

ILUNRM 2015

Smallholder Dairy Farmers Challenges in Milk Production and Marketing in Bathi



Key words: Sustainable Livelihood Framework; Smallholder Dairy Farming; Production; Formal; Informal; market channel; Bathi

Authors:

Marie Amalie Rosentoft Jein
Student no.: sjb896

Markus Naukkarinen
Student no.: jdp690

Trine Østergaard Rasmussen
Student no.: wlp626

Supervisors:

Prof. Ebbe Prag (RUC)
Prof. Martin Skrydstrup (KU)

Roskilde University ♦ University of Copenhagen ♦ University of Nairobi

Abstract

The Sustainable Livelihoods Framework was used to investigate the different challenges that smallholder dairy farmers in Bathi, Kenya, experience in milk production and marketing.

Questionnaires and interviews were performed on dairy smallholders, operators of the formal and informal milk markets and government officials. In addition, productivity concerns, such as feeds and animal health, were assessed. In the investigated village, the informal dairy market was favoured by most of the randomly selected farmers participating in the study and this was attributed to better prices, daily cash flow and more convenient practices, reflecting the farmers' poor financial capital. Concerning other resources, lack of knowledge about animal productivity and poor physical capital were recognised to be among the main challenges that the smallholders need to cope with. Poor productivity of the animals seems, at least in part, be due to limited access to feeds and poor hygienic practices that affect animal health. Kenyan dairy policy is generally aiming at promoting formal dairy markets and increasing milk production. However, a gap between the policy and field level prevents successful implementation. Because of the farmers' limited resource base, the informal dairy market remains vitally important to their livelihoods.

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Contributions

All persons contributed equally to all sections of this report. Main authors cannot be identified for individual chapters as all parts were thoroughly revised and rewritten.

Introduction

Kenya is one of Africa's largest dairy producers and the country relies heavily on its dairy sector (Atieno & Kanyinga(1), 2008:3). In Kenya, smallholder dairy production is estimated to constitute 56% of the total milk production and Kenya has approximately 2.5 million dairy cattle spread out on 625,000 smaller farms (Omore et al, 1999:5). The sector employs many Kenyans and functions both as a source of economic income and as a part of their household diet (ibid.). Smallholder dairy farming is therefore vital to the livelihoods of these farmers (ibid.). Around 60% of the milk produced in Kenya comes from the fertile lands in the Rift Valley and Central Province (ibid).

The dairy sector in Kenya has undergone different political courses, ranging back before the independence of the country in 1963. In the pre-independence period, European settlers brought with them the practice of dairy cattle breeding and took over most of the agricultural land in Kenya in order to perform large-scale farming for export, supported by the colonial administration (Muriuki, 2011:4 & Omore et al, 1999:6). The relationship between state and settle farmers had importance in relation to political regulation. As a result of reductions in dairy prices, following the First World War depression, many dairy operators merged into bigger corporations like the Kenya Co-operative Creameries (KCC), which was established in 1925 (Atieno & Kanyinga(1), 2008:4). The KCC was created to market and process the products, thereby supporting the settlers' dairy production (ibid & Atieno & Kanyinga(2), 2008:1). In 1954, the Swynnerton Plan was released, giving indigenous Kenyans the right to obtain commercial farming (Muriuki et al, 2003:13). Consequently, the indigenous people started participating in small-scale commercial farming and the farmers gathered in co-operatives in order to strengthen the marketing (ibid:15). In 1958, the KCC became the dominant agent in marketing for the dairy farmers and later the Kenya Dairy Board (KDB) was founded to regulate the market (Atieno & Kanyinga(2), 2008,1).

After independence, new policies entailed full inclusion of the indigenous Kenyans into the dairy production. (Muriuki, 2011:4). Large-scale farms were split up and sold, resulting in a high increase of smallholder dairy farms (Omore et al, 1999:7). The dairy sector was prioritized as a key factor for the country's development and was highly subsidized by the government up until the 1980's (Atieno & Kanyinga(2), 2008:2 & Muriuki et al, 2003:14). In 1992, the dairy industry was liberalized and different players now entered the market to compete with KCC. One of the new operators were informal buyers, made up by small-scale milk traders, also known as hawkers,

buying raw milk from the farmers to sell to consumers (Atieno & Kanyinga(2), 2008: 8).

Liberalization thus led to a growth in the informal market, responding to the breakdown of many marketing co-operatives in the 1990's. Additionally, the liberalization led to an increase of formal private processors, such as Brookside. However, the formal actors struggled to compete with the informal market which is estimated to now provide around 86 % of the marketed milk to the consumers in Kenya (Kaitibie et al. 2010:1496).

To counter this development, the informal milk market has been widely suppressed by policy makers, who mainly answer to well-resourced representatives from the formal market. Policies have therefore often failed to accommodate for the interests of the informal market players, despite the fact that these smallholder dairy producers and traders constitute the vast majority of stakeholders in the Kenyan dairy industry (Leksmono et al., 2006:39,40). The policy makers and formal market players especially criticize the informal market for the health risks and quality concerns associated with poor hygienic practices surrounding the production and selling of raw milk (Kaitibie et al, 2010:1496).

The Dairy Master Plan of 2010 aims to transform milk production in Kenya into a globally competitive dairy sector with high quality standards with regards to environmental and public health (DMP, 2010). Policy makers are therefore currently emphasizing on promoting higher production and a shift to the formal dairy market. When formulating and promoting these policy goals it is however important to consider the main stakeholders in the industry and take their challenges regarding milk production and marketing into account. In order to do so, a case study was carried out in Bathi, Kiambu County, where the challenges that the smallholder dairy farmers encounter, concerning milk production and marketing, were investigated. The Sustainable Livelihoods Framework was applied as a theoretical tool to better understand and assess the farmers challenges and associated livelihood strategies.

As basis for the case study, the following problem statement was formulated:

Problem statement

How can the Sustainable Livelihoods Framework explain the challenges that smallholder dairy farmers in Bathi encounter in production and marketing of their milk?

To answer the problem statement, the following research questions have been formulated:

- What are the farmers' main challenges concerning dairy production in Bathi?
- What are the farmers' main challenges concerning dairy marketing in Bathi?
- How are these challenges reflected in the farmers livelihood strategies?
- How do institutions and policies affect the livelihood of the farmer?

Sustainable Livelihood Framework

This chapter will introduce the theoretical framework, which will be used to answer the problem statement.

The Sustainable Livelihood Framework will be applied to describe a means of living, through the analysis of assets, capabilities and activities for a person, household or a larger group of people (Chambers & Conway, 1992). The framework can be very usable when assessing livelihood strategies in order to understand the factors that affect people's choices, whether conscious or not, and their prospects for development (DFID, 1999). According to the DFID the livelihood framework “*provides a checklist of important issues and sketches out the way these link to each other; draws attention to core influences and processes; and emphasises the multiple interactions between the various factors which affect livelihoods.*” (DFID, 1999:1).

The framework is built up around many aspects which all contribute to the final assessment of a livelihood. Firstly, it consists of the *asset pentagon*, which evaluates and visualises people's access to *human, natural, physical, social* and *financial capital* (Ellis, 2000). An overview of the different capitals and what they represent is shown in the table 1 below.

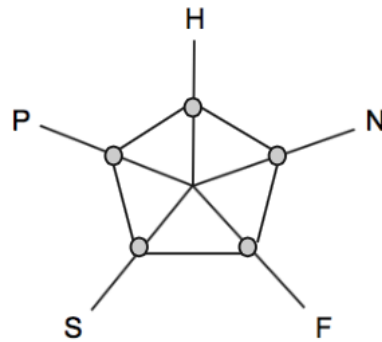
Table 1. Livelihood capitals and their attributes

Capital	Attributes
Human Capital	Skills; knowledge; ability to work; health
Natural Capital	Natural resource stocks; land; water; biological resources
Physical Capital	Infrastructure; producer goods; equipment; facilities
Social Capital	Networks; connectedness; membership; relations; reciprocity; safety nets
Financial Capital	Financial resources; stocks/savings; flows; credit; cash; income; valuables

(Inspired by DFID, 1999 & Ellis, 2000)

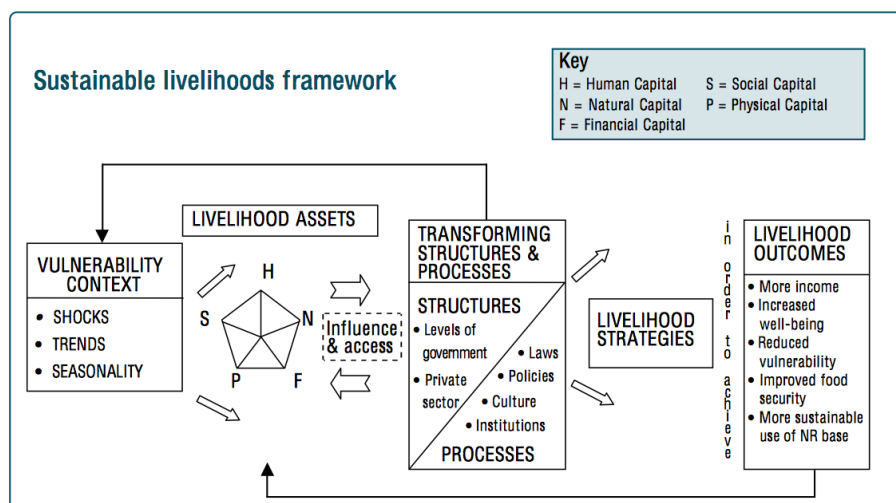
According to their respective levels, these five capitals can then be placed in the *asset pentagon*, which allows a visual presentation that brings together the inter-relationships between them, as shown in figure 1 on the next page.

Fig. 1. Asset pentagon representing the human (H), natural (N), physical (P), social (S) and financial (F) capitals.



Another important aspect of the livelihood framework is the *vulnerability context* that frames the different capitals that make up people's livelihood. The *vulnerability context* entails *trends*, *shocks* and *seasonality* that people have limited or no control over (DFID, 1999). These factors influence the assets and can either destroy, influence or make people dispose of assets. Institutions, organizations, policies, legislation and social relations also influence and shape livelihoods (DFID, 1999 & Ellis, 2000). These are defined as *transforming structures and processes*, within the livelihood framework, and they can affect both the *vulnerability context*, the livelihood strategies and livelihood outcomes (DFID, 1999). When analysing livelihoods all these factors are important aspects of the framework, and need to be considered in order to perform a comprehensive livelihood analysis. An overview of the framework which sums up all its important properties are shown in figure 2 below.

Fig. 2. The Sustainable Livelihoods Framework (DFID, 1999)



The Sustainable Livelihood Framework will later be applied in order to assess the different challenges that smallholder dairy farmers encounter. In relation to this, the next chapter will introduce the political institutions and their policy goals that potentially affect the farmers' livelihoods.

The Kenyan dairy sector

In 1958, the Kenya Dairy Board (KDB) was founded to regulate, develop and promote the Kenyan dairy industry (KDB, 2015). Officials of the KDB have vividly spoken against the informal dairy market, despite efforts to enact a shift in attitudes towards the large informal sector and pay more attention to the smallholder farmers' needs. The Kenya National Dairy Master Plan of 2010, a vision for the future of dairying in Kenya, outlines the current challenges to the dairy sector and the governmental plans to overcome these hurdles (DMP, 2010). The overall aim of the plan is to transform the Kenyan dairy sector into a globally competitive market with high environmental and public health standards (DMP, 2010). Concerns about the informal market are raised due to quality and safety issues and the ministry recognises the informal milk traders as the main targets for training in hygienic practices in milk handling and demands for strict control of both the formal and the informal markets (DMP, 2010).

Besides milk quality and the economic benefits of having a developed dairy industry, the report emphasises productivity with one of the objectives being to *“improve the productivity and competitiveness of Kenya's dairy and dairy products”* (DMP, 2010). Productivity is also seen as a key to another objective: *transforming the dairy industry into a net exporter of dairy animals and their products*. While currently less than one per cent of milk in Kenya is sold to other countries, the potential for exports is high due to the milk deficiency of many African countries. An obvious problem is that since much of the milk in Kenya is going to the informal sector, it is not processed and hence makes a very poor export due to short shelf-life and possible trade restrictions. This relates to the promotion of the formal market, since the exportable dairy products need to go through this market channel as highly value-added products.

Bathi

This case study was conducted in the village of Bathi, located in Kiambu County in the Central Province of Kenya, which is an important area for the Kenyan dairy industry (figure 3). The population of Bathi consists mainly of farmers owning small plots where they grow crops and keep livestock. Bathi is located near to the Kereita forest, where the farmers collect firewood and grass for the animals, while also taking some animals there to graze. Kimende is the nearest town, where many of the residents do their shopping. However, Bathi is also rather close to Nairobi, located about 50 km north of the city.

Fig. 3. Location of Bathi, Kiambu County



Methodology

In order to investigate the problem statement, field research was conducted in Bathi between 30/2/2015 and 9/3/2015. Various research methods were used to obtain important information, which will be explained in the following.

Questionnaires

A total of 32 questionnaires were conducted with dairy farmers in Bathi. The questionnaires would provide us with basic information on the farmers' households and the challenges they encounter in their milk production and marketing (see questionnaire in appendix 3). The selection of the respondents was done by the community elder of Bathi. He selected households with farmers selling to the small scale traders, also known as hawkers and farmers selling to the cooperative. We later found that he had prioritised farmers who practised zero-grazing so that the cows would be present when interviewing.

The questionnaire was revised from the original version after arriving in the field, as some questions turned out to be irrelevant and new information was required. On arrival to the site, we found out that milk quality did not play a part in choosing between markets and that farmers did not need a milk producing licence. Rather, we then decided to focus more on milk quantities and the factors affecting them.

The questionnaires took place at the farmer's private settings and often much time passed with small-talk and hospitality. We often took advantage of the situation and asked the farmers further questions, related to good hygienic practices, record keeping and perceptions of the local co-operative and the hawkers. The questions did not constitute an interview but were not part of the formal questionnaire, either. The approach was valuable as it enabled us to ask relevant questions and elaborate on the questionnaires in a relatively loose manner as our overview of the situation changed in the course of the research.

Semi-structured interviews

Semi-structured interviews (appendix 4) were conducted with the following key informants: secretary of the Kiriita Dairy, officials from the local livestock and veterinary departments, a local milk hawker and 11 small-scale dairy farmers. The questions were designed to get more

comprehensive information about the target group and the project's main focus. The key informants amongst the farmers were chosen based on their answers given on the questionnaire, to make sure that both farmers selling to hawkers and to the co-operative were interviewed. The purpose of interviewing the farmers was to get an understanding of the challenges they meet in their production and marketing of the milk and their perception of the different marketing channels.

The interviews with the government officials from Ministry of Agriculture, Livestock and Fisheries' (MALF) Lari district department were conducted in order to get an impression of how they work on the field-level and what their impression of the situation in Bathi is. The questions asked related to productivity in the area, including feeds, diseases and farmers' access to knowledge and the marketing channels present in the area.

The hawker and the Kiriita Dairy Cooperative, each representing the informal and formal market respectively, were interviewed in order to acquire practical information concerning their work, and to understand their role in and view upon dairy markets in Bathi.

Participatory observations

Participatory observations were done on all the farms that we visited and during our visit to the co-operative's milk collection point. In our research, this method was an intrinsic part of the research process as observations and participatory actions took place during the visits to the farms when we conducted interviews and questionnaires. Direct participatory actions were limited to milking the cows as part of mastitis testing and cutting fodder for the cattle. The observations, relating to milking practices, dairy hygiene and milk transport, provided us with valuable information on the local agricultural practices that we otherwise would not have been able to find out. The method was also reliable as people did not seem inhibited by or overly conscious of our presence.

Mastitis testing

Mastitis is a bacterial inflammation of the cow's udders. It will lower the milk yield and affect its spoilage profile and sensory characteristics, for which reasons it is a vital indicator of milk quality (DairyCo, 2015). Sub-clinical mastitis refers to an infection that is not externally visible and can only be detected by a test, such as CMT (California Mastitis Test) (Blowey and Edmondson 2010). Since we wanted to investigate the milk quantity in relation to milk production we found it relevant to test the cows for mastitis. A total of 17 cows were tested for mastitis on 14 farms. For the test, some milk was squeezed onto a clear plate from the animal's four teats and a chemical reagent was

added – the presence of clotting in the milk was an indicator of inflammation in the udders (see picture 1).

Pic. 1. CMT test, showing the presence of sub-clinical mastitis in (A)



Mapping with Garmin GPS (etrex 10)

All the farms that were included in the questionnaire as well as the local milk collection points of the dairy co-operative were tracked with a GPS. These locations were then placed on a map to provide us with a clear overview of the village and the surroundings in which the study was conducted.

Limitations

When analysing the results obtained through this research it is important to consider the limitations of the methods used and the obstacles that were encountered during the research, in order to assess the quality of the data and consider likely improvements for further research.

Questionnaires

In relation to our questionnaires one shortcoming relates to our sampling strategy, which we did not have great influence on. As mentioned, it was merely the community elder who chose the farms. His sampling strategy enabled us to observe the animals, their surroundings, feeds and the people's practices but it also meant that the sample only included farmers who practised zero-grazing. The community elder was present at most of the questionnaires and interviews, and his presence may

have influenced the respondents answers, given that he has a certain status in the community and might have a relationship to the farmer.

Conducting one questionnaire took approximately 45 minutes. This was more than expected and delayed our time schedule. The length was due to the time it took to translate the questions, the translator and village elder's small-talk with the respondents and the farmers' hospitality. We found it important to follow their pace as a way to build rapport and show respect.

Semi-structured interviews

In our semi-structured interviews one of the limitations that we encountered was the interpretation of the interviewees' statements. At times the interpreter and the respondent had a long conversation in the local language before the interpreter gave a short summary of what had been said. There is a risk that some useful information got lost in translation.

Focus group interview

Due to limited time and a delay in time schedule, we were not able to complete a focus group interview. A focus group interview, where a group of farmers would have been brought together to discuss important aspects of our research, could have been of high relevance for the study in relation to getting a more in-depth understanding of the farmers' concerns and perspective on the situation of market access and milk production.

Participatory methods

The lack of participatory methods may be counted as a limitation to our research. Participatory tools include, e.g. resource maps, seasonal calendars and timelines that the respondents collectively create with the researchers' facilitation (Mikkelsen 2005) We might have been able to see whether the farmers' animal feeding routines are affected by seasonality, whether the milk yields differ between seasons and if this affects the prices that the farmers receive from milk. A timeline could have shown us the historical events that shaped the dairy market in the area to what it is now. However, the language barriers and our tight schedule might have meant that our results would have been modest and carrying out these activities would have taken time away from the other activities, such as the interviews, that were essential to our research.

Group dynamic

Our research group consisted of three Nordic and two Kenyan students. Including everyone's areas of interest in one project was difficult at times due to the different educational backgrounds and the different expectations that the villagers and the university supervisors had. New areas of research were introduced in the project by the Kenyan students and some things were discarded because they turned out to be unimportant. This made our research stronger but clouded our perception of what we were actually working towards. As mentioned, the supervisors also had vastly different views on the aim of our project which at times made it difficult for us to know what was expected of us and what we should actually work towards.

Results

This chapter will present the data gathered from the fieldwork. The results will later constitute a vital part of the analysis and discussion of the dairy farmers' challenges.

The Ministry of Agriculture, Livestock and Fisheries (MALF), Lari District

This subchapter will describe the ministry's work and objectives for Bathi. It will be used to later analyse the *structures and processes* that affect the farmers' livelihood strategies.

Bathi is part of the Lari district within Kiambu County, which has a livestock and a veterinary department representing the county government in the case area. To get information on the ministry's work and objectives, interviews with both of these official bodies were carried out during the research.

The main strategic objectives of the district's department of livestock were as follows: (1) *to create an enabling environment*, (2) *to facilitate access to markets* and (3) *to increase output and productivity*. These objectives seem well in line with the Kenya National Dairy Master Plan.

According to the interviewed representative, the department of livestock deals mostly with breeding and feeding. Specifically in relation to milk production, the department organises field days with the objective of educating farmers on milk handling and marketing. The department encourages the farmers to join the co-operative and talks of the many associated advantages. Attendance to these events was said to be high and it was stated that the farmers were very willing to join the co-operative. Concerning milk quality, it was stressed that the co-operative tests for it and that the quality in the area is fine. Challenges that the department experiences were considered minor, with only the lack of sufficient feeds during droughts mentioned as a problem. The informal milk market (the hawkers) was not recognised as a problem at all and the co-operative was thought to be doing well and increasing in membership.

The ministry representative from the veterinary department explained that the main goal of his department was to control diseases and increase milk quality in the area. However, he emphasized on the fact that the department is only concerned with advisory services and does not engage in any treatment practices. The veterinary officer stated that health technicians were available to the farmers in the field and that these visit farms regularly. When asked about the general level of

health of the dairy cattle in Bathi, he explained that the animal health was “average” and that only 2-3 cases of mastitis had been reported to the department.

The dairy farmers in Bathi

This subchapter will present the main characteristics of the farmers in Bathi, which will later be used to analyse their livelihood strategy.

Questionnaires were performed on 32 dairy farmers in the area (8 males and 24 females) whose average age was 45, household size 5.5 persons and mean income 21 870 Ksh (table 2). The income ranged from 5 000 to 50 000 Ksh per month, which indicates that there is a relatively high inequality in income distribution.

Table 2. Farm characteristics

Category	Mean	Median	Mode	Range
Age of respondent (y)	45	42	multiple	21;73
People in household	5.5	5	5	1;14
Land owned (acre)	1.62	1	multiple	0.25;6
Land rented (acre)	0.07	0	0	0;0.5
Land for crops (acre)	1	0.6	multiple	0;4.75
Income (Ksh)	21 870	15 000	multiple	5 000;50 000
No of cows	4.3	3	2	1;13
No of milking cows	1.8	1.5	1	0;5

Out of the 32 surveyed households, 23 listed dairy production as their main source of income and 21 of these also sold crops as a second source of income. The remaining nine households listed the selling of crops as their main source of income with dairy coming in second. Only two households listed other economic activities besides selling milk and crops, which shows a high dependency on the income from these two activities.

Each household owned a plot of land on which they would house their livestock and grow crops for consumption, for selling and as fodder for their livestock (table 2). Out of all the surveyed households, 22 practiced zero-grazing only. Zero-grazing is a farming system in which the cattle is

kept and fed in the stalls only (Doris, 2012). Eight households practiced both zero-grazing and open grazing. In these households, it was the milking cows that were kept on the zero-grazing system and the heifers, calves and bulls that were taken to the forest during the day to graze openly.

The most common number of cattle for each household was two in total, of which one was milked (table 2). From all the households surveyed, 88.81% of the cows were of the Friesian breed and 10.45% were Ayrshire. Each household would produce an average of 13kg of milk per day, ranging from 4.5kg to 25kg (excluding cows that were about to give birth and thus producing very little milk). Most of this would be then be sold either to the Kiriita Dairy Farmers Co-operative Society Limited or a hawker to provide income. The milk that was not sold would be used for direct household consumption. A notable difference was seen in the income of the farmers who chose to sell solely to the co-operative and those who sold to the hawkers only. The former group earned on average 33 % more than the average income and the latter earned 15% less (table 3).

Table 3. Farmers' income by market channels

Buyer	Number of respondents ¹	Average income (KSh)	Difference to all respondents' average income
Co-operative	4	32 500	+ 33 %
Hawker	18	18 639	– 15 %
Both	5	25 000	+ 13 %

Because dairy farming provides the main income for most of the surveyed households, milk production itself is a very important aspect of the farmers' daily practices. The milk production will be investigated in the following subchapter.

¹ Data on income was not available for all the farmers (27/32)

Milk production

This subchapter will present the challenges the farmers encounter in their milk production, which will be assessed further in the livelihood analysis. The information was obtained through questionnaires, interviews, participatory observations and CMT test.

Milk quantity

On average, Friesian cattle have a lactation volume of 40kg per day under ideal conditions (Doris, 2012). However, as mentioned, farmers in Bathi were producing on average 13kg milk daily. This is more than the Kenyan average of 8–10kg per day but well below the average for Friesian cattle, which is the most common breed in the area (Wambugu et al., 2011). Besides breeds and genetics, factors that affect milk quantity are feeds, diseases and environmental conditions (Doris, 2012). A permanent characteristic affecting low milk yields in the area is the climate. For example, feed intake and feed conversion rates are inevitably lowered by the hot weather in the area (Anon, 2013).

Animal health

The farmers reported that diseases were not encountered often in their cattle. The 32 farmers who answered the questionnaire reported incidences of the most common diseases in their cows. These are summarised in table 4.

Table 4. Most common cattle diseases in Bathi

Name of disease	Number of cases
Clinical mastitis	10
Pneumonia	9
Anaplasmosis	6
East coast fever	2
Foot and mouth disease	2

In Bathi, 17 animals on 14 farms were further tested for sub-clinical mastitis. The results were positive for 82 % of the animals, indicating high prevalence of sub-clinical mastitis in the dairy cattle. A sample of mastitic milk was analysed by staff at the University of Nairobi and the responsible micro-organism was identified as *Staphylococcus aureus*. Literature states that

staphylococcal bacteria, commonly found on cows' skin, are among the major bacteria responsible for mastitis (Argaw and Tolosa 2007).

Shitandi et al. (2004) indicate that mastitis, attributed to poor hygiene, significantly affects milk production in the Rift Valley area and according to Hamann (2010) mastitis will decrease the milk yield of the cow from 10 to 80%, depending on type and degree of infection. Mastitis can therefore be considered a contributing factor to low milk yields of the cows in Bathi.

Several farmers reported open grazing in the forest as problematic due to these diseases, lack of control over animals and poorer milk yield as compared to zero-grazed animals. For this reason they all kept their milking cows zero-grazed. Some farmers, however, stated that open grazing was necessary due to the lack of sufficient feeds and had the calves and heifers still doing open grazing. Open-grazing is associated with the prevalence of more tick-borne diseases like Anaplasmosis and East Coast fever, which were mentioned as common diseases in table 4 (Doris, 2012). Almost all farmers who were questioned on the use of acaricides (pesticides to kill ticks) reported using them for tick control, usually every two or three months. The farmers also regularly dewormed the cattle. Keeping calves and heifers open-grazed, also overlooks the effects of developmental programming on health – malnutrition in the early stages of life can have lifelong consequences for later wellbeing due to changes in the body's metabolism and physiological functions (Barker 1998). Hence, it is possible that milk yields from the adult cows may be lowered due to poor nutrition during the animal's growth and development.

Based on these findings, sub-clinical mastitis seems to be the main health-related challenge to milk production in the area. Given the fact that the farmers practise mainly zero-grazing, many challenges in the milk production are reduced. However several farmers mentioned feeds as an obstacle for them when zero-grazing.

Feeds

Based on data from the questionnaires, the milking cows in Bathi were given an average of 43kg of vegetable crops per day (ranging from 20kg to 90kg). This is mostly comprised of Napier grass, maize stovers, grass and hay, while some individual farmers also reported using weeds and kale stocks. Seven of the farmers were buying hay to feed the animals while 10 of them reported cutting grass from the forest. The amount of concentrates ranged from zero to 12kg/cow/day with an average of 4.7kg.

Based on the data from this research, it is difficult to assess whether the nutritional quality and the quantities of feeds were sufficient for efficient milk production. However, a good general rule is that cattle should be provided with *more* fodder than they are capable of eating to make sure that their nutritional requirements are met. Interestingly, the amount of feeds, either crops or concentrate, was not statistically correlated with the amount of milk the farmers were getting. However, this may just be reflection on the quality of our data, as almost all farmers were unaware of the exact amount of feeds that they are giving to the animals. Several farmers indicated that lack of sufficient and affordable good quality feeds was a big problem for them and some resorted to open-grazing of their non-milked cattle as a result. This indicates that feeds are a challenge for the farmers in relation to production.

Milk quality

The informal market, while a vital part of the dairy economy, has historically clashed with policy makers and large-scale dairy operators, partly due to market shares, but also because of concerns over quality, health and safety (Wambugu et al. 2011). While there is a possible public health risk posed by unprocessed milk, it needs to be pointed out that people commonly boil the milk before consumption, thus reducing the bacterial load (Karanja 2003). The practice of boiling the milk was witnessed by us in all the visited households. However, staphylococcal toxins, for example, will not be destroyed by heating the milk (CDC 2006).²

Raw milk itself is fairly sterile but some environmental contamination (bacteria from feeds, faeces, bedding material, soil) is inevitable (te Giffel and Wells-Bennik 2010). The bacterial count of the milk is increased by poor milking practices, unclean environment, lack of cooling technology and poor animal health (Burgess 2010). Mastitic milk is not sterile as, depending on the stage of infection and the specific organism, pathogenic bacteria are shed in the milk from the infected teat (te Giffel and Wells-Bennik 2010). The hygienic practices of the farmers were largely similar from farm to farm. The floor of the cowshed on all farms was stone, covered by a layer of soil. On some farms, sawdust was used as a bedding material. The animals on average were fairly clean although none of the cowsheds looked like they had been cleaned very recently. During milking, farmers were observed cleaning the cow's udders and teats with water and using milking salve before

² On one farm, the causative agent of sub-clinical mastitis was identified as *Staphylococcus aureus*. Some strains of *S. aureus* also produce heat-resistant toxins that cause food poisonings in humans (CDC 2006). This would then make further studies on the microbiological quality of the milk in the area very relevant.

milking to prevent cracking of the teat skin. The water and cloth used for cleaning the udders were often dirty and the same cloth was used repetitively on all the animals.

Some farmers were seen sieving the milk to clear off any visible particles, such as dust and soil, from the milk. On some farms, the milk was cooled using cold water, but this was not a common practice.

On receiving the milk the co-operative and the hawkers sieved the milk for visible particles. They also reported that the milk density is randomly tested using a lactometre. The test is used to identify milk that has been adulterated with water to increase its volume. However, instances of such fraud were told to be uncommon. Sensory testing of the milk was also done by both the co-operative and the hawkers to determine whether the milk has a normal, non-spoilt taste and smell. This is a very basic method on which to base the decision on whether a batch of milk is accepted or rejected by the buyer.

From these observations it is showed that the two sectors do not differ in their requirement concerning the milk quality. Milk quality can therefore not be seen as an obstacle for the farmers in relation to marketing.

Markets in Bathi

Two sources of market channels can be identified in Bathi, namely the Kiriita Dairy Farmers Co-operative Society Limited and hawkers. The two market channels can be characterized as respectively being part of the formal market and the informal market and.

The formal market

In the formal market the milk is being processed and the farmer can either sell directly to the processor, or to a dairy co-operative. The co-operative might processes the milk itself if processing facilities are available, or sell it to larger processing plant, such as Brookside. In Bathi, the Kiriita Dairy Farmers Co-operative Society Limited (see picture 2) represents the formal marketing channel through which the local dairy farmers can sell their milk. The information obtained about this co-operative has been retrieved mainly through an interview with the co-operative secretary, an interview with the area representative in Bathi and an interview with the milk collector employed by the co-operative

The co-operative is licensed by the KDB and the county council, and sells milk to the processors as they do not process milk themselves.

The co-operative was established in 1967 by farmers in Lari district in order to collect and sell their milk together. The co-operative is the only one currently operating in Bathi. They have a total of 6 400 members, of which 800–1000 are

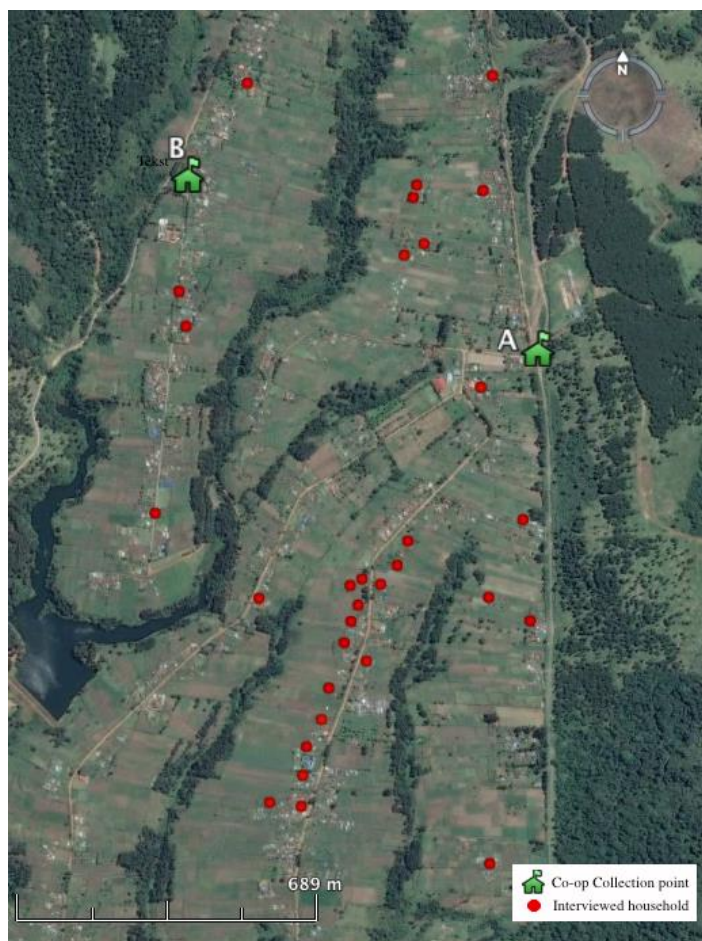
active members. There are no specific requirements to become a member; however, there is a membership fee of 3 190 Ksh. The membership is lifelong, meaning that despite long breaks from the co-operative, the farmer can rejoin at any time. The co-operative has an annual election of board members, who then have a seat in the management for three years. The cooperative is including the farmers in their management, demonstrating that the co-operative belongs to the farmers.

The co-operative picks up the farmer's milk at their two collection points in Bathi at specified times. The two collection points were identified and are shown on figure 4, however only collection point A provided pick-up twice a day; in the morning and in the afternoon. At collection point B, the co-operative would only pick up the milk in the morning and the farmers would have to go to Magina Town to hand in their afternoon milk.

Pic. 2. Kiriita Dairy Farmers Co-operative Society Limited

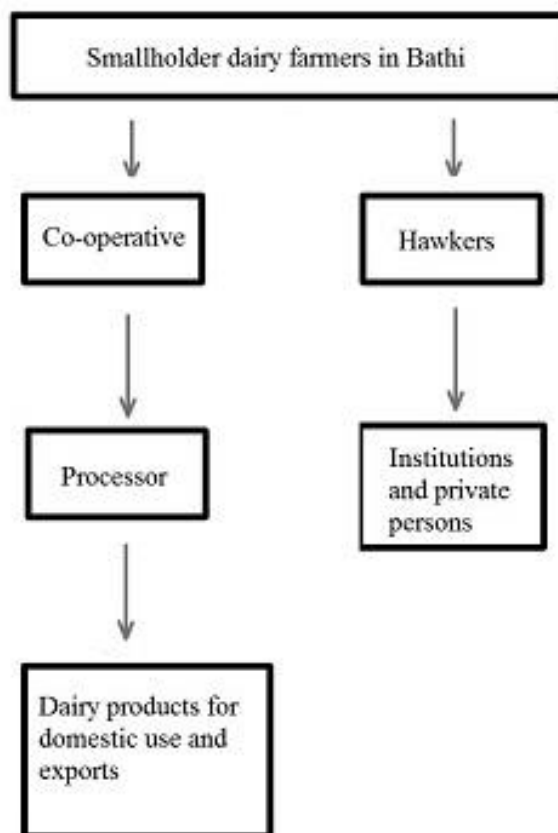


Fig. 4. Interviewed households and co-operative pick-up points



The co-operative sell their milk to the processor Brookside (see figure 5). The price fluctuates depending on the market and currently, the farmers are paid 34 Ksh/kg for their milk once a month. The co-operative offers different services both to members and non-members and money spent on services provided by the co-operative are deducted from the farmers' monthly paycheck. The services available to the farmers differed according to membership status. Loans through the co-operative bank was for example offered to active members, where seminars and training on animal health and veterinary services (such as treatment and artificial insemination) were available for non-active members as well. According to the co-operative, the services provided are a large advantage to the farmers due to their prize and accessibility, and farmers are glad to make use of them.

Fig 5. An overview of the two marketing channels in Bathi



The informal market

This subchapter will present data obtained through an interview with a hawker and the questionnaires.

In the informal market the dairy farmers sell to non-licenced small-scale vendors, who sell raw milk directly to consumers without processing (see figure 5). In Bathi, the hawkers buy milk from the farmers and sell to hotels and private persons in Kimende (see picture 3). They are therefore part of the informal milk market. The interviewed hawker said he would collect milk from 40 farmers in Bathi twice a day. The hawkers pick up the milk at the farmers home, meaning that there is no transportation cost for the farmer when selling to the hawker. In total, four hawkers were collecting milk in Bathi.

Through the questionnaire, it was found that the hawkers bought the farmers' milk at different prices. The average price given by the hawkers was 34.35 Ksh with prices ranging from 33 to 40 Ksh. The prices given by the hawkers are thus in some cases slightly higher than the ones given by the cooperative. The payment was given to the farmer according to what agreement the farmer and hawker had, but often the farmers received payment for their milk on a day-to-day basis.

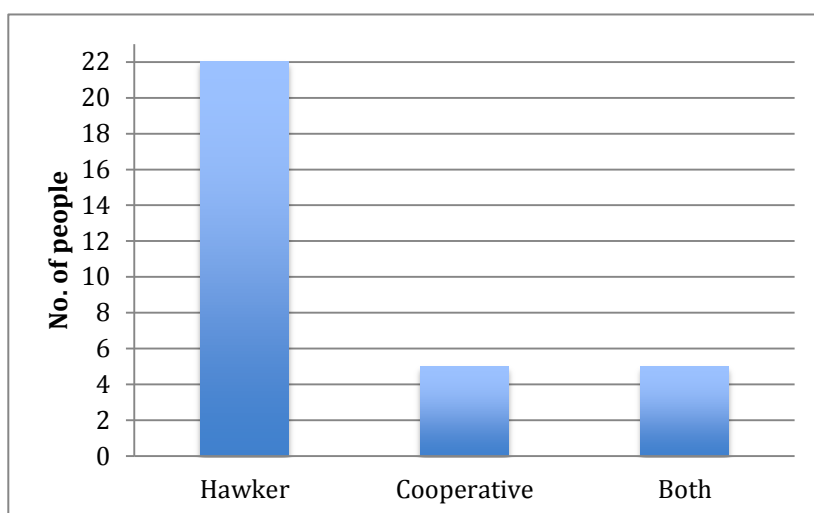
Pic. 3. Hawker collecting milk in Bathi



The farmers' challenges in milk marketing

As mentioned, all the respondents in Bathi sold their milk either to the co-operative in the area or to the hawkers. The 32 farmers were asked which marketing channels they used (figure 6), why they preferred their respective market channel and what they considered the main challenges concerning the markets.

Fig. 6. Number of farmers selling to the respective marketing channels



The five farmers selling only to the co-operative talked about benefits such as cheaper feeds, encouragement to save money (since the co-operative pays monthly and many of the farmers selling

to the hawkers opted for the chance to get money daily) and the chance to get help in case of sudden problems such as animal diseases. Positive attributes such as reliability, safety and trust were used to describe the co-operative (although two of the five farmers selling to the co-operative also worked for it and were naturally the most satisfied in their descriptions). With regard to the hawkers, these farmers expressed a mutual distrust for them; *“the hawkers may run away with the money”* one respondent stated. It appears that besides finding the co-operative advantageous due to the services, they also felt it was the more “proper” option than the hawkers.

Two of these respondents did express dissatisfaction with the co-operative due to milk sometimes getting rejected, change of collection hours in peak season and the distance between their farms and the collection point. One respondent mentioned that the co-operative provides less services now than previously due to loss of members.

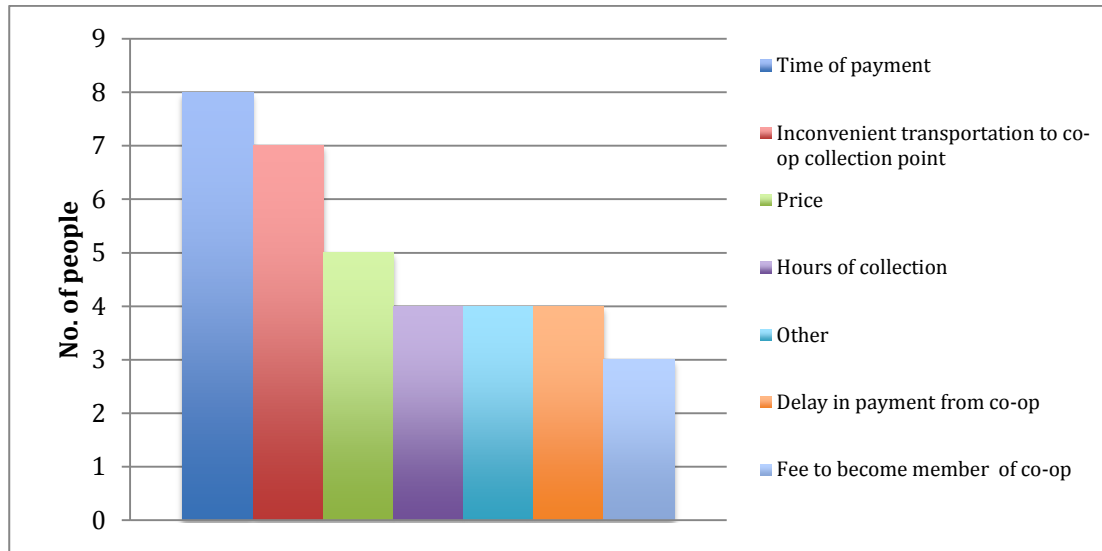
As shown in figure 6, five farmers sold milk to both the co-operative and the hawker. Two farmers attributed this to convenience, since the co-operative does not collect the afternoon milk at collection point B, meaning that they would have to travel too far to transport the milk. Because of this, they were selling the morning milk to the co-operative and the afternoon milk to the hawkers. This strategy of favouring both markets was based on the consideration that being an active member in the co-operative was still seen as beneficial due to the level of services offered to members. Advantages to selling to the hawker included him paying a better price and paying straight away if preferred. The hawker would also collect the milk at the farmer’s doorstep, which was seen as convenient. However, one respondent noted that the hawker was deemed somewhat unreliable.

Almost 70 % (22) of the respondents sold milk solely to the hawkers. Eight of these mentioned that the hawkers pay them right away while seven of them said that the hawkers collect the milk at their house. Four farmers complained about the co-operative collection hours being too early. Five farmers mentioned the better price they are getting from the hawkers. Two farmers, however, mentioned that they felt that the option of getting direct daily payments by the hawkers made it somewhat difficult to manage the money, in the sense that they were more likely to spend the money rather than saving it. An overview of the respondent’s reasons for selling to the hawkers is shown in figure 7.

Four farmers stated that they would prefer selling to the co-operative, but did not because of the delayed payments and the inconvenient distances. Most of the farmers were already members of the co-operative but had become inactive because of lack of trust in the co-operative, inconvenient

pickup times and location, and the possibility of getting paid on a day-to-day basis by the hawkers. Furthermore, some people were concerned that they would be fined by the co-operative for having been inactive for so long.

Fig. 7. Reason for selling to hawkers



This subchapter reveal that the main challenges the farmers encounter in relation to selling their milk. One clear challenge was the farmers need of payment on a day-to-day basis, which indicates a general lack of financial resources. Another challenge emphasised by the farmers was the inconvenience of the time and place of pick-up, and it further became clear that trust is an issue when marketing their milk.

Discussion and analysis

The livelihoods of the dairy farmers

In order to better understand why the farmers chose the marketing channel they do, a livelihood analysis on the dairy farmers in Bathi will be carried out. The data obtained through the various research methods will be used to give an indication of the level of the farmers' different capitals, which will help to explain the farmers challenges. This will further be discussed in relation to the structures and processes affecting the farmers' livelihoods.

The *human capital* for the farmers seems to be at a modest level. Many of the farmers had received formal training on milk production (government courses, co-operative seminars, school classes), but many had also learnt in practice or from their family. It also seemed that many people did not attend the seminars because of lack of time or interest. Arguably, the farmers lacked understanding of the link between good hygienic practices and their animals' productivity. Their hygienic practices also appeared somewhat lacking, proven by the presence of sub-clinical mastitis. Farmers clearly expressed their need for more knowledge regarding the health of their animals. While they were aware of the fact that zero-grazing gives higher yields for their milking cows; the farmers however seemed unaware of the adverse effects to growth and development associated with poor nutrition during the animals' early life.

The information retrieved in the field indicates that the farmers' *natural capital* is at moderate state. The area is suitable for croplands and the land available for the farmers is appropriate to sustain the households; however, more land for growing fodder would be advantageous. The situation regarding water resources seemed acceptable as there was no need for irrigation in the area. Further, the farmers who had limited resources to buy feeds for their livestock still had open access to graze their cattle in the forest, which would also serve as a nearby natural source of fuelwood and grass for the zero-grazed cattle as well. The climate in the area is however a limiting factor for the productivity of the dairy cattle.

The *physical capital* was somewhat limited for the farmers. They had limited access to fertilisers, storage facilities and general farming equipment. Some of the cow stalls were at a relatively bad shape and zero-grazed cattle had limited space. Most of the respondents did not possess any

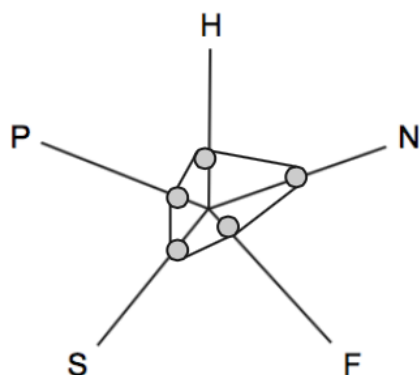
automatic farming machinery or vehicles for transporting feeds, milk etc., though a few farmers had an electric cutter for chopping fodder. The farmers were milking by hand and transported feeds, firewood and other utilities by foot or occasionally by the use of donkeys as draft animals. The infrastructure in Bathi consisted of poor and uneven dirt roads, which made transportation by larger vehicles very difficult and even walking could be challenging in some parts of the village.

The *social capital* was mediocre in the area. Bathi was a small community, where family ties and good neighbourship was of great importance. The culture in the area built on looking out for each other and especially the church would function as a central network and safety net, where experiences and information would be shared amongst its members. However, by analysing the state of the co-operative in Bathi, our data indicates that there are barriers for collaboration regarding the milk industry in the area. The co-operative which could potentially function as a venue for reciprocity and information exchanges, and potentially strengthen the trust and cooperation between the dairy farmers, does not function successfully and therefore does not strengthen the *social capital* in the area. This is further shown by the absence of farmer self-help groups in Bathi.

At last the *financial capital* in the area is limited. The research data shows that a large proportion of the farmers feel the need to sell their milk to the hawkers in the area because of the possibility to get paid on a daily basis and because of the higher price. This indicates that the dairy farmers have limited financial resources to draw on. Further, many of the farmers talked about the difficulties of obtaining a loan, when not an active member of the co-operative, which constrains the possibilities for investment and increasing the financial resources. In regards to milk production, the low financial capital served as a challenge that limited their access to feeds.

On basis of the aforementioned information, an asset pentagon showing the farmers' somewhat limited access to *physical, financial, human and social* capitals was sketched out (figure 8). This lack of resources leaves them vulnerable to stresses, constricts their space for maneuvering, and further less able to influence or manipulate their environment to reduce the impact of those stresses.

Fig. 8. Asset pentagon representing the farmers' access to capitals



The *structures* that mainly affect the dairy farmers livelihood are the KDB, MALF and their sub-department in the district. These institutions formulate the legislation and policies which constitute the *processes* that influence the farmers' access to capitals and thereby affect their vulnerability. Ideally, the *transforming structures and processes* would work towards reducing this vulnerability and developing the farmers' access to the different capitals. The recent policies state how the formal market should be promoted through education and training in order to increase productivity with regards to quantity and quality of milk. However, the district department's representatives seemed to be lacking knowledge about the actual situation in Bathi. Many of the farmers sold to the informal market because of low financial capital, a fact not recognised by the district department. The local veterinary department was further unaware of the high levels of sub-clinical mastitis in the cattle, indicating a limited contact with farmers and little awareness of the animal health in the area. This was highlighted by the veterinary department's statement that they do not examine or treat cattle, but merely act as an advisory body. In relation to this, however, most farmers reported to never having had a visit from the health technicians that supposedly were providing the farmers with education on health and productivity in the field.

The department of livestock production talked about their efforts to encourage the farmers to join the co-operative during educational field days and the farmers' willingness to participate in the formal market – in reality, few farmers were attending these events and most were selling milk on the informal market. The fact that the ministry representative stated that the local co-operative was functioning well was strongly contrasted by our findings, and they appeared somewhat ignorant by not at all acknowledging the hawkers as competition. This further indicates that the purpose of the policies formulated on the government level are either not directly applicable on the field level or that the institutions responsible for implementing them do not possess the information, means or

resources to do so. Considering these facts, there is a strong indication that the present policies and their implementation level do not reduce the vulnerability of the dairy farmers in Bathi. The policies are aiming at promoting production and the formal dairy sector that has the possibility to improve the livelihoods of the farmers and increase their access to the different capitals; however, the *structures and processes* that ought to enlighten the farmers about their possibilities and help them develop their livelihoods, are failing to do so.

Conclusion

The objective of this study was to investigate how the Sustainable Livelihoods Framework can explain the challenges the farmers in Bathi encounter in their milk production and marketing. From our data we found that the main challenges the farmers encounter in production is related to the milk quantity. One of the most revealing findings was a high rate of the disease sub-clinical mastitis, which lowers milk yields. The farmers further mentioned feeds as a big challenge in their production.

In relation to milk marketing, we found that the majority of farmers in Bathi sell their milk at the informal market. The biggest challenges in relation to selling at the formal market were identified as late payment, distrust to the co-operative, transportation to collection point and the inconvenient hours of collection.

Through the Sustainable Livelihood Framework the different capitals were identified. The findings indicate that the farmers' limited financial capital makes them sell to the hawkers since payments in the informal market are given more frequently. The low financial capital also affects the production because it hinders the farmers from buying more feeds and thereby lowers the milk quantity. The level of human capital may be part of the explanation behind the high prevalence of sub-clinical mastitis, since their lack of hygiene knowledge causes the disease. This limited access to different capitals makes it hard for the farmers to increase their production or profits and this is reflected in their livelihood strategies

The objectives of the KDB, MALF and their subdepartment in Lari are to enhance milk production and to increase milk marketed through the formal sector, however it was discovered that these *structures* and *processes* do not fully consider the challenges that the smallholder dairy farmers in Bathi are experiencing. Thereby they fail to support the farmers in developing their livelihoods towards a more sustainable level, where they are less vulnerable to external factors.

By applying the Sustainable Livelihoods Framework we found that the farmers in Bathi have a relatively little room for manoeuvring because of their limited access to capitals. This provides an explanation for the farmers' challenges both in regards to production and to marketing

Acknowledgements

This research was carried out by students from the University of Copenhagen, the University of Nairobi and the Roskilde University. We sincerely thank our Kenyan supervisor Professor Raphael Wahome and our Danish supervisors, Professors Martin Skrydstrup and Ebbe Prag, for their help, support and constructive criticism throughout the planning, fieldwork and the writing process. Our thanks also go to Virginia Kinuthia and Simon Topisia, the Kenyan students who worked with us in Kiambu.

We wish to thank KENVO for their practical assistance, such as arranging our stay with the host families. We are also grateful to the community elder of Bathi and our translator for introducing us to the farmers and for making it possible for us to carry out this research.

Lastly, we thank all the people in Bathi who made us feel welcome in their homes and the farmers who provided the information for our research.

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Appendices

Appendix 1. Synopsis

Synopsis

Milk Production and Choice of Market in Bathi, Kiambu County

**LIVESTOCK
ILUNRM**

Date: 20th of February 2015



Group members:

Marie Amalie Rosentoft Jein

Markus Naukkarinen

Trine Østergaard Rasmussen

Word count: 2.328

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SYNOPSIS

Introduction

Kenya is one of Africa's largest dairy producers and the country relies heavily on its dairy sector (Atieno & Kanyinga(1), 2008:3). However, since the liberalisation of the dairy industry, beginning in 1992, there has been a huge expansion of the informal milk market, which is estimated to now provide around 86% of the marketed milk to the consumers in Kenya (Kaitibie et al, 2010:1496).

The liberalization has led to big challenges for the milk producers and processors in the formal sector, who since pre-independence times and up until the liberalization mainly controlled the dairy market in Kenya. In the pre-independence, European settlers had the sole right to practise commercial farming in Kenya, and in 1925, the Kenya Co-operative Creameries (KCC) was established to market and process their dairy products (Atieno & Kanyinga(2), 2008:1). However, in 1954 the release of the Swynnerton Plan gave indigenous Kenyans the right to also obtain commercial farming (Muriuki et al., 2003:13). Consequently, the indigenous people started participating in small-scale commercial farming and the farmers gathered in co-operatives in order to strengthen the marketing (ibid:15). In 1958 the KCC became the dominant agent in marketing for the dairy farmers and later the Kenya Dairy Board was founded to regulate the market (Atieno & Kanyinga(2), 2008:1). After Kenya's independence in 1963, the political scene changed towards full inclusion of the indigenous Kenyans into the dairy production (Muriuki, 2011:4). Land was sold to Kenyan smallholders and by splitting up the former large-scale farms, a high increase of smallholder dairy farms occurred (Omoro et al, 1999:7). The smallholder farms functioned mainly as suppliers of the KCC and informally traded milk was only tolerated in rural areas that had not been "zoned-off" by the KDB (FAO, year unknown).

The liberalization in 1992 led to the end of the KCC monopoly. This essentially influenced the structure of the market, where different players now entered the market to compete with KCC. For example, there was an increase in the establishment of formal private processors like Brookside, Delamere and Illara, however, some of the new operators were also informal co-operatives. These were made up by small-scale milk traders who were buying raw milk from the farmers to sell to consumers (Atieno & Kanyinga(2), 2008:8). This sudden growth in the informal market caused a breakdown of many marketing cooperatives in the 1990's, and the formal actors started to regard the informal dairy market as highly unfair competition due to factors such as cheaper labour and fewer restrictions and regulations (Leksmono et al., 2006:xi). As a result the informal raw milk market has been widely suppressed by policy makers in the KDB, who mainly answer to big well-resourced dairy producers and formal sector representatives. Policies have therefore often failed to accommodate for the interests of the informal market players, despite the fact that these smallholder dairy producers and traders constitute the vast majority of the total number of stakeholders in the dairy industry in Kenya (Leksmono et al., 2006:39,40). For this reason it is still considerably difficult for a smallholder dairy producer to obtain a milk producing licence, and even though it is not explicitly outlined in the law, trade with raw milk is still considered somewhat illegal, especially in urban areas (Omoro & Bake, 2011:281). Furthermore, the informal dairy market has especially been criticized for its health risks due to poor hygiene in its milk handling practices (Kaitibie et al, 2010:1496). The possibly low quality of the milk affects the farmer's economy if milk is lost due to spoilage and it could also affect his access to the market depending on the existing quality criteria and how they are

enforced. The quality aspect seems especially important concerning the transition from the informal into the formal dairy sector.

In 2004, however, the political scene experienced a slight shift in attitude towards the informal dairy smallholders. A relatively new research initiative, called the Smallholder Dairy Project (SDP), had conducted a study which outlined the poverty reducing effects of informal smallholder dairy producers' activities and the informal market's overall contribution to the livelihoods of small dairy farmers in Kenya (Kaitibie et al, 2010:1495 and ILRI, 2010). The purpose of the study was to stress the importance of the informal dairy markets interests in policy making processes and to make it easier for the smallholder farmer to obtain an official licence which would provide the training necessary to increase the overall milk quality.

The SDP is believed to have had considerable success so far and their studies show that there has in fact been significant changes in attitude and recognition of smallholder dairy producers (Leksmono et al., 2006:x). The overall shift towards more recognition of the smallholder dairy farmers has thus come a long way and more and more farmers now acquire licences in order to engage in the formal market. However, the new reforms have still not been passed and there remain significant challenges concerning the representation of the informal smallholder dairy market and its transition into the formal sector, which must still be addressed (Leksmono et al., 2006:xii). As mentioned, 86% of the marketed milk in Kenya is still sold as raw milk via the informal sector. In relation to this, it is highly relevant to consider which factors actually constitute the farmers position and possibility to join the formal market from the farmers own perspective, or whether some factors might promote activities in the informal sector instead. In order to investigate this the following problem statement has been formulated for this project:

Problem Statement

What factors influence the dairy farmers' decision-making in their choice between the formal and the informal dairy market in Bathi, Kiambu County?

To answer the problem statement, the following research questions have been formulated:

- How does the cultural/social context affect the farmers' choice of market?
- What are the main differences between the formal and the informal dairy market in Kiambu County?
- Is there a qualitative difference in the milk sold by a smallholder farmer in the formal and informal sector and if so, what are the main differences?
- What are the economic drivers affecting the farmers' choice of market?

Methodology

Questionnaire

The questionnaire is very relevant to this project, as it will provide an overview of many relevant factors concerning our research. The questionnaire will mostly contribute with quantitative data that will be used to show characteristics and statistical patterns within our target group (Babbie, 2002). Further it will provide information necessary for a more thorough analysis and comprehensive background information about our target group and the society they live in. The questionnaire will also be an important element in the later triangulation and cross-checking of the gathered data (ibid.).

The questionnaire will be aimed at the smallholder dairy producers within our case area, and will contain questions concerning general household information such as household members, educational background, sources of income and number of livestock in the household and so on. The questionnaire will also focus on farming practices, equipment and hygiene, and market availability to the farmer.

Additionally, the questionnaire may provide information on potential key informants that might be ideal for a more in-depth interview later on.

Semi-structured interviews

The semi-structured interview will be used to gather more comprehensive information about the target group and the project's main focus. A semi-structured interview will allow us to prepare questions for the key informants, and in that way ensure that all important and relevant information, for our research, is discretely covered during the interview, to the furthest extent possible (Casley & Kumar, 1988). This type of interview further allows for more in-depth questions concerning relevant and important issues that might occur unexpectedly during the interview or the interviewer had failed to consider in the investigation (ibid.). Such information can provide new dimensions to a study, which might otherwise have been neglected. The information obtained in the semi-structured interviews will be used for triangulation with other obtained information.

The key informants for the semi-structured interviews will mainly consist of dairy farmers in the case area. In the interview they will be asked to elaborate on some of the topics from the questionnaire, with special attention on the farming practices with regards to livestock, effects of policies and regulations on their practices, market access and personal experiences, considerations, opinions and reasons behind decisions and strategies.

Relatively simple semi-structured interviews will also be carried out with the drivers who are responsible for transporting the milk from the farms/pick-up points and to the respective "market", whether this is the farmer himself or a hired chauffeur. The simple interviews will focus on aspects like transportation time, destination, employer (if applicable) and type of vehicle used to transport the milk.

Participatory observations

Participatory observations are going to form a big part of our research. This approach to obtaining useful information is very important, since it allows for observation and interaction with the target groups within their natural setting and as part of their (somewhat) normal everyday life (Brockington & Sullivan, 2003). The participatory observations will most likely strengthen the relationship to the target group or key-persons, and enhance mutual trust and understanding that potentially could benefit the research. This approach will further provide a great deal of insight into cultural and social aspects, which might be difficult to detect through a questionnaire or interview (Mikkelsen, 2005). The information gathered through participatory observation will be of a highly informal and unstructured nature, since it will be obtained through casual conversation, interactions and observations. This type of information will be extremely useful when assessing the questionnaires and interviews, since it will increase the general understanding and cultural insight, and further provide means of validating the answers.

The key persons for the participatory observations will be the dairy producers, with whom we might be living and/or follow for a day in order to observe and learn about their daily lives and practices. We will take part in activities, make conversation and take note of all possible aspects of their lives. We will take special note of the milking processes, how they handle the milk, and their knowledge and considerations concerning the practice and process. This will tie in with the quantitative methods we are planning to use as we will be able carry out the testing while actively engaging with the people in a setting they are familiar with.

Participatory observations may provide information on a potential key-informant, who could be interesting to interview further, - perhaps through a semi-structured interview.

Mastitis testing

Mastitis is a bacterial inflammation of the cow's udders. It will lower the milk yield and affect its spoilage profile and sensory characteristics, for which reasons it is a vital indicator of milk quality (DairyCo 2015). Based on the test results, we can make conclusions about the effectiveness of the hygienic practices that the farmers are implementing. Mastitis could also have economic significance depending on the mechanism of milk prize formation.

In some cases, mastitis can also be identified by the simple procedure of foremilk (Food Standards Agency, 2006). Foremilk refers to squeezing some milk from the teats onto a clear surface prior to milking the animal. Some indicators of mastitis (clots, stringiness, wateriness) in the milk can be detected by sight and smell (and taste) (Animal Health Ireland, 2015). It is also a hygienic practice that should perhaps be encouraged as it removes potentially unsterile milk from the teat canal (Food Standards Agency, 2006).

Temperature control and predictive modelling

Raw milk is highly perishable and offers a good medium for the growth of both pathogenic and spoilage bacteria due to its high nutrient content and neutral pH (FAO, year unknown). Since we are unable to perform actual analyses for micro-organisms, a predictive model will be used to test the effect that the storage and transportation temperatures will have on milk quality. The model takes into account the initial microbial concentration of raw milk (value derived from literature), the effect of temperature on microbial growth, the pH of raw milk and the lack of antimicrobial components in milk. In practice, we plan to measure the temperature of the milk during different stages of storage and transport to the best of our ability and fit the data into FSSP (Food Safety and Spoilage Predictor), a programme developed for predicting microbial growth in different settings (DTU 2014). The results can be used to evaluate the quality of the farmer's hygienic practices and suggest stages of production where better control could be exercised.

Hygiene testing

Farmers' knowledge of hygienic and sanitary practices can be assessed with questionnaires and by observing, but concrete evidence on the effectiveness of the practical applications of this knowledge is hard to come by. Ideally, we would be able to choose an indicator of overall hygiene and test for its presence in milking equipment and contact materials that should be clean. A possible indicator could be residues of protein and/or ATP (adenosine triphosphate, an enzyme present in all cells) whose presence would imply that the farmers' cleaning practices are too lenient.

Mapping with Garmin GPS (etrex 10)

A GPS can be a very useful tool when conducting fieldwork. It will help keeping track of locations, provide means of navigation and allow for spatial measurements. Recorded data, in the form of waypoints, tracks and area measurements, can provide data which increases the understanding of the spatial organization of the field area, and can be used in the formation of a map showing relevant visual information to the project.

By using a GPS we will take the locations of questionaired and interviewed farmers in the field, and add associated and useful informations that will later be applied in the formation of a detailed digital map in the GIS program. Measured waypoints and tracks in the case area, will be used as elements on the map, and additional elements of importance will be included. Area and distance measurements will further provide useful information to the project.

Equipment

- Dictaphone (+extra batteries)
- GPS: Garmin etrex 10 (+extra batteries)
- Electric thermometer (+extra batteries)
- Mastitis testing kit
- Protein and ATP (adenosine triphosphate) tests

Time schedule

Day	Time	Activity	Method	Person	Notes
Thursday 26.02.15	16:00	Arrival at Langata Conference Center, Nairobi			
	18:00	Welcome dinner	Eating :)		Remember to boil the milk
Friday 27.02.15	10:00 - 14:00	WMI activities			
	14:00	Departure to Kereita Forest Grocery shopping Meeting host families / pick up			
Saturday 28.02.15	Morning	Walk in case area with informant / GPS	PO Mapping	Group	GPS for mapping
	Afternoon	Gather contact-information Arrange interviews, meetings, PO's etc.		Group	
Sunday 01.03.15	10:00	Church visit			
	Afternoon	Go through questionnaire Inform translator Plan sampling strategy		Group	
Monday 02.03.15	All day	Questionnaires for farmers +GPS	Q Waypoints	Group (split up)	Depends on translator GPS of Q's
Tuesday 03.03.15	Morning	Wangari Mathai Day, Baraza			Will there be activities?
	Afternoon	Questionnaires for farmers +GPS Interviews with key-informants	Q Waypoints SSI	Group (split up)	Depends on translator GPS of Q's
Wednesday 04.03.15	All day	Participatory Observation Hygiene tests	PO Mastitis test etc?		
Thursday 05.03.15	All day	Participatory Observation Hygiene tests	PO Mastitis test etc?		
Friday 06.03.15	All day	Interviews with key-informants	SSI		Flexible according to informant
Saturday 07.03.15	All day	Interviews with key-informants Final GPS mapping	SSI Waypoints / tracking etc.		Flexible according to informant
Sunday 08.03.15	All day	Common Excursion (Naivasha, Hells Gate walk, Geothermal Springs (the Gorge), Lake Naivasha, Crater lake)		Martin and David Kuria	
Monday 09.03.15	All day	Last minute stuff			What is still missing?
Tuesday 10.03.15	10:00 - 13:00	Feed back to the community Hand out of evaluation forms to be completed before you leave Kenya Common Lunch Graduation: Certificates		All	
Wednesday 11.03.15	11:00	Departure from Kereita		All	
	12:00	Arrival to Langate (optional lunch at 12:30)			
	17:30	Dinner (optional)			
Thursday 12.03.15		Departure from the field			

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Appendix 1

Data matrix

Problem statement	Research question	Sub question	Data required	Source	Method	Equipment
What factors influence the dairy farmers' decision-making process in their choice between the formal and the informal dairy market in Bathi?	1. How does the cultural/social context affect the farmers choice of market?	1.1 How do the farmers perceive the cattle?	Information on behaviour and practices	Farmers	PO / SSI	Pen + paper
		1.2 What are the social differences between the formal and informal market?	Which social benefits exists in the different markets.	Farmers	PO / SSI	Pen + paper
		1.3 What cultural and social behaviour exists within the dairy production in Bathi?	The social and cultural behaviour within dairy farming in Bathi	Farmers	SSI	Pen + paper
	2. What are the main differences between the formal and the informal dairy market in Kiambu?	2.1 What are the regulations in the formal market in regards to licensing?	The requirement the farmers have to meet in order to get a license.	Secondary data Cooperatives	SSI / Q	pen + paper
		2.2 What role do the cooperatives play in the formal and informal market?	The importance of the cooperatives in the different markets.	Cooperatives Farmers	Q / SSI	pen + paper
		2.3 Who are the main buyers of the raw milk in the informal market?	Information concerning the informal market	Farmers	Q / SSI	pen + paper
	3. Is there a qualitative difference in the milk sold by a smallholder farmer in the formal and informal sector and if so, what are the main differences?	3.1 How are the farmers treating the milk in terms of cooling/ temperature?	Information on cooling equipment. The temperature of the milk at different stages	Farmers	Q / PO Direct measurement	Thermometer Paper Pens
		3.2 How does the transportation to the market influence the milk quality?	The treatment of the milk during transportation: - Transportation vehicle - Transportation time + related milk temperature	Farmer Driver	PO / SSI	Thermometer Paper Pens
		3.3 Do hygienic standards and practices differ depending on market?	Data on how they acquire hygiene information Data on hygienic standards	Farmer	Q / PO	Paper Pens
		3.4 How prevalent is mastitis in the cows?	Somatic cell count of milk samples	Cows	Direct testing	Mastitis tests
	4. What are the economic drivers affecting the farmers' choice of market?	4.1 How much do the farmers earn from their dairy products?	The farmer's financial gain of the dairy production	Farmers	Q	Paper Pen
		4.2 What are the economic differences between selling in the formal and the informal market?	Quantitative data on prices, income, expenses	Farmers in both formal and informal market	Q	Paper Pen
		4.3 What are the economic costs of entering the formal market?	Data on acquiring new equipment and licensing	Farmers	SSI	Paper Pen

Appendix 2

Semi-structured interviews and observations

Interview guides

Sources: Co-operatives, Farmers (key informants), Drivers

Interview guide for cooperatives:

General

- How many households do you collect milk from?
- Do you provide any services to your members?
- eg. animal health services, training, education
- if so, what are the benefits to the cooperative from these investments and services?
- If cooperative founded before liberalization: how did the liberalization influence your work?

Requirements

- Do you set up requirements to your members concerning
 - the quality of the milk?
 - the production methods?
 - A fee to become member?
- How do you measure if these requirements are met?
 - How often do you test it?
- Do you have any numbers or figures of how much milk you have to reject due to the milk quality?
 - If not, do you have any idea?

Price and reselling

- How much do you pay the farmers for the raw milk?
- How much do you resell the milk for?
- Who do you resell the milk to?
 - Does the cooperative process the milk, or do you resell to processors?

Interview guide for farmers selling at informal market

- (Information retrieved from questionnaire: age, gender, etc.)
- How many cows do you own?
- Do you name your cows and how?
- How important is the cow for you in relation to non-monetary value?
 - eg. social status
- How much time do you spend on your cows on a regular day?
- Is your cows' well-being important for you?
- How big a role does your cows have to you?

- why?
- How long have you been selling milk?
 - if before the liberalisation: have you seen any changes in the milk industry
- To whom do you sell your milk?
 - Family, neighbours, bars, restaurants, hawkers etc
 - Co-operative?
- Are you member of a co-operative
 - What is your main reason for being in a co-operative
 - Are you an active member in the co-operative?
 - if yes: do you receive any service from them
 - Do you have to pay a fee to be member
 - Do you consider yourself as having more advantages, being in a co-operative, than people who are not?
- What are the benefits of selling your milk at the informal market?
- What are the biggest costs for you in the production?
- What is your preferred market channel? (Who would you prefer to sell you milk to)?
 - what are the main reason for this? Price, trust etc...
- What have been the main reasons for you to sell at the informal market?
 - Lack of license? Difficult/expensive to get?
 - Lack of resources to invest?
 - Trust in buyers at the informal market
 - Social/cultural relations

Hygienic questions:

- Do you consider hygienic matters when milking the cow?
- Do you wash your hands before, during and/or after milking the cow?

Knowledge:

- Are you member of any self help association?
- How did you learn how to milk a cow?
 - Have you ever received any education or training?
 - From family (parents)?
- Have you ever attended any training or education concerning the milking production?
 - if so, how was it financed?

Interview guide for farmers selling at formal market

- (Information retrieved from questionnaire: age, gender, etc.)
- How many cows do you own?
- Do you name your cows?

- How important is the cow for you in relation to non-monetary value?
 - eg. social status
- How much time do you spend on your cows on a regular day?
- Is your cows well-being important to you?
- How big a role does your cows have to you?
 - why?
- How long have you been selling milk?
- To whom do you sell your milk?
 - how many KSh do you earn from the milk?
- What do you see as the benefits of selling your milk at the formal market?
- ... and the obstacles?
- What are the biggest cost for you to be part of the formal market?
 - did you have to make any investments in order to enter the formal market?
- Do you prefer to sell your milk at the formal market?
 - if so, why?
- Are the hygienic criteria stricter for the formal market?
- Can you specify which hygienic procedures you follow during the milking?
- How did you get your license?
 - Did you have to pay for the license?
 - what are the regulations you had to meet to get the license?
 - Are you ever checked
 - who test / check ??
 - Did you have to change your practices in any way due to licensing?
- Are you member of a co-operative
 - Do you receive services from the cooperation you are member of?
 - if so, which? animal health services, education, training, etc...
 - What is your main reason for being in a co-operative
 - Are you an active member in the co-operative?
 - if yes: do you receive any service from them
 - do you have to pay a fee to be member
 - Do you consider yourself as having more advantages, being in a co-operative, than people who are not?

Interview guide for drivers:

- What are the approximate distance from the pick-up place to the end point (processor?)?
 - How long does it take to drive the distance?
- Do you have any cooling technology to cool down the milk during transportation?
- Do you follow any hygienic procedures during the pick up and transportation?

- Are you wearing gloves when carrying the milk from pick-up to car and car to end point?
- Have you received any training in how to treat the milk during transportation?
- Do you have any spoilage of the milk during the drive?
 - eg. due to accidental spill-overs?
- Do you meet any obstacles when transporting the milk from A to B?
 - If so, what?
 - What do you think could be done in order to make the transportation easier?

Observations

What to be aware of during observations

Observations during milking process:

- Do the farmers wash their hands?
 - and if yes, how clean is the water likely to be?
- Do the farmers wash the animal's udders before milking?
 - if yes, are individual rags used for each animal (if no, you're just spreading the bacteria from one animal to the other)
- Do the farmers practice foremilk?
 - i.e. squeezing some milk onto a clear surface before the actual milking, helps detect clear signs of mastitis (watery, clotty milk, blood) and also clears away some of the bacteria (foremilk has more bacteria than hindmilk)
- is the milk sieved? (for impurities like stones and leaves that may enter the milk if the cow kicks the ground, for example)
- Which type of floor do the cow sleep on?
 - soil, straw, cement, rubber?
 - is it clean?
- What happens to the milk after milking and how is it stored?

Observations of farmer delivering milk at pick up

- How far from home is the milk picked up?
- How do the farmer carry the milk to the pick up?
- How many hours is spent from milking to picking up?

Observation of farmer selling informal

- Who do the farmer sell the raw milk to? (friends, family, neighbours, etc)
- Do the farmer receive payment right a way? If so, how much? Is there barking and negotiation, or is the price fixed?
- How long time from the milking to the milk is sold?
 - How is the milk stored in between?
- Why is the milk sold? (leftovers, rejected at the formal market)

General observations of farmers:

- How do the farmers act around and treat the cows
 - Do the farmers talk to cows?
 - Do the farmers clap and cuddle the cows?
- How do the farmers collect fodder?
 - In case of zero-grazing:
 - Who collects the grass?
 - What is the distance to the place where the grass is collected?
 - How long do the farmers spend on collecting grass?
- Do the farmers seem proud to be dairy farmers (cow owners)?

Observations at host family:

- Do the family boil the milk before drinking?
- How much milk do they consume?
- Where do they buy their milk?
 - What do they know about the milk they buy? Milking procedures, hygiene etc?
- Do they have dairy cattle? If yes, all of the above applies!
- Conversation:
 - Knowledge about formal/informal dairy sector in the area

Appendix 3

Questionnaire for dairy farmers in Bathi

The purpose of this survey is to gather information on dairy farming and markets in Bathi, Kiambu county. The survey focuses only on cow's milk, not on milk from any other farm animals. The data will be used in a student field project concerning livelihoods in the Kiambu county.

All responses will be handled anonymously. For further information and questions, please contact *Markus Naukkarinen* (e-mail: sxf639@alumni.ku.dk).

Part 1: General information

1. **Gender:** ☐ Male ☐ Female
2. **Age:** _____ years
3. **Number of people depending on the income of this household:**
 _____ persons
4. **How much land does the household have?**
 _____ owned _____ rented
5. **How many years have you been a dairy farmer?**
 _____ years
6. How many workers are engaged in dairy production on a daily basis?
 _____ persons
7. Who are the dairy workers on your farm?
 - ☐ Family members ☐ Both family members and hired workers
 - ☐ Hired workers ☐ Other, who: _____
8. How much are the workers paid?
 _____ KSh/month
 - ☐ Not applicable (only unpaid family members)
9. Which economic activities is the household involved in?
 - ☐ Dairy production
 - ☐ Crop production
 - Specify: ☐ crops for household food
 - ☐ crops for fodder
 - ☐ crops for commercial use
 - ☐ Forestry
 - ☐ Service sector (shopkeeping, restaurants, etc.)
 - ☐ Other economic activities, please specify: _____

Part 2: Cattle information

10. **Number of milking cows in the household:**
 _____ COWS
11. What breed are the cows?
 - ☐ Exotic breeds (e.g. Friesian, Ayrshire)

☐ Hybrid breeds

☐ Local breeds

12. What are the cows fed on?

☐ Napier grass

☐ Maize stovers

☐ Concentrate

☐ Other, please specify: _____

13. Which farming system does the household practise?

☐ Zero grazing

☐ Open grazing

☐ Both

14. Who is responsible for milking the cows?

15. How many times a day are the cows milked?

_____ times

16. How much milk does the household produce daily?

_____ litres/day during *wet season* _____ litres/day during *dry season*

Part 3: Markets

17. Do you sell milk?

☐ Yes

☐ No (if no, skip Part 3)

18. Are you a member of a co-operative?

☐ Yes, please name the co-operative: _____

☐ No

19. If a member, do you receive services from the co-operative (e.g. veterinary services, transport, education)

☐ Yes, please specify which services: _____

☐ No

20. If a member, how much time passes between milking and the time the milk is picked up by the co-operative?

☐ 1 hour ☐ 3 hours ☐ 5 hours

☐ 2 hours ☐ 4 Hours ☐ 6 or more hours (how many: _____ h)

21. Are you a member of any other type of dairy association?

☐ Yes, please specify what kind of group: _____

☐ No

22. How much milk do you sell and at what prize? (wet/dry season)

_____ litres per day *during wet season* at the prize of _____ KSh/l

_____ litres per day *during dry season* at the prize of _____ KSh/l

23. Who do you sell the milk to?

☐ Co-operative specify how much: _____

☐ Neighbour/friend/relative specify how much: _____

☐ Hawker specify how much: _____

☐ Other specify who and how much: _____

24. Have you acquired a license to sell milk?

☐ Yes

☐ No

☐ Not sure

25. If you do have a licence, how much did it cost:

_____ KSh

Part 4: Hygiene

26. Do you have a means of cooling the milk down after milking?

☐ Yes, please specify the method: _____

☐ No

27. Do you have to discard milk due to poor quality (e.g. bad taste and smell)?

☐ Yes, please specify how many _____ litres every _____ day/week

☐ No

28. Do you lose milk due to accidental spillage?

☐ Yes, please specify how many _____ litres every _____ day/week

☐ No

29. Do you comply to specific hygiene requirements during milking?

☐ Yes, please specify who sets these requirements: _____

☐ No

30. Where do you acquire knowledge about dairy hygiene (e.d. self-help group, co-operative)?

31. Do you...?

☐ Wash your hands before milking the cows

☐ Wash the udders before milking the cows

☐ Use veterinary services

☐ Check the milk quality by sight, taste and smell

☐ Test the milk quality in some other way, please specify : _____

32. Can we contact you for a more in-depth interview about some of the aspects of this questionnaire, if relevant?

☐ No

☐ Yes Name: _____

Address: _____

Phone number: _____

Thank You for answering the questionnaire!

Appendix 2. Overview of methods

Method	Number of respondents/test
Questionnaire	32 smallholder farmers
Semi-structured interview	11 farmers 3 co-operative employees 2 government representatives 1 milk hawker
Participatory observation	Not applicable
California Mastitis Test	17 tests
GPS mapping	Not applicable

Part 2: Cattle information

12. Number of livestock in the household: _____ cows in total _____ milking cows

_____ sheep

_____ chicken _____ donkeys

13. What breed are the cows?

☐ Friesian

☐ Ayrshire

☐ Jersey

☐ Other: _____

14. What are the cows fed on a daily basis?

☐ Napier grass

☐ Maize stovers

☐ Grass

☐ Concentrate

☐ Other, please specify: _____

15. How much are the cows fed on on a daily basis?

Non-food crops: _____ kg/day per cow

Concentrate: _____ kg/day per cow

16. Which farming system does the household practise?

☐ Zero grazing

☐ Open grazing

☐ Both

17. Who is responsible for milking the cows?

18. How many times a day are the cows milked?

_____ times

19. How much milk is produced per cow at the different times of milking?

1st milking: _____ kg/cow

2nd milking: _____ kg/cow

3rd milking: _____ kg/cow

Part 3: Markets

20. Do you sell milk?

- ☐ Yes
- ☐ No (if no, skip Part 3)

21. Who do you sell the milk to?

- ☐ Co-operative
- ☐ Neighbour/friend/relative
- ☐ Hawker
- ☐ Other

22. Why do you prefer selling your milk to this specific buyer?

23. Regardless of membership, do you receive services from the co-operative (e.g. veterinary services, transport, education)

- ☐ Yes, please specify which services: _____
- ☐ No

24. How much time passes between milking and the time the milk is picked up by the buyer?

Morning: _____ Afternoon: _____ Evening: _____

25. How much milk do you sell and at what prize?

Buyer: _____ Milk sold: _____ kg per day at the prize of _____ KSh/kg

Buyer: _____ Milk sold: _____ kg per day at the prize of _____ KSh/kg

Part 4: Hygiene and Diseases

26. Do you have a means of cooling the milk down after milking?

- ☐ Yes, please specify the method: _____
- ☐ No

27. Where do you acquire knowledge about dairy hygiene (e.d. self-help group, co-operative)?

28. What are the most common diseases in your cows?

29. How often do you encounter these diseases?

30. What is your choice of treatment, and what is the price?

_____ Price: _____ KSh

_____ Price: _____ KSh

31. What is the impact of the government in disease control?

Thank You for answering the questionnaire!

Appendix 4. Interview guides

1. Interview with representative from Ministry of Agriculture, Livestock and Fisheries' Lari subdepartment

1. What is your title and role in the ministry?
2. What is the department's main function in the district?
3. What are you mainly concerned with in Bathi?
4. What are the main objectives/goal of the department?
5. How will you achieve these goals?
6. What services do you provide for the dairy farmers in Bathi?
7. How do you work with the dairy farmers?
8. How do you guide the dairy farmers in their production?
9. How do you guide the dairy farmers in the marketing of their milk?
10. How do the farmers respond to the services you provide? Do they make use of them?
11. Do you inspect or control farms to see whether advice and regulations are followed?
12. What is your general view on the informal and formal dairy markets?
13. Do you collaborate with the local co-operative?
14. If yes, how?
15. What is your impression of the current state of the co-operative? - Is it doing well?
16. How does the department address the informal market in the area?
17. Does the department work with the hawkers?
18. Do you see the hawkers as a challenge for the work of the department?
19. How do you view the present development of dairy production in Bathi?
20. Do you keep records?
21. What are the main challenges to dairy production in Bathi?
22. Do you see the milk quality in the area as a problem?
23. Do you see the milk quantity in the area as a problem?
24. Do you see the forest as a challenge in the dairy production?
25. We found a high prevalence of sub-clinical mastitis in Bathi. What is your view on this?
26. What are the visions/goals for the future dairy production in Bathi?

2. Interview with veterinary officer from Ministry of Agriculture, Livestock and Fisheries' Lari subdepartment

1. What is your main role in the department?
2. What is the main function of the veterinary department in this district?
3. What are the main objectives/goal of the department?
4. Which services do you offer the local farmers and how do you interact with them?
5. How do the farmers respond to the services you provide? Do they make use of them?
6. How is the general state of health in the dairy cattle in Bathi?
7. What are the most common diseases?
8. Is mastitis a problem you often encounter?
9. Do you keep records?
10. What do you think is the main challenge in milk production in the area?

3. Interview with farmers

1. What do you consider the main challenge in your milk production?
2. What are the main factors affecting the quantity?
3. What are the main factors affecting the quality?
4. Do you experience any challenges with regards to the farming system you use?
5. Have you ever had a visit from the health technician from the veterinary department in Lari district?
6. If yes, what did you get out of the visit?
7. If no, do you have a general feeling of their presence in Bathi?
8. Have you ever gone to the offices of the district's Ministry of Agriculture, Livestock and Fisheries department for advice?
9. If yes, why and what did you get out of the visit?
10. If no, are you aware of the advisory services they provide and would you ever make use of them?
11. What are your hygienic practices before, during and after the milking of your cows?
12. Do you perform tick control, deworming or other regular disease preventing measures?
13. Are you member of any dairy self-help group?

For farmers selling milk to the co-operative

14. What do you see as the main advantages of selling your milk to the co-operative?
15. What do you see as the main obstacles in selling your milk to the co-operative?
16. How could the co-operative improve?
17. Have you ever considered selling milk to the hawkers? Why/why not?
18. Do you take advantage of the services the cooperative provides?

For farmers selling milk to the hawkers

19. What do you see as the main advantages of selling your milk to the hawker?
20. What do you see as the main obstacles/problems in selling your milk to the hawker?
21. Have you ever considered selling to the co-operative?
22. Why/ why not?
23. What do you see as the main obstacles selling your milk to the co-operative?
24. What would make you join the co-operative? How could they improve?
25. Do you receive any services from the from the cooperative?

4. Interview with community elder

1. How do you view the current development of dairy farming in Bathi?
2. How do you view the development in relation to the milk production?
3. How do you view the development in relation to the markets?
4. Do you prefer the co-operative or the hawker to be the main marketing channel in Bathi?
5. What do you see as the main advantages and challenges in being in the local co-operative?
6. Are there any improvements that you think will increase the number of members?
7. What do you see as the main advantages and challenges in selling milk to a hawker?
8. How do you view the future of dairy farming in Bathi?
9. What is your general impression of the presence of the extension officer and health technicians in the area and their relationship to the dairy farmers?

5. Interview with Kiriita Dairy Farmers Co-operative Society Limited

General information

1. What is your role in the cooperative?
2. When was the cooperative established?
3. Why was the cooperative established?
4. How is the management structured?
5. How many members do the Kiriita cooperative have?
 - i. How many of these members are active members?
6. What characterises the farmers are members of this cooperative?
7. Is the cooperative licensed?
8. Are there specific requirements to join the cooperative?
9. How much is the membership fee?
 - i. Do you the farmers have to pay to rejoin the cooperative if they have been inactive?
10. How many collection points do you have?
11. Is there specific time when you pick the milk?
12. Have there been changes in the milk quantity from the farmers over the years?
13. Have the structure of the cooperative changed over the years?
14. Do the farmers elect the board members?
15. How much milk do you receive in one day?
16. Is there a limit to how much milk you can receive?
17. Do you keep records?
18. Do you process or treat the milk in any way?
19. How much do you pay the farmers for the milk?
20. When and how do you pay the farmers?
21. Who do you sell the milk to?
 - i. At what price do you sell the milk?

Members

1. Do you provide any services to you members? If yes, what services?
2. Do you provide any services to the community? If yes, what services?
3. Do the farmers use these services?

4. What are the benefits for the cooperative in providing these services?
5. Why should the farmers sell the milk at the cooperative and not the hawkers?
6. How do you try to get new members of the cooperative?
7. Do the government in anyway support the cooperative?
8. Do the cooperative have a main goal?
9. What are the main obstacles in your work?
10. What is your greatest competition?
11. Is the cooperative profit-oriented?
12. Do you conduct the farmers on how to improve your work?

Quality / hygiene

1. Do you have requirements to the members concerning the milk quality?
2. Do you check the milk quality when it is collected?
3. Do you measure the temperature of the milk?
4. Do you sieve the milk?
5. How much milk is rejected due to spoilage?
 - a. Are you able to identify which dairy farmer gave the bad milk?
6. Do Brookside give feedback if the milk has gone bad?
7. Is the milk cooled during transportation? If so, how?
8. How long do you keep the milk at the cooperative before it is delivered to the processor?
 - a. How long is the transportation time to the processor from the cooperative?
9. How long is the transportation time from collecting the milk till it reaches the cooperative?
10. Do you get any money in support from the government?
11. What is the main goal of the cooperative?
12. What are the main obstacles in the cooperative's work?

6. Interview with a hawker

1. How old are you?
2. For how long have you been working as a hawker?
3. Do you have a licence to collect and sell milk?
4. How many households do you collect milk from?
5. How many times a day do you collect the milk?

6. What are the main hygienic practices before, during and after collecting the milk?
7. Do you practice any hygienic control of the milk?
 - a. Which ones?
 - b. How often?
8. How much milk do you collect in a day?
9. How much money do you make from selling milk in a day/month?
10. How much do you pay the farmers per kg?
11. What is the method and frequency of the payment?
12. Who do you sell the milk to and how much do you charge?
13. What are the main challenges of being a hawker in this area?
14. How is your relationship to legal authorities in the area?
15. Have you ever been stopped by the police?
16. Why should dairy farmers sell their milk to you instead of the local co-operative?
17. What do you see as the main challenges in being a member of the cooperative?
18. What do you feel is the general trend in the milk production in the area?
 - a. Quantity?
 - b. Quality?
19. How do you view the future prospects for the milk farmers and their production in the area?