Points that could be improved in the future:
- No producers’ use of gloves (0%)
- The milking areas were almost always dusty (50%), wet (50%) and with manure (100%)
- Milk was almost always collected in plastic containers (89%).

In general, farmers are aware of the need for hygienic milking and clean their own hands, the cow’s udder and the utensils. It was not possible to test the quality of the water used for cleaning.

However, due to the nature of most of the farm layouts, it was not possible to milk the cows in separate and clean surroundings, thus negatively affecting the applied cleanliness of hands and udders. All cows were milked amongst or near other cows (and sometimes their calves) in areas that could not be sheltered from wind and dust.
Moreover, virtually all farmers use plastic containers to store and transport their milk.

5 Discussions, recommendations

Milk collection centres are an indispensable tool under the present situation of the dairy chain in Ethiopia. Small dairy farmers, both in peri urban and rural areas, are not able to individually organise a permanent and reliable market outlet for their milk, thus necessitating collective action. This is taken up mainly by cooperative milk collection centres. Privately operated milk collection centres are located along main roads and considered as less reliable than the cooperative ones: private owners move in and out of the milk collection business easier than cooperatives, which are more stable trading partners. In case of a monopoly situation privately owned milk collection centres can influence the milk price for the suppliers in a negative way (this seems to be the case with the Holeta milk collection centre).

In case of milk collection by cooperatives/farmers associations, more added value could be directed to the farmers. However, operation of milk collection centres incurs costs. The results of this survey show that most of the costs are labour costs. A minimum number of staff per collection centre is required (often 4 part-time employed staff). The more milk is handled the lower the costs per litre processed, and the higher the milk price can be for the farmer. Cooling of milk at each collection centre is likely to lead to too high costs. The model (partly already applied at Chancho area) with primary cooperatives collecting milk at milk collection points and bulking of the milk at a milk collection centre for cooling (evening milk) and further transport to the processing plant is a model applied in many countries. This seems also the most cost effective.

The results of the interviews show that staff of the cooperatives consider marketing as a major problem. They still depend too much on the major dairy processing companies. In the rural areas of Asela there is even no formal market. A possible solution is the processing and marketing of dairy products by the cooperative. This will mean a large expansion of the activities of the cooperatives and will require high investments (processing and cooling equipment, transport etc) as well as skilled staff and excellent management and marketing expertise. So far one cooperative (A'daa Lieben in Debre Zeit) has ventured in processing but it is still in its early stages.

The worries raised in general about the low performance of the milk collection centres regarding safeguarding milk quality by various development agencies (SNV, Land O'Lakes) and studies (Haven, van der, 2007), have only been confirmed by this study.
Milk quality control is limited to some basic tests. Preserving quality of milk by means of cooling is done by a few milk collection centres only.
A considerable improvement of the hygienic quality of the milk (bacteria or germ count) could be achieved by replacing the plastic containers used for milking and transport of the milk by aluminium ones. Experiences from other countries show that this does give a considerable improvement. Another step could be to rinse and clean the transport containers at the milk collection centres so that milk residues are removed before famers return to their homesteads.
Testing of milk on milk composition (fat, protein) could be introduced by using a quick milk tester and should be accompanied by payment according to quality. However, this requires a relatively high investment.
Therefore, it can only be concluded that the general hygiene levels in the milk collection centres are low. There is inadequate quality control, insufficiently trained staff and farmers are insufficiently trained on milking hygiene.

Marketing of milk in the growing urban centres of Ethiopia is negatively influenced by the customers' fear of poor milk quality. This certainly applies to the middle and high income earners in the towns, who tend to prefer expensive, imported UHT milk (Land of Lakes, 2007). This can only be turned around when both production and hygiene standards are improved in a comprehensive approach that focuses both on stimulating a more constant production of milk in the peri-urban areas throughout the year (availability) and improving the quality through intensified training programmes at the milk collection centres.

The performance of a milk collection centre can not be viewed in isolation. The cost effectiveness of a dairy coop or milk collection centres will depend on the amount of milk that can be marketed. In rural areas, surplus of milk is less than in the peri-urban areas. Expansion of milk production in the peri-urban areas will depend on the reliability of the market, the availability of animals (crossbreds) and feed and the possibility to access the surplus milk (infrastructure). Increasing the supply of milk to the urban markets needs an integrated approach in which the production of milk, the collection and marketing is addressed simultaneously.

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Appendices

Appendix 1 Questionnaire Milk Collection Centres

Short introduction:
Our names are Tijmen Leegwater and Elles Pronker. We are from a Dutch University, named 'Van hall Larenstein'. At the moment we are in the last year of our study 'Dairy Farming'. For our final practical work we are doing a research project in cooperation with SNV. With this research we want to get an overview of milk collection and marketing in the highlands of Ethiopia. The overall goal of the milk collection centre evaluation is to help assure a safe, healthy supply of milk to processors, and ultimately, consumers. Many factors influence the quality and quantity of milk produced and collected at milk collection centres. The purpose of this questionnaire is to collect the strong and weak points of the milk collection centres. This will enable us to conclude on what can be improved at the collection points in the future.

Questionnaire

Assessment of the operation of milk collection centres in the central highlands of Ethiopia

General information:
Region:

Zone:

Name of the cooperative/ collection centre:

Name of the respondent:

Position of the respondent:

Date:

Producer

1. What is the total number of producers?
    a. Members:
    b. Non members:

2. What is the composition of the members and non-members of the collection centre?

Members	Non-members:
a. Men:	a. Men:
b. Women:	b. Women:

3. How many dairy cows does the farmer own?
    a. Smallest:
    b. Biggest:
    c. Average:

4. What is total number of dairy cows that the producers own?
    a. Of members:
    b. Of non members:
    c. Total:

5. How many litres of milk are collected at the milk collection centre each day?
    a. From members:
    b. From non members:
    c. Total:

6. What is the composition and production of the dairy cows of this collection centre?

	Amount:	Production:
a. Cross breeds:		
b. Local Borena's:		

7. What is the most common educational background of the suppliers?

8. Do the suppliers receive training of a NGO or other organization?

Transport

9. What is the minimal time to take transport from producer to the milk collection centre?

10. What is the maximal time to take transport from producer to milk collection centre?

11. How is milk transported from producer to the milk collection centre?
    a. Car
    b. Bicycle
    c. Motor
    d. Foot
    e. Donkey
    f. Horse

Milk collection centre

12. What is the ownership of the milk collection centre?
    a. Private
    b. Cooperative
    c. NGO, specify:

13. Of how many employees consist the staff of the milk collection centre?

14. Into which products will be processed on the milk collection centres?

15. Into how much % of the total milk yield are these products processed?

16. What is the price per litre/kilo of each product for consumer?

		Percentage:	*Price:*
a. Yoghurt	YES – NO		
b. Butter	YES – NO		
c. Cream	YES – NO		
d. Pasteurized milk	YES – NO		
e. Cheese	YES – NO		
f. On processing plant	YES – NO		
g. Others, specify:			

17. How many times a day will be the milk collected?
    a. Once
    b. Twice

Milk quality

18. How will the materials that are used be cleaned?
    a. With cold water?
    b. With hot water?
    c. With a detergent?, specify
    d. How many times a day? Before collection / after collection

19. What source of water is used that to clean the materials?
    a. Tap water
    b. Well water
    c. Rain water
    d. River water
    e. Water with bacterial standards
    f. Water from processing plant

20. Has the collection centre a possibility to cool the milk?
    a. No possibility
    b. With refrigerator
    c. With ventilation
    d. Cold water bath
    e. Cool room (electric)
    f. Others, specify:

21. Which quality controls are use at the collection centre?
    a. Lactometer, with thermometer
    b. Alcohol test
    c. Filter
    d. Visual observations
    e. Other, specify:

22. At which measurement will the milk be rejected?
    a. Lactometer: < 1.026 and > 1.032, other, specify:
    b. Others, specify:

Finance

23. What is basis of milk price?
    a. Quantity
    b. Quality
    c. Others, specify:

24. What is the price that the producers earn for one litre of raw milk?

25. Is there a difference in price setting between the different seasons? (Dry season, wet season)
    YES / NO, explanation:

26. Is there a difference in price setting during fasting periods?
    YES / NO, explanation:

27. What is the frequency of payment for the producers?
    a. Every week
    b. Every two weeks
    c. Every month
    d. Others, specify:

28. What are the stationary costs of:
    a. Rent building:
    b. Utilities:
    c. Salaries:
    d. Others, specify:

Open questions:

29. What kind of record keeping is used in the milk collection centre?

30. What are the major problems in this milk collection centre?

31. What are the potential solutions to solve the problem?

32. What do you think of the future of the milk collection centres in five years?

Appendix 2 Visual observation MCC

Checklist for visual observation MCC

Date:

Name of the cooperative/ collection centre:

1.	Has the collection centre…	
	a. good drainage?	YES – NO
	b. a clean floor, walls and ceilings?	YES – NO
	c. the disposal of electricity?	YES – NO
	d. the disposal of lighting?	YES – NO
	e. artificial ventilation?	YES – NO
	f. a direct opening to living quarters/ barn?	YES – NO
	g. toilet conveniently located?	YES – NO
	h. a bin for tested milk etc.?	YES – NO
2.	Are the materials and equipments good repair, accessible for inspection, of proper design?	YES – NO
3.	Is the collection centre located in a not dusty area?	YES – NO
4.	Is it possible to close the milk collection centre, at times that it doesn't collect?	YES – NO
5.	What sorts of milk containers are used? a. Plastic b. Aluminium c. Stainless steel d. Calabash e. Clay poll / gourd	
6.	In which area is the collected milk located at the collection centre?	INSIDE/ OUTSIDE
7.	What they do after cleaning the containers? a. Wipe b. Sun dry c. Put it upside down and dry on clean surface d. Leave it as it is	
8.	Are the surroundings- neat and clean, free from harbourages breeding areas, no insects no rodents?	YES – NO

Appendix 3 Checklist visual observation milking on-farm

Checklist for visual observation Farmers

General information:

Name farmer:

Region:

Amount of cows:

Breed of cows:

Date:

1. Has the farmer cleaned his hands before milking? YES – NO

---

2. How is the udder cleaned?
   a. With paper YES - NO
   b. With water YES - NO
   c. With cloth YES - NO
      i. For how many cows is it used?
      ii. Every time after milking cleaned YES - NO
   d. Not cleaned YES - NO
   e. Others, specify:

---

3. Do you use clean water, what is the source of this water? YES – NO
   a. Rain water YES – NO
   b. Tap water YES – NO
   c. River water YES – NO
   d. Well water YES – NO
   e. Bacteria standard water YES – NO

---

4. On what area is the cow milked?
   a. In barn YES – NO
   b. Under a tree YES - NO
   c. Milk parlour YES - NO
   d. Others, specify

---

5. Is the milking area clean? Is it…
   a. It is dusty YES – NO
   b. There is manure YES – NO
   c. It is wet YES – NO
   d. Others, specify:

---

6. Are the calves separate of milking cows? YES – NO

---

7. In what time is calf separated after calving? Specify:

---

8. In what type of container will the milk be collected?
   a. Plastic
   b. Aluminium
   c. Stainless steel
   d. Calabash
   e. Clay poll / gourd

9. How looks the area where the containers are located?
   a. Free of dust? YES – NO
   b. Cleaned? YES – NO
   c. Free of insects? YES – NO

---

10. Are the materials cleaned after milking?	YES – NO
11. What do they use to clean the containers?	
a. Cold water	YES – NO
b. Hot water	YES – NO
c. Detergent, specify	YES – NO
d. Nothing, they are wet	YES – NO
12. What they do after cleaning the containers?	
a. Wipe	YES – NO
b. Sun dry	YES – NO
c. Put it upside down and dry on clean surface	YES – NO
d. Leave it as it is	YES – NO

Appendix 4 Checklist general information study areas

Checklist general information for each field site

General information:

1. Climate of the area
2. Something about the population of the area (number of people, religions etc.)
3. Number of animals in the area (cows, (local and crossbreeds) sheep's, goats, donkeys etc.)
4. Number of farmers

Producer:

1. Scale: small scale/ middle scale/ large scale
2. Average of cows per farm
3. Farm sizes: Smallest and largest
4. Feed sources
5. Major crops
6. Breeds commonly used, is there AI used?
7. Types of dairy production commonly produced
8. Sales of animals, what type, age, where are they going?
9. Statistics: Number of farms, number of dairy farmers
10. Water sources for cattle
11. Housing systems for cattle
12. Use of manure
13. Average production level?
14. Are the farmers getting training, yes, from which organizations?

Marketing:

1. Which produce is home consumed and which is sold? (volume and prices)
2. Sold were? To Whom? What basis?
3. Percent of total income from seller?
4. Are there seasonal influences or influences in fasting days?
5. What are the different market channels?

Appendix 5 Summary of answers to questionnaire

Chancho, Akaki and Holeta	producers			sex				Dairy cows				
				members		non members		members		non members		
peri-urban	members	non members	total	male	female	male	female	Cross bread	local bread	cross bread	local bread	total
Abdi Lone	21	20	41	19	2	20		95	11	90	10	205
Burka guda	39	20	59	5	34	18	2	52	104	27	53	236
Chancho	130	45	175	83	47			100	200	45	90	435
Debre Tsige	80	20	100	62	18			336	144	84	36	600
Dubar	60	80	140	52	8			260	130	347	173	910
Ganda Guda	23	10	33	2	21	3	7	111	37	81	108	337
Goro Haro	130	75	205	85	45	50	25	275	275	138	138	825
Jate	43	20	63	37	6	18	2	112	92	70	58	332
Lalistu	39	15	54	35	4			86	70	33	27	216
Muka Turi	30	55	85	23	7	18	37	90	0	165	0	255
Salle	67	23	90	64	3	18	5	80	121	28	41	270
Torben Ashe	77	30	107	60	17	20	10	120	120	30	30	300
Hibret milk assosiation 05/06	86	24	110	53	33			150		40		190
Hibret milk assosiation 08	18	15	33	14	4			45		20		65
Hibret milk assosiation 11	26	10	36	11	15			30		20		50
holeta MCC			130									385
Total	869	462	1461	605	264	165	88	1942	1303	1217	764	5611
Average	58	31	91	40	18	21	13	129	109	81	64	351

	producers			sex				Dairy cows				
				members		non members		members		non members		
Rural (Asela)	members	non members	total	male	female	male	female	Cross bread	local bread	cross bread	local bread	total
Bekoji Dairy Coop	68	2	70	62	6	1	1	133	445	4	13	595
Dankaka Konitcha	20		20	11	9			20	12			32
Gonde Makro	26	0	26	16	10	0	0	30	70			100
Gora Fana	21	2	23	21	0	1	1	5	21	1	3	30
Lemu Araya	71	2	73	56	15	1	1	50	400	1	5	456
Lemu Mikael	61	7	68	52	9	0	7	10	173		21	204
Meditu Danisa	30	20	50	25	5	0	20	33	98	8	23	160
Sagure Mole	18	6	24	17	1	2	4	30	42			72
Total	315	39	354	260	55	5	34	311	1260	13	65	1649
Average	39	6	44	33	7	1	5	39	157	3	13	206

Size dairy farm			Amount of milk			transport						
smallest	biggest	average	members	non members	total	min distance	max distance	mean of transport	ownership	employees	kg milk/ employee	times of collecting
1	50	8	200	60	260	5	90	Foot, Donkey	cooperative	2	130	1
2	6	4	200	50	250	5	30	Foot, Donkey	cooperative	2	125	1
1	15	8	1640	360	2000	5	30	Foot, Donkey	cooperative	4	500	2
2	10	6	1000	500	1500	4	30	Foot, Donkey	cooperative	6	250	2
5	8	7	500	300	800	5	90	Foot, Donkey	cooperative	4	200	2
1	5	3	200	85	285	5	30	Foot, Donkey	cooperative	4	71	1
3	10	7	800	400	1200	20	90	Foot, Donkey	cooperative	4	300	1
2	5	4	350	170	520	5	60	Foot, Donkey	cooperative	5	104	1
2	10	4	150	328	478	2	10	Foot, Donkey	cooperative	1	478	2
1	5	3	300	300	600	10	60	Foot, Donkey	cooperative	2	300	2
1	5	3	413	137	550	5	40	Foot, Donkey	cooperative	5	110	1
1	10	6	400	100	500	10	120	Foot, Donkey	cooperative	5	100	1
1	5	3	750	350	1100	5	30	ycle, foot, donkey, ho	cooperative	3	367	2
1	5	3	292	42	286	5	20	foot, donkey	cooperative	3	95	2
1	5	3	583	83	550	5	30	foot, donkey	cooperative	3	183	2
1	85	4			2200	10	60	foot	private	5	440	1
			7778	3265	13079							
1.6	15	4.6	519	218	817	7	51			4	235	1.50

Size dairy farm			Amount of milk			transport						
smallest	biggest	average	members	non members	total	min distance	max distance	mean of transport	ownership	employees	kg milk/ employee	times of collecting
5	12	9	390	10	400	10	120	Foot, Donkey, Horse	cooperative	4	100	1
1	5	3	120		120	15	30	Foot	cooperative	4	30	2
1	4	3	50		50	2	20	Foot	cooperative	2	25	1
0	3	2	65		65	5	60	Foot	cooperative	4	16	2
2	20	6	320	3	323	5	120	Foot, Donkey, Horse	cooperative	6	54	1
2	5	4	130	50	180	2	60	Foot, Horse	cooperative	4	45	1
1	5	3	70	30	100	5	60	Foot, Horse	cooperative	4	25	1
1	5	3	25	15	40	5	40	Foot	cooperative	3	13	1
			1170	108	1278							
1.6	7	3.9	146	22	160	6	64			4	39	1.25

				quality control methode[1]						differnt in price setting	
cleaning materials	times a day	source of water	cool possebility	lactometer	alcohol test	filter	visual	price basis	price a litre	dry/wet season	fasting period
cold water, detergent	2	well, river	no	yes	yes	yes	yes	Qualtity	4.55	no	no
cold water, detergent	2	well	no	yes	yes	yes	yes	Qualtity	4.60	no	no
hot water, detergent	*2*	tap	no	yes	yes	yes	yes	Qualtity	4.50	no	no
cold water, detergent	*2*	tap	no	yes	yes	yes	yes	Qualtity	4.55	no	no
hot water, detergent	*2*	tap	no	yes	yes	yes	yes	Qualtity	4.60	no	no
hot water, detergent	2	tap	no	yes	yes	yes	yes	Qualtity	4.50	no	no
hot water, detergent	2	tap	no	yes	yes	yes	yes	Qualtity	4.55	no	no
hot water, detergent	2	tap	no	yes	yes	yes	yes	Qualtity	4.50	no	no
cold water, detergent	*2*	well	no	yes	yes	yes	yes	Qualtity	4.60	no	no
hot water, detergent	4	tap	no	yes	yes	yes	yes	Qualtity	4.55	no	no
cold water, detergent	2	tap, rain	no	yes	yes	yes	yes	Qualtity	4.50	no	no
hot water, detergent	2	well	no	no	yes	yes	yes	Qualtity	4.50	no	no
cold water, detergent	4	well	no	yes	yes	yes	yes	Qualtity	5.10	no	no
cold water, detergent	4	well	no	yes	yes	yes	yes	Qualtity	5.10	no	no
cold water, detergent	4	well	no	yes	yes	yes	yes	Qualtity	5.10	no	no
hot water, detergent	2	tap	yes	yes	yes	yes	yes	Qualtity	4.25	no	no
		yes	6%	94%	100%	100%	100%			0%	0%
	3	no	94%	6%	0%	0%	0%		4.63	100%	100%

				quality control methode[1]						differnt in price setting	
cleaning materials	times a day	source of water	cool possebility	lactometer	alcohol test	filter	visual	price basis	price a litre	dry/wet season	fasting period
hot water, detergent	2	tap	no	yes	no	yes	yes	Qualtity	3.25	yes	no
hot water	4	well	no	yes	no	yes	yes	Qualtity	4.00	yes	yes
hot water, detergent	2	tap	no	yes	no	yes	yes	Qualtity	4.00	yes	no
hot water, detergent	4	tap	no	yes	yes	yes	yes	Qualtity	4.00	yes	yes
hot water, detergent	2	tap	no	yes	no	yes	yes	Qualtity	3.50	yes	no
cold water, detergent	2	well	no	yes	no	yes	yes	Qualtity	2.00	yes	yes
hot water, detergent	*1*	tap	no	yes	no	yes	yes	Qualtity	2.50	yes	no
hot water, detergent	2	tap	no	no	no	yes	yes	Qualtity	4.00	yes	yes
		%yes	0%	87.5%	12.5%	100.0%	100.0%			100%	50%
	2	%no	100%	12.5%	87.5%	0.0%	0.0%		3.41	0%	50%

	statoinairy costs each month					kosten per	record keeping								ma
ferquenty payment	rent	utilities	salaries	materials	total	litre milk	fit loss acco	milk record	cashbook	minute book	sales book	market	materials	standards	
every two weeks	0	0	150	104	254	0.03	no	yes	no	no	no	no	no	no	
every two weeks	0	0	270	60	330	0.04	no	yes	yes	no	no	yes	no	no	
every two weeks	0	0	1840	370	2210	0.04	no	yes	yes	no	no	no	yes	no	
every two weeks	0	300	1400	200	1900	0.04	no	yes	yes	no	no	no	yes	no	
every two weeks					800	0.03	no	yes	yes	no	no	yes	no	yes	
every two weeks	0	42	500	125	667	0.08	no	yes	yes	no	no	yes	yes	no	
every two weeks	0	300	800	370	1470	0.04	yes	yes	yes	yes	no	yes	yes	no	
every two weeks	0	0	650	42	692	0.04	yes	yes	yes	yes	no	yes	yes	no	
every two weeks	0	0	230	100	330	0.02	no	yes	yes	yes	no	yes	yes	yes	
every two weeks	0	120	550	50	720	0.04	yes	yes	yes	yes	no	yes	yes	yes	
every two weeks	0	0	410	125	535	0.03	yes	yes	yes	yes	no	no	yes	no	
every two weeks	0	0	600	250	850	0.06	yes	yes	yes	no	no	yes	no	no	
every two weeks	120	85	1000	60	1265	0.04	yes	yes	yes	no	no	no	no	yes	
every two weeks	150		1000	40	1190	0.14	yes	yes	yes	no	no	no	no	yes	
every two weeks	100		1000	60	1160	0.07	yes	yes	yes	no	no	no	no	yes	
every two weeks		143	4000	250	4393	0.07	no	yes	yes	no	no	no	no	yes	
							50%	100%	94%	31%	0%	8	8	7	
	26	76	960	147	1173	0.05	50%	0%	6%	69%	100%				

	statoinairy costs each month					kosten per	record keeping							
ferquenty payment	rent	utilities	salaries	materials	total	litre milk	fit loss acco	milk record	cashbook	minute book	sales book	market	buildings	AI/medicin
every month	200	20	1080		1300	0.11	yes	yes	yes	yes	yes	yes	yes	no
every month			350		350	0.10	no	yes	yes	no	no	yes	yes	no
every month		5	240		245	0.16	no	yes	yes	yes	no	yes	no	yes
every month		6	535	30	571	0.29	yes	yes	yes	no	no	no	no	yes
every two weeks		20	1425		1445	0.15	yes	yes	yes	no	yes	yes	no	no
every month			650		650	0.12	no	yes	yes	yes	yes	yes	no	yes
every month	40	6	390		436	0.15	no	yes	yes	yes	yes	yes	no	no
every two weeks	200		300		500	0.42	yes	yes	yes	yes	yes	yes	yes	no
							50%	100%	100%	63%	63%	7	3	3
	147	11	621	30	687	0.19	50%	0%	0%	38%	38%			

ajor problems				solution						five year plans						
education	buildings	ıproved bre	AI/medicin	PP	materials	more milk	education	ıew building	standards	materials	quality	feed	price	AI/medicin	build mcc	market
no	yes	no	no	no	no	yes	no	yes	no	no	yes	no	yes	no	no	no
yes	no	no	no	no	no	yes	yes	yes	no	no	no	no	no	no	no	no
yes	yes	no	no	no	yes	no	yes	no	no	yes	yes	no	yes	no	yes	no
no	no	no	no	no	yes	no	no	no	no	yes	no	no	no	no	no	no
no	no	no	no	yes	no	no	no	no	no	yes	yes	no	yes	no	no	no
no	no	no	no	yes	no	yes	no	no	no	no	yes	no	no	yes	no	no
no	no	no	no	yes	yes	yes	no	no	no	no	no	no	no	no	no	no
no	no	no	no	yes	yes	no	no	no	no	yes	no	no	no	no	no	no
no	no	no	no	yes	yes	yes	no	no	no	no	yes	yes	no	yes	no	no
no	no	no	no	yes	yes	yes	no	no	no	no	no	no	no	no	no	yes
yes	no	yes	no	yes	yes	yes	no	no	no	no	no	no	no	no	no	no
no	no	no	yes	yes	yes	yes	no	no	no	no	yes	no	no	no	no	no
no	no	no	no	yes	no	no	yes	no	no	yes	no	yes	no	no	no	no
no	no	no	no	yes	no	no	yes	no	no	yes	no	yes	no	no	no	no
no	no	no	no	yes	no	no	yes	no	no	yes	no	yes	no	no	no	no
no	no	no	no	no	no	no	no	no	yes	no	no	yes	no	no	no	no
3	2	1	1	11	8	8	5	2	1	7	6	5	3	2	1	1

ıproved bre	education	materials	standart	solution new building	PP	education	materials	standards	more milk	five year plans AI/medicin	market	feed	ıproved bre	quality	price	materials
no	yes	no	no	yes	no	no	no	no	no	no	no	no	no	no	no	no
no	no	no	no	no	yes	no	no	no	no	yes	yes	yes	no	no	no	no
no	no	no	no	yes	yes	no	no	no	no	yes	no	yes	no	no	no	no
no	no	no	no	yes	yes	no	no	no	no	yes	no	no	yes	no	no	no
yes	no	no	no	no	no	no	no	no	no	yes	yes	yes	yes	yes	no	no
no	no	no	no	yes	no	no	no	no	no	yes	yes	no	no	no	no	no
no	no	no	no	yes	no	no	no	no	no	no	yes	no	no	no	no	no
no	no	no	no	yes	yes	no	no	no	no	yes	yes	no	yes	no	yes	no
1	1	0	0	6	4	0	0	0	0	6	5	3	3	1	1	0

mproved breed
no
no
no
no
no
no
no
no
no
yes
no
no
no
no
no
1

	Yoghurt		Butter		Skimmed milk		Raw milk		Cheese		Total sale (income)		outflow	profit
build mcc	KG	Price/kg	KG	Price/kg	KG	Price/kg	KG	Price	KG	Price	KG	Price		
no	250	2	21	65	100	2					371	2065.00	1343.33	721.67
no													491.67	
no													208.17	
no													279.03	
no	30	1.5	1.5	80	15	1.5			37	7	83.5	446.50	1178.67	-732.17
no	18	1.5	9	70	36	1.5			126	7	189	1593.00	381.67	1211.33
no	46	2.25	3.5	70	40	2.5	1	3	3	3	93.5	460.50	264.53	195.97
no	20	3	1.5	50	15	3			1.5	7	38	190.50	176.67	13.83
0	364	10.25	36.5	335	206	10.5	1	3	167.5	24	775	4755.50	4323.73	1410.63
	72.80	2.05	7.30	67.00	41.20	2.10	1.00	3.00	41.88	6.00	155.00	951.10	540.47	282.13

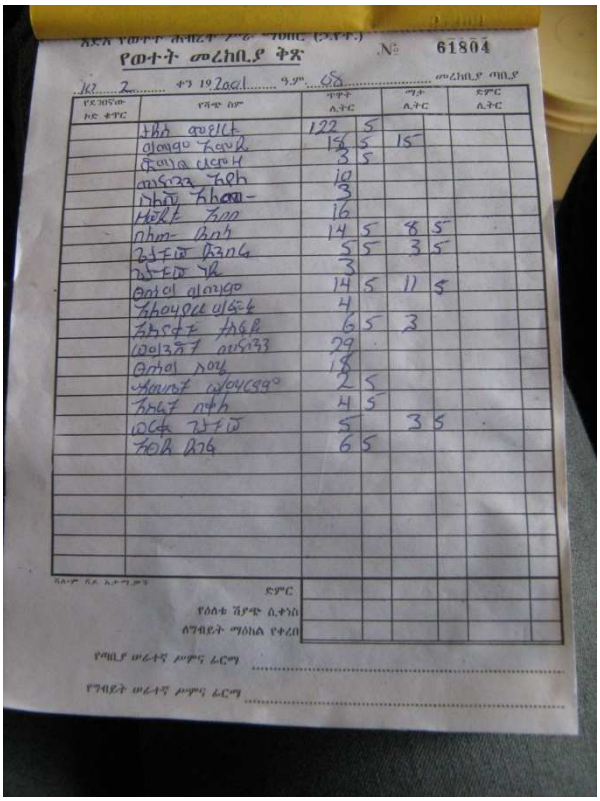
Appendix 6 Summary of visual observation milk collection centres in rural area

	Bekoji Dairy	Dankaka Ko	Gonde Mak	Gora Fana	Lemu Mikae	Meditu Dan	Sagure Mol	Lemu Araya	total yes	total no	% yes	% no
Drainage	no	no	yes	no	no	no	no	yes	2	6	25%	75%
Clean Floor walls ceilings	no	no	yes	no	no	no	no	yes	2	6	25%	75%
electricity	yes	no	no	no	yes	no	yes	yes	4	4	50%	50%
Lighting	no	no	no	no	no	no	yes	no	1	7	13%	88%
artificial ventilation	no	no	no	no	no	no	no	no	0	8	0%	100%
opening to livingquater	no	no	no	no	no	no	no	no	0	8	0%	100%
toilet	yes	yes	no	no	yes	no	no	no	3	5	38%	63%
bin	yes	yes	no	no	no	no	no	yes	3	5	38%	63%
good materials	yes	yes	yes	yes	yes	yes	no	yes	7	1	88%	13%
not dusty area	no	no	no	no	no	no	yes	yes	2	6	25%	75%
loke on MCC	yes	yes	yes	yes	yes	yes	yes	yes	8	0	100%	0%
sort of container												
Plastic	yes	no	no	yes	yes	yes	yes	yes	6	2	75%	25%
Aluminium	yes	yes	yes	no	yes	yes	yes	yes	7	1	88%	13%
stanless steel	no	no	no	no	no	no	no	no	0	8	0%	100%
area for collection of milk												
a. insite	yes	yes	yes	yes	yes	yes	yes	yes	8	0	100%	0%
b. outside	no	no	no	no	no	no	no	no	0	8	0%	100%
how to dry the containers												
a. wipe	no	no	no	yes	yes	yes	no	yes	4	4	50%	50%
b. sun dry	no	no	no	yes	no	no	no	no	1	7	13%	88%
c. put it upsite down	yes	yes	no	yes	yes	yes	yes	yes	7	1	88%	13%
d. leave it as it is	no	no	no	no	no	no	no	no	0	8	0%	100%
e. smoke	yes	no	yes	no	no	no	yes	no	3	5	38%	63%
free of insects enz.	no	no	no	no	no	no	no	yes	1	7	13%	88%

Appendix 7 Summary of visual observation of milk collection centres in peri-urban area

	Abdi Lone	Burka guda	Chancho	Debre Tsige	Dubar	Ganda Guda	Goro Haro	Jate	Lalistu	Muka Turi	Salle	Torben Ashe	Hibret milk assosiation 05/06, 08 and 11			holeta MCC	total yes	total no
Drainage	no	yes	no	yes	no	yes	no	no	no	no	no	no	no	no	no	yes	4	12
Clean Floor walls ceilings	no	no	no	yes	yes	yes	no	no	no	no	no	no	no	no	no	yes	4	12
electricity	no	no	yes	yes	yes	no	no	no	no	yes	no	no	yes	yes	yes	yes	8	8
Lighting	no	no	yes	yes	yes	no	no	no	no	yes	no	no	no	no	no	yes	5	11
artificial ventilation	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	0	16
opening to livingquater	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	yes	1	15
toilet	no	no	no	yes	yes	yes	no	yes	no	no	yes	no	yes	yes	yes	yes	9	7
bin	no	no	no	yes	no	yes	no	no	no	no	yes	no	yes	yes	yes	yes	7	9
good materials	no	yes	no	no	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	no	11	5
not dusty area	no	yes	no	yes	no	no	no	no	no	no	yes	no	no	no	no	no	3	13
loke on MCC	no	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	13	3
sort of container																		
Plastic	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	16	0
Aluminium	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	15	1
stanless steel	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	0	16
area for collection of milk																		
a. insite	no	no	no	yes	no	yes	no	yes	yes	no	yes	no	yes	yes	yes	yes	9	7
b. outside	yes	yes	yes	no	yes	no	yes	no	no	yes	no	yes	no	no	no	no	7	9
how to dry the containers																		
a. wipe	no	no	no	yes	no	yes	no	no	no	no	no	no	yes	yes	yes	no	5	11
b. sun dry	yes	no	no	yes	yes	yes	no	no	no	no	no	no	yes	yes	yes	no	7	9
c. put it upsite down	yes	yes	yes	yes	no	yes	no	yes	yes	yes	yes	yes	no	no	no	yes	11	5
d. leave it as it is	no	no	no	no	no	no	yes	no	no	no	no	no	no	no	no	no	1	15
e. smoke	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	0	16
free of insects enz.	no	no	no	no	no	yes	no	no	no	no	no	no	no	no	no	yes	2	14

Appendix 8 Example of milk records of MCC



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№ 61804

Description of the 5 columns:

1. Number of farmer
2. Name of farmer
3. Amount of morning milk/ farmer
4. Amount of evening milk/ farmer
5. Total day amount of milk/ farmer

Below the table is the total day amount of the milk collection centre calculated and space for a signer.

Appendix 9 Terms of Reference

ToR study on Milk Collection Centres in Ethiopia

Ethiopia has the largest number of livestock in any country in Africa. Despite this large number of animals, the consumption of milk is amongst the lowest in Africa. Milk production, at different levels, takes place across all five agro-ecological zones of Ethiopia. In the lowlands, pastoralist production systems are predominant, in the highlands milk is mainly produced on small scale mixed farms. Few farms have intensive and commercial dairy production. The majority of cows kept are indigenous breeds, with some, but few crossbred and pure dairy animals.
In and around towns, (peri)urban production systems have emerged, comprising of small and medium scale dairy farms. For these farms it is of utmost importance to deliver their milk to markets speedily, at a cost effective manner with no spoilage and with adequate hygiene measures. The development of markets that minimize losses maximize returns is of major concern to all dairy farmers. Little is known of effective milk marketing channels that stimulate farmers to further develop their dairy production.

In Ethiopia, like in many other countries, milk collection centres are set up in various parts of the country to support the marketing of milk from small holders to the processors and retailers in the larger towns.
Milk collection centres can be an important link between the producers and the processing plants or the consumers. During a survey in 2007 it was established that the performance of milk collection centres was of rather poor quality, both in terms of general, but also hygiene and food safety standards.

In order to assess the quality of operations of the milk collection centres, there is a need to further investigate the performance of the milk collection centres in Ethiopia, with the aim:

1) to get better insights in weak and strong points of the performance of the centre,
2) to assess their importance as a tool in the milk marketing channels in Ethiopia and
3) to advise of ways of improving milk marketing channels in Ethiopia.

For this study a number of field sites need to be identified where data will be collected from milk collection centres. These sites will be selected in relation to another study currently ongoing in the country on the reasons for underinvestment in dairy.

The study, and report, will contain the following components:

1. Develop en describe criteria for assessment of milk collection centres. Both at managerial and technical level: emphasis will be on technical performance level.
2. Describe the performance of the selected milk collection centres based on the field research. This will include a description of all milk flows in catchment area of the particular milk collection centre. Furthermore, some insight will be created in the type of farms delivering milk to the milk collection centres vs. the farms that do not deliver milk to the milk collection centres. Figures on seasonal influences of operations of milk collection centres should be gathered.
3. Assess the potential and importance of milk collection centres as a tool for improved access to markets in Ethiopia, also based on literature on milk collection centres in other countries. Assessment will take into consideration the relation between production system (either traditional mixed subsistence farming of commercial dairying) and the appropriateness of milk collection centres as a tool for improving access to markets.
4. Advise on strategies for improvement.

Appendix 10 Milk collections centres in other countries

Kenya

Kenya has a unique smallholder dairy system, which is the most developed in sub-Saharan Africa with an estimated dairy herd of 3 million head. Most of the dairy cattle are crosses of Friesian–Holstein, Ayrshire, other dairy breeds and local zebus. The smallholder dairy farms are concentrated in the crop–dairy systems of the high productivity potential areas of the country, produce about 60% of total milk production and contribute over 80% of the marketed output.

Dairy marketing in Kenya is mainly of liquid milk where over 80% is sold raw. Differences in milk marketing channels exist between and within the country's various regions. Until recently, marketing through KCC dominated in areas with high production and low consumer concentration or few alternative market outlets (Thorpe, 2002).

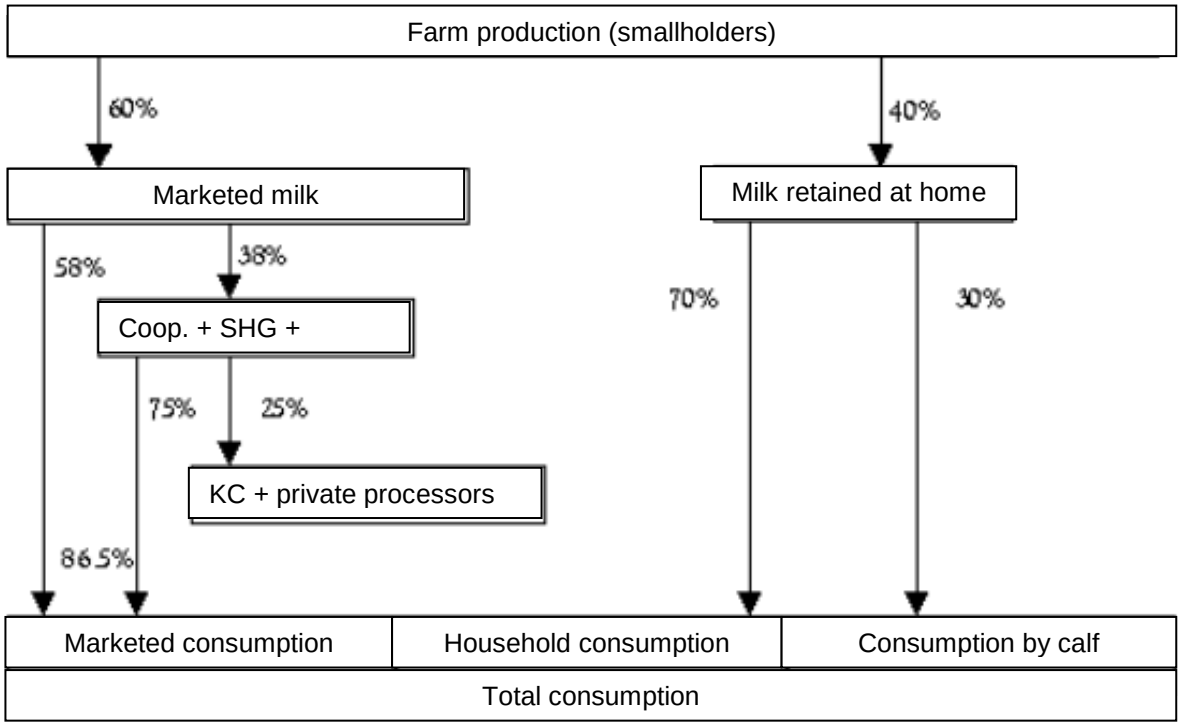

Figure 1 Milk chain (Thorpe, 2002). Note: Percentages indicate the proportions from the source; SHG = self-help groups; KCC = Kenya Co-operative Creameries.

Tanzania

The dairy industry in Tanzania is based in smallholder producers, processors and traders. The production units are small and scattered over wide areas and distances from major consumption centres. This is further aggravated by poor transport infrastructure. Experiences elsewhere have shown that, (India and Kenya) collection and marketing requires the farmers to be organized in producer groups or cooperative societies so as to take advantage of economies of scale in investments such as milk cooling centres and delivery of services such as AI and inputs supplies and extension services. In order to facilitate efficient milk production, collection and marketing the Tanzania Dairy Board will adopt the following strategies:

1. Awareness creation and sensitization
2. Training and skills enhancement
3. Facilitate registration of stakeholders organizations
4. Registration and certification by the Board
5. Develop information, education and communication products
6. Transform informal dairy industry to the formal sector.

(Tanzania Dairy Board, 2006)

Uganda
The Ugandan dairy sector is developing rapidly over recent years and is dominated by small-scale farmers owning more than 90% of the national cattle population. Due to market forces and higher competition for production factors, milk production systems are intensifying, necessitating proper understanding of the new production tendencies. Three intensive and four extensive production systems were identified and analysed, using TIPI-CAL (Technology Impact Policy Impact Calculations model). The results show that the production systems are very different in many respects but share similar development trends. Whereas intensive systems use graded animals and invest heavily into feeding, buildings and machinery, extensive systems use local breeds and invest minimally. Total cost of milk production falls with increasing herd size, while dairy returns vary among farms from 18 to 35 USD/100 Kg of milk. All systems make an economic profit, except the intensive one-cow farm, which heavily employs family resources in dairying. Due to better management of resources and access to inputs and markets, dairy farming closer to urban areas and using improved breeds is highly profitable, especially with larger herd sizes. Stakeholders should favour such practices as well as others that can improve productivity, especially in African countries where traditional systems dominate dairying. (Ndambi, 2008)

Zambia
Zambia is a Southern African county, with a population of ten million people. Zambia is, just like Ethiopia, classified as a low income country. Over the last years the dairy sector of Zambia is growth as a result of increased population and consumption of dairy products. Unfortunately the consumption of milk is not what is should be. Per capita milk consumption in Zambia is estimated at 15 liters per year per capita. According to a research of FAO, this consumption has to be about 45 liters per year per capita. The total milk production in the country is approximately 253 million liters, so a big part of the whole production must be exported to other countries especially to Congo.
Twenty till thirty percent of milk consumed is processed by commercial dairy processors, who buy almost all of the milk from commercial farms. Seventy till eighty percent of milk supplied via local, open markets by small scale farmers who milk traditional herds. In the dairy sector there are the following problems:

- Lack of investment in modern dairy practices and technologies
- Prevalence of cattle diseases
- Lack of resources to improve cattle health and nutrition
- Globalization and competition with powder milk
- Over looked and neglected, smallholders had been unable break into the formal milk market (Mukumbuta, 2006; Neven, 2006; Pandey, 2008)

Cameroon
In the dry season, market demand in Cameroon for milk products is very high but milk is scarce because cattle are on transhumance. Even when milk is available, the lack of refrigeration at farm level forces producers to make and market their products every day. The marketing system is mainly informal. In Garoua, there are large herds of cattle and a lot of milk in the rainy season. Women carry the milk products on their heads and walk around town to retail them. In Maroua where milk output is low, dairy products are expensive because of traditional form of management, and a special site has been provided for the sale of milk in the main market. In Bamenda, milk collection is done in main axes with refrigerated vans by Sotramilk. This is a dairy plant collecting in January 100 litres per day and in September-October (peak), 500liters per day. They use blend and reconstituted milk to make their products. In order to ensure better marketing for their milk, farmers constitute themselves in cooperatives. Surveying one of the cooperative dairy farmers said that the financial responsibility of the household head (gender), input cost, and price significantly influence market supply. They stated however that price is relatively inflexible to changes in market supply.
Formal research on dairy cattle started in Cameroon in the early 1970's on imported and local cattle. However, there is no comprehensive report available providing information on the key aspects of the research done on this topic in Cameroon to this day. In Sub-Saharan countries, because of inadequate available literature, there is always a risk of duplicating research and therefore wasting time and resources. There is also a need for information to be gathered on the subject and made available to policy makers. (Bayemi, 2005).

India

Flood now organizes marketing of milk from 179 milk sheds in over 500 towns. These milk sheds form the catchment area from where milk is brought into the cities. In addition to organizing milk collection and marketing, the cooperative also standardizes methods of procurement, processing and quality control of milk, assuring the producer/farmers of fairness in these procedures. The number of farmers organized into village milk producers' cooperative societies is now 1,000,000 and the daily procurement of milk by the cooperatives is 13,000,000 litres per day. Milk is procured from the farmers at the village cooperative societies and is then sent to the district cooperative dairy union by trucks in cans or by tankers from the bulk coolers located at the villages. It is weighed and tested for fat at the dairy docks and then the milk is pasteurized. The dairy then converts the milk into liquid milk for sale and various milk products as per the product mix provided by the state-level Dairy Federation that markets the products of all the dairies in the state. Surplus milk from the dairies, after meeting the local liquid milk requirement and converting into various products, is then sent to the Mother Dairies situated in metro cities by road milk tankers or rail milk tankers (40,000 litre capacity). Liquid milk is generally sold in urban centres in plastic pouches, which is packed at the district dairies. In metros, milk is also sold through bulk vending booths, where consumers can obtain a measured quantity of milk by inserting a coin in an automatic machine (Chakravarty, 2002).

Thailand

Currently, local milk production comprises only about 20% of the total consumption; the rest has to be imported. Between 1994 and 1997, the demand for drinking milk and milk products in Thailand increased by almost 3% per year, while domestic milk production increased by almost 20% per year. Nevertheless, milk demand was larger than supply, the deficit ranged from 131 to 400 thousand tonnes of milk/year.

Almost all dairy cows in Thailand are crossbreeds between Holstein–Friesians (HF) and zebu breeds (such as Red Sindhi or Sahiwal). Most of these animals are F_2 or F_3 crosses, many of them produce milk yields as high as 5 thousand kg in 305 days but most of them produce around 2500–3000 kg per lactation. Most of the farmers have little formal education and only a limited knowledge of dairy husbandry; consequently, at least two to three months of intensive practical training is required to provide them with a reasonable background in dairy farming. Once dairy production begins, a milk collection and cooling centre is required to collect milk from the dairy farms and then to transport the milk to a milk processing plant for processing and packaging, as well as marketing of the products. Farmers constantly require dairy extension services to provide AI, as well as animal health care (such as vaccination) and other services to improve their farming efficiency.

Dairy co-operatives have been organised as part of the government's dairy promotion programme. In 1999, there were about 106 dairy co-operatives in Thailand. Milk price was based on fat content as well as bacterial counts. About half of the milk was processed into pasteurised milk in plastic sachets and the rest into UHT milk in hard pack containers. The UHT milk was sold through a sales agent in Bangkok, while the pasteurised milk was distributed by the co-operative. (Thorpe, 2002)

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Appendix 11 Good practices for clean milk production: criteria for assessment milk collection centres

As a start of the assignment, a set of criteria for assessing milk collection centres was prepared. These are mainly drawn from existing sources and partially adapted to the Ethiopian situation (Bennet et al, 2000; Draaijer, 2002; FAO 2002; FAO, 2008; Have, 2007; ILRI, 2006; Muzira, 2006; Tosun et al, 2007).

Criteria used cover all the operational aspects of milk collection centres. From starting a centre (with whom, on what conditions), to selecting an appropriate site (accessibility to and from), aspects of hygiene (from milking on the farm to transport to and storage on the milk collection centres), record keeping, preservation (cooling), quality testing, payment systems, marketing.

Good hygiene practice is of utmost importance in the production of clean milk. Clean milk has the following characteristics:

- Low bacterial count
- Pleasant creamy smell and colour
- No dirt matter
- No residues of antibiotics, sanitizers or pesticides

Good hygiene practices need to be applied in all steps of milk production, transport, storage, processing and retailing.

Milking practices and factors influencing milk quality

Milk from the udder of a healthy cow contains very few bacteria. Poor hygiene introduces additional bacteria that cause the milk to get spoilt very quickly. To ensure that raw milk remains fresh for a longer time, good hygiene must be observed during milking and when handling the milk afterwards.

Feeding

A well-fed and watered animal will produce high quantities of milk of good composition. If cows are fed a diet that is low in forages and high in starch, the butterfat content may fall below 2.5%. Thus, a good balance of forage and concentrates is important. Cows may be given feed supplements but it is important that the proper proportions be observed. Cows should not be fed with silage during milking or shortly before milking, as this will give rise to off-flavors in the milk. It is recommended that silage feed be provided two hours before milking.

Health of the cow

An unhealthy cow will feed less and produce less milk of poor quality. Cows should always be kept healthy and clean because sick animals can transmit diseases like tuberculosis and brucellosis to milk consumers. If a cow is suspected to be sick, a qualified veterinary practitioner should be contacted immediately. Milk from a cow that is being treated with antibiotics should not be sold or consumed until after the specified withdrawal period.

Animal and udder health

Zoonoses

Zoonotic diseases like tuberculosis and brucellosis can be spread to humans through milk. Cows suffering from such diseases should be referred to a qualified veterinary practitioner who will decide on the fate of the animal.

Mastitis

Mastitis is an inflammation of the mammary glands in the udder caused by infection with disease-causing bacteria. These bacteria can also end up in the milk and result in illness if the milk is consumed. For this reason, milk from cows suffering from mastitis should not be sold or drunk. Cows suffering from mastitis should be treated by a qualified veterinary practitioner. Milk from animals that are undergoing antibiotic treatment should not be consumed or sold until the withdrawal period has elapsed because antibiotic residues may cause allergies and drug resistance in consumers.

Hygienic milking
Good hygiene and quality control needs to be observed at all stages of milk production, handling and sale. Thus, hygienic practice must begin at the farm level. Good hygiene will ensure that the milk you handle is clean and has low levels of spoilage bacteria. Below is some advice you can give to the farmers who supply you with milk, in order to ensure good quality:

- Maintain clean and healthy cows
- Keep a clean milking environment, free of dust and mud
- Do not milk cows if you are suffering from communicable diseases like diarrhea or typhoid, but seek medical treatment and resume milking only when you have fully recovered
- Do not mix colostrum (the milk produced for the first seven days after calving) with normal milk
- Wash your hands with soap and clean water before milking
- Wash the udder with a clean cloth and warm water
- Dry the udder with a clean dry cloth
- Make the first draw into a strip cup to check for mastitis and throw away from the milking area even if the milk appears clean
- Use clean containers for milking
- Cows with mastitis should be milked last and their milk discarded
- Milk from cows under antibiotic treatment should not be sold until 3 days after last treatment or as advised by the veterinary practitioner
- After every milking, dip the teats into an 'antiseptic dip'
- Release the cow from the milking area as soon as milking is finished
- After milking, sieve the milk through a strainer or muslin cloth to remove solid particles that may have fallen in during milking
- Cover the milk to avoid contamination
- Move the milk to a clean and cool area
- During milking, the milker should **not** (a) have long nails, (b) sneeze, spit or cough, (c) smoke

General guidelines avoiding milk spoilage

- Always handle milk in clean metal containers.
- When transferring milk between containers, pour the milk instead of scooping. Scooping may introduce spoilage bacteria.
- Do not store milk at high temperatures.
- Avoid keeping milk for a long time before it is delivered to the collection point.
- Do not handle milk if you are sick. Seek medical treatment and resume your work only when the doctor says you are fit to do so.

Transport and storage

Equipment for milk handling and storage

- Always use aluminum or stainless steel containers because these are easy to clean and sterilize.
- Plastic containers should not be used.
- Do not store milk in plastic jerry cans that previously contained paint, herbicides and other chemicals because traces of these substances can taint your milk.

Scooping may introduce spoilage bacteria. Transfer milk between containers by pouring.
Store milk in metal containers, not in plastic jerrycans.

Procedure for cleaning of milk containers
Before re-using the milk container:

- Pre-rinse the container soon after use.
- Thoroughly scrub the container with warm water and detergent or soap (using a stiff bristled hand brush or scouring pad).
- Rinse the container in clean running water.
- Dip-rinse the container in boiling water for at least one minute to kill germs. You may also rinse the container by pouring hot water into it.
- Air-dry the container in inverted position on a clean rack in the open. Scrub container with warm water and soap, dip-rinse the container in boiling water for at least one minute to kill germs, rinse by pouring hot water into container and air-dry the container in inverted position on a clean rack

Basic milk quality test
You can check whether the milk you collect from farmers is of good quality by carrying out one or more of the following four tests:

- Sight-and-smell (organoleptic) test
  Basic assessment of smell, appearance and color
- Clot-on-boiling test
  Milk that has been kept for too long without cooling and has developed high acidity, or colostral milk with a very high percentage of protein. Such milk does will clot at heat treatment
- Alcohol test
  Equal amounts of milk and a 79 % alcohol solution are mixed. If the milk coagulates, it must be rejected.
- Lactometer test
  The lactometer test is used to determine if the milk has been adulterated with added water or solids.

Processing and retailing
To ensure hygienic milk storage, preservation and handling at processing and retailing stage, the following points must be followed to maintain good quality of the milk.

Appropriate milk storage vessels

- All containers used for storing milk should be clean and made of food-grade material like stainless steel or aluminum. These are also easy to clean and disinfect.
- The premises used for storing milk should be clean, pest-free, well ventilated with adequate lighting, and protected from dust, rain and direct sunlight.
- Milk should not be stored in the same room with agricultural produce (e.g. onions) or chemicals like paint or paraffin, which can taint the milk with off-odors.

Appropriate milk preservation methods

- Milk spoils easily if it is left at high temperatures for long periods so it needs to be cooled. If you do not have a refrigerator or cooler you can store milk in a cold water bath or wrap the milk can with a wet sack, but ensure that the milk container is well covered to prevent dirt from entering the milk.
- Milk may also be pasteurized to destroy spoilage bacteria but it must be quickly cooled thereafter in a cold water bath so that it remains fresh.

Hygienic milk handling in a retail milk outlet

- Ensure that your business premises are always kept clean, pest-free and in a good state of repair.
- All employees in your milk retail outlet must always maintain high standards of personal hygiene and wear clean protective clothing while handling milk and dairy products.
- Milk handlers should undergo periodic medical check-ups by a qualified medical doctor and should only be allowed to handle milk after being medically certified to do so.
- Immediately after dispensing milk into the customer’s container, hook the metal dispensing scoop inside the milk churn to prevent it from getting contaminated.
- All equipment used for handling milk should be properly cleaned and sanitized immediately after use.

All of the above criteria are incorporated in the questionnaire and the visual observation checklist for milk collection centres used during the study.