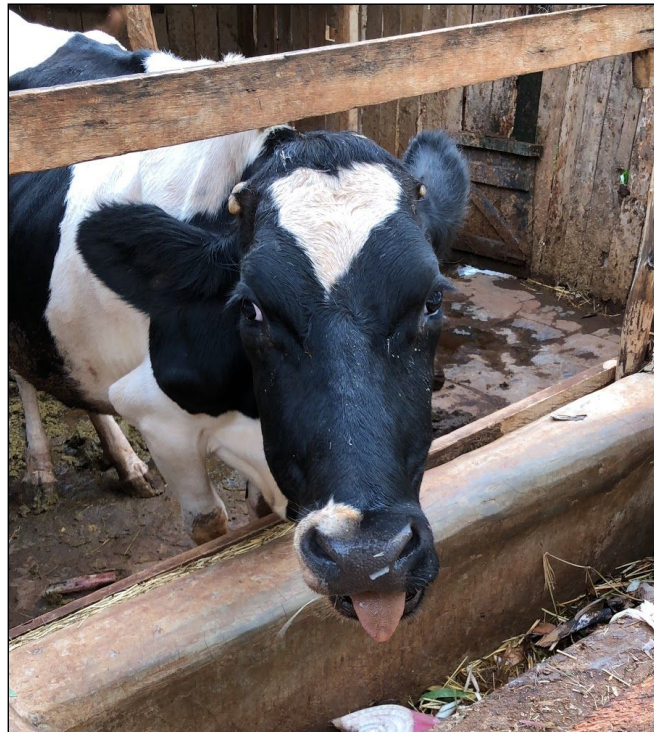


Milking it for All its Worth

The implementation of livelihood strategies and opportunities for market development within small-scale dairy production in Othaya, Kenya



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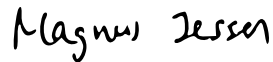
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Declaration

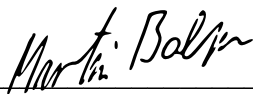
By signing this document, we certify that all members have reviewed and agreed that this is the final version of the study report. Moreover, we declare that the research is our own and all sources of information have been acknowledged. We can also confirm that all authors contributed equally to production of this report.

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Abstract

In the Central Highlands of Kenya, small-scale milk production is an omnipresent factor in farmers' daily lives and a source of financial and nutritional security. The aim of the study is to identify the factors that shape small-scale farmers' livelihood strategies of bovine dairy production based on a study case of the Othaya area. We address the challenge of how farmers can advance from their current methods of dairy production to improve their overall social and economic status. The findings are analyzed using the Sustainable Livelihood Framework (DFID, 1999; Scoones, 2015). This study finds that milk serves as a supplement to the daily diet, and that selling milk is a way of obtaining financial capital in the short-term. Mistrust is a primary issue determining the relationships between the farmers and the buyers. The farmers' common strategy is to diversify agricultural production both for home consumption and marketable products, and sell excess raw milk which is not consumed by the household to the highest bidder. This report argues that limited access to the livelihood capitals and the influence of institutions and organizations reduces the farmers' options of implementing different social and economic strategies within their dairy production. Lastly, the report concludes that the farmers enact a strategy of "hanging in", where they maintain their current livelihood status and therefore, they are stagnant in their ability to advance from that status.

Keywords: cooperatives, Kenya, livelihood capitals, livelihood strategies, milk, Nyeri, Othaya, small-scale dairy

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List of abbreviations

GI	Group interview
II	Informal interview
KCC	Kenya Cooperative Creameries
KDB	Kenya Dairy Board
KSh	Kenyan shilling
ODCS	Othaya Dairy Cooperative Society
Q	Questionnaire
S	Supervision
SLF	Sustainable Livelihood Framework
SSI	Semi-structured interview

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Introduction

According to Swanepoel et al. (2010) “livestock is a major contributor to food and nutritional security, and it serves as an important source of livelihood for nearly one billion people in developing countries”. Small-scale milk production has been suggested as a pathway out of poverty for farmers in developing countries (ILRI, 2011). On a household level, it contributes to food security and food safety through access to animal-based products, it alleviates rural poverty by increasing the amount of income sources, and increases nutritional availability, and general health (ILRI, 2011). On a community level, small-scale milk production also creates numerous job opportunities throughout the dairy value chain by creating a need for raw milk processors, retailers, intermediaries, etc. (Hemme and Otte, 2010).

According to Muriuki (2011), the global dairy sector has seen substantial changes over the last five decades including intensification, scaling-up and efficiency of production driven by demand due to an increase in human population and household income. Developments in animal breeding, nutrition, feed efficiency, and general animal health have made this growth achievable with the necessary support from policies, strategies, and organizations. Development, however, has not been uniform. Some countries experience significant expansion in small-scale milk production, while small-scale dairying in other countries has largely stagnated (Muriuki, 2011).

In Kenya, dairy farming is an essential economic sector and generates substantial income for small-scale farmers, who produce more than half of the country’s total milk production (Baltenweck et al., 2006). Dairy production is a major part of the livestock sector and agriculture in general, it constitutes around 14% of the agricultural GDP and accounts for approximately 8% of Kenya’s GDP (Odero-Waititu, 2017). Dairy cows in Kenya produce 70% of the total national milk output with goats and camels constituting the remaining 30% (Muriuki, 2011). Small-scale farmers supply more than half of the nationally produced milk (Odero-Waititu, 2017). Besides producing milk, Kenya is among the countries with the highest milk consumption in the developing world with an average consumption of 100 kg/year per capita (Muriuki, 2011).

In the past, dairy cooperatives contributed significantly to the development of small-scale milk marketing and provided farm inputs and services at relatively low cost (Muriuki, 2011). The liberalization of the dairy industry in the early 1990s (Baltenweck et al., 2006) was the main reason for the cooperatives to fade out due to increased competition, inability to adapt to change, inadequate payouts and poor management (Muriuki, 2011). Before the liberalization, the state-managed company, Kenya Cooperative Creameries (KCC) had the monopoly on urban milk sales, informal trade was minimal, and trade in unprocessed milk was limited to farmers' immediate neighbors (Baltenweck et al., 2006). According to the EADD (2009), 55% of all milk produced is marketed, but only 20% of the marketed milk is sold on the formal market, which underlines a potential for growth. Engida et al. (2015) also suggest that the livestock sector in Kenya has a strong potential for growth and that improvements in the livestock sector are likely to have macro effects on the entire agricultural development. However, it also faces several constraints, such as quantity and quality of feed, market access, infrastructural conditions, access to veterinary services, artificial insemination, financial resources, level of technical and technological skills, etc. (Odero-Waititu, 2017).

The focus of this enquiry is farmers' livelihood strategies based on bovine dairy production in the Othaya area. Here, as in the rest of the Central Highlands, small-scale milk production plays an important role as an omnipresent factor in the farmers daily life as well as a source of income and stability. The production is mainly based on a zero-grazing, cut and carry system, integrated with rotational crops, where the feed is grown on the farm, harvested and fed to the cows that are kept in sheds (Odero-Waititu, 2017). As a result, farmers in our study area already have the health and economic benefits of having livestock. The challenge they face now is not finding a way out of poverty, but how to advance from their current livelihood status. But first, we need to take a step back and look at the factors that influence the choices of farmers and the strategies they implement in managing their dairy production. This has led us to the following research question:

How do livelihood capitals, institutions, and organizations influence livelihood strategies based on bovine dairy production in the Othaya area, and what are the constraints as well as the potential strategies for social and economic development?

Our analysis is framed by the Sustainable Livelihood Framework (DFID, 1999; Scoones, 2015), since we seek to gain an understanding of the concept of livelihood strategies and the dynamics between factors which influence livelihoods.

Through our 12 days of fieldwork, we gathered interdisciplinary data concerning this research question. The combination of the academic backgrounds in our cross-disciplinary group, as well as the use of qualitative and quantitative methods provides an analysis that can answer the research question with curiosity and an open mind. Our analysis is organized into three main arguments that build onto each other:

Initially, we look into the importance of milk by examining the consumption of milk and the economic strategies of dairy production. We argue that milk serves as a supplement to the daily diet and that selling milk acts as a way of obtaining financial capital in the short-term.

Secondly, we examine the relationship between farmers and private companies, farmers and cooperatives, and the relationships between the farmers. We argue that mistrust is a big issue in determining these relationships.

Thirdly, we analyze how constraints for social and economic development of small-scale dairy production stemmed from the influence of livelihood capitals. We argue, that limited access to the capitals reduces the farmer's options of implementing different social and economic strategies.

We conclude that the farmers' common strategy is to diversify agricultural production both for home consumption and marketable products, and to sell excess raw milk which is not consumed by the household to the highest bidder. The farmers enact a strategy of "hanging in", where they maintain their current livelihood status and therefore, they are stagnant in their ability to advance from that status.

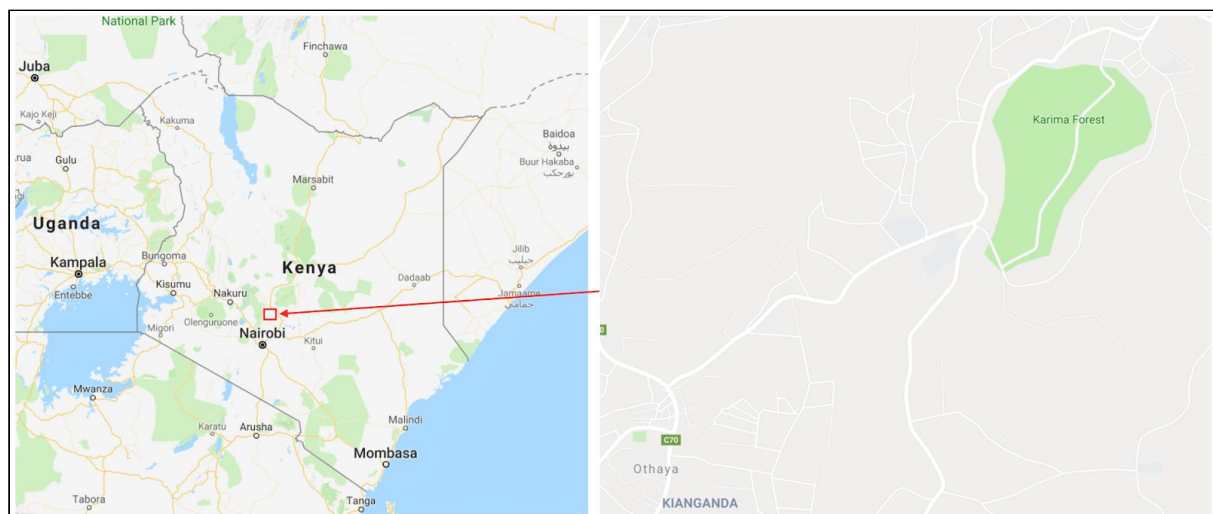
Description of Study Area

Our research was conducted in the region close to Othaya Town in Nyeri County, Kenya, an especially hilly area. Nyeri county is located in the Central Highlands of the country, north of Nairobi and in the foothills of the Aberdare mountain range. Specifically, the area of interest

was Othaya Town as well as the small villages surrounding the Karima forest: Gakina, Gatugi, Mango, Gura, Giathenge, Kinayu, Thuti. The Karima forest is a wooded area with an area of approximately 300 acres. The villages studied were within a 734-acre area with the forest in the center of this area. The altitude varied from about 1640 to 1900 meters.

We observed that in this area households tended to consist of one residential structure made of wood or cinder blocks, and several farm buildings such as livestock shelters or storage sheds. Most of the population supported themselves through subsistence farming, although some individuals grew cash crops such as coffee and tea.

Figure 1: Study area.



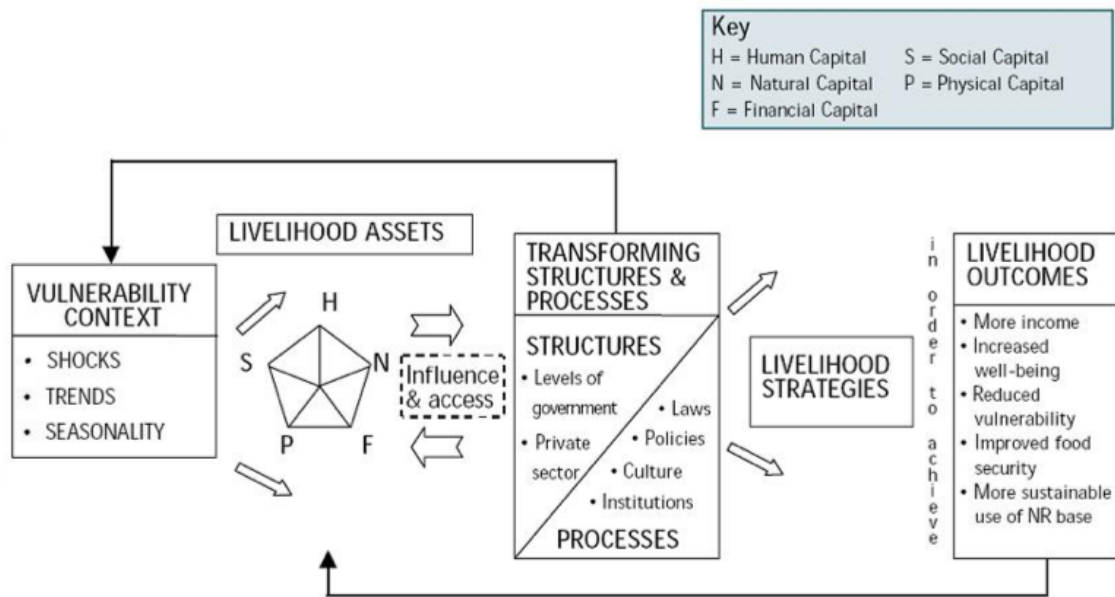
Source: Google Maps

Conceptual Framework

In our research question, we address the concepts *livelihood capitals*, *institutions*, *organizations*, and *livelihood strategies*. These concepts belong to the SLF (Figure 2), and in the paragraphs below, we will explain how this framework is relevant to our research project.

Livelihoods are complex, multidimensional, temporally and spatially varied, and socially differentiated. To achieve an appropriate understanding of livelihood strategies, it is necessary to look into the different livelihood capitals, institutions and organizations as determining factors. The SLF can be helpful in understanding such complexity.

Figure 2: Sustainable Livelihood Framework



Source: DFID (1999).

The livelihood assets refers to the capitals (Angelsen et al. 2011), which are divided into five different categories:

- *Human capital*: This capital covers the skills, knowledge, health, and education of the community concerned.
- *Natural capital*: This capital covers the natural resource stock from which resource flows and services useful for livelihoods are derived such as water, land, forest, air quality, and biodiversity.
- *Financial capital*: This capital covers the financial resources that people use to achieve their livelihood objectives such as wages, savings, loans and remittances.
- *Social capital*: This capital covers social networks, memberships of formalized groups and relationships of trust that can be useful in the pursuit of their livelihood objectives.
- *Physical capital*: This capital covers the physical environment such as infrastructure and producer goods that people use to achieve their livelihood objectives .

Dairy cattle can be considered a form of physical capital which fulfills specific roles in how the farmers implement potential livelihood strategies. These roles, according to Dorward et al. (2009), fit into three different categories of strategies: *hanging in*, *stepping up* or *stepping*

out. Hanging in refers to strategies which aim “to maintain and protect current levels of wealth and welfare in the face of the threats of stresses and shocks” (Doward et al., 2009). The approach of stepping up involves “investments in assets to expand the scale or productivity of existing assets and activities, and stepping out strategies involve the accumulation of assets to allow investments or switches into new activities and assets” (Doward et al., 2009).

The *vulnerability context* refers to the environment which affects the livelihood capitals (Scoones, 2015). The capitals are also influenced by *shocks* such as diseases, natural disasters, and conflicts; *trends* such as technological development, population trends; and *seasonality* such as prices, production, and health. In the research area, we did not come across any shocks or trends, therefore, in the analysis we only focus on seasonality. The vulnerability context, capitals, organizations, and institutions form the basis for the livelihood strategies which end up in livelihood outcomes.

The *structures* refer to organizations and *processes* refers to institutions. Institutional processes and organizational structures are a key element in the framework, as they influence the access to livelihood capitals and the composition of livelihood strategies (Scoones, 2015). Institutions could be defined as “systems of established and prevalent social rules that structure social interactions” (Hodgson, 2006), while organizations are the “settings for implementing the rules” (Scoones, 2015). Institutions and organizations are differently present and relevant in different contexts and scales (Scoones, 2015).

Methodology

Utilizing the SLF and our different academic backgrounds, our team explored various research methods in order to gain perspective on the strategies, constraints and outcomes available to dairy farmers. To study the complexity of livelihoods it is fruitful to link both qualitative and quantitative methods as it provides a better grasp of the dynamics in a local context. The combination of different methods and backgrounds allowed triangulation and therefore increased representativity. This chapter provides a description of our methods (Appendix 1).

Access

Access to the field and the researcher's position are inseparably linked. In order to gain access, one must take up trustworthy social roles (Hasse, 1995). Our access to the field was influenced by the preparation of the university since our arrival was scheduled and arranged. This meant, that some of the informants, like the livestock officer, may have had their own expectations and agenda to our fieldwork. Access to the field is something that is negotiated throughout the fieldwork. Therefore, we were proactive in utilizing different methods to gain access to new informants and data.

Due to the gendered division of labor in the research area, we split up in groups containing both men and women when conducting questionnaires.

Our translators and guides, Mariah and Alexander acted as gatekeepers due to the fact that they were talking on our behalf. Their role meant that we were dependent on their knowledge of the area and the Kikuyu language to gain access to data. The language barrier influenced the data we gathered. Sometimes, instead of translating the exact words, our translators did a summary of the things that they felt was of most importance to the project.

Qualitative Methods

Transect Walk

A *transect* is a Participatory Rural Appraisal-method (Mikkelsen, 2005). During one of the first days, we completed a transect walk of the area with our guide Alexander, a local youth (Figure 3). Alexander advised us on suitable locations to visit and had a lot of information about the area, such as the tenure systems and the use dairy cattle shelters. On this walk, we left the paved road behind, and ventured onto the dirt roads attempting to gain a first look at the area. In total, we walked a loop of 3.4 kilometers and covered an area of 60 acres. We mapped the walk using a handheld tracking GPS (Figure 3). After the transect walk, we decided that we needed to expand the sample size area, otherwise the area would have been too uniform and small to be representative. The purpose of the transect walk for us was to get to know the locale and to identify points of interest. However, the purpose was not comprehended by Alexander, as he tried to lead us back home through the shortest route

possible. Ideally, we would have liked to have complete an additional transect and observation walk with a local farmer as our guide.

Figure 3: Transect walk on day one, Gakina, 03.03.2018.



Source: Google Earth Pro 7.3.1.4507

Semi-Structured Interviews

The semi-structured interviews were done with the intention of following up on farmers who participated in the questionnaires. We selected people for these interviews based on their answers and locations. Prior to the interviews, we created an interview guide (Appendix 3a) in order to get an understanding of the farmers' reasons for owning dairy cows and their individual interactions within the markets. By not having a predetermined list of answers, we encouraged the informants to express themselves, but still got answers that were somehow comparable (Casley and Kumar, 1988). The interviews were recorded and either completed in English or translated from Kikuyu by Alexander, Mariah or Lilian. We implemented a total of five semi-structured interviews with smallholder farmers each lasting approximately 30 minutes.

To supplement the accounts coming from the farmers, and to gain a business and governmental perspective of the livestock industry, we did three semi-structured interviews with different local organizations and the local livestock officer, John Maina. From what we

observed conducting the questionnaires, we made two different interview guides, one for the organizations (Appendix 3b) and one for the livestock officer (Appendix 3c).

On the morning of March 7th, six group members traveled to Othaya Town in order to interview the manager of the Demka Dairy Shop. The purpose of this interview was to understand how a private company operates and the process of sourcing milk suppliers from the community. This interview lasted for approximately 45 minutes and was also attended by professor J. Mutembei and professor L. Tjørring. Directly following the interview with Demka, the group walked a few streets over to Brookside's milk drop-off and cooling center for a meeting with an employee, who requested to remain anonymous. The day prior to this interview we were denied an opportunity to have an interview with an employee. However, due to the presence of professor J. Mutembei we were granted access. The presence of the professor meant that the interview was somewhat guided by the questions which he thought were important to ask. The purpose of interviewing Brookside was to understand the dynamics of a large national dairy brand and their interactions with the local farmers. This interview lasted approximately one hour.

After our interview at Brookside, we walked to the Othaya Dairy Cooperative Society (ODCS), where we held the final interview of the day. Our group sat down with two board members, the chairman Mr. Josphat Gitahi and the vice-chairman Mr. George Hangai. Being one of the two main dairy cooperatives in the area, we wanted to conduct a semi-structured interview with these organizations in order to understand the role of representation of the farmers as well as market dynamics for a publicly backed enterprise.

Market Mapping

In the last two semi-structured interviews completed we used market mapping (PRA-method) to obtain knowledge about the dynamics of the milk market. We asked the employee at Brookside and the cooperative manager Mr. Ibrahim Juma from ODCS to draw a market map of all the various players, inputs and outputs of the dairy sector as it relates to the individual organizations according to the interviewees. By asking these individuals to draw a market map on paper, we were able to identify the market factors which they perceived to be

important. It especially helped us gain an overview of the different prices the different companies were offering.

Group Interview

Following the two days of implementing questionnaires we decided to organize a semi-structured group interview with farmers. The goal of the group interview was to observe the dynamic between the participants to see if these observations would offer additional information. One of the reasons to do a group interview, instead of a focus group, was that the translation could be done in a more straightforward way.

First of all, we analyzed the questionnaires in order to decide which individuals would be valuable members of a group interview. However, reaching the farmers was not easy, and we ended up calling all of them, inviting anyone who was available to join the collective interview session the following morning. We successfully invited ten farmers from different villages, as well as the livestock officer. After the confirmation of the participants, we formed an interview guide with a list of questions. We wrote the questions on large sheets of paper to make them more visible (Photo 1), and we planned to write the group answers on post-its to tack to the papers.

Photo 1: Planning the group interview, Gakina, 08.03.2018.



The next morning the interview took place at Professor Kiama's house, in the village of Gakina. There, we set up tables, chairs, and snacks, and we waited for the participants to

arrive. Some time passed before six farmers and the livestock officer arrived and we decided to start the interview. Lilian was in charge of translating the questions into Kikuyu. The answers given by the participants were translated into English along the way by our guides, Mariah and Alexander, as well as Lilian. The interview lasted about one hour. Approximately twenty minutes into the session, the livestock officer got up and left the interview without a word. This resulted in a visible dynamic change within the group of farmers, who became more vocal in their responses. The livestock officer did return at the end of the session with a handful of local plants he had collected. He shared with the farmers that these specific plants could supplement the nutrition of their dairy cows if they were unable to purchase dairy meal (Photo 2).

Photo 2: Livestock officer showing plants at the group interview, Gakina, 09.03.2018.



Participant Observation and Passive Participation

The methods of either *passive participation* or *participant observation* (Spradley, 1980) were constantly applied during our fieldwork. We tried to immerse ourselves in the context we were studying by observing and taking notes about our surroundings and general observations, and also by participating in activities concerning the dairy sector and everyday life. These two methods helped us to gain insight in the cultural norms that played a prominent role in the research area. We quickly learned that because of our skin color, it was impossible to just observe, since people always stopped what they were doing and wanted to talk with us.

By utilizing participant observation while spending time with our host families, we were able to get an insight into the life of a farmer. Furthermore, in order to gain first-hand knowledge about the workings of keeping a dairy cow, we learned how to milk a cow (Photo 3) and we asked questions about the basic care and maintenance of this form of livestock. This information was useful to understand the motivations and challenges of owning cows.

Photo 3: Participant observation, Gakina, 05.03.2018.



Quantitative Methods

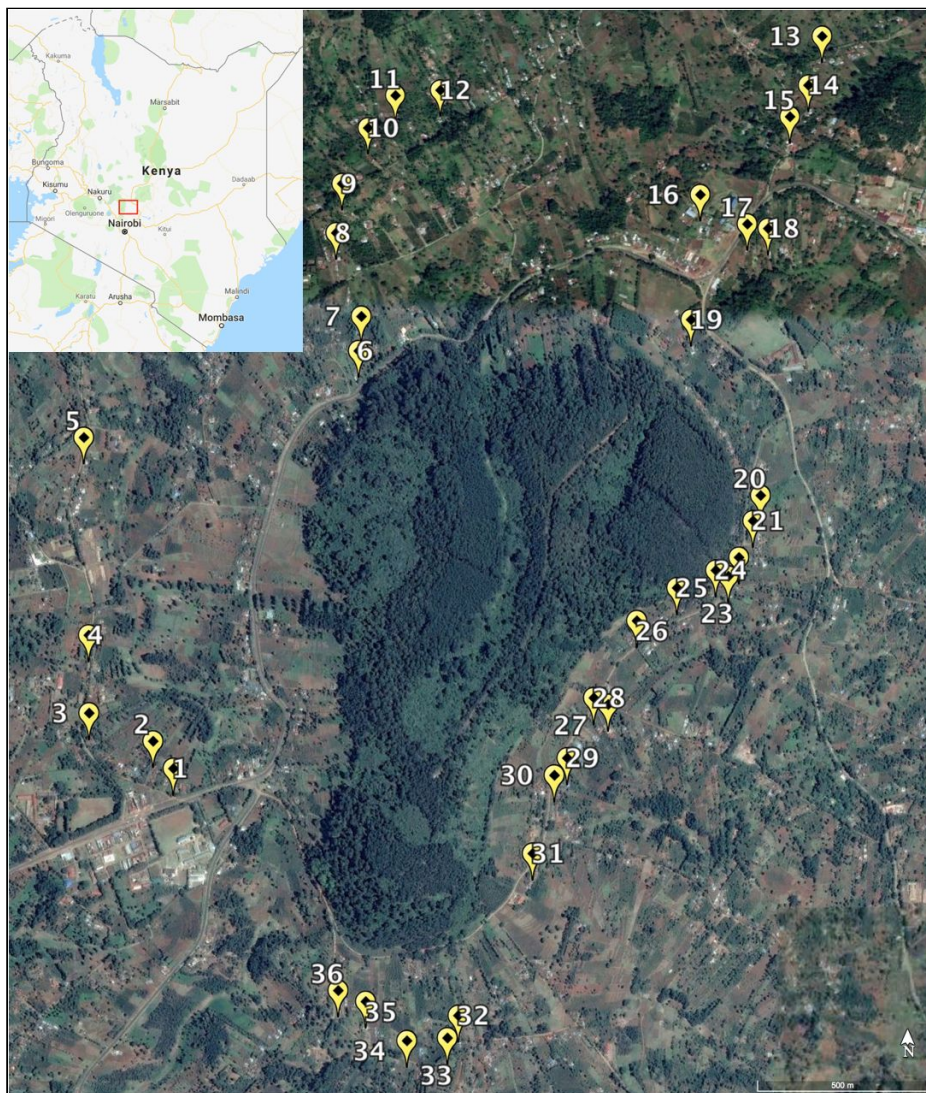
Questionnaires

Questionnaires were used in this fieldwork as a tool to assess the different types of capital present in the community and within individual households, as well as to get an overview about institutions and organizations which were relevant for our further research. We specifically collected data concerning demographics, farm management, livestock keeping, dairy production, market access and prices.

Our questionnaire (Appendix 5) started as a draft in Copenhagen which was later tested on one respondent in Gakina at the beginning of our work. Some changes were made after the test.

With our two guides and our Kenyan counterpart, Lilian, we had three individuals fluent in Kikuyu to aid our research. We decided to split into three different groups in order to cover the most ground. Each group spent two days walking the roads surrounding Karima forest intending to stop at every third house to gather information. Though, sometimes this sampling strategy was not effective due to vacant houses or inaccessible gates, in which case the groups moved on to the next house. In figure 4, our questionnaires sample area is presented.

Figure 4: Questionnaires sample area.



Source: Google Earth Pro 7.3.1.4507

The sample size from our data collection was sufficient to get an overview of the selected area, but later on we discovered that there were farms with much larger cattle herds south of Othaya. To get a broader perspective as well as more data to compare, it could have been useful to also conduct questionnaires in a location further away from Karima forest.

Photo 4: Questionnaire with a farmer, Gathugi, 05.03.18.

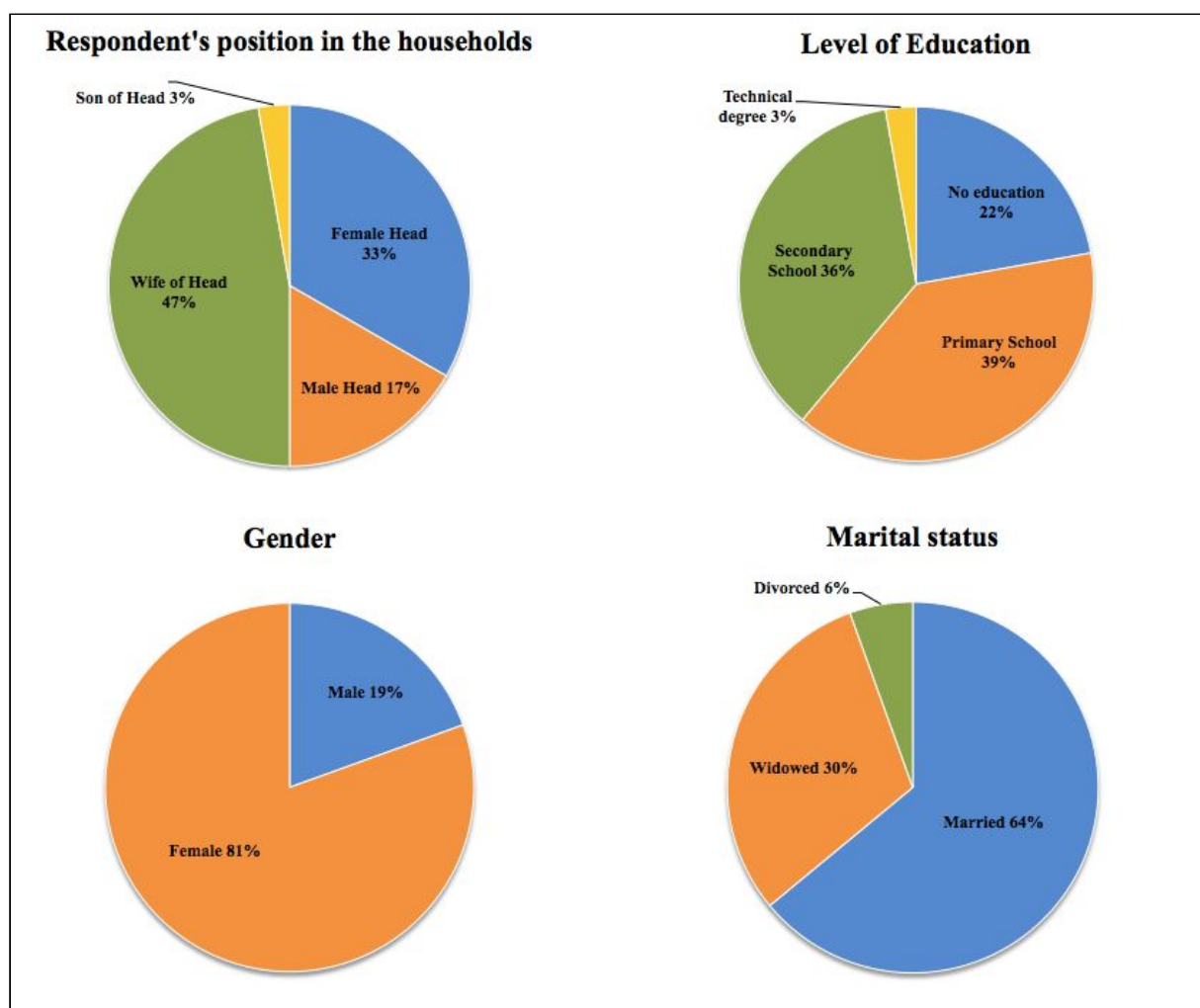


Results

The Livelihood Strategy of the Typical Farmer

In this section, we provide a profile of the typical farmer observed in the research area, as well as their livelihood strategies. The description is based on median and mean values of the questionnaires. In figure 5 and table 1, we illustrate the household information of our respondents.

Figure 5: Household information of our respondents.



Source: Questionnaires

Table 1: Livestock information of our respondents' farms.

Numbers of livestock	Mean	Median	Min.	Max.	Range
Cattle	1.5	2	0	6	6
Dairy cattle	0.9	1	0	4	4
Goats	1.9	2	0	6	6
Dairy goats	0.5	0	0	2	2
Poultry	8.9	4	0	50	50
Sheep	0.4	0	0	7	7

Source: Questionnaires

On average, the typical farmer was a woman of 55 years old who was married and owned one acre of land. Observing the median, the household consisted of four people, and of those, two people worked on the farm. The farmer grew different crops, such as maize, coffee, Napier grass, different kinds of fruits and vegetables. The most common cattle breed was, Friesian dairy cows.

Constitution and Relevance of Livelihood Capitals

In this section, we will report the results related to the different capitals highlighted in the conceptual section: human, natural, physical, financial, and social.

Human Capital

Examining the types of human capital in this area allows us to create a profile of the individuals studied. The table below includes details describing our typical farmer.

Table 2: Household information of our respondents.

	Mean	Median	Min.	Max.	Range
Age	55.4	52	23	88	65
Number of people in the household	3.7	4	1	6	5
Number of people in the household working at the farm	2.7	2	1	6	5
Farm size (acres)	1.60	1	0.03	8	7.97

Source:
Questionnaires

The level of education was not high, 75% of our respondents attended primary or secondary school (Figure 5). Most farmers learned how to take care of their cows from their parents. Furthermore, some educational meetings and dairy training courses were organized by Mr. Maina, Brookside, and ODCS, with the purpose of informing farmers of strategies to increase their milk production. Those meetings were especially focused on feeding methods (SSI 3; SSI 4). Farmers were taught how to improve their feed production in terms of quality and quantity, as well as on appropriate dairy meals employments. However, the attendance of these meetings appears to be low because they are inconvenient and expensive for the farmers to travel to (GI).

Natural Capital

The region of our research area was a naturally hilly location, with some of the farms existing on steep slopes and others in flatter valleys. According to our observations, the forest was used as a location for firewood collection and fodder was grown around the edges of the forest to supplement farm grown livestock feed. Use of irrigation was rare in the observed population, with most farmers relying on the natural precipitation to support their crops. Some households utilized rainwater collection wells for personal consumption, while others bought water which was pumped into elevated on farm water containers.

Physical Capital

The different buildings at the farms consisted of the family home, as well as storage buildings and shelters for the livestock. Ownership of livestock was universal, with families owning various farm animals (Table 1). The utility of manure produced by the cows was also a valued form of output. The manure was widely used to fertilize the crops grown on the farm (SSI 9; GI).

The primary source of nutrition for the dairy cattle was Napier grass and other forms of foliage found around the property, such as banana leaves during the dry season, and hardwood leaves (Questionnaires). As we observed, a large portion of the land used for cultivation was commonly supporting Napier grass in various stages of growth. Furthermore, crop residues can be fed to the livestock which in turn provides manure for the crops.

Manual labor was the primary source of work on the farm. However, one farm included in the study owned a Napier grass cutting machine (Photo 6), which according to the farmer made digestion of the cut foliage easier for the cattle and increased milk yield (Q 1). This farm was an exception and had a larger than average land acreage (two acres) and a more extensive dairy cattle herd size of six cows.

Photo 5: Napier grass cutting machine, Gatugi, 05.03.2018.



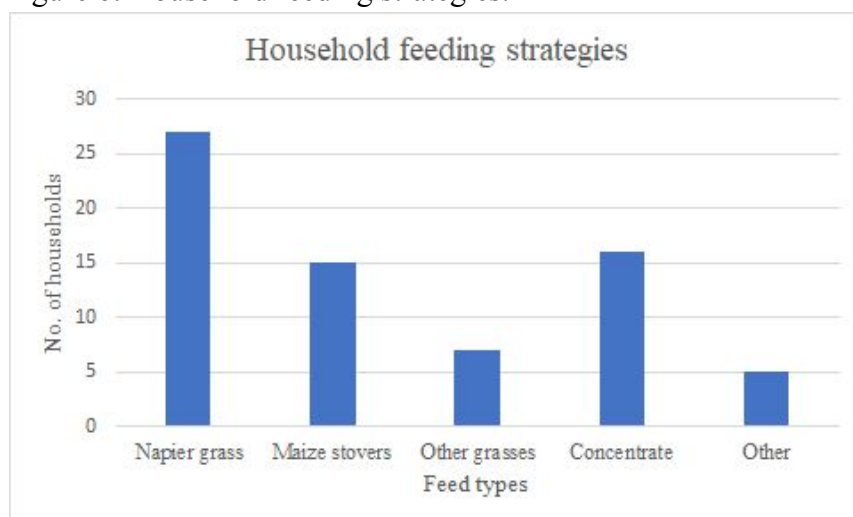
Milking was always done by hand, and the only method of cooling milk for preservation was to submerge the milk containers in cool water containers. If the milk was sold to a cooperative or a private company, the farmers carried the milk in large uniform aluminum cans to a local collection point, where brokers would pick it up (SSI 1). The aluminum cans were often sterilized by setting dry, empty cans in the sunlight for solar sterilization (SSI 6; S). All of the cows were kept as zero graze livestock and kept in wooden sheds at all times without access to pasture. Previously mentioned, the most commonly owned cow breed was Friesian, which according to the livestock officer was due to its higher productivity:

Here in this area, people don't buy milk for quality, they buy milk for quantity (...). The Friesian cows produce more milk (...) then the farmers earn more money. (SSI 4).

Most of our respondents either purchased their cows, bred them from previously owned cows or combined the two methods. 81% of the respondents who owned cows participated in the government-sponsored artificial insemination program orchestrated by the veterinarian, making this strategy by far the most predominant.

All of the 27 respondents who owned cows utilized Napier grass as feed. Moreover, farmers supplemented their cows with either maize stovers, concentrate, other grasses or other types of feed or farm residue such as banana leaves, cabbage or hay (Figure 6). The farmers of the group interview talked about the problems of not being able to afford supplement feed (GI).

Figure 6: Household feeding strategies.



Source: Questionnaires

Financial Capital

Farming was mentioned as the primary source of income by 89% of the respondents, and among these, 39% were specifically referring to livestock as their main or secondary source of income, highlighting the importance of the economic relationship existing between farmers and their animals. Less frequently, the financial capital of households depended on other kinds of business not related to farming.

The profits originating from livestock were mostly due to the sale of cow's milk (56%), and prices vary according to the buyer (Table 3). According to John Maina, and the farmers participating in the group interview, 40 KSh/L would be the fair price for profitable and sustainable milk production.

Table 3: Prices of milk sale for different buyers.

Buyers	Price (KSh/L)
Neighbors	40-50
Shops	35
Private companies (Brookside, Demka)	32-38
Othaya Dairy Cooperative Society	30-35

Source: Questionnaires, SSI 1, SSI 2, SSI 3, SSI 4

11% of the farmers also mentioned the sale of livestock as a source of profit. In most cases, cows were sold in case of urgent need of money (SSI 9; GI), while in one case selling cows appeared to be a business in itself (Q 17).

Remittances from children represent another sort of financial capital mentioned by 14% of the respondents.

Concerning the livestock sector, loans, credits, and advances from public or private institutions and organizations could constitute a further source of financial capital. According to the interviews, loans were commonly provided by banks (SSI 4; SSI 6). Brookside also offered a service of loans and feed advances the farmers could benefit from. Demka had a credit system for feed and veterinary services, although the debt for each farmer could not be

higher than the economic equivalent of ten liters of milk. If necessary ODCS sometimes paid the farmers in advance and did not charge interest. Generally, farmers avoided loans since the risk of not being able to pay them back was high, especially under unforeseen circumstances (SSI 9; GI).

Social Capital

Commonly, adult family members were working on the farms, and at times kids and elderly family members were also contributing labor. The respondents lived in the same household for generations, because of the traditional inheritance practice. This custom will be elaborated in the section *Traditions and customs*.

Most of the families owned cows, and according to Mr. Maina, cattle ownership contributes to one's social status within the community (SSI 4). However, this perspective wasn't mentioned in any other cases.

Another type of social capital observed in the field was the relationship between neighbors. When farmers sold milk to their neighbors, there was no formal method of recording sales, and thus it was a common occurrence that payments were never received in this type of market. There also seemed to be few options for the farmers to seek past due payments, other than direct confrontation (GI). The relationship between neighbors was therefore influenced by conflict.

We did not observe any participation in self-help groups, or non-economic associations related to the production of dairy.

Institutions and Organizations

In this section, we will present the institutions and organizations observed in the research area.

Institutions

Based on Hodgson's definition of institutions, two main institutions appeared to frame our study case: traditions and customs, and the market.

Traditions and Customs

We observed two different traditions and customs in the research area: the inheritance practices and the role of milk.

As mentioned previously, the general trend in the study area was that the farmers inherited their land. When land was inherited, it was split between the children of the deceased, which is one of the reasons why the land plots became smaller over time. In SSI 4 and S 1, Mr. Maina and Dr. Kunyanga elaborated on some current challenges concerning succession management and passing on of land. Mr. Maina stated that the older men were keeping the land and not passing it on to the young men, and Dr. Kunyanga mentioned that girls rarely asked for land.

The milk produced on the farms was either sold or consumed, and used several times a day as a base for tea. From the interview, we learned that if the farmers did not sell their milk, it was used for cooking tea or consumed raw (SSI 5; SSI 8; SSI 9). Like our respondents in SSI stated, when we asked her about what she is using milk for:

To mix in the tea, sometimes to take a glass or two of milk during the day (SSI 9).

According to the farmers, preparing tea without milk was unimaginable, and a meal without tea was lacking. Even when a farmer's cow was not sufficiently productive, milk would be purchased either from informal or formal markets.

Farmers rarely consumed dairy products other than milk. Butter or cheese was not found in the supermarket. Dr. Kunyanga stated that traditionally, Kenyans did not consume processed dairy products only milk, and that new products such as yogurt were slowly becoming more widely accepted (S).

The Market

The market was visible in two different forms: formal and informal. Farmers participated in specific markets based on the networks available and convenient to them. All the farmers had access to selling in both the formal and informal market (Table 4). Some farmers sold in both the formal and informal market. We found that, out of the total households sampled, 56% were selling milk, and 65% were buying milk.

Table 4: Market access tendencies

	Farmers selling to	Farmers buying from
Formal market	80 %	45 %
Informal market	45 %	73 %

Source: Questionnaires

The informal market was constituted by the transactions happening between neighbors or between farmers and local shops. The farmers participating in the group interview said that they often had problems with neighbors not paying for the milk that they were taking (GI). The farmers also mentioned some advantages of participating in an informal market. The milk could be sold at 40-50 KSh/L, a higher price compared to the formal market (SSI 6). Furthermore, the informal market could be accessed at any time (SSI 7).

The formal market was constituted of farmers selling milk to private companies or cooperatives. The farmers mentioned different reasons why they were participating in the formal market: Payment was straightforward and guaranteed as a monthly deposit (SSI 9; GI). In addition, the milk was collected by the buyers through a more developed infrastructure (SSI 9). The constraints of being part of the formal market were mainly due to prices, as the price offered was lower than in the informal market. Furthermore, the farmers were more time-dependent since they needed to be ready and sell the milk at the appointed time, typically in the morning (SSI 7).

The farmers showed a lack of interest to be loyal to a single private company or cooperative and preferred to sell their milk where they could get the highest price (GI; SSI 1). This view was shared by the livestock officer as well:

Marketing is liberalized. The buyer goes with the highest price (...) You cannot tell the farmers where to sell the milk (SSI 4).

Organizations

In this section we will present the different organizations that the farmers interacted with in the formal market.

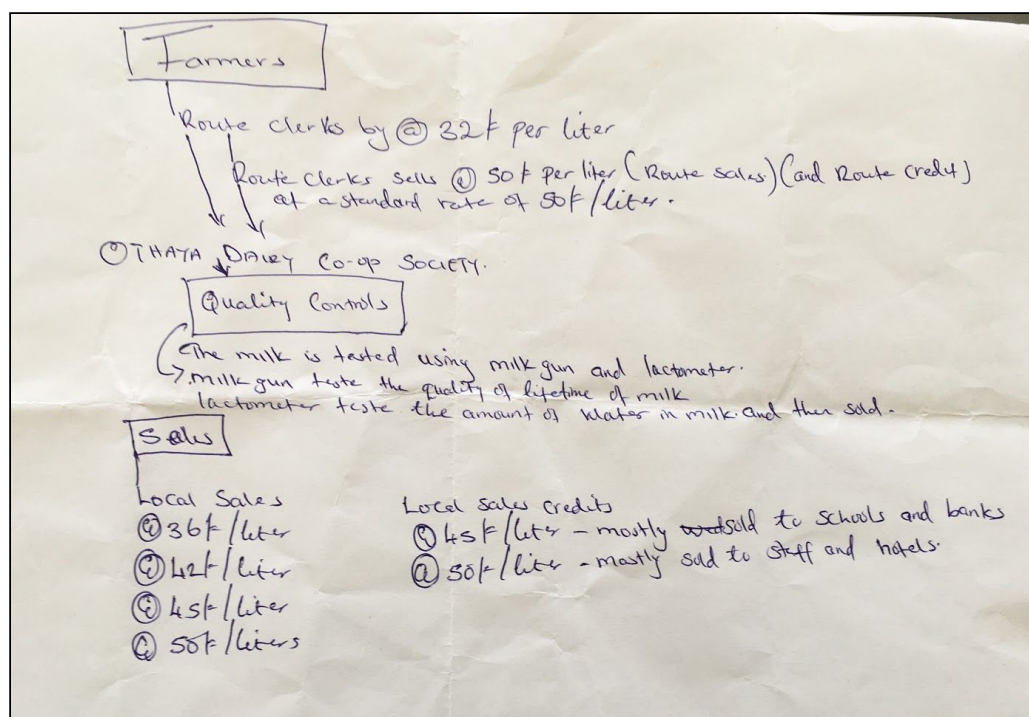
Othaya Dairy Cooperative Society

ODCS is a public company owned by farmers in Othaya, active since 1969 (SSI 1). An Annual General Meeting is held by ODCS, in which they elect the committee. ODCS has around 200 active members who supply raw milk. The milk is then sold to private buyers, who pay in cash (Figure 7a; figure 7b). The price ODCS receives for the collected and bundled milk is divided among the members equal to how much milk they supplied, adjusted for cooperative costs, such as salaries and transport costs. ODCS collected and weighed the milk at specific collection points. The milk was collected in 50-liter containers and brought to ODCS, where it was cooled. Besides cooling the milk when storing it, ODCS did not do any value addition.

At the time of the interview, ODCS had approximately 12,000 inactive members, who had stopped supplying milk to ODCS. According to the chairman Mr. Gitahi and vice chairman Mr. Wangai, this inactivity was because they were paying farmers less than the private companies (SSI 1). ODCS pays farmers 32-35 KSh/L (SSI 1). Only two of our respondents were supplying milk to ODCS and stated that they were paid respectively 30 and 35 KSh/L (Q 35; Q 2). According to the chairman, the farmers were paid every fifth of the month. However, at the time of the interview, a delay was caused by technical problems:

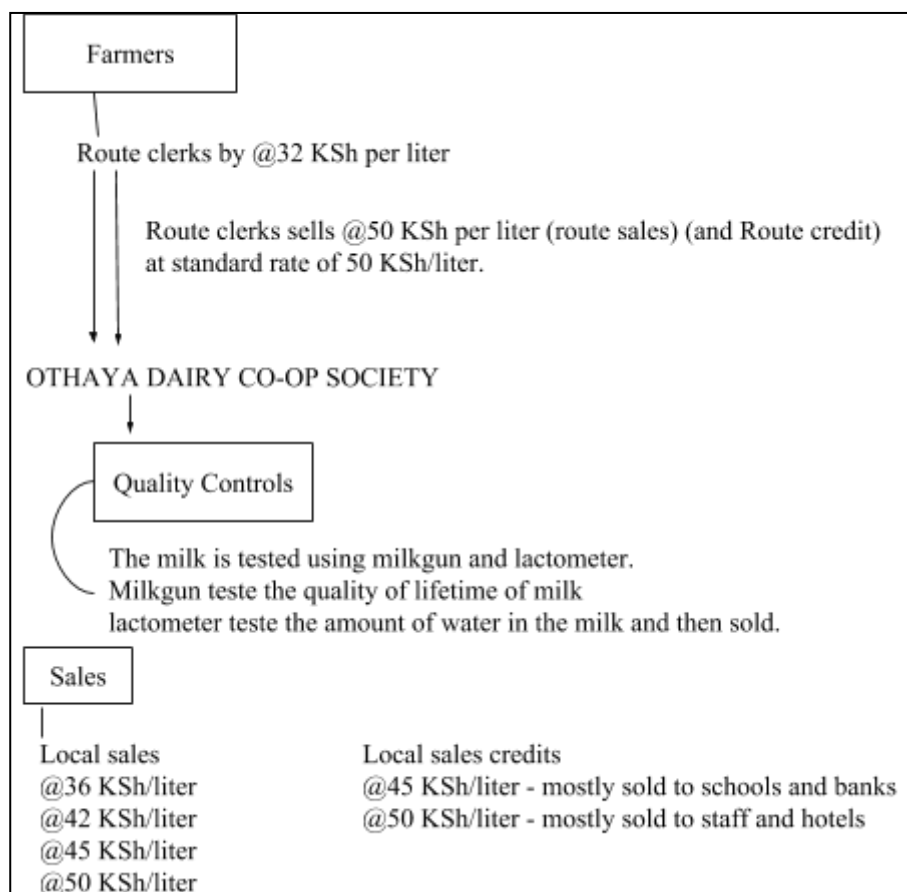
Especially now we have told them, that we pay at every fifth of the month, but we have not paid yet (laughing) (...) When you go to the meeting, you must explain why. In fact, our computer had a problem yesterday, they should have been paid by yesterday. (SSI 1).

Figure 7a: PRA of the value chain, ODCS.



Source: Mr. Ibrahim Juma, Manager of ODCS

Figure 7b: Analyzed figure of the value chain, ODCS.



ODCS was also offering extension services, such as educational meeting and advances on the monthly payments.

When you know that your milk is here, and you have any problem, let's say you have a sick person at home, you can be given an advance on whatever you have brought (SSI 1).

Demka

Demka is a private company owned by three brothers, which processed raw milk and sell its products all over Kenya and also own a shop and café in Othaya town.

According to the shop manager Eunice, the company had 3,000 farmers supplying milk in Othaya and Muranga. Of our respondents who owned cows, 18.5% sold their milk to Demka (Q 19; Q 20; Q 22; Q 30; Q 31). Eunice stated that they offer the best prices at 35 KSh/L and that climate variability between the dry and the wet season did not affect the price much throughout the year. The farmers were paid with either M-Pesa (mobile phone-based money transfer) or bank transfers on a monthly basis (SSI 2).

Milk collection occurred through brokers, who picked up farmers' milk at collection points. Around 5,000 liters were collected per day (SSI 2).

The raw milk was entirely processed by the company in their processing factory in Othaya. First of all, Demka controlled the quality of the milk by using a lactometer to detect any water or powder addition. Moreover, the milk was measured and checked for chemicals, and the company did not accept morning and evening milk mixed. After the quality control, the milk was pasteurized and cooled down. The processed milk was either packed or processed into yogurt or ice cream. The products were sold in their café, as well as other supermarkets and shops (SSI 2).

According to the shop's manager, Demka was assessed once a week by the Kenya Dairy Board (KDB) with regards to food safety. Furthermore, Demka was required to pay a tax to the KDB:

You are supposed to pay. Any liter you buy from farmers, you are supposed to pay to the Kenya Dairy Board. 0.1 % of that milk, that you get from farmers. Daily. (SSI 2).

Brookside

Brookside is a private dairy company that was founded in 1993. Brookside is one of the leaders in milk processing in Kenya and East Africa, and the head office is located northeast of Nairobi (SSI 3).

The Brookside facility located in Othaya had 350 walk up suppliers who did not participate in the transportation program and instead dropped off their milk by foot. Farmers who did not live close to Brookside, delivered their milk at collection points (Figure 8a and 8b). Employed brokers took care of the transportation and, if necessary, informed the farmers about how to preserve the milk appropriately (SSI 3). Of those who responded as owning cows, 18.5% farmers sold their milk to Brookside (Q 4; Q 7; Q 9; Q 12; Q 27). The sellers were provided with a card, which was used to count the exact litres of milk they produced during the month. Furthermore, the brokers had a digital scale to monitor the milk provided by the farmers, which made it easier to calculate the monthly salary and avoid disagreements. Trust was a challenge in the past since some brokers were stealing milk by cheating on the measurements (SSI 3).

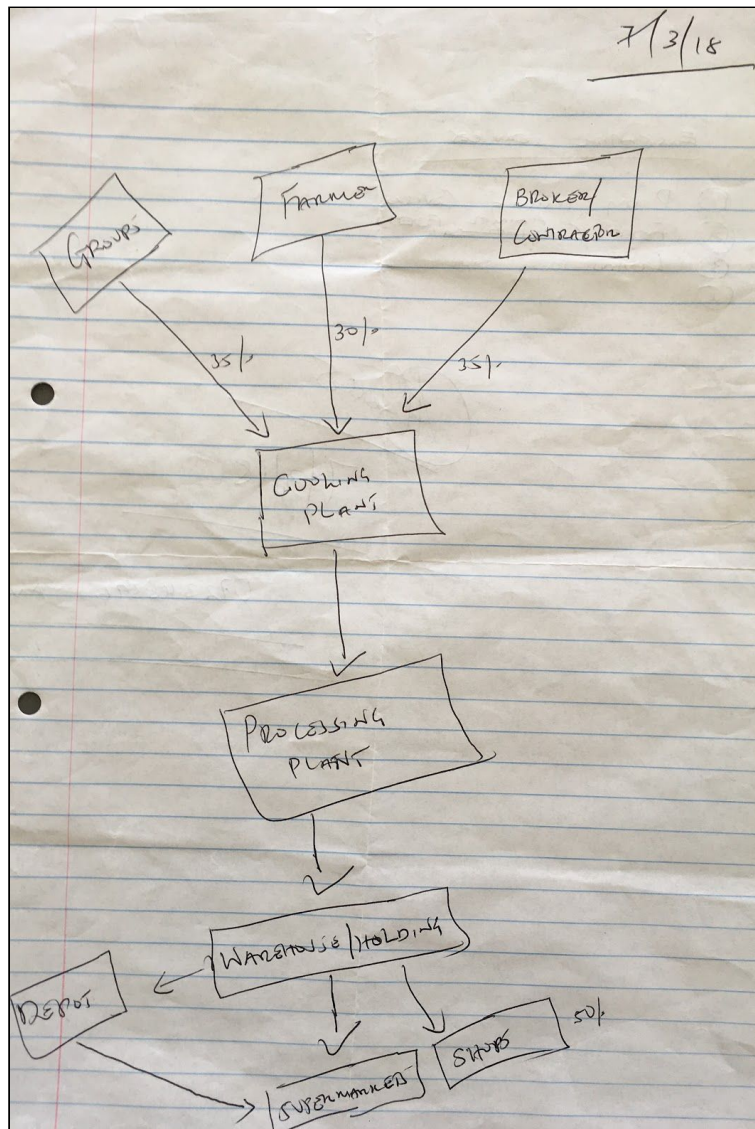
The collected milk was cooled down at the local Brookside facility. Brookside used different quality control methods to ensure the milk had not been watered down, and that the farmers were not were using milk powder or chemical preservatives. Afterward, it was transported to a processing plant, and the resulting products were stored or sold to shops and supermarkets all over East Africa.

For the milk supplied, the farmers were paid approximately 35 KSh/L. However, the price was slightly unstable, since the equilibrium between demand and supply was related to the seasons, and therefore extremely variable. During the rainy season the supply was higher than the demand, so the milk price decreased. In this period the milk was more frequently processed into other products, which included milk powder. On the other hand, during the dry

season milk production was lower and could not satisfy the demand. Therefore, the price of the milk increased (SSI 3).

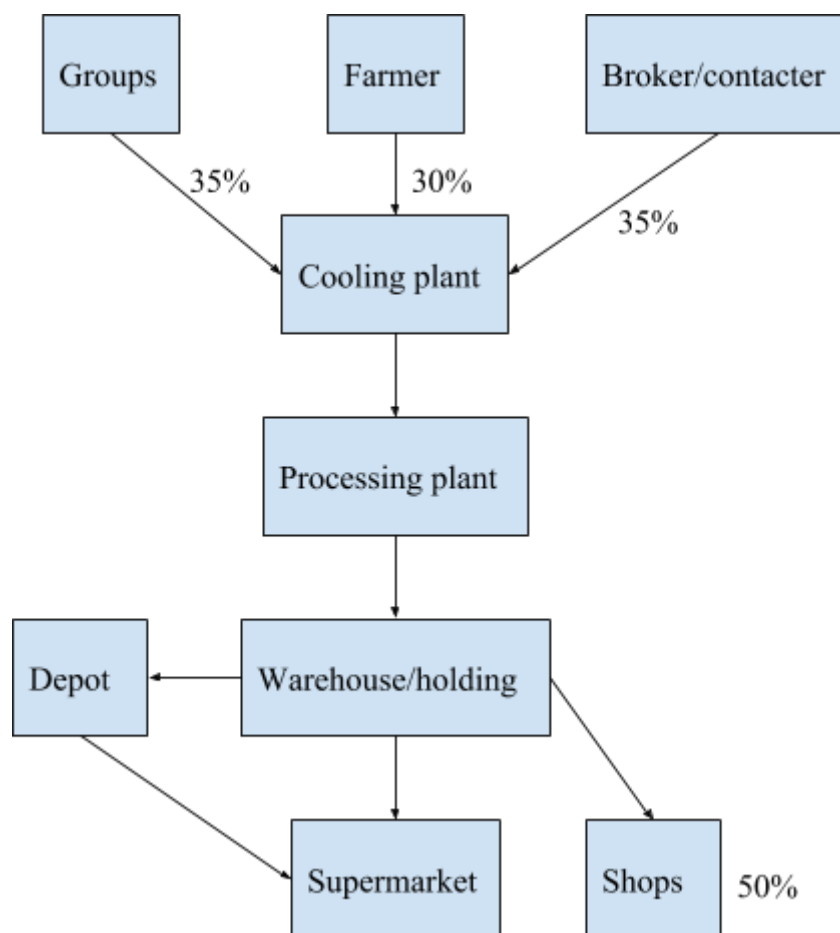
Converting plain milk into other products was considered to be an important market strategy for Brookside, making production more sustainable. Powdered milk production was specially mentioned as a strategy to prolong the shelf life of dairy products and thus stabilizing the prices. However, this practice had the disadvantage of being expensive and extensive (SSI 3).

Figure 8a: PRA of the value chain, Brookside.



Source: Brookside employee

Figure 8b: Analyzed figure of value chain, Brookside



Brookside offered some extension services. The company was partner to specific feed companies, where farmers could collect dairy meal on credit. The access to feed credits depended on how much milk the farmers were providing (SSI 3). Brookside also organized some dairy training courses, especially about feeding recommendations. Private feed companies sponsored these courses, where the farmers were instructed primarily on feeding methods. However, attending these training courses was not popular among farmers (SSI 3).

Government Agencies

We interviewed the livestock officer, John Maina, who was employed by the Nyeri County Government. He was responsible for the livestock extension services in Nyeri South sub-county. The livestock officer's services included advising the farmers on housing, feeding, breeding, protection and milk marketing. Mr. Maina stated that they aimed to visit ten farms per month, but due to problems with employment, only two were covering the area and their reach was limited. Therefore, the farmers came to the livestock officers' office and

discussed their problems, and then the livestock officers visited them. Of those who responded to the questionnaire, 33% stated that they had a conversation with the livestock officer. However, several farmers were not distinguishing between the livestock officer and the veterinary, who was also employed by the government. Therefore, one-third of the respondents have met with representatives of the government.

From the governmental side, there were no funds, advances or loans provided for the livestock sector. All in all the outreach of government agencies in the dairy market and production practices was limited.

Vulnerability Context

Seasonality

The area we were working in experienced changes in seasons throughout the year, from the rainy season to the dry season. Rainfall varied and directly affected the growth of crops used to feed dairy cattle. In the dry season, Napier grass growth was limited, and the livestock's diet either suffered or was supplemented with other forms of native greenery. The poor diet in the dry season impacted the milk output (Questionnaires) and also changed the market prices. In the dry season, production was low, so prices were higher than in the wet season when there was more milk available for sale. Though, the price difference was only one to two KSh from season to season (SSI 3). Some farmers were only producing enough milk for personal consumption during the dry season and were not able to sell milk at all, some even need to purchase milk at this time (SSI 2).

Discussion

In the following section, we will discuss how the different capitals, institutions, and organizations influence livelihood strategies found in the Othaya area. Through doing this, we will also discuss the constraints and potential strategies for social and economic development.

Swanepoel et al. (2010) emphasizes the importance of livestock to food and nutritional security in developing countries and describes it as a source of livelihood. This view could be adopted to describe the Othaya area, where we observed two main factors relating to the importance of dairy cattle: consuming milk and the economic strategies of dairy production.

Milk was an important element of food security and nutritional supplementation. The daily diet mainly consisted of starchy plant-based carbohydrates low in fat and protein. Therefore, the high nutritional value and energy density of milk was essential to supplement the daily diet, which otherwise would have been nutritionally lacking. Furthermore, the domestic milk production and consumption allowed the farmers to spend less money on food. The sale of milk acted as a way of obtaining financial capital in the short-term, where farmers followed the highest milk prices. Observing the formal and informal Othaya dairy markets, it is possible for the farmer to sell to several various actors, namely private companies, Othaya Dairy Cooperative Society, and neighbors.

When looking at the dynamics among the private companies, Brookside and Demka, and the farmers supplying them, we saw a general trend. Both Brookside and Demka had several installments put in place to prevent and detect fraud on both sides of the transaction. The farmers wanted assurance that they were being paid for the exact amount of milk they were supplying, and the companies wanted to make sure that the quality of milk was not compromised. Both Brookside and Demka previously had problems with brokers stealing milk from farmers. These private companies took preemptive action as a response in order to make sure, that the farmers could trust them.

Traditionally, the values of a cooperative which attract membership include representation and ownership as well as increased market influence, by giving members the ability to pool milk and sell it in large quantities. Surprisingly, the farmers solely listed financial benefits of

being a member of a cooperative, without mentioning the social community aspect, or the influence on decision making. The farmers stated price and access to extension services as the main drivers for determining where to sell their milk. However, it is paradoxical that ODCS, which is supposed to care for the interests of its members, offers the lowest price and has issues with payment. It becomes evident that the dynamics of the cooperatives, following the liberalization as described by Muriuki (2011) still apply. This results in livelihood strategies being based on individual short-term conditions rather than acting as a community. Therefore, without unity, ODCS was not able to offer a price that could compete with private companies or informal market prices.

Concerning the informal market, the main issues were that there was no standardized measurement or quality control nor was there any record of the sale. Payment did not always occur simultaneously with the trade, which made this strategy risky. Selling on the informal market was therefore heavily dependent on trust between seller and buyer, which the farmers did not seem to have.

As the above sections illustrate, it became clear that trust, or the lack thereof, influenced the dairy livestock sector in this area. According to the anthropologist Mathew Carey (2017), trust builds relationships and gives rise to communication. *Mistrust*, on the other hand, sunder relationships and create confusion and isolation (Carey, 2017). Mistrust seems to be the main issue affecting farmers social capital, considering the inactivity of ODCS members and the cooperative's management issues as well as the previous trust issues between farmers and private companies, and the farmers' unwillingness to unite.

Additional constraints for social and economic development of the small-scale dairy production stemmed from the influence of other livelihood capitals. The scarcity of land was the main natural capital limitation in the study area, though this is not mentioned by Odero-Waititu (2017) in his description of the various constraints. The land used to support livestock was minimal since the majority of the land was used to grow crops. This influenced the implementation of a zero grazing system strategy and limited the possibility of growing sufficient feed. Furthermore, the farmers could not afford supplemental feed of high quality. Due to the traditional inheritance system, it was not only difficult for the farmers to expand the size of their plot but it also led to smaller plots. Due to the fact that land was limited there

was a need to strategize its use, because the balance between supporting livestock and growing crops was a difficult but important task. A mixed crop-livestock system is a way of diversifying the production system as crops and livestock complement each other (Herrero et al., 2010). Diversification is a strategy farmers use to cushion them from stresses and shocks, because it offers alternative and flexible food and income sources.

Engida et al. (2015) suggest the potential for growth of the dairy livestock sector in Kenya. Considering our study case, we believe that value addition could be a strategy for growth. Value addition would require extensive economic, educational, and temporal investments. Furthermore, additional equipment and technology would be required to cool and process dairy. However, considering the lack of financial, physical, and human capital, value addition was not a pursued implementation in the farmers' dairy production practices. As suggested by Hemme and Otte (2010) and as seen in our study area, small-scale milk production had the potential to create job opportunities throughout the dairy value chain on the community level. From a farmer's point of view, however, the financial, nutritional, and food safety benefits seem to have stagnated. Further value addition and development in the value chain took place at the processors, retailers, etc.

To sum up, the limited access to social, natural, physical, financial, and human capital reduced the farmers' options and restricted the types of social and economic strategies farmers could implement. From the environment created by the constraints as well as the institutions and organizations elaborated upon above, we can conclude that there was a common livelihood strategy. The farmers' strategy was to diversify agricultural production both for home consumption and marketable products, and those with dairy cattle sold excess raw milk which was not consumed by the household to the highest bidder.

Considering this common strategy, and referring to the idea that dairy cattle have the potential to act as assets which influence livelihood strategies (Dorward, 2009), we notice a dynamic from our data resulting in the trend of dairy production as a "hanging in" strategy (Dorward, 2009). Besides the limits previously discussed, it can be seen that the farmers were accepting of their current situation and did not have a proactive approach to uniting for improved market representation. "Hanging in" in this context refers to the fact that the farmers were utilizing dairy cattle as a form of a buffer, an economic cushion which shielded them from excess

shocks and stresses. The actions of “stepping up” and “stepping out” required more flexibility and more access to capitals than what was available to the farmers, this accompanied with their reluctance to join together restricted their options for livelihood strategies. A key part of the definition for “hanging in” is that individuals are maintaining their current livelihood status. This is concurrent with our findings in the Othaya area, in that the farmers were stagnate in their ability to advance from where they currently are.

Conclusion

There are two main factors relating to the importance of dairy cattle: that milk serves as a way to supplement the daily diet and that the sale of milk acts as a way of obtaining financial capital in the short-term. The farmers sell their milk in either the formal market to private companies or through a cooperative, or in the informal market to neighbors and shops. Due to the history of problems with payments, mistrust is influencing the relationships between the farmers and the buyers. This dysfunction results in livelihood strategies being based on individual short-term conditions rather than acting as a community. Furthermore, the farmers’ limited access to social, natural, physical, financial, and human capital reduces their options and restricts the types of social and economic strategies farmers could implement. The limited access to capitals and the relationship with institutions and organizations leads to a common livelihood strategy. This strategy is to diversify agricultural production both for home consumption and marketable products, and sell excess raw milk, which is not consumed by the household, to the highest bidder. Lastly, the farmers adopt a strategy of “hanging in”, where they maintain their current livelihood status and therefore are stagnant in their ability to advance from that status.

Recommendations

Given the dynamic and complex factors which shape livelihood strategies in this study, the conclusion leads to the following recommendations for potential social and economic development:

- Farmers should unite in groups and sell their milk in bulk quantities, in order to have a greater impact on the supply side, and ultimately to be able to charge a higher price.
- Within these groups, farmers should encourage specialists such as business women and men, animal health officers and nutritionists to join them, in order to have access to independent training and guidance.
- To supplement this education farmers should seek out support from NGO's for further training, education and capital to invest in cooling and treatment facilities.
- Farmers could benefit from specialization in dairy production and value addition to intensify and increase the production of milk through selling processed products. This could include investing in pasteurization or cooling facilities, as well as investment in learning the methods to process dairy products such as butter, yoghurt, or cheese.

We acknowledge the fact that these recommendations are the product of a 12-day field course. Further research on how small-scale farmers move from subsistence to professional farming is needed before these recommendations can be implemented with success. Uniting in functional groups requires trust, which will take time to establish. We also recognize that the success of value addition is dependent on the fact that there needs to be a market for products such as butter, yoghurt, or cheese.

References

- Angelsen, A., Larsen, H. O., Lund, J. F., Smith-Hall, C. and Wunder, S., 2011. *Measuring Livelihoods and Environmental Dependence: methods for research and fieldwork*. London (UK): Routledge Ltd.
- Baltenweck, I., Yamano, T. and Staal, S. J., 2006. Dynamic Changes in Dairy Technologies Uptake in the Kenya Highlands. In: Yamano, T., Otsuka, K., Place, F., eds. 2011. *Emerging Development of Agriculture in East Africa*. Dordrecht (NL): Springer. Ch.6.
- Carey, M., 2017. *Mistrust: An Ethnographic Theory*. Chicago (USA): Hau Books.
- Casley, D. J. and Kumar, K., 1988. Qualitative Interviewing of Individual Informants. In: Casley, D. J. and Kumar, K., eds. 1988. *The Collection, Analysis, and Use of Monitoring and Evaluation Data*. Baltimore (USA): Johns Hopkins University Press. Ch. 2.
- Department For International Development (DFID), 1999. *Sustainable Livelihoods Guidance Sheets*. [pdf] DFID. Available at: <https://www.eldis.org/vfile/upload/1/document/0901/section2.pdf> [Accessed 16 February 2018].
- Dorward, A., 2009. Integrating Contested Aspirations, Processes and Policy: Development as Hanging In, Stepping Up and Stepping Out. *Development Policy Review*, 27(2), pp. 131-146.
- East Africa Dairy Development Project (EADD), 2009. *The Dairy Value Chain in Kenya*. [pdf] Kenya: EADD. Available at: <http://hdl.handle.net/10568/2407> [Accessed 16 February 2018].
- Engida, E., Guthiga, P., Nyota, H. and Karugia, J., 2015. The role of livestock in the Kenyan economy: Policy analysis using a dynamic Computable General Equilibrium model for Kenya. *ReSAKSS Working Paper No.37*. [pdf] IFPRI and ILRI. Available at: <http://www.resakss.org/node/5459?region=eca> [Accessed 5 April 2018].
- Hasse, C., 1995. Fra journalist til Big Mamma - Om sociale rollers betydning for antropologers datagenerering. *Tidsskriftet for Antropologi*, 31, pp. 53-64.

Hemme, T. and Otte, J., 2010. *Status and Prospects for Smallholder Milk Production - A global Perspective*. Rome (IT): Food and Agriculture Organization of the United Nations.

Herrero, M., Thornton, P. K., Notenbaert, A. M., Wood, S., Msangi, S., Freeman, H. A., Bossio, D., Dixon, J., Peters, M., van de Steeg, J., Lynam, J., Parthasarathy Rao, P., Macmillan, S., Gerard, B., McDermott, J., Seré, C. and Rosegrant, M., 2010. Smart Investments in Sustainable Food Production: Revisiting Mixed Crop-Livestock Systems. *Science*, 327(5967), pp. 822-825.

Hodgson, M., G., 2006. What Are Institutions?. *Journal of Economic Issues*, 40(1), pp. 1-25. DOI: 10.1080/00213624.2006.11506879.

International Livestock Research Institute (ILRI), 2011. *Livestock: A pathway out of poverty. Interim strategy of the International Livestock Research Institute, 2011-2012*. [pdf] Nairobi (KE): ILRI. Available at: <https://cgspace.cgiar.org/handle/10568/4188> [Accessed 5 April 2018].

Mikkelsen, B., 2005. *Methods for Development Work and Research: A New Guide for Practitioners*. New Dehli (IN): Sage Publications India Pvt Ltd.

Muriuki, H. G., 2011. *Dairy Development in Kenya*. [pdf] Rome (IT): FAO. Available at: <http://www.fao.org/3/a-al745e.pdf> [Accessed 5 April 2018].

Odero-Waititu, J., 2017. Smallholder dairy production in Kenya: a review. *Livestock Research for Rural Development*, 29 (7).

Scoones, I., 2015. *Sustainable Livelihoods and Rural Development*. Rugby (UK). Practical Action Publishing Ltd.

Spradley, J. P., 1980. *Participant Observation*. New York (USA): Holt, Rinehart & Winston.

Swanepoel, F., Stroebel, A. and Moyo, S., 2010. *The role of livestock in developing communities: Enhancing multifunctionality*. Cape Town, South Africa: University of the Free State and CTA.

Appendices

Appendix 1: Applied Methods

Method	Number	Respondents
Transect walk	1	Guided by Alexander
Questionnaire	36	Small-scale dairy farmers
Semi-structured interview	5	Small-scale dairy farmers
	3	Market channel representatives <ul style="list-style-type: none"> - Brookside - Demka - ODCS
	1	Livestock officer
Group interview	1	Small-scale dairy farmers and the livestock officer
Participatory Rural Appraisal <ul style="list-style-type: none"> - Transect walk - Market mapping 	3	Transect walk: Alexander Market mapping: Brookside and ODCS
Participant observation and passive participation		

Appendix 2: Overview of Interviews

Interview type/number	Respondent	Date
SSI 1	Othaya Dairy Cooperative Society Chairman Mr. Iosphat Gitahi Vice chairman Mr. George Wangai	07.03.18
SSI 2	Demka Shop manager Eunice	07.03.18
SSI 3	Brookside Anonymous employed	07.03.18
SSI 4	Livestock officer, Mr. John Maina	08.03.18
SSI 5	Pascal (farmer)	08.03.18
SSI 6	Margaret Kianja Muita (farmer)	09.03.18
SSI 7	Jane Rose Wambugu (farmer)	09.03.18
SSI 8	Margret Wambui Gikongo	08.03.18
SSI 9	Feliciano Wairimou (farmer)	09.03.18
GI	Group Interview	09.03.18
II 1	Dr. Mutembei	01.03.18
II 2	Mr. John Mancheria	04.03.18
S	Dr. Cathrine Kunyanga	10.03.18

Appendix 3 - Interview Guides

Appendix 3a: Interview Guide for Farmers

Why do you own a cow?

How do you take care of your cows during the day?

- How did you learn to take care of the cows?
- Do you wish you could do something different?

Have you ever sold a cow? Why?

Do you think is profitable to have a cow? Why?

How do you think you could make your dairy production more profitable?

What is the price you think would be your break even point?

Are you engaged in a cost-benefit analysis?

What do you think about the feed you give to your cows?

- Why your cow is feed in this way?
- What do you think about the quality of the feed?
- What do you think about the quantity of the feed?
- Have you ever attend any informational meeting about feeding methods?

What do you use milk for?

- Why do you put milk in tea?
- Do you ever serve tea without milk?

What do you usually do if you get a male calf?

Why do you keep your cows in the shed?

Do you use manure to fertilize your farm?

Do you have access to any loan?

Where did you get the money from in order to purchase your cows?

Social capital

How do you feel about your family working on the farm?

How do you feel about an employee taking care of your cows

For cooperatives members

Can you tell us about Demka/ Brookside/ Othaya Dairy Cooperative Society.

Which are the opportunities you get from being a supplier for Demka/Brookside/....

Do you see any disadvantage in being a supplier for Demka/...

Did you switch from a cooperative to another in the past?

- If yes, why?

Informal market

Which advantages and disadvantages do you see in participating in the informal market?

Appendix 3b: Interview Guide for the Livestock Officer

What's your name?

What is your educational background?

Where is your office located?

What does your job consist of?

- Are you employed by the government?
- Is there any other employee at your office?
- What is the area your authority covers?
- Which are your responsibilities?

Is there any rule or regulation imposed by the government you have to follow?

- Is there any goal for the livestock sector you aim to reach at local and national level?

How often do you visit the farmers?

How do you choose who to visit?

What do you do when you visit the farmers?

Do your visits have an educational aim?

Which are the trends related to livestock in this area?

- Could you give us some more information about cows?

How often do you work with cows?

- Do you have a cow? Why?
- Do you know how much it would cost to buy a cow?
- Do you know how much it would cost to maintain a cow?

Does your job have something to do with milk production?

- What is your relation with Brookside, Mukurweini, Demka, Othaya Dairy Cooperative Society

Do you know anything about loans farmers can get for their livestock?

What is your relation with the veterinary?

Appendix 3c: Interview Guide for Market Representatives (Demka, Brookside, ODCS)

Is this a private company?

Who are your suppliers?

Farmers

How many farmers sell milk to your company?

- Are they on contract?

How many litres of milk do you purchase from the farmers each day?

Do you collect the milk at the farm or is it delivered and who pays for transport?

What is the payment method?

Why do you think farmers sell to you and not to someone else?

How do you attract farmers?

What is your relationship with the farmers?

- Have there been any problems between you and the farmers?
- Which opportunities do you provide farmers with?
- Is there any consultation between you and the farmers?
- Do you train farmers on value addition? (Yoghurt, processing milk, etc.)

Brokers

How many litres of milk do you purchase from the brokers each day?

Cooperatives

How many litres of milk do you purchase from cooperatives each day?

Which?

What is the price you pay per litre (Specify for brokers, farmers, etc.)?

- How is the price at which you buy determined?
- Is there variability in milk accessibility during the year?
 - Is this an issue?
 - Does it affect the price?

Which products do you sell?

Who are your customers?

- Groceries/shops
- Consumers
- Cooperatives
- How do you sell the products?

Is there any governmental regulation policy/rule that you need to follow?

- Is there any food safety precautionary policy you need to follow?
 - If yes, which are the safety precautions you take?

Does your company set up any policy/rule that farmers need to follow?

- Do you give any parameters to the farmers for milk production?
 - If yes, which are these parameters?

What methods do you use to store the milk?

What are your processing methods for milk?

What is your relationship between your company and other companies involved into similar business?

Appendix 4: Questionnaire Participant List

Number	Age	Gender	Marital status	Position in the household	Primary occupation
1	80	F	Widowed	Female head	Farmer
2	80	F	Widowed	Female head	Farmer
3	50	F	Married	Wife of the head	Farmer
4	72	F	Widowed	Female head	Farmer
5	55	F	Married	Wife of the head	Farmer
6	28	F	Married	Wife of the head	Farmer
7	50	M	Partner	Son of the head	Fabrication of shipping containers
8	29	F	Married	Wife of the head	Farmer
9	68	M	Married	Male head	Farmer
10	55	F	Married	Wife of the head	Farmer
11	66	M	Married	Male head	Farmer
12	50	F	Married	Wife of the head	Farmer
13	69	F	Widowed	Female head	Farmer
14	53	F	Married	Wife of the head	Farmer
15	80	F	Widowed	Female head	Farmer
16	42	F	Married	Wife of the head	Farmer
17	23	F	Married	Wife of the head	Businesswoman, broker
18	52	F	Partner	Female head	Businesswoman
19	50	F	Married	Wife of the head	Farmer
20	48	F	Married	Wife of the head	Farmer
21	70	F	Widowed	Female head	Farmer
22	45	M	Married	Male head	Farmer
23	41	F	Married	Wife of the head	Farmer
24	N/A	F	Married	Wife of the head	Farmer
25	78	F	Widowed	Female head	Farmer

26	35	M	Married	Male head	Farmer and businessman
27	36	M	Married	Male head	Business man
28	71	F	Widowed	Female head	Farmer
29	60	F	Married	Wife of head	Farmer
30	47	M	Married	Male head	Security
31	52	F	Married	Wife of head	Farmer
32	34	F	Married	Wife of head	Farmer
33	55	F	Widowed	Female head	Farmer
34	82	F	Widowed	Female head	Farmer
35	88	F	Widowed	Female head	Farmer
36	45	F	Married	Wife of head	Farmer

Appendix 5: Revised Questionnaire

SLUSE/ILUNRM Field Work 2018, Kenya

GPS point x: y: z:	Interviewer:
Sub-Location:	Group Number:
Note Taker:	Translator:
Picture:	Date and Time:

Introduction and Statement of Purpose:

We are a group of seven university students from the University of Nairobi and the University of Copenhagen participating in a field work course as part of our masters programs curriculum. We are studying agriculture and the environment and we have a specific interest in dairy livestock in this region of Kenya. As part of our research, we are administering a questionnaire in order to collect information about the farmers of this region and their agricultural livestock production and practices.

Ask consent for participation.

Thank you very much for participating and for helping us with our research. This survey should take approximately 20 minutes. All responses will be kept anonymous.

Section One: Personal Information:

1. Name: _____
2. Age: _____
3. Gender:
 - ☐ Male
 - ☐ Female
4. Marital status
 - ☐ Single
 - ☐ Married
 - ☐ Widowed
 - ☐ Divorced
 - ☐ Partner
5. Position in the Household: _____
6. Primary Occupation: _____
7. Education: Which level of education did you finish?

- ☐ No Education
- ☐ Primary School
- ☐ Secondary School
- ☐ Technical Degree
- ☐ Bachelor Degree
- ☐ Master Degree
- ☐ Other: _____

Section Two: Household Information:

8. How many people live in the household? _____

Please state their relationship to you, age, gender, occupation and whether they work on your family farm.

Relationship	Age	Gender	Occupation	Does he/she work on the farm?
1)				
2)				
3)				
4)				
5)				
6)				
7)				
8)				
9)				

Section Three: Farm Information

9. How large is your farm (in acres)? _____

10. How did you obtain your land?

- ☐ Inherited
- ☐ Purchasing
- ☐ Renting
- ☐ Other _____

11. Do you have any paid workers on the farm?

- ☐ Yes
- ☐ No
- ☐ If yes: how many? _____

12. What type of livestock do you own? And how many?

- ☐ None
- ☐ Cows _____ (if 0, go to 12a)
 - ☐ (Number of cows used for dairy _____) (go to 12b)
- ☐ Goats _____
 - ☐ (Number of goats used for dairy _____)
- ☐ Poultry _____
- ☐ Donkey _____
- ☐ Horses _____
- ☐ Sheep _____
- ☐ Pigs _____

12a. Did you used to have cows?

- ☐ Yes
- ☐ No

12b. Why are the cows not used for dairy?

13. Which of the crops following are grown on your farm?

- ☐ Maize
- ☐ Coffee
- ☐ Tea
- ☐ Fodder
- ☐ Vegetables _____
- ☐ Fruits _____
- ☐ Other _____

Do you sell it?

YES / NO
 YES / NO
 YES / NO
 YES / NO
 YES / NO
 YES / NO
 YES / NO

Section Four: Dairy

14. How did you obtain your cows?

- ☐ Breeding from previously owned cow
- ☐ Purchase
- ☐ Traded
- ☐ Gift
- ☐ Other _____

15. Have you participated in breeding programs? (artificial insemination banks)

- ☐ Yes
- ☐ No

16. Characteristics of the cows

Cow/name	Age (years)	Breed	Number of times milked/day	Approximately liters of milk produced a day	How many times per day fed

17. What are your dairy cows fed on a daily basis?

- ☐ Napier Grass
- ☐ Maize Stovers
- ☐ Other Grasses
- ☐ Concentrate
- ☐ Other (please specify) _____

18. Is there typically someone responsible for feeding the dairy cows on a daily basis?

- ☐ Yes
- ☐ No
- ☐ If yes: who (role of the person)?

19. Is there someone typically responsible for milking the cows?

- ☐ Yes
☐ No
☐ If yes: who (role of the person)? _____

21. Do you sell milk?

- ☐ Yes
☐ No

22. If you do sell milk, who do you sell to and what is the price? (circle)

Buyer	Price/L
Neighbors/friends/relatives	
Cooperatives	
Shops/Groceries	
Broker	
Other _____	

23. Do you buy milk?

- ☐ Yes
☐ No

24. If you do buy milk, who do you buy from and what is the price? (circle)

Seller	Price/L
Neighbours/friends/relatives	
Cooperatives	
Shops/groceries	
Other _____	

25. Are you a member of any milk cooperatives?

- ☐ Yes

- ☐ No
- ☐ If yes: which one? _____
- ☐ If no: have you been a member in the past?
 - ☐ Yes (which one) _____
 - ☐ No (why not) _____

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

- ☐ Yes (please specify the methods) _____
- ☐ No

27. Have you ever had a conversation with the livestock officer (NAME) about issues on your farm?

- ☐ Yes
- ☐ No

28. What is your main source of income? _____

29. What other types of income do you have? _____

Thanks for participating! We really appreciate your help with our research.

Do you have any questions for us?

If you would potentially be interested in helping us further with a follow up interview please let us know.

- ☐ Yes
- ☐ No

Phone Number? _____

Appendix 6: Synopsis

A Cow's Tale

The importance of dairy production in smallholder livelihoods in Othaya, Kenya



Synopsis

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1. Introduction

1.1. The potential of the livestock sector in Kenya with focus on dairy production

According to Engida et al. (2015), the livestock sector in Kenya has a strong potential for growth, due to the fact that improvements in the livestock sector are likely to have macro effects on the entire agricultural development. Furthermore, the link between the livestock sector and the other economic sectors appears to be strong, at the point where a general economic growth could be enhanced by only increasing the livestock productivity (Engida et al. 2015). Dairy production is a major part of livestock production, it constitutes around 14% of the agricultural GDP and accounts for around 8% of the Kenya's GDP (Odero-Waititu 2017). Kenyan cows produce 70% of the milk of the total national milk output (Muriuki 2011). Smallholder farmers produce more than half of the nationally produced milk, and the dairy production systems are mainly extensive, intensive or semi-intensive with variations from region to region, depending especially on the agro-ecological zone and human population density (Odero-Waititu 2017).

The dairy livestock sector appears to have a large development potential (Burke et al. 2015). However, it also appears to face several constraints, such as quantity and quality of feed, market access, infrastructural conditions, access to veterinary and artificial insemination, financial resources, level of technical and technological skills etc. (Odero-Waititu 2017).

1.2. The importance of dairy cattle livestock in the Central Highlands

The field of this enquiry is farmers and their livelihood strategies based on cattle dairy production in the Othaya area in the Central Highlands of Kenya. Here, as in the rest of the Central Highlands, small-scale milk production has an important role as an omnipresent factor in the farmers daily life as well as a source of income and stability. The production is mainly based on a zero-grazing, cut and carry system, integrated with rotational crops (Odero-Waititu 2017). However, many factors influence the choices of farmers and the strategies they implement in managing their dairy production. We assume that the diversity of strategies implemented by the farmers will depend on the forms of capital the farmers have access to and how they are utilized. Furthermore, institutions and organizations construct the framework which influences these decisions (Scoones 2015).

Our initially aim is to determine what forms of livelihood resources are accessed and utilized by the farmers, and what role the institutions and organizations play. As a further step we intend to analyze these findings in relation to the farmers' opportunities and their livelihood strategies.

In this paper, we will first present the research question and the following sub-questions. Then, a conceptual part introducing the sustainable livelihood framework and why it is

relevant to answer the research question. The conceptual part is followed by a methodology section, which is divided into social science and natural science methods. At the end of the paper, a time schedule with the day-specific activities is presented.

2. Research question

How do livelihood resources, institutions and organizations determine livelihood strategies based on cattle dairy production in the Othaya area and how do they create opportunities for farmers?¹

2.1. Sub-questions

1. *What is the constitution and relevance of livelihood resources (social, natural, physical, financial, human) in the farmers' dairy livestock practices?*
2. *What is the role of institutions and organizations in the dairy livestock sector in this area?*
 - 2.1. What are the different institutions and organizations present?
 - 2.2. What are the opportunities and constraint of participating in formal markets and informal markets?
 - 2.3. What is the path of the value chain for formal and informal markets?
 - 2.4. What is the role played by policies and authorities in the dairy livestock sector?
 - 2.5. How do traditional knowledge and customs impact the dairy livestock sector?
3. *What are the different livestock management strategies implemented in this area, and what are the outcomes?*
 - 3.1. How do farmers implement breeding strategies in rearing dairy livestock and what are the outcomes in dairy yield?
 - 3.2. How do farmers strategize breed choice and what are the outcomes?
 - 3.3. How do farmers implement feeding strategies and what are the consequences?

3. Conceptual Framework

In our research question we address the concepts *livelihood resources*, *institutions* and *organizations*, and *livelihood strategies*. These concepts are elaborated upon by different scholars within the *sustainable livelihood framework*. In the paragraphs below we elaborate on how the framework is relevant for our research project.

¹ See data matrix in Appendix 1

Livelihoods are complex, multidimensional, temporally and spatially varied and socially differentiated. To achieve an appropriate understanding of the livelihood, it is necessary to look into multiple factors such as political and economic processes and at a more local scale on the specific conditions in the area that are being investigated (Scoones 2015). The *sustainable livelihood framework* can be helpful to understand such complexity.

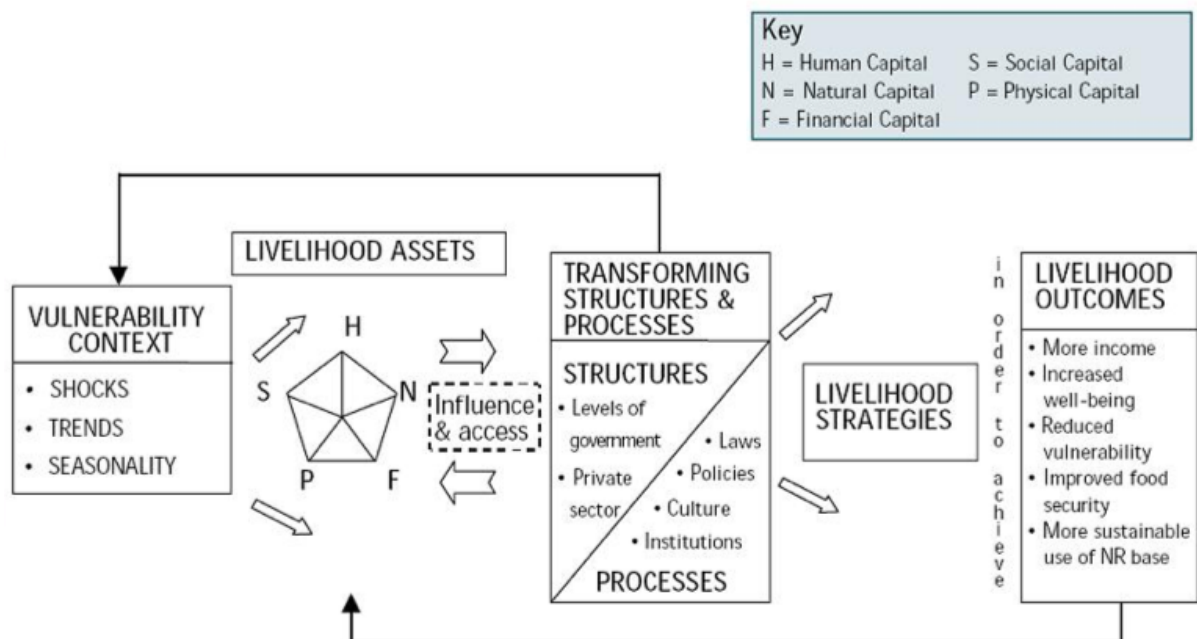


Figure 1: Sustainable Livelihood Framework (DFID 1999).

The framework is centred on people and does not work linearly and do not try to present a model of reality (DFID 1999). The *vulnerability context* refers to the environment which can affect the livelihood resources (Scoones 2015), which in *figure 1* appears as *capitals*. The livelihood resources is influenced by *shocks* such as human health shocks, natural hazards and conflicts; *trends* such as technological development, population trends, national or international trends; and *seasonality* of prices, production and health. Policies, processes and institutions, which refer to formal constraints such as rules and laws, and informal rules and constraints such as norms of behaviour and cultural practices, mediate access to different sources of capital, which is divided into five different categories (Angelsen et al. 2011):

- *Human capital*: This capital covers the skills, knowledge, health and education of the community concerned.
- *Natural capital*: This capital covers the natural resource stock from which resource flows and services useful for livelihoods are derived such as water, land, forest, air quality and biodiversity.
- *Financial capital*: This capital covers the financial resources that people use to achieve their livelihood objectives such as wages, savings and remittances.

- *Social capital*: This capital covers social networks, memberships of formalised groups and relationships of trust that can be useful in the pursuit of their livelihood objectives.
- *Physical capital*: This capital covers the physical environment such as infrastructure and producer goods that people use to achieve their livelihood objectives (Angelsen et al. 2011).

The *vulnerability context*, *capitals*, *structures* and *processes* form the basis for the *livelihood strategies* which end up in *livelihood outcomes*. Such outcomes could be higher income, increased well-being, reduced vulnerability or improved food security, for instance (DFID 1999). The framework is shown in *figure 1*.

In the case of dairy cattle livestock, the framework provides the opportunity to analyze the different capitals, and look further into the various livelihood strategies and which types of outcome they are pursuing in the Othaya Area. Therefore, the sustainable livelihood framework and capitals will be used as a conceptual framework to understand the different livelihood strategies that are implemented in the dairy livestock sector and what type of outcomes are achieved through these strategies.

4. Methodology

Our main methodology is to use triangulation to overcome the problems that stem from studies relying on a single method (Mikkelsen 2005). By doing this we will draw from both qualitative and quantitative as well as social science and natural science approaches in order to gain a broader and more representative perspective. In our cross-disciplinary team our goal is to use our different expertise as well as learning from other members of the group.

4.1. Social science methods

4.1.1. Questionnaires

The intention of our use of questionnaires in this field work is to use them as a tool to collect information about the following:

- General demographic information in order to gain insights about the composition of households in the community
- Quantitative data on breed, productivity, tenure, ages, income sources, expenditures, activities etc.
- Assessment of the types of capital present in the community and within individual households. Also quantifying who is participating in formal and informal markets, and who has access to milk coolers.

For our sampling method we plan to determine our area of interest on the first few days during our grand tour, while utilizing the gps to mark important boundaries and points of significance. After determining this area, we will develop a uniform and appropriate grid

system with several households in each block. During our time seeking participants we will attempt to gain a respondent from each square so that our answers are representative of a diverse area.

4.1.2. *Participant observation*

To get an insight into the farmers' lives we will use the method *participant observation* (Spradley 1980). By spending time with dairy farmers and participating in their daily activities such as milking, feeding and taking care of the animals we will try to create a dynamic atmosphere, where we can sharpen our attention and try and understand the farmer's reality (Ingold 2014:389). An additional goal is to hopefully gain perspective as to why small hold farmers are participating or not participating in formal or informal markets. We also hope that from utilizing participant observation we are able to achieve an comprehension surrounding the traditional knowledge and customs which impact dairy livestock farming. Finally, it is important for us that we give something back to the farmers. Helping out with the cows simply allow us to learn from the farmers and through our labour give them something in return for their participation in the project.

4.1.3. Interviews

4.1.3.1. *Informal interviews*

While doing participant observation we will use informal interviews to explore the broader subject of our project and encourage the farmers to share their views, experiences and values. Through the process of talking with the different farmers about our project we will get to know them better and figure out who has potential for future semi-structured interviews or focus groups. Furthermore we will get an on-the-ground perspective of the farmers in the area.

4.1.3.2. *Semi-structured interviews*

Through the answers of the questionnaire and informal interviews, we will select dairy livestock farmers who would offer diverse perspectives in the value chain. Semi-structured interviews will allow us to gather information on perceptions on the quality of life and the steps the farmers go through in making decisions (Bernard 2011). We plan on choosing our subjects for the semi-structured interview based on responses during our implementation of the questionnaire. We will also interview the livestock officer and other people who are a part of the livestock sector in Othaya area.

4.1.3.3. *Focus groups interviews*

We plan to host a focus group involving community members with an emphasis on markets and breeding methods. We will seek an understanding of the livelihood strategies which are pursued within the context of dairy farming, this includes inquiries concerning motivation of participation in formal and informal markets, cooperative memberships, and feeding and breeding strategies. A group of farmers can be optimal for in-depth information about farming systems (Mikkelsen 2005). It could also be interesting and beneficial to include not

only farmers, but also livestock officers, extension agents, or representatives of the various cooperatives in order to better understand the dynamics of institutions and livelihood strategies.

4.1.4. Participatory rural appraisal (PRA) methods

4.1.4.1. *Grand tours*

When we arrive in the community within the first few days we hope to identify a farmer in the community who is willing to take us on a *grand tour* (Spradley 1980) of the area; this could potentially be our host family or our contacts on the ground. When we walk around in the area, we will use the GPS to mark important places and boundaries.

During the walking tour, we will observe what the different farmers point out and find important in their the surroundings (Spradley 1980, p. 77). We will ask descriptive questions to get an insight to which part of the work with livestock they emphasize. Through this method, we hope to learn emic terms about the work with dairy livestock. These terms will be useful in later interviews and fieldwork.

4.1.4.2. *Ranking and well-being ranking*

Ranking can be used to give an expression of different interest or opinions, which then may be compared (Mikkelsen 2005). We will use this method to look into the local criteria of wealth and well-being according to the farmers. We hope to involve this exercise as part of the focus group while we have community members gathered together. And our intention to spark a conversation among them about their opinions and perspectives surrounding general livelihood wellbeing. This session will help us with creating a standard of what it means in the community to be “successful” and “secure”, as well as some insight into potential motives for livelihood strategies.

4.1.4.3 *Market Mapping*

Towards the end of our time in the field, once we have a broader overview of the systems and dynamics at play, we would like to create a market map. This outline will delineate the formal and informal market dynamics. For example of what we want to create, see *Figure 2* below:

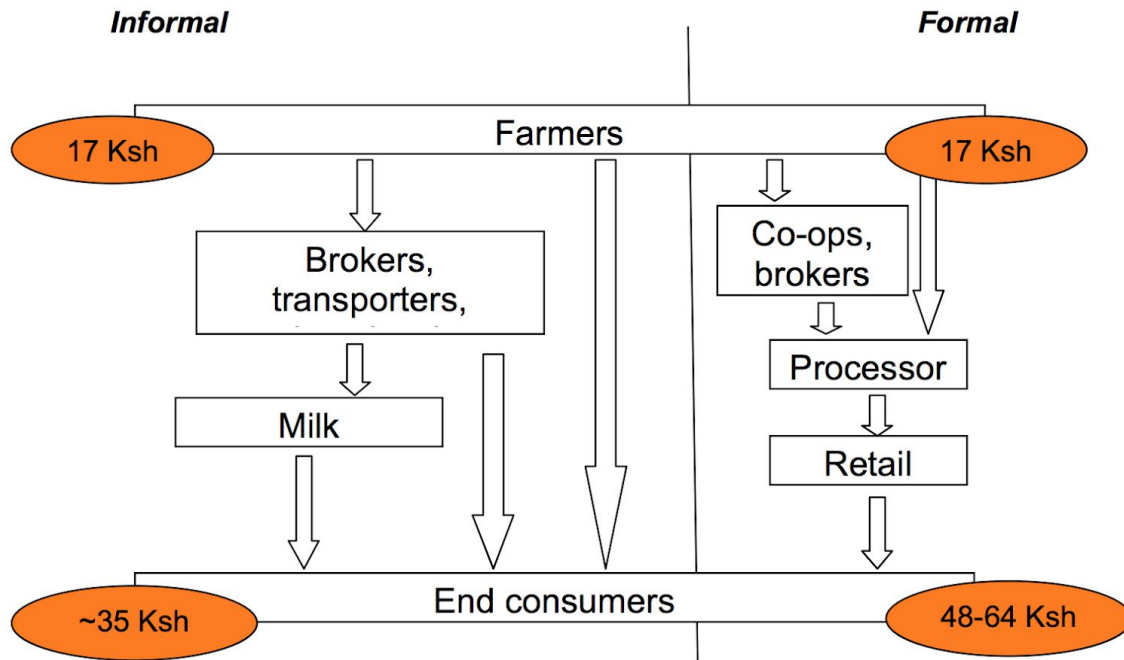


Figure 2: Market Map Example (TechnoServe Kenya 2008).

4.2. Natural science methods

4.2.1. GPS - Area mapping

We will use a handheld GPS to map the study area and locate small-scale dairy farmers in the area. The GPS will be used on our grand tour to mark places of importance and interesting points important to the farmers. Local people will show the way and help to provide an overview of the area and we will mark coordinates and paths for further reference as waypoints.

4.2.2. Measuring yield

We intend to measure and categorize the input of feed and the output of milk in order to be able to conclude trends and correlations between these two factors in relation to other demographic tendencies. Logistics of this will most likely be determined once we are in the field and once we know more about willing participants and their needs. Ideally, we would have a small sample size of cows spread out through the area in diverse situations. From these cows, we hope to measure type and amount (weight) of feed and the resulting output of milk. This potentially looks like us collecting the information about daily volume of milk output per cow every day from the individual farmers. If there is a more straightforward way of collecting this information that becomes evident once we arrive, we can adjust our methods.

5. Planned collaboration with counterparts

Our group has been in contact with our Kenyan colleagues, Lillian Gakuki and Osuman Kiazolu throughout the process. We have had a Skype meeting on 2/16/18 with spotty connection, but we sent a follow-up email in order to have clearer communication. We already discussed the research questions, questionnaire and some questions for the interview guide. Once we meet up with them in Nairobi, we want to go through the questionnaire and interview guide to make sure everything is clear.

6. References

- Angelsen, A., Larsen, H. O., Lund, J. F., Smith-Hall, C. & Wunder, S. 2011. Measuring Livelihoods and Environmental Dependence. Earthscan. Washington, DC.
- Bernard, Russel. 2011. Research Methods in Anthropology: Qualitative and Quantitative Approaches. Plymouth: Altamira Press.
- Burke, W. J., Myers, R. J., Jayne, T. S. 2015. A Triple-Hurdle Model of Production and Market Participation in Kenya's Dairy Market. *Amer. J. Agr. Econ.*, 97(4), pp.1227–1246. doi: 10.1093/ajae/aav009
- DFID, 1999. Sustainable Livelihoods Guidance Sheets. Department for International Development. Available at: <https://www.eldis.org/vfile/upload/1/document/0901/section2.pdf> [Accessed 16 February 2018]
- Engida, E., Guthiga, P., Nyota, H., Karugia, J. 2015. The role of livestock in the Kenyan economy: Policy analysis using a dynamic Computable General Equilibrium model for Kenya. *Resakss Working Paper No.37*.
- Ingold, Tim. 2014. That's Enough about Ethnography! *HAU:Journal of Ethnographic Theory* 4(1), pp. 383–95.
- Mikkelsen, Britha. 2005. Methods for Development Work and Research: A New Guide for Practitioners. London: SAGE Publications.
- Muriuki, H.G. 2011. Dairy Development in Kenya. FAO, 2011. Rome.
- Odero-Waititu, J. 2017. Smallholder dairy production in Kenya; a review. *Livestock Research for Rural Development*, 29 (139), [online] Available at: <http://www.lrrd.org/lrrd29/7/atiw29139.html>. [Accessed 16 February 2018].
- Scoones, I. 2015. Sustainable Livelihoods and Rural Development - Agrarian Change and Peasant Studies. Practical Action Publishing Ltd.
- Spradley, James P. 1980. *Participant Observation*. New York: Holt, Rinehart & Winston.
- TechnoServe Kenya, 2008. *The Dairy Value Chain in Kenya*. [pdf] Kenya: East Africa Dairy Development Program. Available at: <https://cgspace.cgiar.org/handle/10568/603/browse> . [Accessed 16 February 2018]

7. Appendices

Appendix 1: Research matrix

Research matrix				
Research question	Sub-questions	Sub-sub-questions	Data required	Methods
How do livelihood resources, institutions and organizations determine livelihood strategies based on cattle dairy production in the Othaya area and how do they create opportunities for farmers?	What is the constitution and relevance of livelihood resources (social, natural, physical, financial, human) in the farmers' dairy livestock practices?		Livelihood pentagon	Questionnaire, Interviews, Participant observation, PRA, Measuring Yields, GPS, Market map
	What is the role of institutions and organizations in the dairy livestock sector?	What are the different institutions and organizations present?	Market preferences, market prices, market access, buyers and sellers, value chain infrastructure.	
		What are the opportunities and constraint of participating in formal and informal markets?		
		What is the path of the value chain for formal and informal markets?		
		What is the role played by policies and authorities in dairy livestock sector?	Authorities interventions, policies, collaboration with organizations, past and future projects.	
		How do traditional knowledge and customs impact dairy livestock sector?	Understanding the role of dairy cattle for the households, informations about knowledge, traditions and customs related to dairy cattle production and marketing.	
	What are the different livestock management strategies implemented in this area, and what are the outcomes?	How do farmers implement breeding strategies in rearing dairy livestock and what are the outcomes in dairy yield?	Milk yields, reports of breeding methods	
		How do farmers strategize breed choice and what are the outcomes?	Milk yields, type of breed	
		How do farmers implement feeding strategies and what are the consequences?	Milk yields, type of feed, amount of feed	

Appendix 2: Time schedule

Date	Activities	Persons	Notes
1/3	Meeting with Kenyan counterparts in Nairobi	All	
2/3	Departure to Othaya Grocery shopping Settling in with host families Taking a walk in the area/transect walk	All Group split up: some walk with farmer and translator, some do the GPS mapping	GPS for mapping
3/3	Wangari Maathai Day in the morning Setting up input/output measuring scheme with contacts	All	
4/3	Church service in the morning Go through questionnaire Inform the translator Plan sampling strategy	All	Remember nice clothes
5/3	Start questionnaire + GPS Participatory observation	Group split up	
6/3	Continue questionnaire + GPS Participatory observation	Group split up	
7/3	Testing and adjusting interview guide Interviews with key informants	All Group split up for different interviews	
8/3	Interviews with key informants	Group split up for different interviews	
9/3	Focus group		
10/3	Buffer day		
11/3	Wrapping up		
12/3	Feedback meeting in the morning Farewell party in the evening	All	
13/3	Departure Othaya Travel back to Nairobi		

Appendix 3: Questionnaire

SLUSE/ILUNRM Field Work 2018, Kenya

GPS point x: y: z:	Interviewer:
Sub-Location:	Group Number:
Note Taker:	Translator:
Picture:	Date and Time:

Introduction and Statement of Purpose:

We are a group of seven university students from the University of Nairobi and the University of Copenhagen participating in a field work course as part of our masters programs curriculum. We are studying agriculture and the environment and we have a specific interest in dairy livestock in this region of Kenya. As part of our research, we are administering a questionnaire in order to collect information about the farmers of this region and their agricultural livestock production and practices.

Ask consent for participation.

Thank you very much for participating and for helping us with our research. This survey should take approximately 20 minutes. All responses will be kept anonymous.

Section One: Personal Information:

1. Name: _____
2. Age: _____
3. Gender:
 - ☐ Male
 - ☐ Female
4. Marital status
 - ☐ Single
 - ☐ Married
 - ☐ Widowed
 - ☐ Divorced
 - ☐ Partner
5. Position in the Household: _____
6. Primary Occupation: _____

7. Education: Which level of education did you finish?

- ☐ No Education
- ☐ Primary School
- ☐ Secondary School
- ☐ Technical Degree
- ☐ Bachelor Degree
- ☐ Master Degree
- ☐ Other: _____

Section Two: Household Information:

8. How many people are in your household? (including living outside of your village that are contributing to the household)

Please state their relationship to you, age, gender, occupation and whether they work on your family farm.

Relationship	Age	Gender	Occupation	Does he/she work on the farm?
1)				
2)				
3)				
4)				
5)				
6)				
7)				
8)				
9)				

Section Three: Farm Information

9. How large is your farm (in hectares)? _____

10. How did you obtain your land?

- ☐ Inherited
☐ Purchasing
☐ Renting
☐ Other _____

11. Do you have any paid workers on the farm?

- ☐ Yes
☐ No
☐ If yes: how many? _____

12. What type of livestock do you own? And how many?

- ☐ None
☐ Cows _____
 ☐ (Number of cows used for dairy _____)
☐ Goats _____
 ☐ (Number of goats used for dairy _____)
☐ Poultry _____
☐ Donkey _____
☐ Horses _____
☐ Sheep _____
☐ Pigs _____

13. Which of the crops following are grown on your farm?

- ☐ Maize
☐ Coffee
☐ Tea
☐ Fodder
☐ Vegetables _____
☐ Fruits _____
☐ Other _____

Do you sell it?

YES / NO
 YES / NO
 YES / NO
 YES / NO
 YES / NO
 YES / NO
 YES / NO

Section Four: Dairy

14. How did you obtain your cows?

- ☐ Breeding from previously owned cow
☐ Purchase
☐ Traded
☐ Gift
☐ Other _____

15. Have you participated in breeding programs? (artificial insemination banks)

- ☐ Yes
☐ No

16. Characteristics of the cows

Cow/name	Age (years)	Breed	Number of times milked/day	Approximately liters of milk produced a day	How many times per day fed

17. What are your dairy cows fed on a daily basis?

- ☐ Napier Grass
☐ Maize Stovers
☐ Other Grasses
☐ Concentrate
☐ Other (please specify) _____

18. Is there typically someone responsible for feeding the dairy cows on a daily basis?

- ☐ Yes
☐ No
☐ If yes: who (role of the person)?

19. Is there someone typically responsible for milking the cows?

☐ Yes

☐ No

☐ If yes: who (role of the person)? _____

20. Do you notice variability in the milk output of your cow/s?

☐ Yes

☐ No

21. Do you sell milk?

☐ Yes

☐ No

22. If you do sell milk, who do you sell to and what is the price? (circle)

Buyer	Price/L
Neighbors/friends/relatives	
Cooperatives	
Shops/Groceries	
Other _____	

23. Do you buy milk?

☐ Yes

☐ No

24. If you do buy milk, who do you buy from and what is the price? (circle)

Seller	Price/L
Neighbours/friends/relatives	
Cooperatives	
Shops/groceries	
Other _____	

25. Are you a member of any milk cooperatives?

☐ Yes

☐ No

☐ If yes: which one? _____

☐ If no: have you been a member in the past?

☐ Yes (which one) _____

☐ No (why not) _____

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

☐ Yes (please specify the methods) _____

☐ No

27. Have you ever had a conversation with the livestock officer (NAME) about issues on your farm?

☐ Yes

☐ No

28. Have you ever had issues with milk spoilage?

☐ Yes

☐ No

29. Have you had any problems with the health of your dairy cattle? (diseases, illnesses)

☐ Yes

☐ No

Thanks for participating! We really appreciate your help with our research.

Do you have any questions for us?

If you would potentially be interested in helping us further with a follow up interview please let us know.

☐ Yes

☐ No

Phone Number? _____