Interdisciplinary Land Use and Natural Resource Management

# Emergent crops/livestock and anticipation of markets

## Factors affecting farmers' decisions on selecting emerging crops and livestock


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# ABSTRACT

In Kenya, 69 % of the population is employed in the agricultural sector where the cash crop coffee traditionally have played a huge role. The agricultural conditions in the Central Highland areas are very good and population density high. Our field work took place in one of these areas; Gatugi. The increasingly population in the area creates a pressure on the land resource and some farmers tries new types of cash crops and livestock. In this report we examine which factors influence farmers to adopt this "emerging" crops and livestock.

The report shows that both knowledge, profit and risk affect the farmers' decision. However, the factor that combines them all is knowledge gap. The analysis suggests that the current sources to information for the farmers are limited and highly biased. The knowledge gap limit the farmers outcome of the emerging crops and livestock. Additionally, the lack of qualified information also place the farmers in a vulnerable situation in connection to the market. By studying emerging crop and livestock we found that the adoption can both increase risk for the farmers, but also, how it sometimes is a risk reducing strategy.



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# 1 INTRODUCTION

The agricultural sector is of immense significance in Kenya. Out of the country's total area 47 % are covered by agriculture-related activities (FAO, 2015). Also in relation to Kenya's economy the agriculture is of high importance. In 2013 agriculture was estimated to account for 30 % of the country's total Gross Domestic Product (FAO, 2015). Moreover, agriculture is estimated to account for 65 % of Kenya's national export (Poulton and Kanyinga, 2014), which shows that it plays a major role in the rural population's livelihood. Due to the country's high climatic differences only about 20 % of Kenya's area have good potentials for agricultural production. This has resulted in high population density in the fertile central highland area.

Nyeri County is located in Kenya's central highland and has good agricultural conditions. The increased population density and the land tenure system have resulted in a subdivision of land among family members. The average plot size per farmer in Nyeri is 1.5 ha (Nyambari, 2008), which means that most of the farmers in Nyeri are smallholders. For that reason, the farmers need to find new ways of expanding their production to maintain their current livelihood (Dorsey, 1999). They have to get the same yield as their ancestors used to get from much bigger plots.

In Nyeri diversity among crops is already high (Poulton and Kanyinga, 2014). The agricultural system is divided into production of subsistence crops and cash crops, where cash crops are sold both to the domestic market and to the global market (Poulton and Kanyinga, 2014). Through diversification, farmers are able to produce a wide range of crops (Nyambari, 2008). Aside from the traditional cash crops coffee and tea, some farmers have started investing in new crops and livestocks (Nyambari, 2008). This diversification, where a shift to new kind of crops and livestock is taking place, is often related to risks especially at the beginning stage, where favorable market conditions are critical (Nyambari, 2008 & Dorsey, 1999). The crops and livestock present in Nyeri are thus not only static but also dynamic.

The emergence of new crops and livestock have lead us to wonder about where the knowledge about them comes from and why farmers choose to have them. On the basis of this interest we have formulated the following problem question:

*How do social, natural and economic factors affect farmers' decisions on selecting emerging crops and/or livestock?*

To consider the different factors we have formulated the following research questions:

- *When have the ECL we focus on been present in Gatugi within the past 70 years?*
- *What is the general timeline for an emerging crops/livestock?*
- *How do farmers learn about ECL?*
- *How does the traditional cash crop coffee affect the adoption of ECL?*
- *How does existing information sources influence the farmers' knowledge and adoption of ECL?*
- *How do agents affect the farmers' relation to market of ECL?*
- *How do the farmers anticipate the market?*
- *What are the risks related to ECL and how do local farmers understand and try to overcome these risks?*

The term "emerging crops/livestock" is popularly used by the media and organizations like Feed the Future (FeedtheFuture, 2014) about new crops/livestock that farmers adopt to diversify their farm. However, we decided to focus on farmers' perception of these "emerging crops/livestock". As the term was not normally used by farmers, we explained it to them as new cash crops, accordingly to our definition of ECL.

To answer our problem question we have defined emerging crops/livestock as a crop/livestock that has only been present on the farms within the last 10 years. They might have appeared before as well, but been neglected due to disadvantages like diseases or declined demand. As the temporality in the term is more of a process than a static volume, therefore the definition is blurred and flexible. Furthermore, the farmers who have the crops or livestock need to have an intention of selling the crop/livestock in the future.

After having analysed and discussed factors affecting farmers' decisions on ECL, our main conclusion is that lack of qualified information is the most determining factor. This we conclude as it is connected to all the other factors and therefore seem like the most important factor.

# 2 RESEARCH METHODOLOGY

### 2.1.1 Introduction

This research included qualitative and quantitative methods. In qualitative parts, we applied a naturalistic approach such as grand tour, participant observations and semi-structured interview, that seeks to understand phenomena in context-specific settings(Patton, 2002), for instance, what emerging crops/livestock(EC/L) they have in this village, the chronological calendar of EC/L, how farmers acquired information and knowledge about EC/L etc. In the quantitative part, researchers emphasize the measurement and analysis of causal relationships between variables (Denzin & Lincoln, 1998) to find out the ranking of the EC/L, the relations between social factors and engaging in EC/L farming, and the drivers and constraints for having EC/L. Furthermore, the quantitative data of chronology of EC/L which gathered through interviews to understand how EC/L booming and developing. We also applied natural science method-soil sampling to compare with farmers perception of their soil.

In the field research process, the group divided three sub-teams to ensure the information gathered are comprehensive at the limited time. One team was in charge of natural science method. The second team was responsible for EC/Ls' agents interviews and the last one mainly communicated with local agriculture office. The three tour guides were also local informants, two of them were from administrative office of the village and one was old, wise person in the village. They helped us to interview the key persons in households and government officer. All the three teams collected data both qualitative and quantitative methods to surmount the limitation of one method. Combining the two methods, it would be helpful in validating data and ensuring the information gathered is also reliable (Flick,2002).

## 2.2 Research site

The research site in the study is one village which is from Othaya, a Kenyan town about 125 kilometers north of Nairobi (Google map). It is a major town and one of administrative center in Nyeri South district, which has four locations: Chinga, Iria-Ini, Karima and Mahiga. The majority of the residents in the district are of Kikuyu tribe (Wikipedia ).

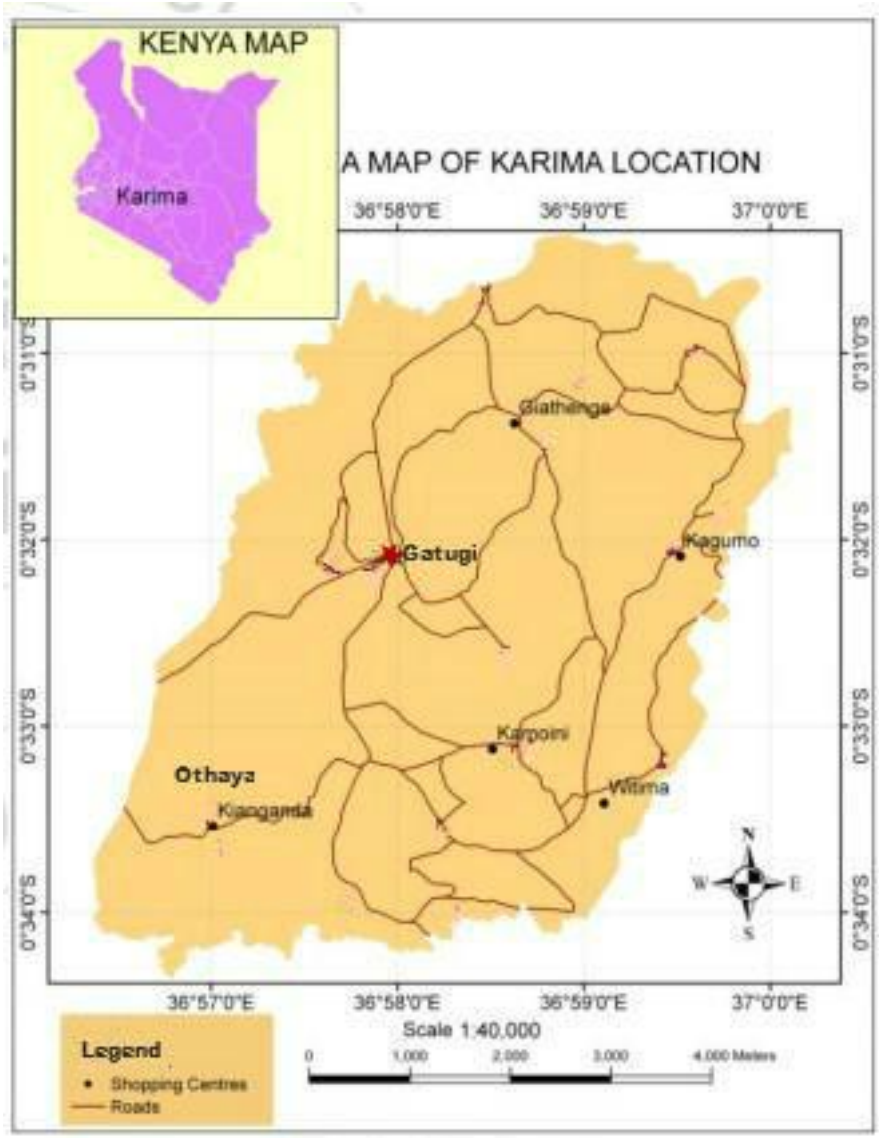


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**Figure 1: The geographical location of the field work. Source: Duncan et al. 2013**

Gatugi, where the research data was collected, is situated in Karima location. Here, the average annual temperature is 16.8 °C. Average rainfall is 1,401 mm per year (climate-data.org, 2016). The center of Gatugi is located along the road 3.5 kilometers Northeast of Othaya town with an elevation of 1740 masl. (citipedia.info, 2016). In the village, there are approximately 300 households ( source: Assistant chief ). Most households are small-scale farmers planting coffee and tea as well as small subsistence crops, maize, beans, banana, avocado and livestock rearing. In present days, they are inclined to plant new crops and livestock which emerge in recent years and values are not only for subsistence.

## 2.3 Research respondents

In the village, there are approximately 300 households ( source: Assistant chief ). Most households are small-scale farmers planting coffee and tea as well as small subsistence crops, maize, beans, banana, avocado and livestock rearing. In present days, they are inclined to plant new crops and livestock which emerge in recent years and values are not only for subsistence.

| Respondents | No. of respondents |
|---|---|
| Semi-structured Interview | |
| Respondents from households in Gatugi | 50 |
| Respondents from local agricultural office | 1 |
| TOTAL | 51 |
| Questionnaire Survey | |
| Pilot | 1 |
| Respondents from farmers who plant emerging crops | 31 |
| TOTAL | 32 |
| Spontaneous Focus group Discussion | |
| The Farmer Family (4 generations) | 6 |
| TOTAL | 6 |
| Structured Interview | |
| Mecadamia Nuts Agent (From local market) | 1 |
| Arabicum Flower Agent (From global market) | 1 |
| TOTAL | 2 |
| All Respondents Numbers | 91 |

**Table 1. Number of respondents interviewed in the research study.**

## 2.4 Chosen crops and livestock

In our project we have chosen to focus on four crops and two livestock (see table 1), as they were all present in Gatugi and had different properties[1]. Further on, we use the local names of them.

| Scientific name of crops/livestock | Family | Common name of crops | Local name of crops |
|---|---|---|---|
| *Macadamia spp.* | Proteaceae | Grafted macadamia | Hybrid macadamia |
| *Solanum betaceum* | Solanaceae | Tamarillo | Tree tomato |
| *Cucumis metuliferus* | Cucurbitaceae | Kiwano | Thorn melon |
| *Ornithogalum arabicum* | Asparagaceae | Arabian star flower | Arabicum |
| *NA* | Leporidae | Hybrid rabbit | |
| *NA* | NA | Bees | |

**Table 1. Chosen crops and livestock. Made by Amalie, Frida and Vanda.**

## 2.5 Positioning

As researchers we are not objective but subjective persons, therefore we have to be aware of our perceptions and position in the field. Prior to the fieldwork we all had some ideas about the locals and also about our project. For instance, we thought people would be less accommodating. These prejudices possibly affected our fieldwork but we tried to overcome them by being very open in our methods.

The village of Gatugi all seemed to know who we were and why we had come, as they had been informed by the chief. This made it difficult to observe everyday life in Gatugi, as everyone always noticed us. Most of our informants seemed happy to help us and often offered gifts, mostly fruits, upon our visits. This put us in a challenging situation, but one of our guides explained us that it is rude to reject such gifts and therefore, we decided to accept them. First we interpreted it as the informants felt they had been given something through the interview we had conducted and then wanted to reciprocate this with a small gift (Mauss, [1950] 2002). But as networking is very important for the Kenyans, we later interpreted it as relation-creating.

[1] See Appendix

While we conducted fieldwork in Gatugi we collaborated with two guides and one elder who also functioned as interpreters as we could not speak the local languages, Kikuyu and Kiswahili. This biased our data due to language differences, and therefore the interpreters might not found exact translations for what was said. Our guides furthermore influenced our visits of households at the beginning, which possibly affected our first semi-structured interviews and observations. However, later we made it clear that we intended to visit every household to avoid being biased by whom our guides knew.

## 2.6 Research methods

### 2.6.1 Landscaping

To study a dynamic volume like 'emerging', we started our learning process by familiarising with the 'landscape' we conducted research in. It was important to understand what kinds of ECL the farmers in Gatugi had. To gain knowledge about the environmental background and a visual understanding of Gatugi, we used different explorative methods (Caspersen and Nellemann, 2005) described in the following part.

### 2.6.2 Grand tour

Grand tour is just the beginning of the interview journey and is followed by a variety of questions that probe deeper into the domains uncovered through the grand tour initiation(Mary, 2006). At first, we intended to take a grand tour in Gatugi area with GPS during one of the first days to see what emerging crops smallholders are growing. In the field, the first grand tour was leaded by tour guides, and five households were selected by purposeful sampling and convenience sampling to understand EC/L conditions in the village. Then the group decided to focus on two emerging crops research, tomato tree and macadamia nuts . The supervisors suggested we need to know the overview of EC/L in the village. From the second day, we started the real grand tour, mapping EC/L in Gatugi. Through this method, we gained the general impression of EC/L in the village. This method, combined with semi-structured interview and questionnaire survey, run through the whole research process. Figure 2 is described the research route and locations that households were surveyed.

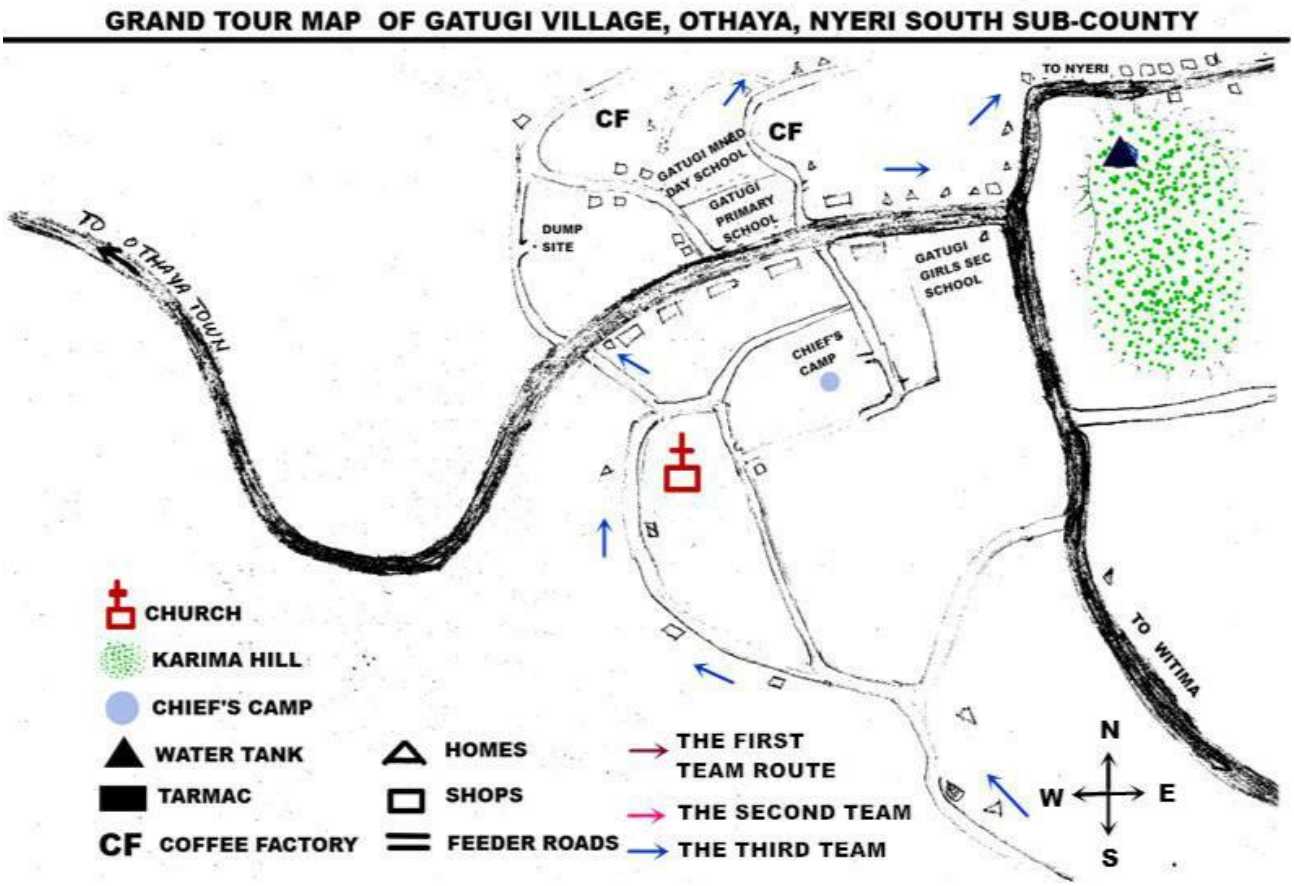



**Figure 2: The grand tour map of Gatugi. Source: Assistant chief.**

### 2.6.3 Participant observations

Our entire fieldwork was characterised by participant observation. Our host families were farmers like our respondents, and some of them also had ECL, which gave us the opportunity to do participant observations at home. We have used participant observation to get an impression of our research site and to understand our informants and their perceptions of the world. It has helped us to see what our informants did not say and what we did not ask them about. For instance we have been able to get an insight on how field days at Wambugu farm[2] take place and how the atmosphere is there. We documented our observations in notebooks and by taking pictures.

[2] Wambugu farm Agricultural Training Centre is a place where farmers can buy emerging crops.

### 2.6.4 Semi-structured interviews

Most of our interviews with farmers have been semi-structured. We used them as our primary method in the beginning to widen our perspectives of ECL. In most cases we kept to the semi-structured form as we wanted to keep the interview focused, but flexible at the same time. We asked specific questions, but at the same time enjoyed the freedom of going in-depth with a specific theme if the farmers said something relevant for our project. Many of our semi-structured interviews happened while we walked. Often, the farmers showed us their farms while we asked questions. That helped us to see the different ECL as well as their amount. The different kind of interaction created an atmosphere of co-presence and informality, which made the interview situation less contrived.

### 2.6.5 Farming system analysis

Initially we intended to conduct a nutrient flow analysis to investigate how the adoption of ECL affects a farm in contrast to a non-adopting farm. However, as this method is fairly data and time demanding, and a miscalculation of time-frame, we chose to perform a simplified version and called it "Farming system analysis". The purpose of this analysis was to depict benefits, allocation strategies, importance of ECL and assess improvement potentials on the farm. In addition, whether we are able to outline any signs of lack of knowledge.

We were provided with a comprehensive overview about the main resource flows of the household-, crop- and livestock system and their relation to the market system. As gathering data on lower yield crops was fairly onerous, the nutrient map contains estimated amounts regarding harvesting and consumption, as in some cases they were almost negligible or was used only for subsistence. Therefore, we used scientific literature to extend the missing data, including but not limited to animal feed and crop yield.

### 2.6.6 Soil sampling

The intended purpose of this method was to investigate the effects of intercropping and how homogenous the soil quality is in the area. However, due to time limitations and lack of experience in soil science, we could not gather sufficient amount of data to answer these questions. Therefore, we decided to use the results to triangulate our respondents' intuitions on their soil quality and hence reduce bias. We selected four sites with similar backgrounds in terms plot size and the amount of manure used. We compared overall farming areas from two

sites; one where emergent crops were not present and soil quality was perceived as satisfying, with another where emergent crops were present but the soil quality was perceived as poor.

The other two comparisons were made on plots allocated only to tree tomatoes. At one site the quality of soil, plant and yield was perceived high, whereas at the other site the farmer had been encountering yield and plant quality issues, and believed it was due to poor soil quality. Therefore, we intended to examine those two plots allocated to tree tomatoes.

Composite samples were taken from all of the farms by a soil auger from the upper 20 cm of the sites and we measured pH and permanganate oxidizable carbon content. However, the results are not of significant importance as the low number of samples (n=5) are not sufficient for a statistical analysis and they rather served to reflect on farmers' perception. Although the experiments contributed greatly in widening our knowledge in natural sciences.

### 2.6.7 Structured interviews

We chose our interviews with non-farmers to be structured as it was more specific knowledge we aimed for when we conducted interviews with them. Therefore, our interviews with agents and the government representative were structured. The order of our questions was to some degree chanced as well as some extra questions were added, in order to obtain the best possible data.

### 2.6.8 Survey

In the synopsis, this method aimed at mapping out the farmers' general practices. Four parts in the questionnaire were designed. The first part shows social factors are queried such as age, households size, education and so on. The second part focuses on investigating what crops respondents grow, when they had EC/L and the challenges they face etc.. The third part is how they get the information of emerging crops and training. The fourth part is market factors.

In the field work, the questionnaire was used to look into households with EC/L. At the beginning we made the surveys by sampling randomly to find the households. Subsequently, due to time restriction, we also used snowball sampling to target these households. The questionnaire should be a written document that is completed by the person being surveyed (source: through supervision), but in the field, the respondents can only answer the questions

through the translator or they talked more when they answered questions. so we had to lead them back to the surveys, filling in the questionnaires by ourselves. Some of the questionnaire surveys were like questionnaire survey mixed with interview survey. And the important information they mentioned was recorded on the blank of the survey paper.

### 2.6.9 Spontaneous focus group interviews – a note on how flexible fieldwork can be

Between two interviews we took a break under the shade of a tree along a road. Suddenly a farmer passed by and was curious about who we were and what we were doing. We told her our reasons and started talking with her and asking questions about ECL After some minutes more farmers joined our conversation about ECL and its relation to coffee. That created an opportunity for different opinions to be brought to light. We did not try to control the discussion, but to keep it open and only guide the farmers in the direction of our study. We did not want them to agree in the end either, but to have a friendly conversation about differences between their thoughts and perceptions of ECL. Other of such sudden opportunities arose during fieldwork and it seemed very much to be a part of it. For us it has seemed very exciting, but also sometimes stressful, because we have had to change plans very instantly.

### 2.6.10 Discussion of the interaction/relation between natural and social science

To answer our objective, we used both qualitative and quantitative methods due to our interdisciplinary problem statement.

Data gathered solely from either natural or social science would not grant satisfactory results as both study areas are highly influenced by each other, whereas the combination of natural, social and cultural aspects can provide a more holistic overview (Hansen & Simonsen, 2007).

As it is imperative to understand the reasoning behind farmers' decision in whether or not to adopt cash crops, we examined the farmer's natural, human and social capitals and their influence on each other and thereby, we applied a combination of methods from both social and natural science. For instance we used our soil samplings to verify whether farmers' perceptions about their soil were correct and to investigate a possible knowledge gap.

# 3 FINDINGS

This chapter intends to introduce our findings. First we give a more detailed presentation of ECL in Gatugi, illustrated by a chronological calendar made on basis of interviews. Then we proceed to explain the typical development and spread of an ECL. Then the results from analysing survey data show the relations between social factors and engaging in ECL farming, the ranking of ECL, constrains and drivers, and then triangulated chronology of ECL by the survey data. Thenceforth, we elaborate on the cash crop coffee and how it has affected the adoption of ECL. Finally, we introduce our findings from farming system analyses.

## 3.1 Chronological calendar

We have designed a calendar to elaborate on ECL (figure 3). The purpose of the calendar is to answer the following research question:

- When have the ECL we focus on been present in Gatugi within the past 70 years?

The calendar shows periods the selected ECL have been present based on our collected data. It goes 70 years back as our respondents could not remember further back in time.

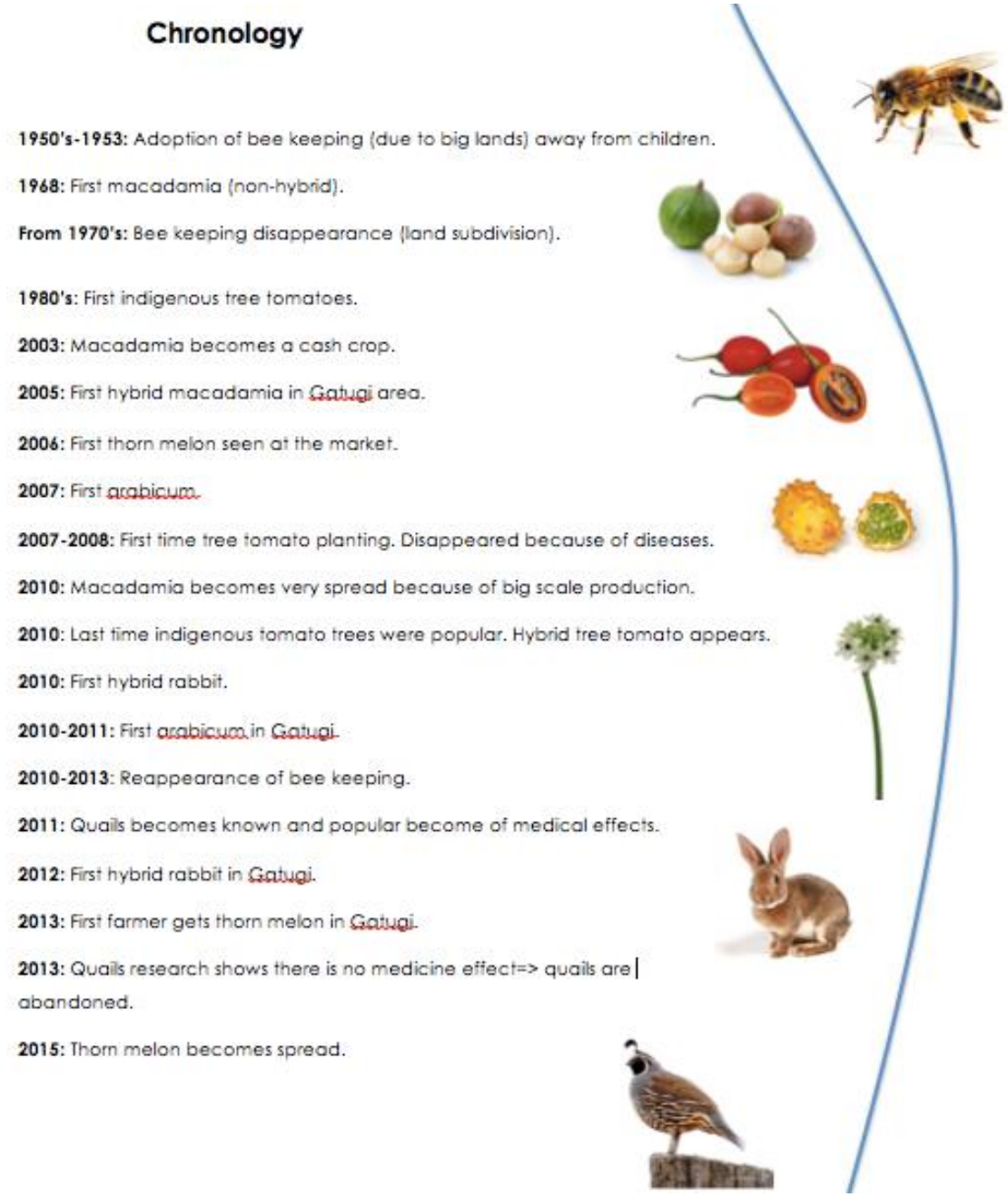



**Figure 3. Chronological calendar. Based on our data collection. Made by Amalie, Frida and Vanda.**

It appears how different crops/livestock have been popular at different times and also why they have disappeared and re-entered in Gatugi. The calendar shows how land use is dynamic and how some crops suddenly became popular. As both the presence of quails (2011-2013) and bees (1950s-1970) illustrates, some ECL can suddenly disappear due to changes in the

surroundings. Further, the example with bees also shows how ECL can reappear as a few farmers started in 2010 having bees again after a period of 40 years without them.

Thorn melon was the newest of the crops we worked with (2013) and hybrid macadamia was the oldest (2005). However it is important to note, that it normally takes some years for crops and livestock to become widespread. For instance 64 % of the farmers in our survey had macadamia, where only 38 % had thorn melon. The spread of the crops are of course also determined by other factors, but we find time is a central aspect. Building on the observations in figure 3, it is possible to generalise the development of ECL, which we present in the following section.

## 3.2 The journey of an emerging crop/livestock

To further elaborate on ECL, we would like to give a review of the ECL timeline in Gatugi based on our collected data. How ECL develops is very different from crop to crop and livestock to livestock, and therefore this chapter offers only an overview of the general timeline for an ECL. Here we intend to answer the following research question:

- What is the general timeline for an emerging crops/livestock?

We tracked many of the crops/livestock to have come from either a neighbouring country or other counties within Kenya. A farmer or a family member travels, and on his way encounters a new kind of crops/livestock. He decides to bring some seeds or one creature with him home. Then he starts growing the crop or having the livestock, having said “just for experimenting”. He only has one or two plants/animals to see if they can figure out how to treat them. Local farming institutions hear about ECL as well and ECL starts getting promoted there. This is followed by rumours about how the crop/livestock performs and how farmers earn a fortune on investing in them. This is backed up by the majority of our informants. It occurs simultaneously with a few farmers start selling the crop/livestock. By extension, more farmers learn about the crop/livestock and more farmers start experimenting, most often with the vision of selling in the future as soon as they have had sufficient knowledge about the ECL. This phenomenon spreads until almost everyone has the crop/livestock either for subsistence but often for commercial purposes as well. Whether the crop/livestock survives and becomes a regular part of the farm depends on what challenges are met and how well they are overcome. As it appears in figure 4 the crop/livestock does sometimes disappear and sometimes it stays for many years.

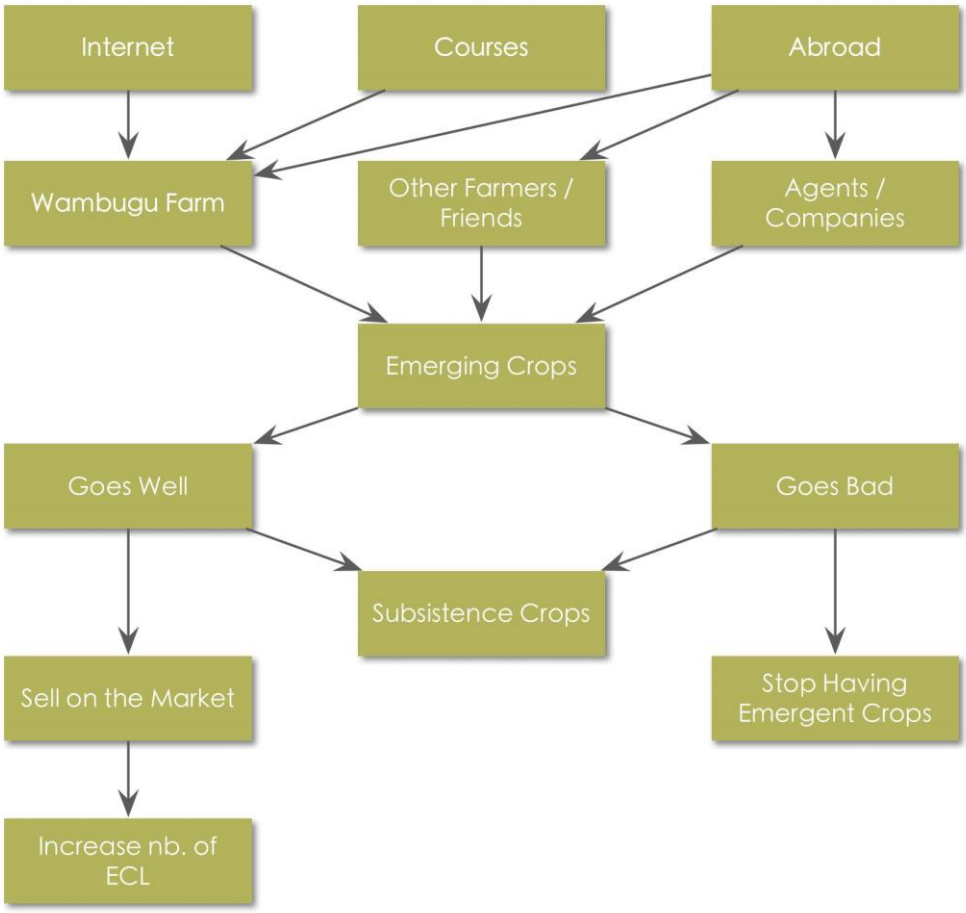



**Figure 4: A typical development of an ECL. Based on our data collection. Made by Amalie, Frida and Vanda.**

What we have done here is to highlight a typical development of an ECL and therefore we have generalised.

## 3.3 The results from survey data

Data source, 31 questionnaires of the survey from the farmers who have EC/L.

**a. Factors of age, household size, plot size, education**

In our random sampling survey, we gathered the farmers who have EC/L, 2 respondents are under 30 years old, 11 respondents are above 60 years old, the main group engaging in EC/L farming are from ages between 31-60. Farmers from different ages show different characteristics on their household size, plot size and education. The table in the following is the statistics of the factors.

We can see from the table, that most of the farmers have education. The farmers less than 30 years old have small plot sizes comparing to their household size. The farmers between 31-60 years of age have large households sizes. In the plot size, the farmers under 1 acre are almost

two times of farmers between 1-3 acre in numbers. The inadequate living conditions and adequate labor force are possible motivation that influence them to have EC/L. Above 61 years-old farmers have large plot size and the household size appears downwards comparing to the farmers of 31-60 years old. From table 2, they have more various EC/L that could be in view of their capital strength.

| Age | Household size (person) | | | Plot size (acre) | | | Education* | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | Within 2 | 3-5 | Above 6 | Within 1 | 1.1-3 | Above 3.1 | 1 | 2 | 3 | |
| 30- | --- | 1 | 1 | 1 | 1 | --- | --- | 1 | 1 | 2 |
| 31-60 | 3 | 9 | 6 | 12 | 6 | --- | 1 | 4 | 13 | 18 |
| 61+ | 3 | 6 | 2 | --- | 6 | 5 | 1 | 7 | 3 | 11 |
| Total | 6 | 16 | 9 | 13 | 13 | 5 | 2 | 12 | 17 | 31 |

**Table 2: The statistics of social factors of EC/L farmers in Gatugi**

*** education: Non-education-1; Primary education-2; Secondary education and above-3**

**b. Ranking of the emerging crops that farmers have in Gatugi**

From the table, we can see that MN, TT, TM are the top three emerging crops in Gatugi, but in 10 households who plant TM, only one household sell TM to the market. On the contrary, 18 households sell MN and one household just bought the young trees without any harvest. Only 4 households plant AF, and all are for sales purpose. TT in quantity is ranking second, that the numbers for sale and consumption are equal, 6 households. If ranking the EC/L according to market value, the sequence is MN, TT,AF, as top three emerging crops that Gatugi farmers grow (BEE is not counted because only one respondent sell honey).

| Plot size (acre) | MN* | TT* | TM* | AF* | BEE | RB* | Total quantities | Total households | Diversification multiples* |
|---|---|---|---|---|---|---|---|---|---|
| Within 1 | 8 | 4 | 3 | 1 | 1 | 3 | 20 | 13 | 1.54 |
| 1.1-3 | 7 | 6 | 3 | 3 | 1 | 1 | 21 | 13 | 1.61 |
| Above 3.1 | 4 | 2 | 4 | 0 | 0 | 1 | 11 | 5 | 2.2 |
| Total | 19 | 12 | 10 | 4 | 2 | 5 | 52 | 31 | --- |

**Table 3: The ranking of EC/L stratified by plot size in Gatugi**

**MN* Hybrid macadamia nuts; TT* Tree tomato; TM* Thorn melon ; AF* Arabicum flower; RB* Rabbit.**

**Diversification multiples : The varieties of EC/L in one household.**

All five households who raise rabbits don't sell them in the market.

The households with the plot size within 1 acre and 1-3 acre have similar diversification multiples. And the households with more plot size have more diversification multiples.

**c. The ranking of challenges for farmers**

EC/L farmers face many different challenges. The table below shows the main challenges.

| Challenges | MN | TT | AF | TM | BEE | Rabbit | Total |
|---|---|---|---|---|---|---|---|
| Disease and Pests | 7 | 5 | | 4 | 1 | | 16 |
| Financial Capital | 3 | | 3 | | | | 6 |
| Lack of water | 3 | 5 | 1 | 5 | | | 14 |
| Small plot size* | 3 | 1 | | | | | 4 |
| Died in rain season | | | | | | 4 | 3 |
| Lack of manure | | | 1 | | | | 1 |
| Soil Quality | | | | 1 | | | 1 |
| Theft | 1 | | | | | | 1 |
| No Challenges | 2 | 1 | | | | 1 | 4 |
| Harm kids | | | | | 1 | | 1 |
| Total | 19 | 12 | 4 | 10 | 2 | 5 | --- |

**Table 4: the main challenges of planting emerging crops in Gatugi**

**Small plot size*: Some respondent mentioned, that MN grow bigger than coffee and cover sunlight to coffee, some respondent felt it challenging that he can't plant any other crops under MN. Both views refer to small plot size.**

From the respondents information, the top three challenges for all EC/L are disease and pests, lack of water and financial capital. If we look through specific emerging crops, the main challenges of MN are firstly disease and pests, secondly lack of financial capital, lack of water and small plot size. As for TT and TM, the main challenges are disease and pest, and lack of water. The main problems for AF is lack of financial capital.

In the survey process, the farmers who raise rabbit showed their anxiety, because they don't know why their rabbit died, when the rainy season came.

Disease and pests problems can be reduced gradually by training. To solve financial problems is a long term task and lack of water need to be supported by government investment on infrastructure.

**d. Information and market factors**

From the information part, we investigated information source and the training conditions in the village.

We investigated where the farmers sell their EC/L and which EC/L have the most monetary value per year.

| | Information source | Training | | Remark |
|---|---|---|---|---|
| | | No | Yes | |
| Family&Friends&farmers | 20 | 11 | | Among the 16 respondents facing disease and pests, among them, 12 persons have no training, 2 persons claimed they trained in the government field days, 1 person received at Wambugu farmer, 1 person received in KTDA. |
| Government field day | 2 | 1 | 3 | |
| Wsmbugu | --- | | 2 | |
| Organizations and agency(NGO,AGENT) | 1 | | 4 | |
| Other places (Market, other counties,KTDA) | 7 | 5 | 3 | |
| School | 1 | | 2 | |
| Total | 31 | 17 | 14 | |

**Table 5: The statistics of information and training conditions in Gatugi**

AF has the highest Monetary value per year. MN ranks second, and is also the crop that most farmers are planting. Most of the EC/L are sold in the local market. 4 respondents claimed their MN were sold in Global market. All the respondents planting AF confirmed their products are purchased by Wilmer company which sell directly AF to Holland. The calculation of monetary value is an average number for one year sales per person. The MN respondents stated the quantities they sold every year around 130-140kg and 60-70shillings per kilogram. The TT respondents every season sold TT around 1600shillings and they harvested two times a year. There is standard price system for different grade AF. The average price is around 5 shillings one flowers. The respondents can sell 3200-3700 flowers per year. There is only one respondent from bee. He said bee price is fluctuated between 600-800 shillings per kilogram. Every year he can sell around 12kg to the Iriani Tea factory and

local market.

| Where to sell | | | Monetary value (shillings/year) | | | | |
|---|---|---|---|---|---|---|---|
| Local market | Products company | Global market | MN | TT | AF | TM | BEE |
| 20 | 4 | 4 | 8000-9000 | 3000-4000 | 17000-18000 | --- | 7000-8000 |

**Table 6: market factors of emerging crops in Gatugi**

**Results from the survey:**

1. Relations between social factors and engaging in EC/L farming

- The main group engaging in EC/L farming is between 31-60 years old, who are facing inadequate living conditions and adequate labor force.
- Above 61 years-old farmers have more diversification multiples and the minority to have EC/L is from young people under 30 years old.

2. The ranking of EC/L

- The ranking of EC/L in quantity: MN, TT, TM
- The ranking of EC/L in market value: MN, TT,AF

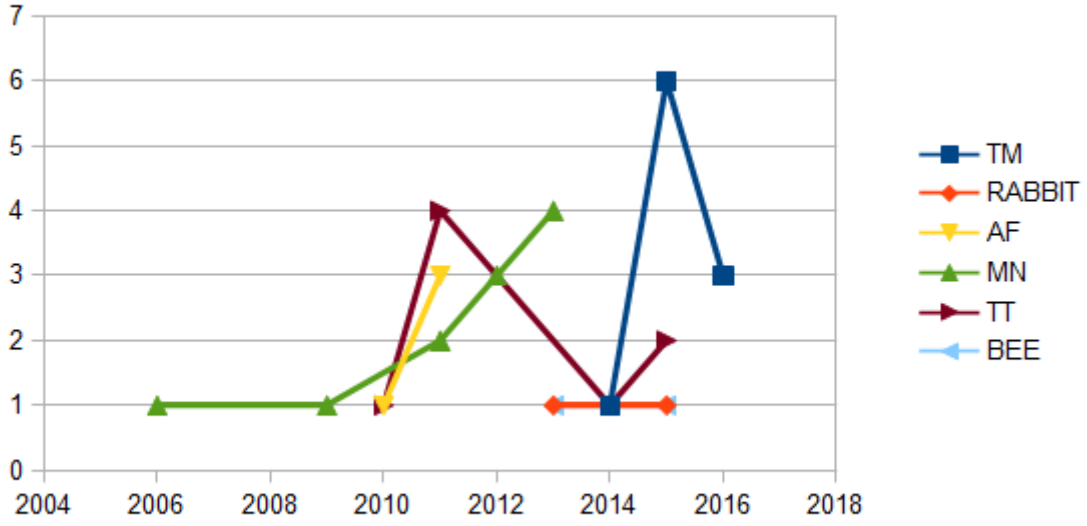
3. Main three constraints: training, financial capital and irrigation system.

4. Drivers:

- From MN and AF, we can see there isn't only one main driver for farmers to decide which EC/L grow. The profit is one of the drivers. We need to explore more characteristics of MN and AF, even TT, TM to find more drivers.

**The chronology of the EC/L from survey**

**Figure 3 : Booming and Developing Chronology of the six EC/L in Gatugi**




**Data source: 31 questionnaire survey in Gatugi**

The booming of MN was  in 2006. Between 2006-2008, MN was in experiment time. After that MN was increased stably until 2014. Since 2010,  AF had a explosive growth and then no new farmers joined after 2012. TT had a booming in 2010 and then disappeared. In 2014, TT started to develop again. The booming of TM was in 2014, and within these two years, TM is developing quickly.

## 3.4 Information sources

Now we elaborate on different information sources the farmers have access to, based on what institutions and information source representatives told us about themselves. We will do this in order to answer the following research question:

- How do farmers learn about ECL?

### 3.4.1 Wilmar Flowers Ltd. agronomists and agents

In the production of arabicum flowers the agents play a big role. A flower company called Wilmar Flowers Ltd has employed agents to promote the flower among the farmers. He drives to Gatugi with a refrigerated van to certain collection points and buy the flowers at a so called 'collection day' from farmers. The collection day is happening on a weekly basis. Moreover, the seeds can only be purchased through the company and its agronomists provide all the necessary information about both horticultural and market knowledge of the flowers (interview A) Therefore we asked farmers if they had ever contacted the agronomist, but they had never.

### 3.4.2 Agricultural extension officer

The agricultural extension officer represents the government in the area. His role is to assist farmers in applying good practices on their farm. According to him, it is the national government who deals with ECL and his job is only to handle the cash and subsistence crops (Interview B). He also told us that field days are held on demand for disease training and that once a week a plant clinic was open for farmers to come with their diseased crops and get recommendations from an agronomist. The officer did also mention that farmers were assisted whenever possible by the government.

### 3.4.3 Wambugu farm

During our interviews and questionnaires we became acquainted with Wambugu Agriculture Training Center located in Nyeri, which we longed to further investigate as we saw it as a potential information source. Wambugu farm was placed on a field and is divided into two different sections. One where new crops were presented and sold and one where different associations and small booths were located. We observed that there were no official salesmen,

but only individual farmers, who sold their crops, even though we were told that Wambugu Farm is sponsored by the government and the local university. We encountered one who gave a typical sales speech on her tree tomatoes. She was obviously trying to sell her crops, which is why she presented them as wonder-crops. We also talked to other farmers, who explained that they had gained their knowledge from either participating in courses, via internet or personal experiments.


**Figure 5. Emerging crops solb by private farmers from the luggage compartment of a car.**

To get a broader impression of the information flow, we asked several of the sellers if farmers ever returned to get more information if for instance they had problems with the crops they had bought. None of them had ever tried that.

**Figure 6. Seller at the Wambugu Farm. In this stall hass avocado and tree tomatoes are sold. Also, an entirely new crop, called pepino melon, was promoted.**

Thenceforth we visited the other part of Wambugu farm where several booths were placed. However, here neither any formal information was provided about ECL.

After our visit at Wambugu Farm we were very surprised. We had got an impression from the farmers that it was more of an education center than a marketplace in contrast to the original aim of Wambugu farm, which was to introduce and sell crops. Due to the sales agenda, knowledge provided by Wambugu farm is hugely biased.

### 3.4.4 Coffee

We now elaborate on how we reached the finding that coffee affected the adoption of ECL. We do this to answer on the following research question:

- How does the traditional cash crop coffee affect the adoption of ECL?

Coffee is a widespread cash crop in Nyeri, and is a great contributor to the Kenyan economy both on individual and national level (Thuku et. Al., 2013). During our fieldwork a range of different relations between coffee and ECL appeared. Our survey showed that 77 % of the farmers had coffee besides ECL. Further, most of our informants had had coffee before they had ECL.

Due to the frequent appearance of these aspects related to coffee, we asked our elder about his impression of the area's old primary cash crop. He explained how coffee in the 1970s had been a good business, how it made farmers able to send their children to school (interview G). However, that picture changed fast as a result of mainly political reasons, for instance corruption.

Some of our informants told us that President Uhuru Kenyatta is trying to fight corruption. However, many farmers chose to abandon coffee for the sake of ECL. Some of the previous coffee farmers motivated their exit with *"the profit was too low"* (interview D) and referred to the coffee price falling since the time when it was called the black gold. After the glorious coffee years in the 1970's, too many farmers worldwide decided to grow coffee and the increased supply lead to price pressure. The low price left many farmers in debt and despair (Addison et al., 2015).

The description of the 'good old days' for the coffee farmers was common for the current farmers as well as the previous. As an older farmer explained, "*now is it only the old people who remember their old friend [the coffee]. The young people want to try new crops*" (interview E). This might be due to the older farmers are more resistant to changes, but it

might also be because they are the only ones who can remember that the coffee industry has once been good.

According to a farmer, who had coffee had tree tomatoes, problems for coffee farmers arose under President Daniel Moi. Further he stated how politicians since had been making promises but only few things had happened. This had led to that he in the future wanted to replace his coffee (interview F).

Another context, where the conditions about coffee farming was present in relation to start having ECL, was the time span between delivering the coffee beans and the receipt of payments. The time span for coffee farmers is normally 6 month, which many farmers found highly problematic, as it meant that they had to pay their workers and feed their children. Furthermore, this aspect seemed to be problematic as it was closely linked with farmers' worries about not getting any payment at all. It seemed as the longer the farmer had to wait for the payment, the more unlikely he found that he would get paid at all.

To conclude, this shows that the reason to have ECL is sometimes more a de-selection of coffee, than a selection of the new crop.

# 4 DISCUSSION

Here we discuss our findings. As our report focuses on farmers' decisions and all the factors affecting the farmers' decision are interrelated, our chapters are also highly connected and overlapping. Firstly, we will discuss the knowledge gap, then agents, market and profit and lastly risk.

## 4.1 Knowledge gap

Where do farmers find knowledge about ECL? Knowledge plays a huge role on having ECL and according to our respondents, it was a serious problem for some of them even though we identified several information sources providing information on ECL. In this chapter we intend to discuss farmers' perceptions of ECL based on the information available, and thereby, to answer the following research question:

- How does existing information sources influence the farmers' knowledge and adoption of ECL?

### 4.1.1 Farmers and information sources

29 % of the farmers have attended or used the help of the institutions providing knowledge. There could be several reasons behind this. For instance 21 % of our respondents believed that the information/help they had access to have not been helpful.

Other reasons not seizing these opportunities for information was lack of time and too high age. The farmers mentioning lack of time could be in relation to that the information is not helpful and therefore it is waste of time to try to get it. It could also be understood as though it is too hard to get the information because of transportation to the information sources. In regard to age, it can be hypothesized that elderly people are more resistant towards change and risk taking, which some of our semi-structured interviews also point to. Further, older farmers are often less willing to make long term investments and also less willing to take risks (Mwangi & Kariuki, 2015). Last but not least, our respondents might not be aware of these institutions in the first place, and therefore not attend them, as many of the farmers explained they would be willing to adapt new technologies or crops, if they knew more about them. Several of our informants had not heard about Wambugu Farm when we asked them during semi-structured interviews. Considering only 29 % of our respondents have attended or used

the help the information sources offer, this might explain why farmers do not know these institutions.

The information we gained at Wambugu Farm differed from the stories we encountered in Gatugi. This is due to that the information at Wambugu farm originated from farmers selling crops. That however we find very paradoxical. If farmers get their information from salesmen it is no surprise that the information they get does not meet the information they need.

The farmers who did receive information, shared it within their social network, and in that way information does spread, although slowly, through observational learning. Those who succeeded with the crops/livestock are a good example for their neighbours and friends. According to our survey, 57 % of the farmers heard about ECL from either a family member, a friend or another farmer and in 42 % of them heard about ECL from an educational institution or from another source. This substantiate that farmers' experiments and success are encouraging for their surroundings.

However, in general the farmers do not receive information and especially not qualified information. This demonstrates that there is a lack of access to qualified knowledge.

### 4.1.2 How does farmers' information affect the adoption of ECL?

We now present how knowledge gap affected farmers' adoption of ECL.

Tree tomatoes' root system is relatively small and not extensive, why the plant is vulnerable to droughts and strong wind. Therefore, to reach the maximum yield, the plant need a stable supply of water (Prohens & Nuez, 2001). This fact inspired us to investigate if the water supply was a challenge for farmers with tree tomatoes. The answers varied between a "lot" and "not much". This contradiction and the information from the saleswoman at Wambugu Farm also substantiates the presence of a knowledge gap and a lack of qualified knowledge that affects the adoption of ECL. Several studies also points to that lack of information is a challenge in relation to adopting new farming technologies (Mwangi & Kariuki, 2015). Information is both necessary for the farmers in relation to knowledge of the existence of ECL, but also in relation to know how to treat the plant subsequent.

Another example is thorn melon, which are known among farmers for their positive effects on health for instance they are said to reduce blood pressure (interview H). Many of our respondents mentioned they started growing thorn melon because they had heard about its

benefits. We wondered if it was just a belief or an actual fact, but the positive effects of thorn melon is supported by scientific literature (Dembitsky, et al., 2011). In relation to ECL health has also earlier been an important aspect. Around four years ago quails were the major emerging livestock. One of our guides told us about the fast spread of quails. In Smart Farmer Magazine, from December 2013 the health benefits are described: "*Eating the eggs, it is said, boost the physical and mental balance of children, while improving their IQ. The eggs are also said to help counter the ageing effects in the human body.*" (Maina, 2013:44). The magazine was introduced to us by the elder in our group. He told us, that much of the information he had gained about quails was from Smart Farmer Magazine. However, when it turned out, that the promised health aspects were not true, the demand decreased dramatically. This is another example of how the lack of knowledge and in this case qualified knowledge led to unproductive investments. Further it shows how health also is a reason for farmers to have ECL.

### 4.1.3 Soil quality

A retold reason for not planting emergent crops was, a perception of bad soil. According to a farmer, agronomists and extension officers do not provide any information regarding soil (interview A). Therefore, farmers perceive their soil either as good or bad quality without any scientific evidence behind it, which can become problematic when a new crop is to be adopted. To test whether the farmers' perceptions of their soil were correct we collected soil samples and analyzed them (see appendix 3). Based on our results we can conclude, that our respondents' intuition on their soil quality were both correct and incorrect. In regard to the overall land quality, the farmer stating low soil fertility, was indeed accurate. However, pH values for all the investigated soils are considered favorable for most crops (Breuning-Madsen & Krogh, 2013), we assume more qualified knowledge would contribute to higher soil fertility and yield.

### 4.1.4 Sub-conclusions

We have now analysed and discussed how information sources affect farmers' decisions on ECL. We have found that there is a lack of qualified information, as the information farmers obtain now is often biased and contradicting. Further, we have discovered that this knowledge

gap affect the adoption of ECL and also how assumptions about soil is not build on scientific knowledge.

## 4.2 Agents, market and profit

How do farmers connect to the market and what do they expect from it? Profit was one of the main drivers for many farmer to have ECL. However, to sell several of their ECL they had to communicate with agents. But before being able to sell to the market the farmers had to invest in ECL. This chapter will discuss these observations in order to answer the following research questions:

- How do agents affect the farmers' relation to market of ECL?
- How do the farmers anticipate the market?

### 4.2.1 Agents

In this section we analyze how the farmers with ECL are connected to the market. Both macadamia and arabicum are typically sold through a connecting link - by the farmers known as agents. The role of agents will first be analyzed in connection to arabicum and then macadamia.

### 4.2.2 Arabicum

The fact, that we found a horticulture product as emerging in Gatugi fits well with the existing academic literature on the area. The global demand for horticultural products is increasing, which creates an economic incitement for companies to connect rural farmers with the global market (AFCAP KENDAT and Partners, 2013). Further, the topic has been on the 'development agenda' in recent years (AFCAP KENDAT and Partners, 2013 & Wanyama et al., 2010). The Kenyan government made several strategies[3] to improve the productivity in the country's agricultural sector. The improvement strategies were largely made through privatization and public-private partnerships and in Kenya's plan called Vision 2030, the

[3] Economic Recovery Strategy for Wealth and Employment Creation (ERS) policy framework produced in April 2003. 2) Strategy for Revitalising Agriculture (SRA) that was launched by the President in March 2004. Vision 2030 in 2008 (Central Bank of Kenya, 2007 )

agricultural sector is the main driver for the country's goal on an annual growth rate on 10 % (Central Bank of Kenya, 2007 & AFCAP KENDAT and Partners, 2013).

Wilmar Flowers Ltd has employed agents to both promote and collect flowers from farmers. The company's active promotions could indicate that arabicum's presence was created from a top-down oriented practice. This means that the farmers' decision about having emerging crops is formed by the company and therefore deprives some of the farmers' agency.

**Figure 7. Flower collection day. Arabicum flower agent showing 1. grade flowers in front of the refrigerated van.**

The payment system for arabicum is detailed and highly systematized by the company. Every flower is measured and placed into 4 different categories at the collection day, determined by e.g. stalk length. The prices fluctuate in relation to for example seasonality. Compared to the prices we had heard before we met the agent, they were low at the collection day (table 2).

| Grade | Price |
|---|---|
| | KES/flower |
| 1 | 9 |
| 2 | 2 |
| 3 | 3 |
| 4 | 2 |

**Table 2. Arabicum prices based on grades.**

The farmers normally do not know the week's prices before the collection day. The huge differences in price between grades are relevant in relation to knowledge. If the flowers do not have the right conditions while they grow, only very few will meet 1. grade criteria. The UKaid report also mention '*lack of information and training*' (AFCAP KENDAT and Partners, 2013: 14) as a huge challenge for the farmers.

Even though arabicum is a high value crop and hypothetically can provide a high income, we did not get the impression that it was the case due to primarily two aspects: huge price fluctuations and a lack of knowledge and information about how to grow the flowers.

### 4.2.3 Macadamia

The role of the macadamia agent in Gatugi is quite different from the arabicum agent. Where the arabicum agent is employed by a company, the macadamia agent we talked with was self-employed and his contact with the farmers was solely buying. Like the prices on arabicum, the macadamia price varies as well during the year. The agent told us, how the prices in good periods are 150 KES/kg for hybrid nuts, but the prices the day we met the agent were 80 KES/kg for the indigenous and 90 KES/kg for the hybrid.

**Figure 8. Macadamia agent buying nuts from a farmer.**

On top of the seasonal price fluctuations, we also experienced another type of variation. During our interview with the agent, a farmer visited the place to sell her macadamia. She had

25 kg of indigenous nuts and got 1.750 KES and therefore 70 KES/kg. As the arabicum farmers, she did not know the prices before she went to the agent, therefore the price was not called into question. This is an example of why it is problematic that the farmers do not have access to more information. The unawareness of the current prices could indicate, that the farmers are not well organized or do not share knowledge with each other about prices. This could fit to what we were told by a man employed by the agricultural ministry (at Wambugu farm). He said that the biggest problem with farming groups was, that many farmers did not show up at the meetings.

The unawareness of the prices might also be linked to farmer's traditions. The agent told us how his experienced, that most people did not take the macadamia harvest seriously compared to tea and coffee. He experienced only few farmers whose income was based on macadamia nuts.

### 4.2.4 Profit, market expectations and investment

Now we discuss farmers' anticipation of the market.

Every time we asked a farmer about the reason for having ECL, economic profit was mentioned. Furthermore, high prices and high market demand were the typically mentioned terms. One female farmer told us *"there is a big market for tree tomatoes. The price goes more and more up"* (interview J). Sometimes farmers described the future market in an almost utopian way. We found that very paradoxical. According to our view the market was not always good for ECL. The prices on macadamia, arabicum and rabbits fluctuate a lot and for us the prices did not seem very high. For example one farmer told us that arabicum prices can vary between 7 and 17 KES for a first grade flower. However, we have reflected further on this and have come to the conclusion that the farmers have a different view on what a good market is than we do. First, we interpreted it as a lack of knowledge about price fluctuation. But they did not mention it as a challenge even after they started to have and sell ECL, even though they mentioned many challenges and reasons for not having ECL. This might be related to how the farmers are used to the coffee market, where the prices have fluctuated enormously and where they sometimes have not been paid at all.

A challenge that the farmers on the other hand did mention is the investment that ECL requires. The investment was also a hindrance for people who did not have emerging crops.

The size of investment however depends on the specific crop/livestock. For instance thorn melon only requires one fruit from the market to get seeds. However, in terms of bees the adoption requires not only the bees themselves, but also bee hubs and beekeeper uniforms. In that way it can be very expensive to change to ECL, which is why it is the more privileged farmers who choose to invest in ECL. Thus, it depends on whether the farmer have the funds to invest or not. However, the investment span was shorter for some of the old cash crops according to the extension officer and the farmers and therefore it became a driver to get ECL for the farmers.

#### *4.2.4.1 A case example – Hybrid rabbits*

The interest in hybrid rabbits is connected to market expectations. One farmer told us that a governor had invested 5 mio. KES in a new rabbit slaughterhouse in the neighbouring town, Karima, which had inspired her to start having hybrid rabbits, so that she would know more about rabbit farming when the slaughterhouse opened (interview I). Therefore, the promise of a future market that lead to an investment. The slaughterhouse is, according to the extension officer, to encourage the farmers to diversify their farm activities. However, for us it seemed strange that she wanted to invest in something there was no market for yet. Nonetheless, she was not the only one, another farm told us a similar story (interview D). Thus, even though from our point of view there was no market and therefore no profit, the investment still made sense for the farmers.

### 4.2.5 Sub-conclusions

The agent's role is important in relation to connect the farmers to the global market. Knowledge gap about price fluctuations is a challenge for the farmers, that results in a low price. Therefore, the agents affect the farmers' relation to the market in a nonproductive way. However, the farmers still have very good anticipations of the market and do want to invest in ECL if they can afford it.

## 4.3 Risk

What risks might affect ECL and result in economic loss? And how can investing in ECL be a strategy to reduce risk? Both approaches of risk were mentioned by our respondents and therefore we discuss both in the following chapter. This to answer the following research question:

- What are the risks related to ECL and how do local farmers understand and try to overcome these risks?

### 4.3.1 Main risks

Based on our findings, farmers face five main risks related to ECL, which could perhaps be avoided if farmers acquired necessary knowledge.

#### *4.3.1.1 Uncertainty*

Our respondents did not always know what kind of risks they would encounter with the ECL and neither how to overcome them. As mentioned, farmers have very limited and even confusing knowledge on how to manage ECL, which results in bad harvest or even asset loss. An example is the farmer Belis' hybrid rabbits. She decided to feed 14 new born rabbits with grass from her farm. Unfortunately they did not tolerate this kind of grass and all died. This example clearly demonstrates one of the risks related to ECL and the consequences caused by lack of knowledge.

#### *4.3.1.2 Pests, diseases and water*

Many farmers decided not to replant e.g. tree tomatoes as the previous batch had been damaged by pests and diseases and they did not have any information on how to solve the problem. One farmer had decided to accommodate this challenge by turning back to *"the old and safe crops"* (interview E). Also other crops and even livestock were attacked

**Figure 4. Tree tomato infected by pests.**

by various diseases and pests that the farmers did not know beforehand.

Water was likewise a huge issue according to the farmers. 29 % of our informants mentioned it as a challenge to having ECL. Moreover, they told us that water has always been a problem, however governmental actions are already in place to implement an irrigation system (observation at community feedback).

**Figure 5. One farmer had tried to protect his macadamia from pests by making a fence around the tree.**

#### *4.3.1.3 Thievery*

Theft was also mentioned in relation to ECL. We mostly heard about this in relation to tree tomatoes and macadamia but in some cases it was mentioned in relation to rabbits as well. As an evidence of awareness, some farmers took precautions against theft. One farmer had decided to build a fence around his tree tomatoes and another farmer planted the tree tomatoes close to his house. However, we did not hear of anyone who had actually experienced theft themselves. It was a risk constantly thought of by the farmers, but nevertheless it did not seem to be there. This shows a lack of information of which risks are present and which are not. Thus, this is another example of the knowledge gap.

### 4.3.2 Plot size and diversification strategy

Before we went to Gatugi we had the impression that plot size would be an important factor for the farmers in their decision on adopting ECL. The literature suggested that smallholders were less likely to adopt new crops (Njine, 2010) and therefore this was our hypothesis.

However, when we interviewed the farmers about constraints and challenges to having ECL they rarely mentioned plot size.

The explanation could be that either plot size was not of huge influence in decision making procedures, or it was considered as "common sense" which was not worth mentioning.

When we asked directly about plot size, some farmers agreed that it was a hindrance to getting ECL. But they also explained that plot size is a reason for the farmers to reduce risk through diversification. This is supported by Nyambari (2008) and Ellis (1998), who writes that diversification is more important for smallholders, than for larger landowners as diversification provides higher production and sustainability. By investing in different kinds of crops/livestock, farmers' livelihood can be ensured even in the case of a crop's failure.

### 4.3.3 Farming system analysis

We now analyse and discuss, how ECL is part of a diversification strategy in one household.

To show the connection we conducted a farming system analysis inspired by the nutrient flow map (figure 11). The figure demonstrates an overview of crop diversification and how the line between ECL to market and consumption in the household is not always clear and how investments in ECL happens progressively.

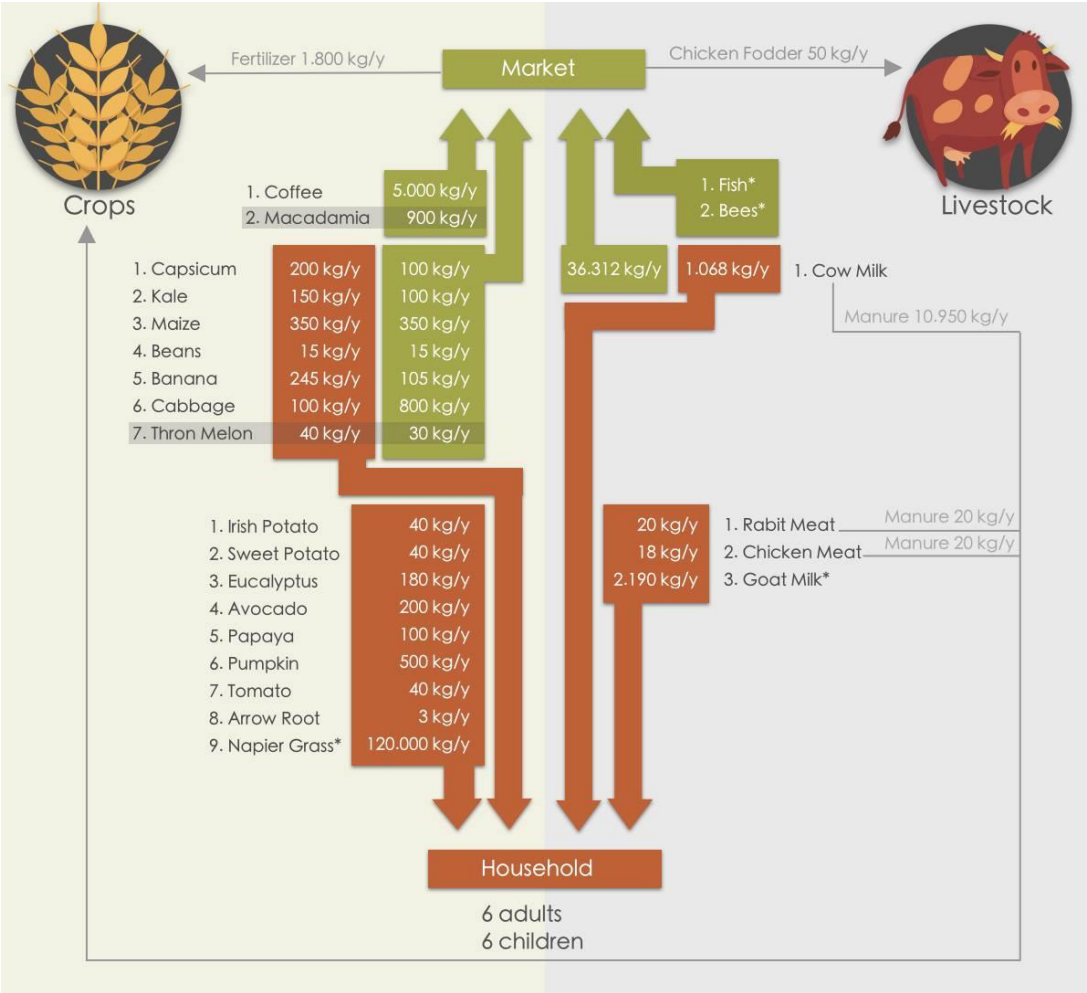



**Figure 11. Farm system analysis. Made by Amalie, Frida and Vanda.**

The farm, which activities, in- and outflows we analyzed, had 4 ECL (crops highlighted with green on figure 11) of the 6 we looked at. This is an example of a farmer who spread risk and only allocated a small part of her land to ECL (figure 12 see EC circled). In this household, thorn melon was both used domestically and sold to the local market. This shows how farmers' first adoption of ECL is connected to low risk due to the little investment it requires.


**Figure 12. Hand-drawn sketch of the farm.**

### 4.3.4 Sub-conclusion

We have now mapped the different risks related to ECL to be uncertainty, pests, diseases, water and thievery. These are related to lack of knowledge and like many of our other analysis demands that knowledge is made more available to the farmers. However, farmers also try to overcome risk by diversifying with ECL, which we have shown in a farm system analysis.

# 5 CONCLUSIONS

We have now analysed and discussed how social, natural, and economical factors affect farmers' decisions on selecting emerging crops/livestock.

First we presented our chronological calendar and the timeline of an ECL. Through this we got an overview over the dynamic development of ECL. We further found that the adopting of the ECL is often a de-selection of coffee and that many of the challenges related to coffee like long waiting time before payment are not present when having ECL.

We moved to investigate where the knowledge the farmers have concerning ECL comes from and how it affects their adoption of ECL. We found that the information sources available to the farmers do not succeed in providing the farmers with qualified information either because the farmers do not know the information sources or because the information provided is biased and therefore contradicting. The lack of qualified knowledge affects the adoption of ECL in a nonproductive way. On the other hand experiences with crops are shared within social circles and farmers' good results are often encouraging for other farmers.

We found that the lack of knowledge is also relevant in relation to agents and market access. The agent's role is important in relation to connecting the farmers to the market. They know the market and the prices and therefore the farmers are more or less dependent on them. A central point is that farmers normally only hear the price level, when they sell the crops/livestock which place the farmers in a vulnerable situation. However, the farmers had high expectations to the market demand in spite of price fluctuations, which we interpreted as a different view on markets than we have.

Finally we discovered which risks are related to ECL, namely uncertainty, pests, diseases, water and thievery. However, these risks could be avoided if the farmers had more knowledge about ECL. To mitigate this risk, we found that most farmers in the beginning only allocate a small part of their land to the new plant or livestock. If the outcome is satisfactory, then increasing land is allocated to the specific crop or the amount of livestock. Further, we discovered that the adoption can be a strategy to reduce risk for farmers – a diversification strategy. Both of these last point we showed in a farm system analysis.

In general the factor that is continuous is lack of qualified knowledge. It is both a question of access and value of the knowledge and is by far the biggest challenge for the farms.

# 6 PERSPECTIVES AND REFLECTIONS ON THE FIELDWORK

After arriving back to Denmark and having time to evaluate our findings and experiences, we identified a few key points, which, in case of unlimited time, could have been further investigated.

On the practical level, we would have gathered more data on locations during interviews and surveys, if each of our sub-groups had a GPS instead of one, common GPS in order to avoid visiting already interviewed households by other sub-groups.

Structured interviews with institutions such as Wilmar Flower Ltd and Kenya Nuts could have greatly contributed to provide more information on the research questions related to institutions and market anticipation. Their points of view could have provided us knowledge on price fluctuation, market demand and potentially, identification of more persons involved in sales procedures and thereby, we could have been able to conduct a commodity chain analysis. However, we decided at the field that this should not be our first priority, as our main focus was the *farmers'* perceptions.

To further investigate more sources of information, we would have visited tea farmers' field school, as we were informed that the school educates farmers not only about coffee but about other crops as well. Unfortunately, due to time limitations, a visit to both Wambugu farm and farmers' field school was not possible.

We would also have deeper investigated the reasons behind the knowledge gap and why farmers chose not to seize available opportunities to improve their farming strategies. To better understand this phenomenon we would have for example interviewed agronomists hired by Wilmar Flowers Ltd. and what availabilities does the government offer in contrast to what can be found on the internet.

Lastly, we would have investigated whether any groups exist which could serve as unions to educate farmers about farming practices and market demands.

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