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Madlen Krone, Gilbert M. Nduru and Maria C. Velte (Eds.):

Horticulture in the Mt. Kenya Region – Dynamics and Challenges in the Context of Globalization.

Experiences of an Intercultural Study Project

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Preface

Horticulture in the Mt. Kenya Region – Dynamics and challenges in the context of globalization

Experiences of an Intercultural Study Project

Madlen Krone, Gilbert M. Nduru and Maria C. Velte

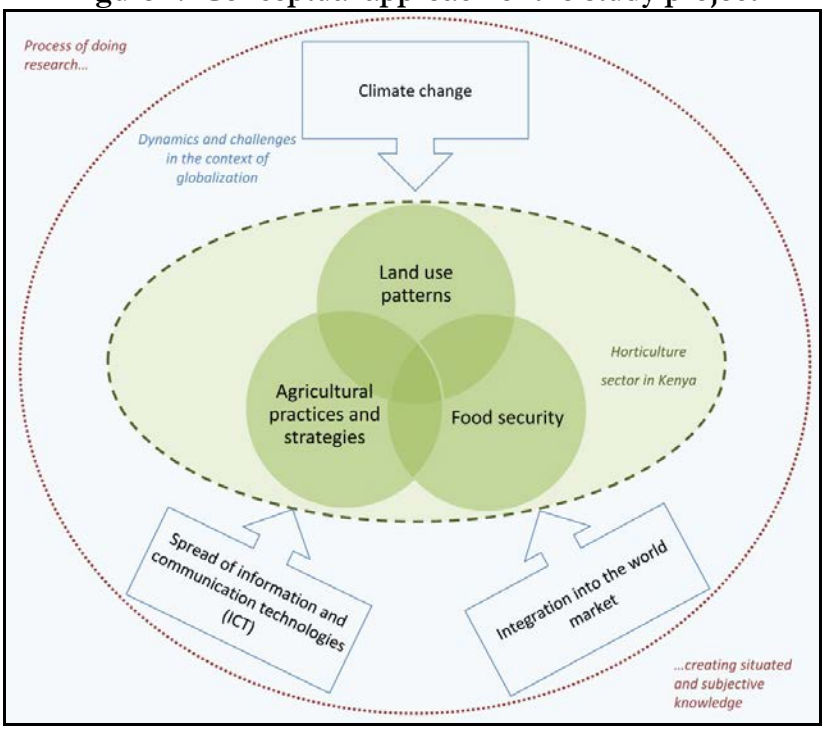
From November 2014 to March 2015, an intercultural study project was conducted by the partner institutions Karatina University (KarU), the Humboldt-University of Berlin (HUB), the University of Cologne (UoC), and the University of Vechta. It was partly realized as a staff and student exchange activity of the *Value Chain Development for Food Security in the Context of Climate Change* project (ValueSec) which is co-financed by the *ACP-EU Cooperation Programme in Higher Education* (EDULINK II). The overall goals of ValueSec are:

- to strengthen the capacity of higher education in Kenya (and Ethiopia) to cope with issues of food security, poverty reduction and climate change adaption/ mitigation in the area of food value chains;
- to sustainably foster the development of inter-institutional linkages networking and academic partnerships among higher education institutions (HEIs) within Eastern Africa as well as with European HEIs.

The main foci of the study project were to research the impact of horticultural export-orientation, climate change and the use of information and communication technologies (ICT) on food security, land use patterns and agricultural practices of small-scale farmers in the Mt. Kenya Region (see Figure 1). According to this, the objectives of the students participating in the project were to gain knowledge of value chain analysis, the challenges of rural areas in the context of globalization and climate change and to develop theory-based research questions to carry out individual research projects. The collaboration in international teams aimed to promote flexible and independent learning, develop communicative and problem-solving competences, and especially build teamwork and intercultural skills. This report is the outcome of the joint research and learning processes and will be shared with all value chain stakeholders who participated in the project.

In East Africa, the majority of the poor lives in rural areas and depends on agriculture for their livelihoods (IFAD 2011). Within the scientific development discourse, export-oriented production is seen as an important strategy to mitigate food insecurity of the rural poor and foster development in the global South (WINTERS 2000, HERTEL et al. 2007). The most supporting argument for this strategy is increased income either directly through the shift from food to cash crop production or indirectly through economic growth in general (BRIGHAM 2011). More critical voices point out the risk that the dominance of capital-intensive large-scale farms might exclude less capitalized producers and, hence, inhibit a trickle-down effect (ESKOLA 2005, BERNHOLZ 2007). Furthermore, it is argued that the use of scarce resources for cash instead of food crop production may decrease food availability in domestic markets and increase exposure to volatile world market prices and other external shocks (WILSHAW 2013).

Figure 1: Conceptual approach of the study project



(Source: authors)

In Kenya, agriculture accounts for about 30 per cent of the gross domestic product (WB 2014); about 70 per cent of Kenya's crop production is generated by small-scale farmers (WILSHAW 2013, p. 40). Comprising about more than one third of the Kenyan AgGDP, horticulture is one of Kenya's most dynamic agricultural sub-sectors (MOA 2013). Due to its professional large- and small-scale production and marketing structures, the Mount Kenya Region plays a crucial role for export horticulture (DANNENBERG & NDURU 2015, MITHÖFER et al. 2008) and is consequently referred to as a "success story of African regional development" (DOLAN & SUTHERLAND2002, p. 1). Even though production difficulties for smallholdings are numerous, export horticultural farmers have achieved higher turnovers and a rise in living standards in recent decades (MCCULLOCH & OTA 2002). Most of these farmers have started to use ICTs like mobile phones and the internet not only to access valuable information concerning export production, but also to transfer money over distance (AKER & MBITI 2010). The rapid increase of mobile phone subscriptions in Kenya is symptomatic of the whole Sub-Saharan Africa (SSA) region, even though Kenya leads in ICT use (MURPHY 2013, BAUMÜLLER 2012). The percentage of the population with access to mobile phones increased from 10 per cent in 2000 to 90 per cent in 2013 in the SSA region (ITU 2014, p. 2). Even in rural areas, a large number of people own and use mobile phones due to improved accessibility, coverage and affordability (PFAFF 2010). Advances in ICTs have reduced geographical distances enabling instant contact between consumers and producers in rural areas (KRONE et al. 2015).

At the same time, the Mt. Kenya Region is facing an increased population pressure as well as changes in mean temperature and rainfall patterns (IFPRI 2013). This impacts on growing seasons, crop yields and food prices and, hence, the risk of hunger (PARRY et al. 2004). Especially small-scale farmers are vulnerable to climate variability and change as well as external shocks like the eruption of the Icelandic volcano Eyjafjallajökull and the resulting closure of the airspace over destination markets in Europe in 2010 and the Jomo Kenyatta International Airport fire in Nairobi in 2013. Against this background, the issues of food

security, land use change as well as adaptation strategies and new farming practices need to be analyzed.

The study project group consisted of 14 students and 4 PhD candidates from Karatina University, 8 students from Humboldt-University, 9 from the University of Cologne, 2 students from the University of Vechta and teaching staff from all four universities. The project started in November 2014 with seminars held in Cologne and Karatina to prepare for joint field work in March 2015 (14.3-26.3.2105) in the Mt. Kenya Region, Limuru and Nairobi. The two-week study trip was divided into two phases: The first phase kicked off with a 3-day introductory and team-building session at Karatina University. Next, to get everyone up to speed, there were general lectures on value chains and the horticultural sector in Kenya. The German students also had the chance to participate in a Kiswahili lesson.

Students then prepared their research design in small international teams and presented it in a plenary discussion. Appropriate methods had to be chosen according to the subject of investigation as well as (at least for the German students) the limiting aspects of language (i.e., the need for translation) and doing research in a large group context. Methods included a standardized questionnaire (see appendix 2), semi-structured qualitative interviews or structured group discussions. In the following reports, the methods will be elaborated in detail.

The second phase consisted of nine days' field research in the Mt. Kenya Region, Limuru and Nairobi. During the field trip, the students conducted interviews with stakeholders along the value chain with a special focus on small-scale farmers. Several farmer cooperatives and individual smallholders producing for the export and domestic market were interviewed at farm level in different ecological zones (see map, p. 14). Furthermore, the group visited KHE (in Mwea) and the fresh fruit and vegetable (FFV) exporter Instaveg (in Embu) and got insights into packaging facilities. During visits at KALRO (in Embu), HCD Headquater (in Nairobi), and local offices (in Meru and Limuru) and the MoA district offices (in Meru, Naro Moru, and Limuru), the students carried out group discussions with experts and different stakeholders.

At the end of every research day, everyone got together to share, discuss and analyse experiences, insights and challenges. These sessions were not only to discuss scientific content, but also to exchange intercultural experiences. In the following section, the research results of the different research projects will be briefly summarized.

Based on the concept of situated knowledge (HARAWAY 1988, HARDING 1991) LIN HIERSE, ISABELLA STINGL and SIMON A. WIELAND analyse the research process of the different participants in the study project. With a problem-oriented approach they firstly work on the interactions "off the field", while forming teams and dealing with different interests, agendas and obligations. Secondly, they examine teamwork challenges in the field, especially stressing the complex task of translation as "situative sociocultural mediation" (quoted from CARETTA 2014). Subsequently, the relation between the researchers and participants and their expectations concerning the project are reflected on, as well as the researcher's behaviour and the question of what to give back. In order to ensure "good research", they derive four aspects from their results that need to be considered in the conceptualization of future projects: adequate teambuilding to ensure socializing off and in the field, reciprocity, realization of realistic expectation management between researchers and participants and a sufficient time frame.

LAURA PARGEN´S report questions if integration into the horticultural export industry has a positive impact on food security of small-scale farmers in the Mt. Kenya Region. As one dimension of food security, she analyses the food access of households. Her results show that the shift to export production has a positive impact on food security in terms of improved income generation (increased reliability and amount of income). Nevertheless, water scarcity

and irrigation problems in the dry season are main factors for causing food shortages and, hence, food insecurity. These insights are in line with SAHRAH JOCHMANN ´S results of the research on the quality of access to food and coping strategies in times of food insecurity. Especially in the dry season from December to March, 70 percent of the interviewed farmers are found to eat smaller portions or to skip meals. The study of SEBASTIAN CHRISTOPH draws on the resilience of the Kenyan horticultural sector in dealing with external shocks and analyses preventative and adaptive options for individual households and local economies. Outcomes of his research are that a larger size and higher intensity of vertical and horizontal integration and capitalization of enterprises have a positive impact on the capacity to respond to shocks. Smaller and less capitalized exporters tend to pass on risks and damages to the producers. Farmers organized in producer groups and social networks tend to weather crises due to joint support better than individual farmers. None of the farmers have risk management for times of crises yet.

Due to the intensively practiced agriculture in the east of the Mt. Kenya Region, MAX WILLKOMM and BENEDICT VIERNEISEL derive information about land use change based on high spatial resolution and multi-temporal data from RapidEye satellite images. They find that deforestation is used to create new farmland which, in turn, implies that there is a high demand for farmland.

A large group of the students worked on the question in how far ICT can impact small-scale production in the horticultural sector. JULIA PÜTZ examines the use of phones and access to different types of knowledge by small-scale farmers. She finds that ICT facilitate the transmission of simple information and reduce the transaction costs of coordination, regardless of the level of education. In contrast, mobile phones are not suitable to exchange more complex information so that face-to-face meetings remain crucial for business practices. In general, her results show that knowledge exchange via mobile phones depends on various variables, which are highly context-specific. One of those variables is investigated in detail by OLIVER RÖWER who analyses the role of ICT in producer organizations. Even though he can show that simple phones are used among members of producer organizations to coordinate activities, face-to-face communication especially for complex knowledge transfer is still dominant. In line with this, ANNA WANETSCHEK and MAREEN HÜLS examine the support networks of small-scale farmers in the Mt. Kenya region by viewing the farming support networks of individuals as part of their social capital. They additionally focus on the impact of mobile communication and, hence, on mobilising this support within the farmers' social networks. They conclude that mobile communication has an impact on the support networks of farmers mostly because it enables them to strengthen contact with already existing strong and weak ties but also by facilitating contact with new weak ties. Furthermore, JOY HEITLINGER investigates in her paper how mobile phones influence the bargaining power of small-scale farmers. She illustrates that bargaining power varies between the farmers and cannot fully be explained by phone use. However, the use of phones is mainly valuable for the contact with the buyer and the coordination of selling. Factors like the location of the farm, trust and marketing channel seem to be additional determining factors influencing bargaining power. FREDERIC BECKER, ISABELL STIEBNER, FIONA SCHUBERT and KIRA-SOPHIE SCHETTLER-KÖHLER explore in their paper the role of Mpesa in the horticultural value chain in comparison to other payment systems. They conclude that - in contrast to export value chains - Mpesa is the most common form of payment in the local value chain. Furthermore, they show that not only the power structure can affect the mode of payment, but also the extent of trust between sender and receiver. Use of Mpesa seems to be only possible if the two business partners trust each other.

As the following reports are independently written by the students taking part in the seminar, the content, literature used and conclusions drawn represent their scientific

understanding, but not necessarily the opinion of the editors. The scientific value of the report is limited as it is mainly based on the data that could be gathered during the relatively short period of the study.

The reports of the Kenyan students on the issues of climate change will be published in Karatina University Working Papers.

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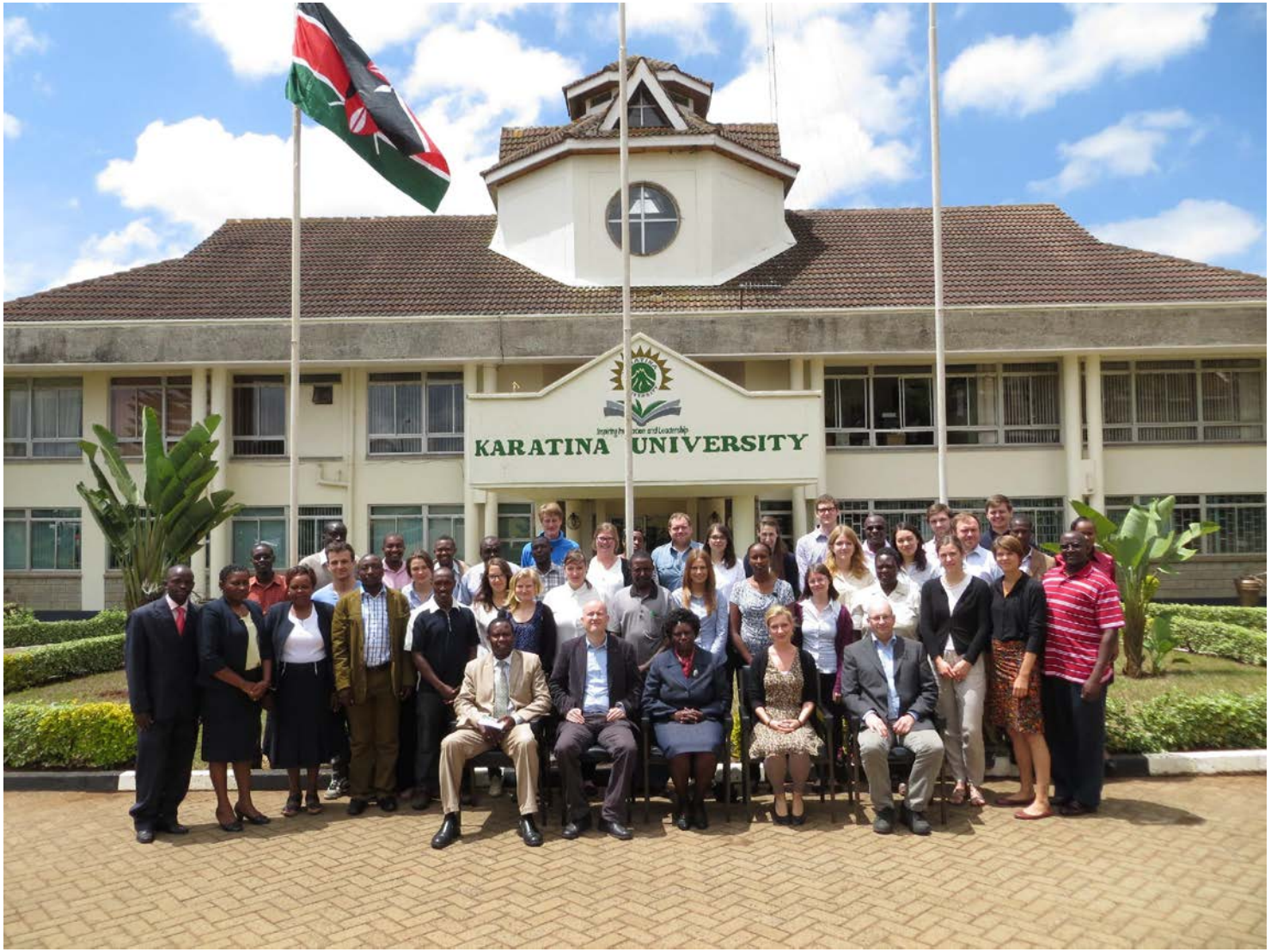
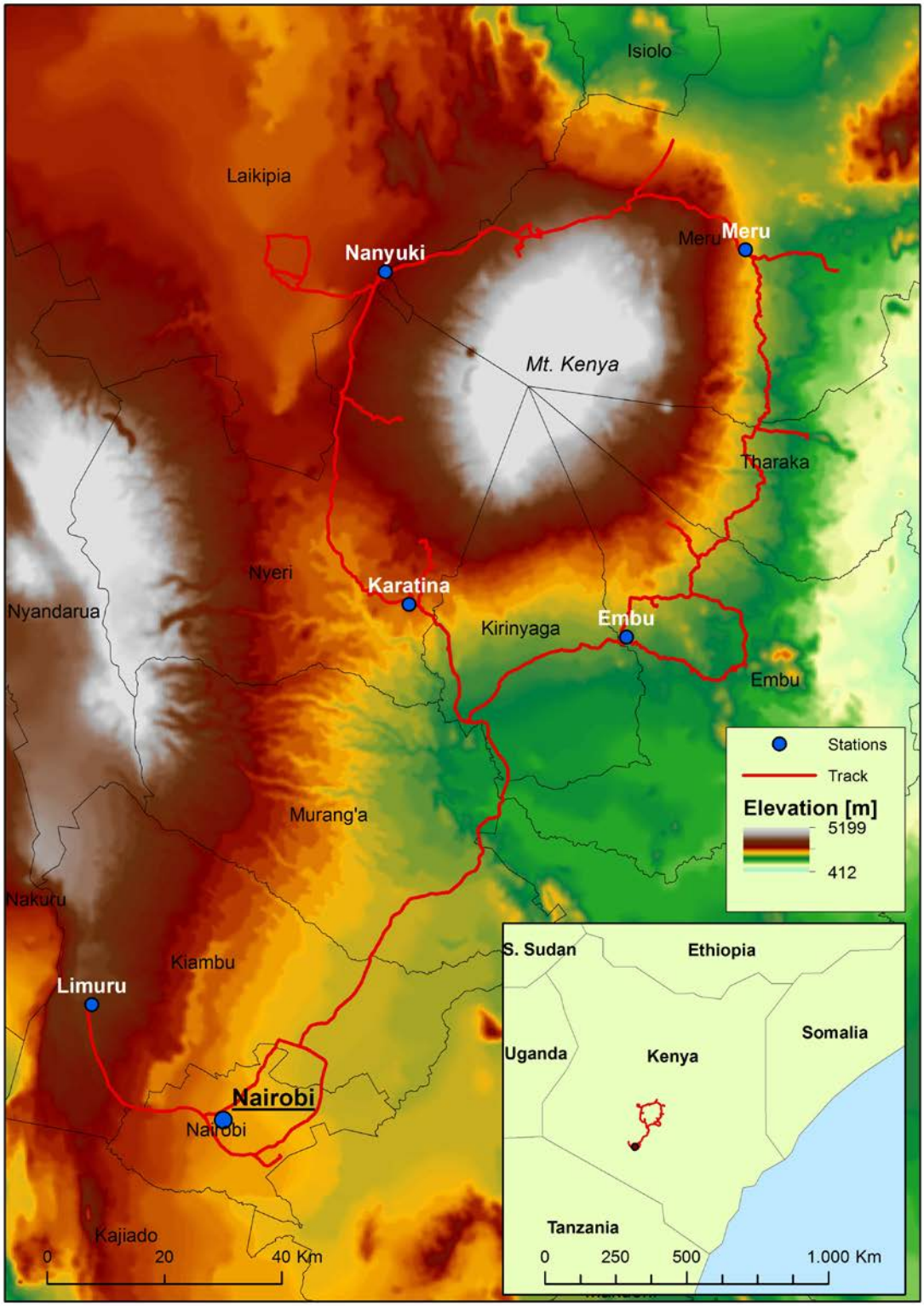


Official study project group photo at Karatina University (Source: KARU STAFF 16.03.2015)

Map of region of investigation with travelled route



(Source: Cartography by VIERNEISEL. Data source: SRTM 2000 and track data by WILLKOMM)

Program of Study Project

Theme: Horticulture in the Mt. Kenya Region – Dynamics and Challenges in the Context of Globalization.
Venue: Karatina University (Excursion around Mt. Kenya Region)
Dates: 14th to 26th of March 2015

Saturday, 14th March:	**Arrival day**
10.00	Arrival of German guests at JKIA
13.30	Arrival at Karatina Town
16.00 - 18.00	Kiswahili lesson
Sunday, 15th March:	**Getting to know each other**
14.00 - 16.00	General lectures on agricultural geography and historiography of cash crop production in Kenya
16.00 - 20.00	Informal bonding session for German/Kenyan students (Walk and through Karatina town, barbecue…)
Monday, 16th March:	**Workshop on Agribusiness in Mt. Kenya region at KARU**
08.40 - 09.00	Courtesy call at VC`s office at KarU
09.00 - 10.30	Welcome and introductory remarks
11.00 - 12.00	Developments in Value Chains in the Mt. Kenya Region (Speakers: Dr. Beatrice Ng'ayu (PhD), HCD; Prof. Dannenberg, UoC)
13.00 - 13.30	Presentation on fieldwork activities and methods (Speaker: Prof. Nduru, KarU)
13.30 - 16.00	Presentation of respective research projects by students
16.00 - 18.00	Forming of student's teams/groups for field work and discussion of program
Tuesday, 17th March:	**Field Work around Sagana area**
08.40 - 12.30	Field work in groups
16.30 - 17.30	Travel to Embu
Wednesday, 18th March:	**Field Work around Mwea area**
08.30 - 10.30	Guided tour of KHE packing facility at Wamg'uru
10.30 - 13.00	Field work in groups, visiting farmer cooperative Kangai Tisa
17.00 - 18.00	Travel to Embu
Thursday, 19th March:	**Field Work around Embu town**
08.30 - 11.00	Guided tour of and discussion at KALRO field station at Embu
11.00 - 13.00	Field work in groups, visiting horticultural exporter InstaVeg
14.00 - 18.00	Travel to Meru

Friday, 20th March:	**Field Work around Meru town**
08.30 - 11.00	Visit at HCD Nkubu field station and MoA
11.00 - 13.00	Field work in groups
17.00 - 18.00	Travel to Nanyuki
Saturday, 21st March:	**Field Work around Timau**
08.20 - 13.00	Field work in groups, visiting a farmer cooperative
17.00 - 18.00	Travel to Nanyuki
Sunday, 22nd March:	**Recreation day**
06.00 - 17.00	Sweet Waters Conservancy for game viewing
17.00 - 17.20	Travel to Nanyuki
Monday, 23rd of March:	**Field work around Naro Moru**
08.30 - 13.00	Visit at MoA, Field work in groups
17.00 - 18.00	Travel to Karatina
Tuesday, 24th March:	**Field work around Limuru**
09.30 - 12.00	Visit HCD and MoA Limuru for a discussion on food security
13.00 - 16.00	Field work in groups
16.00 - 18.00	Travel to Nairobi
Wednesday, 25th March:	**Expert interviews in Nairobi**
10.30 - 12.00	Visit at HCD headquarter for a discussion on horticultural development policy and meeting exporters
15.00 - 16.00	Visit at DAAD office Nairobi
18.00 - 22.00	Final reflection and farewell dinner
Thursday, 26th March:	**Day of departure**
12.00	Travel to JKIA for group's departure

Impressions from the study project

Team building day in Karatina (Source: KRONE 2015)

Interview with farmer in Sagana, Kirinyaga County (Source: BECKER 2015)

Guided Tour of KHE packing facility at Wamg'uru in Mwea area, Kirinyaga County (Source: SCHUMACHER 2015)

Interview with Peter Ngigi, Chairman of Kangai Tisa, Kirinyaga County (Source: SCHUMACHER 2015)

Visiting a cooperative at Naro Moru, Nyeri County (Source: VELTE 2015)

Visiting HCD Headquater Nairobi (Source: VIERNEISEL 2015)

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Mediating fieldwork challenges in international teams:

Reflexivity, positionality and participatory ethics

Lin Hierse, Isabella Stingl, Simon A. Wieland

1. Introduction

The practice of scientific research is still a dominantly result-oriented field. The papers we read and write usually present the methods we use, the theory we build on, the data we gather and the conclusions we draw from it. Often omitted stay the *why* and *who* behind the process of research, meaning the reflection on intersecting positionalities and perceptions of all actors involved, their steady re-negotiation, as well as the therefrom deriving dynamics of fieldwork that strongly influence the character of our data and the results finally presented.

To acknowledge the broader socio-cultural and structural contexts in which individuals and their actions are inseparably embedded (SOLE & EDMONSON 2001, p.3) is an integral part of taking on a feminist perspective on knowledge production, pointing out how it has to be understood as situated and subjective. This is especially important in a cross-cultural and cross-language context, where the *triple subjectivity* of researcher, 'assistant' and researched shapes and conditions the dynamics of fieldwork (TEMPLE & EDWARDS 2002).

The following sections offer insights to selected examples of experienced challenges in and off the field during a joined study project in the Mt. Kenya Region in March 2015. A mixed-method approach, including interviews, participatory observations, research diaries and one group discussion, aims at giving voice to various participants of and contributors to the research process.[1] The data thus points out the specific challenges of the joint-research project from multiple perspectives, sheds light on case-bound issues of group dynamics and overall organization and finally gives a transferable reflection on the implementation of research ethics and power structures that evolve in the course of fieldwork in an international team.

2. Theory

Theoretically our research intent can be contextualized within a central theme of many recent discussions of feminist research methodologies: Situating the production of geographical knowledge (see e.g. ROSE 1997 or CARETTA 2014). The term situated knowledge was brought forward by DONNA HARAWAY (1988) and SANDRA HARDING (1991) as a critique to the positivist generalizations and objectifications of knowledge production in order to highlight that the production of knowledge always has a contingent, hierarchical, contextual and relational nature.

Following ROSE (1997, p.309), doing research in the tradition of this approach means to examine the nature of the research process by looking inward – reflecting one's own position within the research process – and looking outward – reflecting on the relations with others that are involved in the research. According to representatives of this approach this praxis is crucial to achieve more ethical research practices (SULTANA 2007, p.375) and to enhance the

[1] For reasons of simplicity, the group of students from German universities will be referred to as *KBV* (Köln, Berlin, Vechta) and the Karatina group as *K*.

validity of studies by allowing the reader to fully grasp the contextual nature of knowledge production. Consequently the trustworthiness of research and its outputs can be increased (CARETTA 2014, p.2).

In cross-cultural and cross-language research, TEMPLE AND EDWARDS (2002) identify three main actors that shape and condition the development of field research and thereby the knowledge being produced: the researcher, the assistant and the research participants. To capture these three figures, TEMPLE AND EDWARDS apply the term "triple subjectivity in the field", but stress that their subjectivities are mutual: researcher, assistant and participant embody multiple positions in relation to one another, depending on several axes of intersectionality such as race, nationality, age, gender, culture, economic status, educational background etc.

In the context of international research the pivotal role of research assistants is being emphasized. These assistants must be viewed not only as translators, but as important cultural brokers, mediators and gate keepers with the ability to bridge cultural-, knowledge- and language- gaps and who therefore also strongly affect the information being provided in scientific works. Given their significant role within the research process, it is critiqued that their voices are rarely present in texts (CARETTA 2014, p.2).

With regard to the reflection of the relationship between the researcher and the researched, issues of "giving back" are closely related to those of positionality, reflexivity and representation. In the context of international research especially, the ability and morality of academics to speak of or for members of the so-called "Global South" has been thoroughly critiqued. This "crisis of representation", as it is referred to, centers on ethico-political implications of the elite global professional class speaking for marginalized groups and subaltern in the "Global South" (STADDON 2014, p.254). KOBAYASHI (1994, cited by ibid.) blames this crisis on naïve assumptions about the researchers' ability to contribute to others. Thereby KAPOOR (2004, p.631) notes that although the speaker might be trying to materially improve the situation of some lesser-privileged group, the effects of his or her discourse holds the potential of reinforcing racist, imperialist conceptions and perhaps also contributes to further silencing the lesser-privileged groups' own ability to speak and to be heard.

Researchers such as NAST (1994, cited by STADDON 2014, p.254f.) stress that the politics of representation is strongly linked to the politics of fieldwork. Just as our ideas of how to analyze, structure and present our findings begin to evolve during or even before our time in the field, the potentially unequal power relations between researcher and researched suffuse our work – meaning fieldwork can never be separated from the representational texts that emerge. In line with this argument SULTANA (2007, p.379) posits that the issue of "giving back" does not start with considerations of how to reimburse participants and end with their representation in written works, but rather manifests around "everyday acts" of fieldwork, including the decisions of what to eat, where to sit within a person's house, what to wear and how to address people. According to her, it is thus imperative that ethical concerns should permeate the entire process of the research, from conceptualization to disseminations, and that researchers are especially mindful of negotiating ethics in the field.

Our own research intent was especially inspired by MARTINA A. CARETTA (2014) who analyzes situated knowledge in the process of conducting fieldwork in Eastern Africa. By reflecting on episodes of failure, anxiety and misunderstanding, CARETTA and her three field assistants disentangle the power geometry of situated knowledge and shed light on how subjectivities and positionalities of researcher, assistants and participants influence "the making" of cross-cultural, cross language research. Consequently our research interest can be summed up in this question: Which challenges for different participants (Kenyan researchers, German researchers, interviewees) emerge in course of the joint research in the Mount Kenya Region? The following chapter will introduce the methodological approach applied by us in

order to enable researchers, assistants and participants to reflect on the two weeks of field research in Kenya.

3. Method

Our research took part in the context of a student research project between Karatina University and three German Universities from Vechta, Berlin and Cologne. The fieldwork focused on global value chains in the Mount Kenya Region, where different groups dealt with ICT usage, food security, climate change and land use change, deploying qualitative and quantitative methods. This paper's research question aims at identifying challenges that evolve in course of this research for different actor groups. We[2] therefore relied on four ways to generate a broad database for our analysis. Using participant observation we took part in field research activities, splitting up and following the different research teams, focusing on the respective research setting, the context as well as particularities and commonalities that occurred during the research. Secondly, we carried out short interviews with the participants at the end of research situations, reflecting on their experience and motivation for participation. In order to have a continuous and honest insight into the experiences made by the researchers on both sides, we thirdly handed out research diaries that included guiding questions but were otherwise open to the writer's preferences. A group discussion among the *KBV* students at the end of the project opened up the possibility for a critical reflection on the entire cooperation process. On the *K* side of the project two individual interviews were carried out on the same topic.

The intended multi perspective was hindered in parts by the homogeneity of our project group, which consisted of four *KBV* students. In addition, there is a slight preponderance of reflection from the *KBV* side (research diaries, group discussion). Overall 97 cases were observed, recorded and transcribed.[3]

We based our following qualitative analysis on the methodology of Grounded Theory developed by GLASER AND STRAUSS (1967). Grounded Theory enables researchers to a detailed, rigorous, and systematic method of analysis, giving greater freedom to explore the research area and allow issues to emerge (GLASER, 2001; JONES & ALONY, 2011). Following the Glaserian school of Grounded Theory (GLASER, 1992) we used theoretical coding to develop decisive categories that influence the field research. In the simple coding phase the authors individually went through the entire material and assigned codes to respective data identified as relevant for answering the research question. This was followed by the substantive coding phase during which the previously defined codes formed the basis in identifying categories. Among these categories concepts such as language, expectations or context emerged which reappeared throughout the material. Grounded on these categories we developed a narrative that points to challenges in doing research in international teams and that is structured by the different actors involved and their respective relations. Firstly, we exemplarily raise topics of differing individual motivational contexts and time capacities, mutual expectations and experienced insecurities within the research team – in the field as well as during free time. Subsequently, dynamics concerning researchers and researched are analyzed, questioning who gives, who takes and what is expected from our research project.

[2] *We* at this point refers to four students from Germany (three from Humboldt University, one from Vechta University) who conducted fieldwork and analyses for this paper. All of us grew up and were mainly educated at institutions located in the "Global North".

[3] This splits into 48 observations, 38 interviews with participants (farmers, pack house staff, government officials), eight research diaries, two reflection interviews with project participants and one group discussion.

4. Results

4.1 Besides the Field: Contextualizing the Others

Before entering the field as a team, the team has to be made. Usually, the researchers themselves are active organizers – responsible for establishing contacts, planning a schedule and negotiating the interests of all respective participants – not only during, but also in the run-up of fieldwork. In the special case referred to here, the researchers were students taking part in a study project. The overall organization was mainly undertaken by lecturers from the involved four universities, which did not require the establishment of contacts between the students before the first face-to-face meeting in Karatina. As a result, most (*KBV* student) participants felt clueless about the "unknown Other's" research agenda and scientific interest. One states at the beginning of his research diary:

> I am curious how the collaboration with the Kenyans works out. Until now, it is absolutely uncertain [to the students] whether they [K students] will additionally have to work on own questions or only several Kenyans will be involved in this. If they have their own questions, we will still have to do quite some coordination.
>
> [Research diary entry translated from German by the author]

Moreover, the *KBV* students initially did not know about the triple occupation of the *K* students, who were not only acting as researchers, interpreters and local experts/gatekeepers[4] in the field, but also had to follow their regular occupations as e.g. teachers, parents and/or farmers during the two weeks of fieldwork. The issue of triple responsibility was not raised by the *K* students in the data we gathered, whose perspective on the topic is therefore not presented here. Their persistent embeddedness into their daily lives has to be seen in contrast to the *KBV* group though, who left their daily contexts with the prior goal to conduct research in the Mount Kenya Region. Due to resulting asymmetric time-capacities of the group members, expectations concerning team-building and organization on the *KBV* side could not always be met in the course of the project, which was pointed out by a *KBV* student in his research diary:

> The Kenyan who was assigned to my group is now already missing for more than two days. His help was extremely good. Now we just take one, who is somehow available (if at all). To me, this discontinuity is a little difficult, but it works anyways.
>
> [Research diary entry translated from German by the author]

In the group discussion the *KBV* students linked the mentioned unsteadiness of teams and the resulting difficulties in the field to the organizational challenges stemming from the project's specific design (internationality, group size, time restraints etc.). Asked about their perceptions of the collaborative work with the *K* students, the participants of the discussion did acknowledge how the administrative effort of the project was highly challenging and complex, but also pointed out how steady, smaller groups would have facilitated and improved the research process. Expectations from a *K* student towards the *KBV* student group rather related to interaction on levels of socializing and learning from each other – not only during fieldwork, but also in periods of "in-between-time":

> If you consider that Germans are the ones who are in Kenya then more or less they are studying what is happening in Kenya. But if you see that these students [K students] have never been to

[4] We refer to the *K* students as gatekeepers here, as it was witnessed several times in the field, in how far their position as "locals" and their knowledge about customs opened up opportunities for in-depth talks and the establishment of new contacts to interviewees which would not have been possible without them.

Germany, there was much to learn from the Germany-side. So there was no excuse that any German student don't have something to tell to the Kenyan students. In respect to what they are doing, or socially or the academic perspective, the schoolwork, the research and all those other things. [...] Leisure time. Leisure time is the one, which now influences the research. [...] So when you go to the field it's like we're going together like this.

[Individual interview]

The interviewee's statements point out to a perceived lack of motivation regarding the willingness to initiate conversations or simply mingle with the *K* students on the *KBV* student's side. A certain responsibility is ascribed to the *KBV* students here, to take more action in approaching the *K* students and exchange knowledge. On top of that, the interviewee also highlighted the interconnectedness between social interaction during leisure time and successful joined fieldwork.

When it comes to the separation of groups, similar perceptions can be identified on both sides, as some *KBV* students pointed out how long days of fieldwork are tiring for everyone and might have led to lowered motivation to interact in English in leisure time as well:

Well, I also realized that the groups are always a little separated. I wouldn't necessarily ascribe this to the Kenyan group or to us Germans, but I rather think that communication can be tiring in the long run if you speak English in the group when your mother tongue is actually German. […] and at the same time it's probably also tiring for the Kenyans if you have to speak English all the time.

[Statement in group discussion translated from German by the author]

In an overall context, questions about individual motivation on both sides go hand in hand with the experienced difficulties stemming from not knowing the other person's interests, agenda and obligations. Both *K* and *KBV* students mentioned in several ways, in how far a research project based on a jointly formulated concept might have had positive influence on the team building process and the team working practice alike.

In this regard, the challenges "off the field" that have presented themselves to the student groups are closely linked to the following section on anxieties and insecurities that were experienced in the field.

4.2 In the Field: Who's in the driver's seat?

Statements about the overall collaboration between *KBV* and *K* students in the field and during the interviews were dominantly positive. The report's problem-oriented approach still identifies several sensitive factors however, that had a strong impact on individual moods, mutual perceptions (*KBV* and *K*) and the overall atmosphere of the interview-situation.

Apart from the task to adapt their own expectations to the multifaceted role of the *K* students as researchers, local experts and interpreters in the field, the *KBV* students were challenged by "letting go of control" when being dependent on a translator due to language barriers in the field, as it was mentioned in both, research diaries and group discussion:

We often need a Kenyan who translates the questions. So I think that many details and information get lost because of the translation.

[Research diary entry]

[…] he [the interpreter] once just kind of rushed ahead that we didn't get a chance to speak and he totally wanted to help us but this just really went into the wrong direction.

[Statement in group discussion translated from German by the author]

The quotes above show how dependency on translation is strongly linked to trust and dynamics of coordination between researcher and interpreter, which could in our case be

directly traced back to the insufficient amount of time spent on the process of getting to know each other and working on a team identity.

Moreover, interpretation itself has to be regarded as a complex transfer, which cannot simply be understood as a word-to-word translational process, but rather embodies realms of situative sociocultural mediation (CARETTA 2014). As local experts, the *K* students provided contextual knowledge, which could have been implemented in the questionnaires and therefore made these more accessible to the farmers, which was strongly emphasized by a *K* student during the individual interview:

> Like me, if I sit with you with your questionnaire I will not change any single context. But I will change the way you ask those questions. I will change these questions to be statements. [...] And because I am taking you to the field, I know many things [...] I could have told you how to fine-tune it. [...] That would make the farmer understand.
>
> [Individual interview]

One of the most important findings that presents a strong factor of influence on the whole research process is, that in a broad majority of our collected data, participants identified the tight time schedule as well as organizational structures, inner-team misunderstandings and personal laziness stemming from the everyday physical and psychological efforts to have influenced the group dynamics over time. One of the *K* students reviews:

> Well I would say the first couple of days it was like a team, but then with time it felt like there was this pulling out.
>
> [Individual interview]

A participant of the group discussion referred to the same process of decreasing motivation:

> […] maybe we were full of expectations at first to really become one team and then it just somehow did not work out in the beginning so you sort of start to accept that it is separated, and then I think everyone got quite lazy.
>
> [Statement in group discussion translated from German by the author]

Altogether, many of the thoughts and experiences referred to above depict the extent to which the contextualization of the respective research partners is rather a process than a state, and therefore strongly linked to time.

Having presented some of the most striking challenges affecting inter-group relations between the researchers, the following sections continue by focusing on the perceptions and reflections concerning the collaboration between researchers and research participants.

4.3 Research footprint I: What to give back?

We get a grade on our papers, but what about the people involved in our fieldwork? Along with academic qualifications, by visiting beautiful farms, tasting unknown fruits and other experiences, we also gain from the fieldwork situation in terms of experiencing other cultures, which would be inaccessible to us, were it not for the purpose of doing research. Acknowledging this opens up the question of our own "research footprint": what do we leave behind, what do we actually give back to the people who we interviewed in exchange for the time they give us during interviews and other activities? To get closer to answering these questions, this section features researchers' reflections on the interaction with and the perception of people being researched during our two weeks of fieldwork. Thus it seeks to give voice to the participants by presenting their expectations and motivations concerning our research project.

KBV students being asked in the group discussion how they think their interviewees perceived them, state that it is impossible to really know what the participants actually thought of them. What the students did notice however, was their constant visibility as being a *mzungu* (Kiswahili for *white person*) in the field. Easier to grasp are the perceptions of the people being interviewed by the students. Our gathered material is well filled with narratives of *K* and *KBV* students on how welcoming, participative, patient, polite and friendly their interviewees were. Also during the group discussion a *KBV* student wants to highlight the fact that not a single farmer refused to talk to them or to show his or her farm. That this behavior might be linked to certain perceptions of the students' status as researchers, and expectations concerning their research by the farmers and other interviewees was not reflected on though.

In the research diaries research experiences where the students were actually able to have a conversation with their interviewees and exchange more than just information for their questionnaires were described as their most positive ones. Also during the group discussion one student notes:

> It was always exciting when the farmers asked questions too, then it felt like they were actually interested in what we are doing and why we are here… That was very nice, because it felt like more of an actual exchange.
>
> [Statement in group discussion translated from German by the author]

Concerning the raised issue of "giving back", the student makes the important acknowledgement that her research is actually a chance for a two-way informational, but also personal exchange. But when talking about these positive experiences of rapport while having a tea or lunch with the interviewees, the students also point to time and language as important factors that often limit them. Looking at the whole bulk of our gathered material, these episodes of spending time and interacting with the participants must be viewed as exceptions though. Due to the perceived time pressure and the awareness of not returning to the specific research situations, especially on the *KBV* side, the students often felt like they had to "hunt down" as many farmers as possible and line-up when doing their different questionnaires to gather as much information as possible during their short period of fieldwork. Also tours around farms needed to be interrupted in order to start doing the questionnaires.

This also affects what Sultana (2007) referred to as the "everyday acts" of fieldwork. A *KBV* student recalls during the group discussion that his Kenyan colleagues had to remind him to introduce himself before an interview and to express his thanks afterwards. Thus, even though many of our participants were picked spontaneously without beforehand notice of our coming, not a single interview we accompanied started with the question of *"Would you have time to answer a questionnaire?"* and very few ended with granting the participants the possibility to ask questions themselves. When raising the question of *"Why do we forget these most basic ethical practices when conducting an interview?"* many factors that restrict us in being constantly aware of doing "good fieldwork" can be identified within our data: a mostly unknown local context, uncertainties about who is being interviewed, tiring working arrangements, language barriers, unfamiliar research settings especially regarding the heat etc. During the group discussion one of the *KBV* students also talks about misunderstandings due to a temporary inattentiveness of the specific local context his group was conducting fieldwork in:

> Sometimes there were misunderstandings or such situations…, like with the weather. They [farmers] are all waiting for rain and during small talk we [research group] were like: Oh what a marvelous weather here today!
>
> [Statement in group discussion translated from German by the author]

4.4 Research footprint II: What is expected in return?

In the following remarks we focus on the participants' expectations towards our research project. When being asked how the participants might have perceived being interviewed by an international team in the course of an individual interview one of the *K* students states:

> Well to some of them it was like a privilege, because most of the farmers did not have foreigners at their homes and not just foreigners, even us, Kenyans. They not had the privilege of having visitors asking questions about their farming activities and everything. [...] Yeah so, some of them have expectations. But some others are just sharing out of you know sharing.
>
> [Individual interview]

Due to the fact that following our research design, we as the researchers choose where our fieldwork is carried out and who we want to interview, a critical and reflexive questioning of what motivates people to take part in our research and what we are actually able or willing to "give back" is in order.

As a result of the large number of farmers, exporters and members of official institutions we interviewed concerning their motivations and expectations towards our research project a wide variety of motives can be identified. Nevertheless it is striking that to the largest extent farmers explained that they are willing and often also very happy about "being picked" to take part in our research because they hope for an improvement of living conditions for them personally and for Kenyan farmers in general alike. Thereby farmers were hoping that the researchers could improve their living conditions inter alia by improving their farming skills and performance via the provision of help with irrigation, plant diseases and marketing; by exerting influence on the HCD – the Horticultural Crops Directorate – and the government as well as by opening up new export markets for their produce in Europe. These sorts of expectations were in line with participants having no or only little information about the people interviewing them, their research topic, intention and targeted results.

Some participants also expressed their disappointment with researchers in the past who never got back to them on their results although they had promised to do so. Furthermore some farmers admitted that answering all our questions was exhausting and felt like time being stolen. In this context it was continuously stressed by many participants that it is absolutely necessary to get a written report with our final results. Thereby it is questionable whether the participants are aware that also the often-promised written report will primarily show the results of our learning process. Consequently it might be able to give certain suggestions, but most likely won't provide the research participants with clear solutions to enable direct improvements of their living conditions. These insights show a huge mismatch concerning the motives of farmers and other participants to take part in our research on one side, and our real research intention and our ability to contribute to their businesses and lives on the other. This imbalance might be traced back to our perceived status as (international) researchers on the part of our participants and was also noted in the course of an individual interview with a *K* student:

> […] You know that people have their own expectations and here you ask, you are being international visitors, visitors like the donors they see, coming to support them. […] So that would be like a very clear way of making people understand what you are doing: Yeah I am here because I am a German student. We are working with the University of Karatina and we decided to come and do our homework here in Kenya, but when we go back to school our teacher is going to mark us and give us points so that we can now get our degree. That's something that is common. […] it would close the gap between the expectations and the actual thing you are doing.
>
> [Individual interview]

As the interview goes on, the student identifies the reason for the inability to close this gap during our research to be a lack of five minutes of proper introduction to the research participants. This highlights the need of strong transparency and clear communication regarding the research project for all participants. It also suggests that positioning us as student researchers and making clear the limitations of our work, this would be understood by the interviewees and would not change their willingness to provide us with information. This proposed positive reaction to students and their limited ability for causing great effects in the short-run of their work, can also be found in our conversations with farmers, exporters and members of official institutions. For example, one farmer being asked about his expectations concerning our research states that since this is obviously a school project, he doesn't have any personal expectations, but just wants to help students in their learning process. Another farmer states that she just had fun being interviewed and since she thinks that we are students, she couldn't expect anything monetary anyway.

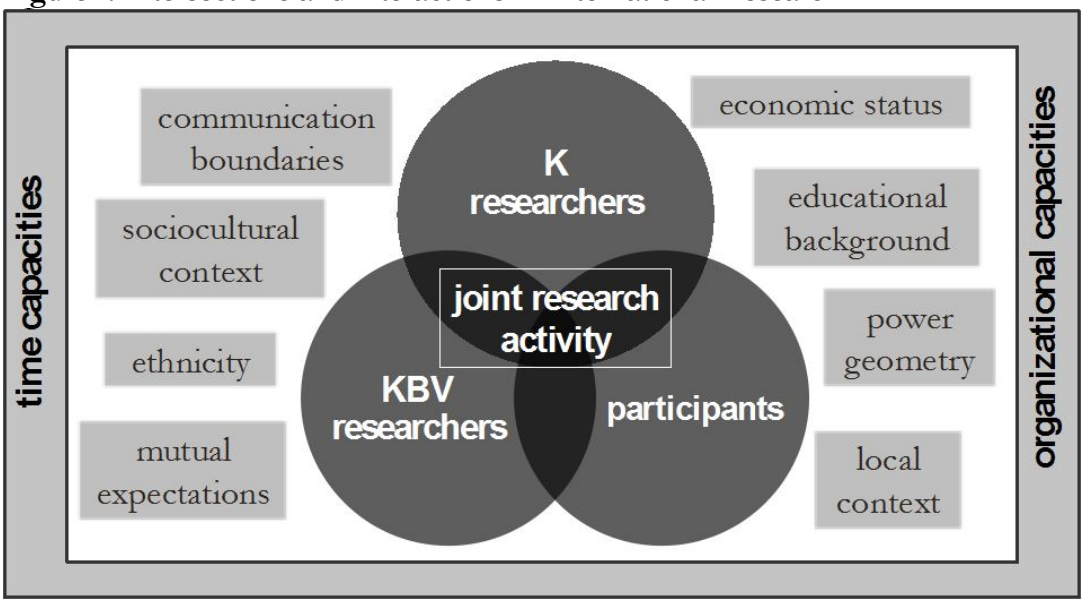
This chapter set out to reflect on the "research footprint" of our study project and our own "performance in the field". It became clear that also for us as student researchers with seemingly limited resources of "giving back" an important avenue for our "giving" is ensuring open and respectful communications with all collaborating participants as a priority.

5. Discussion and Conclusion

In the light of the above analyses, this report can be regarded as a highly necessary preface to the carried out research projects in the Mount Kenya Region. Their critical accompaniment did not primarily aim at evaluating the joint research trip though, but rather pointed out specific challenges in doing international research, regarding the collaboration with participants as well as within the international research group. This problem-oriented approach led us to identify specific challenges that need to be considered in order to ensure "good research". Summing up the results presented above, we try to answer the question, of how to ensure fair collaboration on an equal level with all participants and thus applying a reciprocal, honest, open and polite research practice. Figure 1 visualizes the intersecting actors and makes visible dimensions that influence the cooperation during research.

Socializing off and in the field within the research group as well as adequate **teambuilding** form a challenge that may be unique for this short-term student project (group size, organizational boundaries). A coherent group atmosphere appears to be decisive to actually perceive collaborative research work as a joint research project. This does not only start during the actual field work, but needs to be considered in conceptualization and design of research questions, methods and approaches as well as in dealing with the gathered data in the process of analysis.

Figure 1: Intersections and interactions in International Research



(Source: authors)

Regarding the carried out research, **reciprocity** is of central importance as well**.** This should include inter alia acknowledging that our fieldwork must not only serve as a learning experience for us as researchers, but also has the chance to become a two-way exchange of information with the potential to generate benefits for the research participants as well. Long-term international cooperation should also include the possibility to have the transfer of knowledge, experience and hospitality for both sides of the cooperation.

Furthermore we need to apply a large sense of **sensitivity** in order to ensure that our "everyday acts" of fieldwork remain respectful and appreciative despite various factor restricting us in the awareness of our performance in the field.

Most striking it becomes clear that as researchers it is our obligatory responsibility to engage in open and honest conversations with each other and research participants about background and purpose of our research by making clear what we are and especially what we are not able to give. This is key in realizing a realistic **expectation management** between researchers and participants.

Considerations about our own position as researchers should start before undertaking fieldwork, need to be constantly negotiated according to the local context while conducting fieldwork and continue to influence the way gathered information is being analyzed, dealt with and presented in the aftermath of the research trip.

Almost all identified challenges can be linked to the factor **time**. It influences the research cooperation, the interaction with interviewees in regards to sensitivity and transparency, but also impinges on the way the cooperation is conceptualized as either a joint research or a combination of different research foci, where participants merely support each other. This appears to be of special importance in such a study project where the time frame is pre-set due to organizational and financial restraints. Nevertheless aiming for efficiency concerning the research output should not be the dominating paradigm when aspiring sustainable, respectful and reciprocal research in international teams.

Despite the identified challenges and setbacks experienced during the research, international research cooperation continues to be a very unique and important experience for all involved actors. Across the board participants of this critical reflection assessed the cooperation as fruitful and the research as satisfying. The general aspirations to take part in and improve further such collaborative approaches remain notable.

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Land use change detection in the Mt. Kenya region via RapidEye satellite images

Benedict Vierneisel & Maximilian Willkomm

1. Introduction

The Mt. Kenya region in central Kenya is one of the most important areas for horticultural production in eastern Africa (LENNÉ et al. 2005, p. 226). Not only because of favorable environmental conditions, but also in consideration of higher returns per hectare, more than 90 % of farmers in Kenya participate in horticultural production. The horticultural sector can be divided into two different markets. On the one hand the domestic market produced 70 to 80 % of the value of fruit and vegetables produced in Kenya in the beginning of the 21st century (MUTUKU MUENDO et al. 2004, p. 17). The main reason for local cultivations is food demand and thus subsistence farming, this factor becomes even more important in the context of a growing population. On the other hand, there is the export market which has a highly dynamic economic importance. This subsector driven by international actors has been the focus of a couple of publications in the past years (e.g. BARRETT et al. 1999, LENNÉ et al. 2005, MITHÖFER et al. 2008, DANNENBERG & NDURU 2012). In many cases the results of these studies showed that the export dynamics can often be linked to the concept of global value chains (GEREFFI et al. 2005).

Former studies showed that multiple participants of agricultural value chains have influence on cultivation structures of many smallholders (DANNENBERG 2012). In case of the Mt. Kenya horticultural sector these influences occur not only in a regional scale, but also globally. Changes in agricultural value chains may affect the decisions and therefore the behavior of smallholders. Further dynamics of this kind can have influences on land use patterns of regional structures. In order to understand the processes in agricultural markets the investigation of land use changes can contribute to a better understanding of superordinate relations. In this context, the analysis of regional land use patterns can provide useful information to highlight running processes.

Against the background of the described agro-economic developments, in this elaboration a remote sensing approach is presented to get a better understanding of changing land use structures. Due to the intensively practiced agriculture in the east of the Mt. Kenya we derive information about land use change based on high spatial resolution and multi-temporal data from RapidEye satellite images. The presented study monitors and analysis the dynamics and heterogeneities of general land use and its changes in the past five years. These aims are investigated by implementing a supervised pixel classification of the given satellite imagery. For the analysis of the satellite data there will be three main focuses: In a first approach the aim is to clarify whether RapidEye data is suitable for an accurate classification of land cover characteristics in the Mt. Kenya region. Secondly the detected structures and its changes between 2010 and 2015 are supposed to be identified. In a last step the authors try to connect and explain the determined results to occurring economic processes in Mt. Kenya region.

Based on the experiences the authors made on a fieldtrip in the end of March 2015, the following hypotheses were assumed:

1. Relating to an intensification of the agricultural production and increasing importance of Kenyan export markets the agricultural land enlarged. Especially in the northern parts of Mt. Kenya these processes happened according to higher land availability for intensive agriculture.

2. At the expense of agricultural land the area of forests decreased.
3. In the context of an increasing population pressure and a general development of infrastructures, traffic and settlement areas in the observed study region enlarged.

2. State of the art – Agriculture in the Mt. Kenya

As stated in the introduction there are many effects that influence the dynamics of agricultural production in Kenya. This chapter will outline some of these and their concern for the research questions. Results of current studies that concentrate on agriculture and agriculture monitoring will be presented in order to give an overview.

Intensification of agricultural production is often based on multiple reasons. Historically speaking Africa has relied on area expansion to increase agricultural production (MUYANGA & JAYNE 2014, p. 98). If there is no space for expansion due to increasing population pressure as it is the case in the eastern part of the Mt. Kenya agricultural production has to be intensified in order to have access to food. This increasing population pressure was not only visible (e.g. through the construction of buildings and streets) during the field trip of the authors but was also mentioned many times by Prof. Gilbert Nduru who supervised the field trip and acted as a local expert who lives in the Mt. Kenya region. Additionally this densely populated rural region (with often more than 500 people/km²) is highly dependent on agriculture for food and income (GRACE et al. 2014, p. 258, WIESMANN et al. 2014, p. 32). Generally agricultural practice is done by rain fed farming, especially in the drier regions in the eastern part of the study area (see also chapter 3). Due to inconsistent rain patterns and different temporal cultivation methods food security is often linked to the debates concerning food production in Kenya. These debates link food security to the climatic dynamics (e. g. FUNK et al. 2008), but also the general status of the agricultural production. As experienced by the authors the study area is roughly separated into two parts: Firstly the highly intensified agriculture practiced in the northern areas of Meru and secondly the strong horticultural sector in the eastern part of Mt. Kenya. The horticultural sector has been the focus of many studies in the Mt. Kenya Region (e.g. DANNENBERG & LAKES 2013, DANNENBERG 2012, DANNENBERG et al. 2011) and is often referred to as a general success story due to its possible high margins for the farmers and international demand of the produce. But this sector is mostly based on manual labor on small field sizes, this is evident not only in the literature but was also obvious during the field trip. In relation to the first research question it would be interesting to monitor an increase of these horticultural production areas as well as a general increase of intensified, industrial agriculture as seen in the north. The data which is made available to monitor agriculture is mostly outdated and therefore does not fit this highly dynamic sector. Thus a remote sensing approach like the one performed by GRACE et al. (2014) delivers strong results without compromising temporal effects. The monitoring via remote sensing of the current status as well as a generation of most current changes (between 2010 and 2015) is therefore a comprehensive approach.

Further there seems to be a general lack of literature concerning deforestation in the Mt. Kenya region. Based on the above mentioned expansion of land there has to be a decrease of other land use such as forest areas and this can be monitored rather well using remote sensing (e.g. KUENZER et al. 2014, HARRIS et al. 2014). The third research questions is based on the population pressure and the resulting land use change due to the increase of for example infrastructures, traffic and settlement areas. This is roughly related to the agricultural practices in the region because there is a lot of manual labor involved. But not also this labor intensiveness employs people but also direct and indirect effects of other linked industries (DANNENBERG & KULKE 2015, p. 16).

All in all the literature review shows that there is not enough insight of current small scale changes in the Mt. Kenya region and also that a remote sensing approach can deliver highly up to date data for monitoring of the surface and land use patterns.

3. Data and methods

To answer the developed research questions and to verify the hypothesis shown in the introduction, an empirical study using remote sensing methods was conducted. The approach used high-resolution multispectral satellite data to determine land use changes between 2009 and 2015. In the following sections, the area under investigation, the utilized data and the empirical methods are presented.

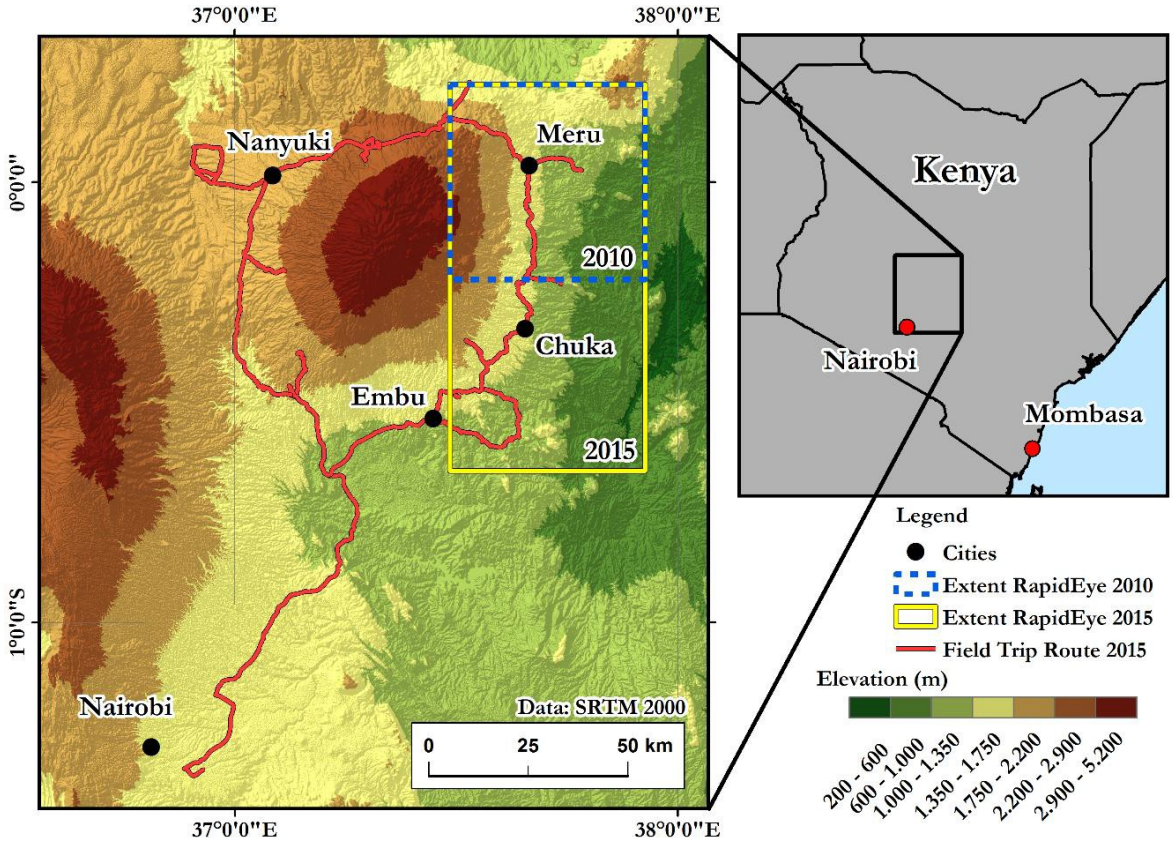
3.1 Study area

The study area is the Mt. Kenia region in central Kenya ranging approximately from longitude 36°45'00" E to 38°10'00" E and latitudes 0°50'00" N to 1°07'00" S (fig 1). Amongst other aspects due to the favorable environmental conditions, for instance climate or soil conditions, horticultural production became of socio-economic importance for the region and characterizes the landscape.

The agro-climatic setting is very advantageous for agriculture, especially for horticultural production (McCULLOCH & OTA 2002, p. 4). The location on the western African equator provides a climate pattern dependent on the effects of the monsoon (NE and SE) and especially in the study area on the topography. There are two rain seasons ranging from April to June and from October to December. The average annual rainfall amounts to 1600 to 2000 mm, where the eastern side of the Mt. Kenya ranges from a humid to a sub-humid climatic zone with increasing precipitation towards the Mt. Kenya (WIESMANN et al. 2014, p. 20). Between these seasons, relatively dry and especially in higher altitudes cloudy conditions occur. Average temperature varies annually between 17 and 22 C°. These conditions enable a perennial production of different crops. In comparison to other countries that produce horticultural crops like Egypt or Morocco this can be a big market advantage for the region. The Mt. Kenya region also benefits from the contiguity to Nairobi and Nairobi airport. Nairobi plays a key role for the export market of Kenyan horticultural products. According to DANNENBERG et al. (2011) the average transportation time from the study area to the export markets of Nairobi is around 3 to 4 hours.

As shown in Figure 1 the topography of the investigated area is for the most parts very heterogeneous (MWANIKI & MÖLLER 2015, p. 60). In the extent of the given satellite imagery the altitude differs from about 800 to 3000 m (based on SRTM by NASA 2015). Especially the elevation of the Mt. Kenya (5200 m) has great influence on clouding and precipitation. However, the relief intensity can also have agro-economic effects. Thus, the average size of agricultural holdings in the southern part is relatively small (less than 15 ha) (McCULLOCH & OTA 2002, p. 9). Here the fraction of horticultural farming is higher. Only in the northern parts, industrial agriculture is possible.

Figure 1: Study area of Mt. Kenya and extent of the used satellite imagery



(Source: Cartography by B. VIERNEISEL and M. WILLKOMM)

3.2 Used data

For the classification of the eastern Mt. Kenya region a dataset of optical RapidEye satellite imagery was used. The data consists of eight adjacent quadratic tiles that cover 625 km^2 (25 x 25 km) in size each (Figure 1). The tiles were numbered by the authors (1a to 4b) to get a clear idea of the spatial arrangement of the data. Because of the duration of the rain seasons and the related cloud cover the data had to be filtered in order to acquire the images with the least cloud cover. For this reason the leeward side of Mt. Kenya was chosen as study area to reduce cloud cover effects. As a result of this filtering process the tiles shown in Figure 1 were used for land use analysis. To acquire multi-temporal information about land use changes in the study area satellite images from September 27th 2010 and February 2nd/5th 2015 were used.

The RapidEye mission is a commercial earth observation system, which consists of a constellation of five satellites each carrying high-resolution cameras. These sensors acquire multispectral spatial data that give the user five individual optical bands in the blue, green, red, red- edge and near infrared portion of the spectrum (BLACKBRIDGE 2015). The images were ordered as Level 3A, so that the spectral data was radiometric and geometric corrected. Further the spatial resolution is processed to a 5 m pixel size. Detailed descriptions of the spectral wavelength ranges of the bands and further information about the RapidEye mission can be found in Table 1.

In addition to the spectral data set ground truth data was collected during a field trip from 16th to 20th March 2015. Regarding to the possible changes between the acquisition date of satellite imagery and ground truth observation in 2015 only explicit areas were observed.

However, it was possible to survey a heterogeneous spectrum of different types on surfaces. Furthermore, some additional regions of interest (ROI) of the RapidEye images were included.

Table 1: general information about the used satellite date

satellite information	RapidEye (BlackBridge
spatial resolution	5 m after geometric
bands available	blue: 440-510 nm green: 520-590 nm red: 630-685 nm red-edge: 690-730 nm
acquisition dates	2010/09/27 2015/02

(Source: authors)

3.3 Applied Remote Sensing Approach

For the remote sensing approach the images of the RapidEye satellites deliver a very high spatial resolution of 5 x 5 m pixels, this gives a lot of options for the usage and detail of processed data.

Studies showed that the multispectral bands of RapidEye imagery make it possible to distinguish between different vegetation covers and surfaces (e.g. IMUKOVA et al. 2015). Also for small-scale analysis of urban vegetation the RapidEye images have been used and found to be fitting to adequately map different ground surfaces and vegetation based on the phenology and the plant species (TIGGES et al. 2013). The details concerning the time (2010-2015) and extent (eastern part of the Mt. Kenya, see Figure 1) of the RapidEye images were based on the availability of tolerably cloudless images. After receiving the files visual analysis was undertaken to find the images with the least cloud cover and the longest time interval. Since not all the images were taken during the same monthly periods a comparison between classifications has to be done rather carefully. Thus, phenology, crop rotation and cultivation time have to be important factors that influence different land use patterns.

The next step involved the merging of the different tiles based on the same date the images were taken. In order to classify the images with a supervised method regions of interest (ROIs) have to be chosen and manually incorporated into a geographic information system (GIS). These ROIs were based on the collected ground truth data. For the correct classification of an image it is necessary to collect ground truth data in order to validate what is actually seen on imagery. To minimize the error because of the time shift between the imagery by RapidEye and the collected ground truth data additional interviews with local experts and farmers have been conducted. These interviews during the fieldwork helped to understand the growth of certain kinds of vegetation in the context of spatial distribution and temporal reasons for growth. The experts could also help to understand what crops were grown.

After creating the ROIs the GIS-Software ENVI 5.1 was used to do a Maximum-Likelihood Classification. This method is commonly used for image classification and classifies pixels based on an estimation of likelihood (MWANIKI & MÖLLER 2015, ALBERTZ 2009). Based on the dispersion of the reflection values in the five bands and their combination in the presented RapidEye data, nine different classes for land cover were chosen. To support the process of choosing these classes, an unsupervised Maximum-Likelihood approach was applied before. The

classes are namely (1) water, (2) urban areas, (3) forest, (4) light forest and scrubland, (5) agricultural land and especially (6) tea and (7) barren ground. Tea surfaces were handled as a discrete class, because it's spectral information is very different to general agricultural areas (see Figure 2). Additionally the cloud cover (8) and their shadows (9) were detected and categorized.The result of the first classification delivers a land cover map that has a lot of scattering of different pixel classes. In order to get a more smoother image and thus eliminate these effects it is necessary to use a set of filters: namely smoothing and aggregation was used. Smoothing removes speckling noise while aggregation cleans the image from small regions (EXELIS 2015). This filtering process just like the overall classification has a generalization effect on the imagery. After the filtering there are two images one from 2010/09/27 and another one consisting of two images 2015/02/02 – 2015/02/05 that are used for the classification comparison. In order to be able to compare these images the clouds have to be clipped out so that only areas that are not influenced by the clouds or their shadow are used for the creation of the land use statistics. This was done by selecting the classified clouds and shadows of the images and using a buffer to enlarge them. So the error of wrongly classified pixels at the border of the clouds and shadows will not further influence the classification comparison. To blank all the areas influenced by cloud scattering a 100 m buffer was used. The overall workflow for can be seen in Figure 2.

4. Results

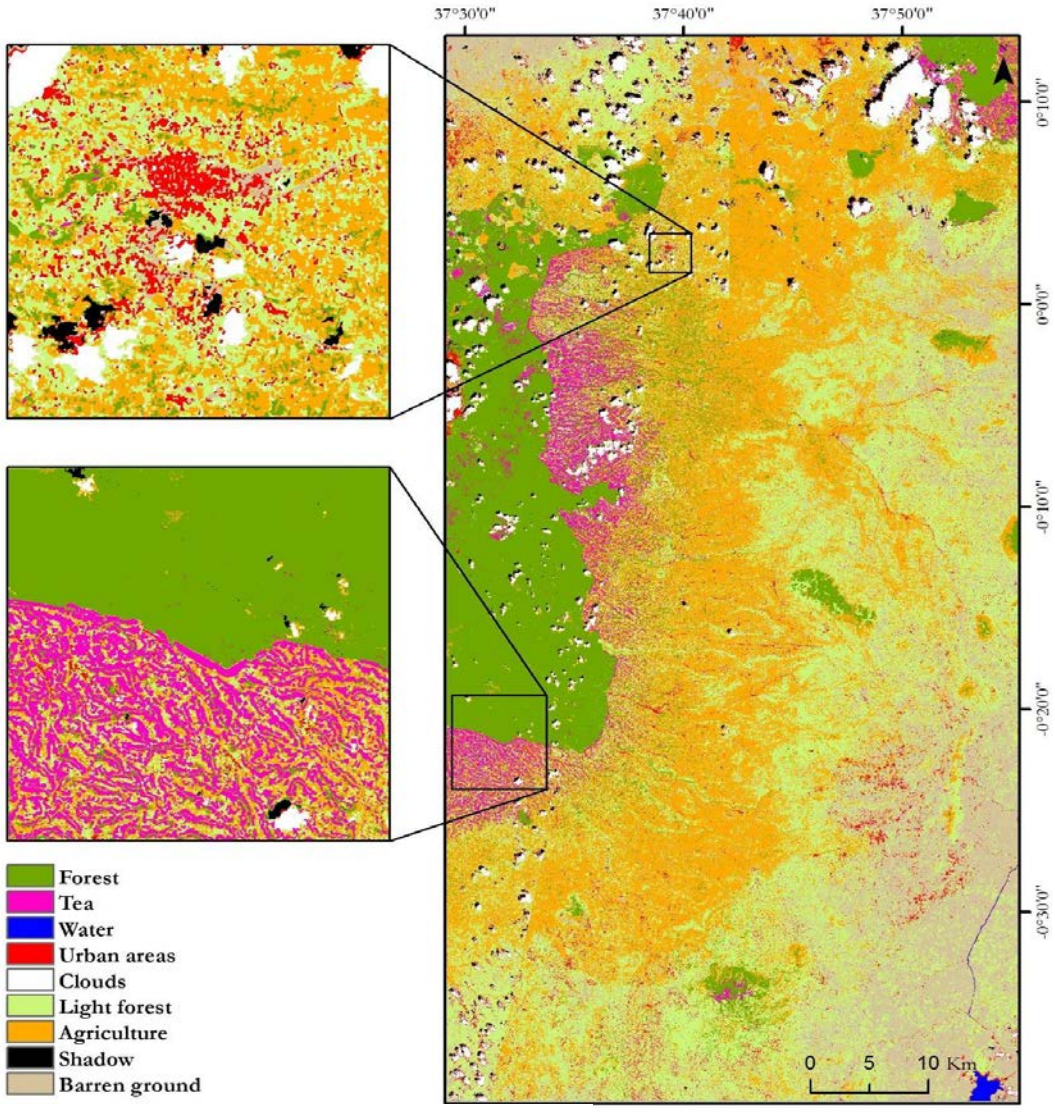
This chapter presents the classification results. The first part will focus on the current land use pattern therefore using the images of February 2015. The second part will be on the classification of the images from 2010. Finally a comparison of the two classifications and geographic changes will be presented.

4.1 Current land use pattern

The classification results of the given RapidEye images show that it is possible to detect clear land cover patterns with the applied remote sensing methods. The output information of the data processing for February 2015 outlined above are shown in Figure 4. A statistical approach is shown in Figure 3. There are five major land use classes to be identified. Firstly the forest as a land cover in the western part of the image. This is a very unique area because the forest is rather dense and therefore builds up a homogenous surface cover. The forest is part of the Mt. Kenya National park and is separated very sharply by a fence from other areas. As the forest is secured and therefore untouched by human agriculture it's canopy has a very high density. The forest cover of the study area can be seen as the central part of a circular and zonal pattern. The following four land use classes are more or less arranged in a concentric way around Mt. Kenya. The second surface cover that can be identified are the tea plantations around the edges of the forest. It should be noted that these tea fields can only be found around the larger forest areas (also in the NE) and at regions with higher altitude and slope (see Figure 1). The focused lower subset in Figure 4 show very clearly that the classes of forest and tea can be circumscribed very sharply. There is a strict boarder of the forest detectable and the shapes of the tea plantations orientate oneself in order to the valley configurations. The third and fourth classes are agriculture and light forest. These classes seem to be part of the concentric surface pattern as well. But in comparison to other classes they have a very smooth transition and are spatially mixed. Nevertheless an agricultural ring around the Mt. Kenya can be detected. Also in the north there is less light forest to be found within the agricultural surfaces. Here the agriculture seems to have a much broader scale than in the southern parts of the classification map. At the lower altitudes in the eastern parts of the images there is a bigger amount of light forest and also

barren ground in the classified image. Further land use classes represent lesser surfaces in the considered image. Namely there are the settlement areas and streets, which centers closer to Mt. Kenya, and the expanses of water in the SE. On the one hand the classified urban areas describe the extent of real settlements quite good. On the other hand there seem to be mixing problems with the classified pixels of barren ground. Because there is a high proportion of barren grounds in the settlements the range of both reflection values cannot be distinguished clearly (see focused upper subset of Figure 4). This comes along with greater urban areas in the SE of the classified image, which could not be found in original RapidEye images. Further analysis of different random errors are presented in the third section of this chapter. In course of the expanses of water it should be noted that they can only be detected in the SE of the study area. Due to the acquisition of the image in dry season in February 2015 the wadi systems were not containing water in the most cases. To quantify the described areas a simple class statistic is shown in Figure 3. As presented the areas of water and urban systems represent a low percentage of the pixel count (less than 3 %). The spatially illustrated main classes can be distinguished in the areas of forest and barren ground, which each represent about 15 % of the study area, and the areas of scrubland and agriculture. The last mentioned groups represent around one third (circa 1600 km2) of the whole surface. In the 2015 image the influence of cloud cover is less than 3 %.

Figure 2: Image classification of February 2015



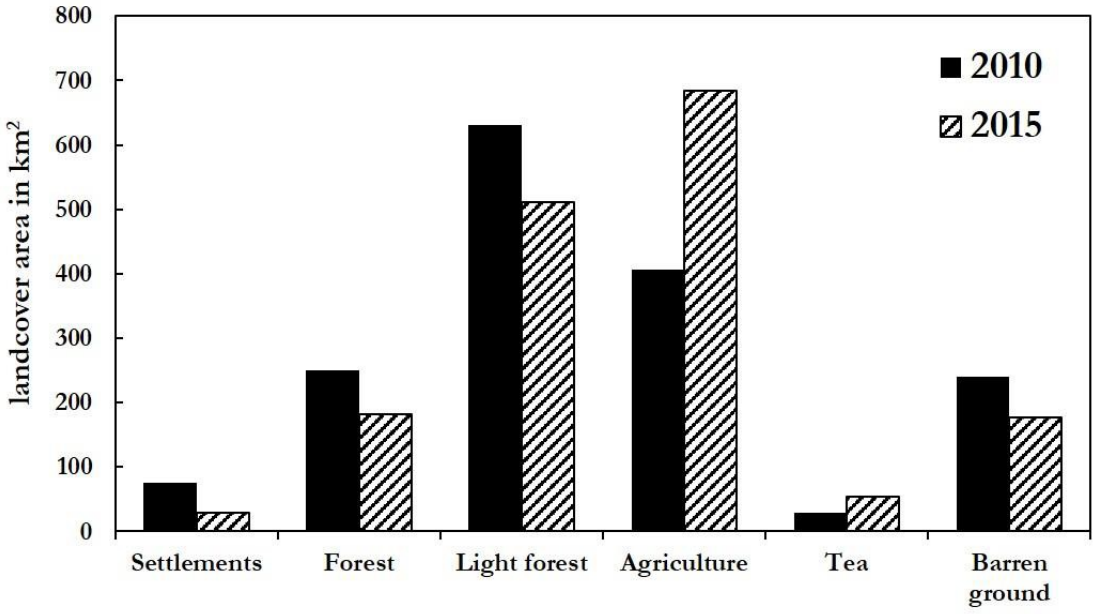
(Source: B. VIERNEISEL and M. WILLKOMM)

4.2 Comparison between 2010 and 2015

A comparison of the classified images from 2010 and 2015 can be seen in Figure 6. Two subsets namely A and B were chosen in order to see a direct comparison between both dates on a larger scale. For the corresponding change statistics (see Figure 5) between classified land use the classes shadow and clouds were cut out of both images so that a comparison was made possible. As shown in Figure 6 (A: 2010) scattering effects of the cloud cover can result in an allocation of urban areas in the periphery of the clouds. For this reason a buffer was created for statistic export to remove these effects. For the comparison it has to be kept in mind that the images from 2010 were taken at the end of September while the once from 2015 are from the beginning of February. This has vegetative effects on the land cover depending on water regime and plant phenology. These effects will be discussed in chapter 4.

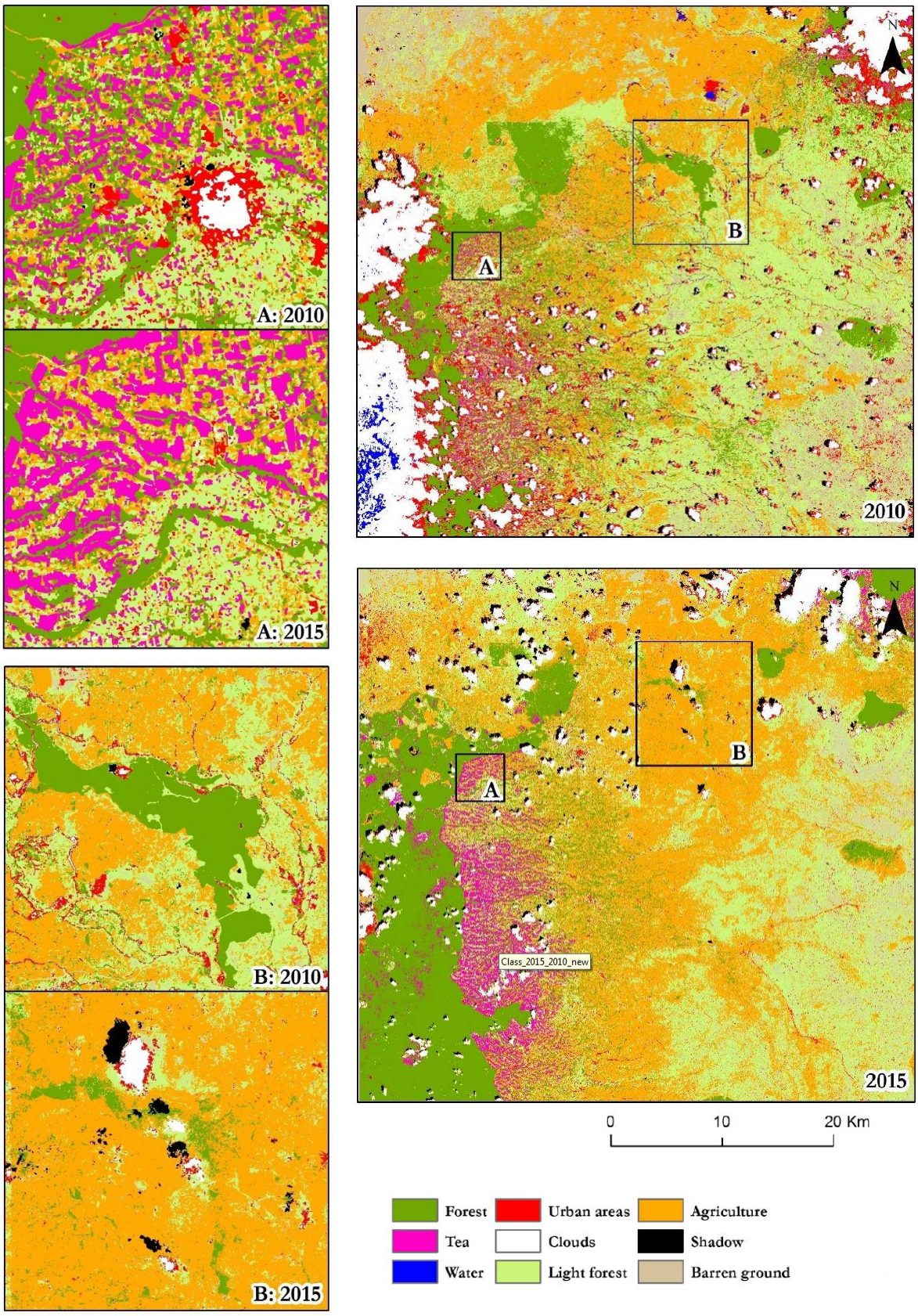
The statistics show that the classes light forest and agriculture are strongly connected as a lot of pixels that were classified as light forest in 2010 changed to agriculture in 2015. In general the surface of agricultural land increased about more than one half (Figure 6). This can be seen in an overall growth of the agricultural belt described in the previous section. But also the accretion of the tea areas (also about 50 %) represents the general growth of agricultural areas (Figure 5, A). A decrease of forest land cover, as shown in subset B, is also noticeable both in the image and the statistics. But spatially the Mt. Kenya National park, classified mostly as forest, seems untouched and therefore represents an exception. The decrease of forest areas about one quarter can be detected in the valley systems around Mt. Kenya, but also in aggregated regions at lower altitude. An example is presented in Figure 6 in subset A. Here a continuous plot of forest was mainly transformed in agricultural land. Similar examples can be found for the class of barren ground, which also changes to the use agricultural pattern. The class settlement and streets show a strong decrease between 2010 and 2015. In this case the results will be separately discussed in chapter 4.

Figure 3: statistical area changes between 2010 and 2015



(Source: authors)

Figure 4: Land use changes between 2010 and 2015



(Source: B. VIERNEISEL and M. WILLKOMM)

4.3 Error and confusion matrix

Table 2 and 3 show the error matrices of the 2010 and 2015 image classifications. Each matrix presents the percentage of pixels for each class that have been correctly classified based on the chosen ROIs (see also chapter 2). The allocation of the classes of water, forest, tea and mostly barren are correct in more than 90 % of all pixels. Especially the classification of the tea plantations delivers an accuracy of more than 98 %. For the classes light forest and agriculture there are bigger rates of classified pixels to be found in other classes thus the inaccuracy is big. While 78 % of all pixel in the ROIs in light forest class were correctly classified in the 2010 image, in the 2015 data the ratio is only about 37 %. Especially the agricultural class covers many areas of light forest in this surfaces. The same problem appears in the urban areas. As mentioned before there is a great influence caused by barren grounds. So the error matrices show low accuracies (in 2010 about 23 %; in 2015 about 52 %).

For the measure of a general accuracy of the classification the Kappa coefficient was used. It ranges between numbers from 0 to 1, where 1 implies that all pixels are classified correctly. For the classification of the images from 2010 the Kappa coefficient comes to about 0,82. For 2015 imagery the software computed a value of 0,85.

Table 2: Error matrix for 2010 classification

	Forest-ref	Tea-ref	Water-ref	Urban areas-ref	Cloud-ref	Light Forest-ref	Agriculture-ref	Shadow-ref	Barren-ref
Forest	91.45	0.66	0	0.21	0	9.14	7.39	0.05	0.02
Tea	0.47	98.98	0	0	0	0.17	0.22	0	0
Water	0	0	94.14	0.1	9.46	0.01	0	0	0
Urban areas	0.16	0.02	3.13	22.84	0.32	0.26	0.68	1.39	1.8
Cloud	0	0	2.29	0.41	90.22	0.01	0	0.08	0
Light Forest	6.93	0.16	0.04	10.42	0	77.94	28.89	1.29	10
Agriculture	0.95	0.17	0	8.82	0	5.39	61.59	1.22	3.93
Shadow	0.01	0	0	0	0	0	0.22	95.97	0
Barren	0.02	0	0.4	57.2	0	7.07	1.01	0	84.26

(Sources: authors)

Table 3: Error matrix for 2015 classification

	Forest-ref	Tea-ref	Water-ref	Urban areas-ref	Cloud-ref	Light Forest-ref	Agriculture-ref	Shadow-ref	Barren-ref
Forest	93.95	0.75	0	0.07	0	4.94	15.34	1.44	0
Tea	1.73	98.26	0	0.01	0	0.02	0	0	0
Water	0	0	96.00	0	0	0	0	0	0
Urban	0.01	0	1.02	52.84	1.86	3.47	2.8	0.24	4.36
Cloud	0	0.11	0.01	1.51	97.93	0	0	0.04	0
Light	0.56	0.27	0.12	9.17	0.09	37.3	13.48	0.11	4.01
	3.43	0.62	0.01	9.77	0.02	21.68	63.73	0.67	1.18
Shadow	0.05	0	0	0	0.06	0	0	96.02	0.01
Barren	0.28	0	2.83	26.62	0.04	32.59	4.66	1.48	90.44

(Sources: authors)

5. Discussion

5.1 Methodology

There are different major factors that can influence the classification of the images. First of all the cloud clover greatly decreases the possible areas for comparison. Also there mostly is an area of error adjacent to the classified clouds and shadows. Another factor is the slope of the Mt. Kenya area. Areas a greatly generalized when the remote sensor collects ground data. Further the different cultivated crops (with the exception of tea) on the fields could not be distinguished. The small scale farmers tend to plant different crops in one field in order to increase the plant resilience and produce many different crops (MCCORD et al. 2015). The error of classification in the classes of agriculture and light forest is bigger than in the classes of tea and forest because the surface in these classes is not as homogenous. The class urban areas show a strong decrease between 2010 and 2015 but this can be explained with the wrongly classified pixels just at the edges of clouds and shadows as well as the class barren ground that was sometimes added to it. Also there are some wrongly classified water pixels just at the border of southwestern parts of the image classification from 2010. Overall this class was not really regarded due to the fact that the amount of water pixels was just too low. All in all the classifications deliver good results with a high Kappa coefficient. The different phenology effects can be left out because of the scale of the classified images and due to the fact that different kind of plants were not distinguished.

5.2 Linkage between the results and hypothesis

The results show clearly that there has been an increase of agricultural surface within the past five years in the eastern part of the Mt. Kenya region. This increase is spatially divided into the northern part of Mt. Kenya that allows intensive agriculture with the help of industrial tools such as tractors whereas the eastern and southern part show a different mixed land use between light forests and agriculture (see also chapter 2). These areas a more prone to be used for small scale farming. Although the monitored increase of agricultural land use cover does not automatically imply that the agricultural production grows as well it can be linked to the growing subsectors export and domestic markets (LENNÉ et al. 2005: 226).

Based on the assumption that the production of higher volumes depends not only on intensification but also on the valorization of unused or different used areas the increase of farmland fits to the current trends in agriculture of the region (DANNENBERG 2012: 60). This can also be seen in fig 6 part B 2010 and B 2015 where unprotected dense forests have been cut an turned into farmland. There is a difference between these unprotected forests and the Mt. Kenya National park where almost no areas have undergone change. Local experts explained that the tea fields the so called "tea boundary" helps to secure the border of the park as an addition to the fences (NYAYO 2015). Due to the harvesting of the same plant the tea plants do not have to be removed in order to reassure other harvests. The effects of the "tea boundary" can also be seen in fig 6 A 2010 and A 2015 and in Figure 7.

In the context of high population pressure in the region it would be interesting to see an increase of infrastructures, traffic and settlement areas. Due to the poor classification results in the class urban areas it was not possible to investigate or monitor this change. However it could be argued that an increase of farmland or agriculture has to go along with an increase of labor force. This is especially the case with the horticultural sector that uses mainly manual labor and therefore is more likely to engage many people (MUYANGA & JAYNE 2014).

Figure 5: "Tea boundary" at the Mt. Kenya National Park (own photo 19.03.2015)

(Source: Own Photo, 19.03.2015)

6. Conclusion

The aim of this paper was to answer the research questions as stated in the introduction. For this purpose high quality image classifications were produced in order to monitor land use change and current land use patterns in the eastern Mt. Kenya region. The results were linked to current geographic discourses. Although there does not seem to be a classification of the used extent and scale of the study area in the literature. The produced classification delivered a good accuracy in the monitoring of forest and tea land cover. The decrease of forest land cover was one major result that was the topic of the second research question (see Figure 6). Most of the lost forest area was turned into agricultural land pointing to the fact that deforestation was used to create new farmland thus expanding the possible cultivation area (MUYANGA & JAYNE 2014: 98). This implicates that there is a high demand for farmland. This could be discussed in many contexts such as food security and population pressure or climatic events (FUNK et al. 2008, MUYANGA & JAYNE 2014). The reasons for this increase could be further investigated by analyzing additional imagery or by using quantitative approaches such as standardized questionnaires. This further research would have to focus on the question why the farmland is increasing. This could also be linked to economic value chain concepts as mentioned in chapter 2 (DANNENBERG & KULKE 2015).

In terms of the impacts of deforestation and possible socio-economic effects on the population one could argue that the observed area and especially the Mt. Kenya national park seems not to loose any of its forest land cover and therefore is well secured. The functionality of the tea border (see Figure 7) in combination with a fence systems is therefore proven and this shows clearly that areas of certain land use can be preserved successfully in the Mt. Kenya region. Furthermore the differences in cultivation within the agricultural ring (as observed in chapter 4) around the Mt. Kenya were successfully represented by the classification showing intensive agriculture in the northern parts of the Mt. Kenya and strongly mixed land use consisting of light forest and agriculture in the eastern part of the mountain. Unfortunately it was not possible for the authors to monitor the land use increase of urban areas as expected from the

general research and the literature review. Different methodical approaches within remote sensing and making use of smaller subsets could help to increase the accuracy of detected urban areas (ALBERTZ 2009). In this way better results could be produced.

Finally the results show that the land use pattern in the Mt. Kenya region is highly dynamic presenting a very quick change in a time frame of less than five years. These changes and especially their reasons as mentioned above could be the focus of further research.

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Food Security of Horticultural Small-Scale Farmers in the Mount Kenya Region

The influence of income levels on food access of small-scale farmer households

Laura Pargen

1. Introduction

The *Millennium Declaration* of the *United Nations* includes the *Millennium Development Goal* (MDG) 1.C, which target is to halve the proportion of hungry people between 1990 and 2015 (UN 2015). Furthermore, the *Food and Agriculture Organisation of the United Nations* (FAO) publishes the annual report *State of Food Insecurity in the World* (FAO 2015). So in the last two decades food insecurity or respectively food security emerged to a popular topic which is often discussed in the publicity and literature (INGRAM 2011, p. 1 f.). Food access is one dimension of food security and comprises the purchasing power and economic access of a household, the physical access and infrastructure as well as the social, cultural and political allocation of food (FAO 2014, p. 14 f.; INGRAM 2011, p. 420 f.).

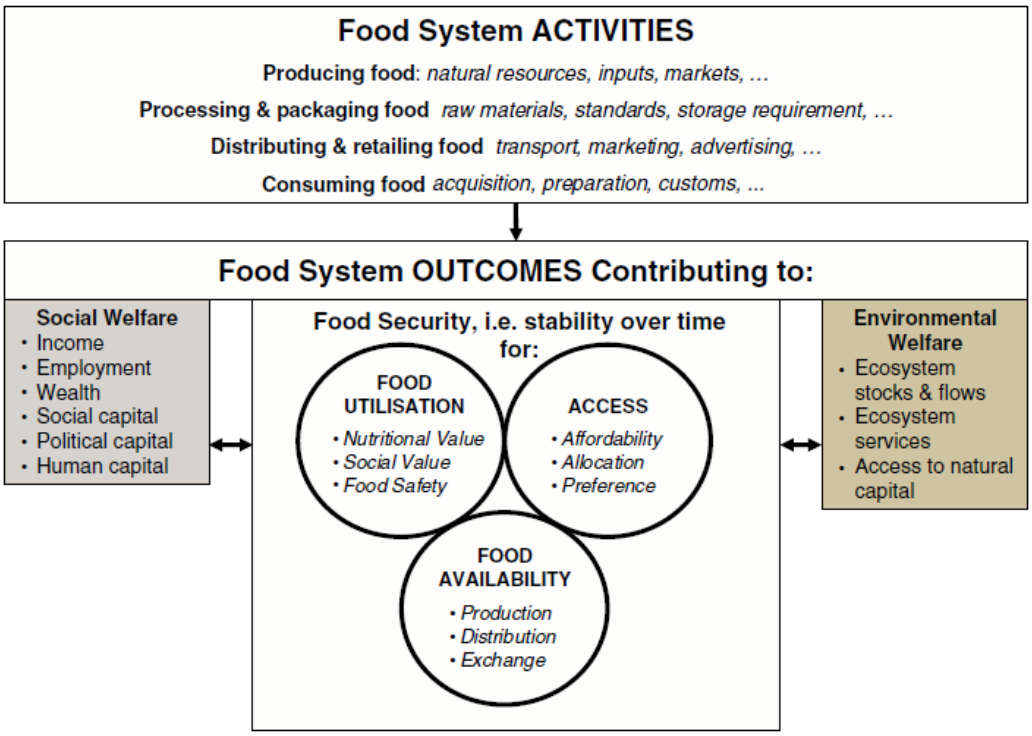
The following report is concerned with food security measured through the food access of small-scale farmer households in the Mount Kenya region. To improve the food access the agricultural productivity of rural households should be strengthened to eventually raise the income levels and purchasing power of those households. Besides the subsistence production, income generating activities are still important to secure food access (MASEKOAMENG & MALIWICHI 2014, p. 277). The research region is known for its agricultural and especially horticultural imprint and the impressive growth of the horticultural export sector (DANNENBERG 2012; MCCULLOCH & OTA 2002; MINOT/NGIGI 2004).

The following paper will discuss if this development and growth of the horticultural industry has a positive impact on food accessibility by securing the income generation on household level. At first, the concept of food security will be explained to answer the following questions: How is the situation of food security shaped in the Mount Kenya region? Do small-scale farmer households face any problems in accessing food? Is it possible that the success of horticultural sector has contributed to assure food security on household level?

Horticulture includes the growing of vegetables, fruits and cut flowers and offers an alternative for traditional export crops like tea and coffee (MINOT & NGIGI 2004, p. 1 f.). A high proportion of the small-scale farmer households in the Mount Kenya region are involved in growing horticultural products for the domestic and export market. The sector of horticultural cash-crop production is seen as a possibility to wealth and higher income generation. In fact horticulture is one of the major income-generating activities in rural households (MUENDO & TSCHIRLEY 2004, p. 18 f.; SURI et al. 2008, p. 9 f.). Following this, are horticultural farm households accessing enough food to be food secure? Is income one of the main factors influencing food accessibility? What other socio-economic variables have an impact on food access and income?

2. Concept of Food Security

Figure 1: Food System Activities and Outcomes



(Source: Ingram 2011, p. 421)

The FAO points out that food security is given if "[…] all people at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 1996). Ingram (2011, p. 420) is guided by the definition of the FAO and defines three different aspects of food security, namely *food availability*, *food access* and *food utilisation* (cf. Figure 1). The production, distribution and the exchange of food are parts of the *food availability. Food access* is another aspect of food security and indicates that the purchasing power or the price levels of food are important as well as the social, cultural and political redistribution of food and the individual preferences. Additionally there is the *food utilisation* dimension influenced by nutritional value, social value of food and food safety. Those core aspects are embedded in social and environmental circumstances and dependent on *food system activities* e.g. supply chains (INGRAM 2011, p. 420 f.). WEBB et al. (2006, p. 1405) are considering that the three dimensions could be hierarchic: "[…] food availability is necessary but not sufficient for access, and access is necessary but not sufficient for utilization" (WEBB et al. 2006, p. 1405). Some researchers define four dimensions of food security and add to the availability, the access and the utilization the aspect of stability. Stability comprises the exposure to food security risks and the incidence of shocks (FERDOUSHI & CHAMHURI 2013, p. 350 f.; MIGOTTO et al. 2006, p. 2).

Former research focused on the availability of food and the main goal was to increase the production of food. During the 1980s and 1990s there was a shift of the focus from the dimension of food availability towards food accessibility. This was caused by the incidence that some people still suffered from hunger although there was sufficient food production on the international level (IDALINYA 2012, p. 47 f.). This study measures food access of rural households in the Mount Kenya region. "Access has been defined as a household's ability to

acquire enough food of sufficient quality to have all its members meet their nutritional requirements and lead productive lives" (LABADARIOS et al. 2011, p. 891). Generally there are different accessing strategies used by households to reach food security. First of all food access could be seen as *physical access* to food products. Due to that it is important to get an idea of the household's own food production and consumption. This is influenced by the access to different food markets which is dependent on the distance and on the mode of transport to the nearest food market, here termed as *local access*. Furthermore the wealth and the cash income of the household are accessing strategies and should be investigated to measure the *economic access* to food (FAO 2014, p. 13; MASEKOAMENG & MALIWICHI 2014, p. 277 f.; MIGOTTO et al. 2006, p. 3 f.).

2.1 Food Security in the Mount Kenya Region

Horticulture became one of the most important production sector in Kenya especially in the Mount Kenya and the Rift Valley region. This study addresses solely the Mount Kenya region which is characterized by good climatic conditions that allow a year-round cultivation (DANNENBERG 2012, p. 62f.; MUENDO & TSCHIRLEY 2004, p. 1 f.). Horticulture in Kenya is seen as a 'success story' because it is fostering among others the economic level of small-scale farmer households (MINOT & NGIGI 2004, p. 1 f.). As BRIGHAM (2011, p. 730 f.) stated the households involvement in horticultural export could raise the income of a small-scale farmer household. Following this, it will be an opportunity to increase the access to food due to the higher purchasing power (BRIGHAM 2011, p. 730 f.). Thus, are households' involved in the horticultural sector accessing enough food and are therefore food secure? Does the income level of a household mainly contribute to food access? Which variables influence the income generation of households?

On average the main source of the household income in the Mount Kenya region are earnings from horticultural production (MCCULLOCH & OTA 2002, p. 1 f.; MUENDO & TSCHIRLEY 2004, p. 18 f.). But the household income should be maintained through diversified income generating activities. If the main source of earnings is agricultural production the household is eventually more vulnerable to food shortages during a year due to the seasonality and perishability especially of horticultural products (AFARI-SEFA 2007, p. 437 f.; IDALINYA 2012, p. 157 f.; MINOT & NGIGI 2004, p. 31). On the other side the displaced use of scarce resources (e.g. land and irrigation water) for horticultural cash crop production will have a negative influence on the staple crop production for subsistence. As named before, the households access to food is both influenced by the proportion of income spent on food and the proportion of food produced for own consumption (BRIGHAM 2011, p. 734; IDALINYA 2012, p. 59 f.).

Gender is another variable influencing food security, female-headed households are more vulnerable to be food insecure. In general female-headed households have disadvantages in several ways; if it's in the accessibility of land, livestock, labour and other assets or credit, education and health care. These disadvantages are consequences of cultural constraints on women preventing them in their food production activities (KASSIE et al. 2014, p. 154 f.). DUFLO & UDRY (2004, p. 15 f.) assessed that income controlled by women is primarily spent on food and education while men were prone to buy private goods e.g. alcohol and tobacco. In a nutshell female headed households should be more likely to appropriate a higher proportion of the household income for food products than male-headed households do (DUFLO & UDRY 2004, p. 15 f.). Another point is that female-headed households apparently produce more food-crops than cash-crops which could be resulting in a lower income compared to male-headed household income (KASSIE et al. 2014, p. 155). So, are female-headed household more vulnerable to food insecurity caused by lack of adequate economic access? Or is the food access secured through the high proportion of subsistence production?

3. Methodology

A mixed methods approach was used consisting of quantitative questionnaire and qualitative interviews with farmers, extension officers and employees at the Ministry of Agriculture. The foundation of the quantitative analysis is based on a literature review to determine variables that could have an impact on the households' food access. Expert interviews in different agricultural ministries in Nyeri County, Embu County, Kirinyaga County and with HCD station managers in Nyeri and Meru County facilitated targeting sub-regions strongly influenced by horticultural farming. To select small-scale farmer households who are producing vegetables for the domestic and/or the export market in those regions, a snowball-sampling method was deployed. Contacts to the person in charge of the households' farming business were made through introduction by an extension officers or a local leader. At the beginning the standardised, quantitative survey was verified with a small pre-test. The data was gathered in farming households in Nyeri County, Embu County, Kirinyaga County and Meru County.

In this research design, the access to food is the dependent variable and measured through components of the households' economic, local and physical access. The monthly income level of the household is used to operationalise the economic access. The GPS data, the distance to the nearest food source (e.g. shops and markets) and the type of transport used to reach the food sources is a measure for the local access dimension. Household data on the frequency of grains, vegetables, fruits, dairy products, meat and fish is operationalised as physical access, as well as the number of meals consumed by adults and children. Food security or respectively food insecurity is captured through the occurrence of food shortages during a year and the number of months characterized by food shortages. If there were food shortages during the year the interviewee was asked about coping strategies (e.g. reducing or skipping meals).

4. Results

First of all, it should be proved if there are statistical significant relations between the variables measuring food security and the different access measures. Remarkably, it was found that there is no significant correlation between the variables used to measure the local access and households' food security. To strengthen these findings, several small shops that offer a stock of food products are rather close to the farms and to some extent easily accessible.

The proportion of farm land used for subsistence production, one variable to measure the physical access, is highly significant correlated (0.459***) with the occurrence of food shortages during a year. Noticeably, households using more than 30 % of the farm land for subsistence production are prone to be food insecure. Those households are generating a smaller income compared to others and may not have a sufficient supplementation in the dimension of economic access to food. Albeit the sampling is too small to exhibit a strong, significant argument it could be seen as an indication. Otherwise it was found a significant correlation between the frequency of consuming grains (0.233*), fruits (-0.334**), meat (-0.279*) and the number of months characterised by food shortages. Following this the household consumption of more expensive food products (e.g. meat) could be a hint towards a higher income and therefore reducing the prevalence of food insecurity.

Of the 88 farmers interviewed with the standardised questionnaire 54.1 % said their households have no issues of food shortages during a year while 45.9 % of the households claimed to be affected by food shortages. 48.7 % of the food insecure households are facing food shortages during two months of a year. It should be mentioned that the food insecure farmer households still have access to basic foods like maize and other grains but the access to

vegetables, fruits etc. is restricted. This could be an indication for the shift from the issue of food security to the issue of food sufficiency. In general the interviewed households' have access to food products to ensure their food security but from the nutrition angle there is lack of food security (Expert1). According to the Ministries and supported by the quantitative survey, the occurrence of food insecurity is subject to the dry season and as a consequence thereof the water scarcity which obstructs sufficient irrigation (Expert2, Expert3). 89.7 % of the food insecure households named the dry season and difficulties to irrigate their land as a reason why they experience food shortages. Furthermore income and gender variables have a statistical relevant impact on the food accessibility dimensions of the interviewed households. Subsequently it will be mainly focused on the variable income and the economic access.

Table 1: Gender and Food Security

			Sex farmer		
			female	male	Total
Food shortages during a year	no	Number	10	36	46
		% in sex farmer	32,3%	66,7%	54,1%
	yes	Number	21	18	39
		% in sex farmer	67,7%	33,3%	45,9%
Total		Number	31	54	85
		% in sex farmer	100,0%	100,0%	100,0%

(Source: author)

If looking from the gender perspective it is remarkably that in only 32.3 % of those households not affected by food shortage, the farming business is done by a women. But those households who have issues with food shortages, the farming business is female-headed in 67.7 % of the households. It was found high significant coherence (0.332**) between the gender of the person in charge of the farming business and food security. In addition gender differences are still an important variable influencing decisions about the income allocation in particular (Expert1). Unfortunately the data gathered in this study offers no explanation for those differences so further research should be implemented.

The average monthly income of the households included in the survey is 23,825 KES (1000 KES are approximately 10 €). The sources of those incomes are differentiated and involving selling crops at the domestic market, export crop production, dairy production, employment, casual work, self-employment and commercialised meat production. Most of the interviewed households (73.9 %) are involved in horticultural production for the domestic and export sales-market, while 21.5 % of the households produce only for domestic markets and 4.5 % are solely involved in the horticultural export production. It was found that there is a high significant coherence (0.323**) between the categorised monthly income and the issue of food shortage. Households with increasing monthly income levels are most likely not to be affected by food insecurity. Additionally, income is negatively correlated (-0.322**) with the number of months of food shortages during a year. Following this the number of months affected through food shortages will decrease with a higher monthly income. Thus income is still an important accessing strategy of the farming households in the Mount Kenya region.

Table 2: Income Categories

	Quantity	Percentage	Valid Percentage	Cumulative Percentage
<= 10000	37	42,0	45,1	45,1
10001 - 20000	20	22,7	24,4	69,5
20001+	25	28,4	30,5	100,0
Total	82	93,2	100,0	
Missing	6	6,8		
Total	88	100,0		

(Source: author)

The land size used for export production has a significant positive impact (0.246*) on the monthly income of the household. This means if the proportion of the land used for the export production increases the household will generate a higher income. So it seems that the households' involvement in the horticultural export sector is profitable for the income generation. A contribution to that may be the trainings of the so called *Home Economics Officers* and the *Extension Officers* from the agricultural Ministries, since they are mainly focused on the agribusiness and income generation. Former aspects of those trainings were e.g. food security and kitchen gardens. The idea of kitchen gardens was and still is a highly recommended strategy to ensure food access and food security (Expert5, Expert6). But the focus of small-scale farmers shifted likewise to income generation (Expert1, Expert3). The proportion of the farming land used for the export production has a negative impact (-0.341**) on the proportion of the land used for the households' subsistence production. As well as there is a highly significant negative correlation (-0.494***) between the proportion of land used for export and the proportion of land used for domestic market production. I a nutshell, the expansion of the export production is at the expense of the production for the domestic market and the subsistence production.

5. Conclusion

Food security was a topic early emphasized by the Kenyan Ministry of Agriculture at regional and national level (Expert1, Expert2, Expert3, Expert7). It may be one reason why the small-scale farmer households have no chronic issue with food shortages or respectively food insecurity. There are no profound difficulties in accessing food on the household level. Even those households who claimed to have some food shortages during the dry season just have restricted access to superior food products. Following this, the incidence of food insecurity shifted from the dimension of food accessibility towards the utilisation dimension (WEBB et al. 2006, p. 1405). This assumption has to be validated by further research.

Horticulture and especially the export sector seemed to have a positive impact on food security through the opportunity of a higher income generation. Although horticultural production is characterized through seasonality and high perishability it is a more or less reliable source of income. And income or respectively the dimension of economic access is an important factor influencing food security on household level. Otherwise, it is still problematic

to detect the balance between production for income purposes and subsistence production. In fact there is a tendency shown that households which are producing a higher percentage for the own household consumption have some slight food access problems.

Gender differences are still an influencing variable on both the access to food and the household income. In this study it was not possible to examine the assumptions of DUFLO & UDRY (2004, p. 15 f.) about gender biased income allocation for different consumer products. Furthermore, there were no statistical relevant coherences found to explain the gender differences in food security. After all water scarcity in the dry season and the following irrigation problems were termed as the main factors causing food shortages and therefore food insecurity.

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Expert1 (Conversation held: 24.02.2015) Assistant Director of Agriculture, Directorate of Agriculture Nyeri County (http://www.nyeri.go.ke/agriculture%20directorate).

Expert2 (Conversation held: 09.03.2015) Employee, Agriculture, Fisheries, Livestock and Cooperative Department Embu County (http://www.embu.go.ke/Departments/Agriculture-Livestock-Fisheries-and-Cooperatives-Department.html).

Expert3 (Conversation held: 09.03.2015) Employee, Ministry of Agriculture, Livestock, Veterinary and Fisheries Kirinyaga County (http://www.kirinyaga.go.ke/agricultre-and-livestock.html).

Expert5 (Conversation held: 18.02.2015) Agricultural Officer, Agricultural Office Sub-County Kieni East (http://www.nyeri.go.ke/agriculture%20directorate).

Expert6 (Conversation held: 20.03.2015) Agricultural Officer, Department of Agriculture, Livestock and Fisheries Meru County http://meru.go.ke/department.php?com=45#105).

Expert7 (Conversation held: 05.03.2015) Agricultural Officer, Agricultural Office Sub-County Imenti South (http://meru.go.ke/department.php?com=45#105).

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Food Security:

The access to food in the rural region of "Mount Kenya" and used coping strategies in times of food insecurity.

Sarah Jochmann

1. Introduction

The following report deals with the problem of food insecurity and the access and availability of food for small scale farmers in the Mount Kenya region. The population of Kenya grew in the period from 2010 to 2013 from approximately 38.5 million people to 41.8 million people (KENYA NATIONAL BUREAU OF STATISTICS 2014). The World Bank categorised 45.9 percentage of population living below the national poverty line (THE US GOVERNMENT'S GLOBAL HUNGER AND FOOD SECURITY INITIATIVE 2015). More than 75 percent of the population in Kenya earns its livelihood from agriculture (IDALINYA 2012. p. 2). This study examined the different types of farmers and evaluates the coping strategy with food insecurity. The report has three main parts. The second chapter of this report is mainly focused on the conceptual background of food security, food consumption, coping strategies in food insecure times and on the Export-Base-Hypotheses. The food security concept deals with the question why people get into trouble caused by food insecurity. Food consumption means which nutrition is needed for a healthy diet; this is a main pillar for food security. In times of food insecurity the framers need coping strategies, this report shows how the farmers use these strategies. The Export-Base-Hypotheses explains the correlation between economic growth and export. In this context the Export-Base-Hypotheses deals with the question how important export is for the famers and which impact it has on their personal economic growth and on the probability of food insecure times.

The third chapter illuminates the field research and answers how the data are obtained and in addition from where the data are sourced. Furthermore it shows how reliable and resilient the data are. The fourth part of empirical findings answers the main research question: "How good is the access to food in the rural region of Mount Kenya and what possible coping strategies are used in times of food insecurity?" In this report access to food is evaluated in terms of economic criteria and its functional chain on the choice of healthy, balanced nutrition. This part is divided into three sections: firstly the farmer characteristics, secondly food consumption and at last the coping strategies in food insecure times. Finally this report ends with the conclusion.

2. Theoretical Background

2.1 What is food security?

The "World Food Summit" of 1996 defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life". Commonly, the concept of food security is defined as including both physical and economic access to food that meets people's dietary needs as well as their food preferences. In many countries, health problems related to dietary excess are an ever increasing threat, in fact,

malnutrition and foodborne diarrhea are become double burden (WORLD HEALTH ORGANISATION).

2.2 What are the elements of food security?

Food availability

Food availability is a question of production, distribution and exchange. It is important to know how much and which types of food are available through local production. Distribution means: "how food is made available (physically moved), in what form, when and to whom". For Exchange it is necessary to know how much of the available food is obtained through exchange mechanisms such as barter, trade, purchase or loans (INGRAM 2011, p. 420).

Access to food

The access to food contains the affordability, allocation and preference to get food. The affordability is the purchasing power of households or communities relative to the price of food. Allocation is the economic, social and political mechanisms governing when, where and how food can be accessed by consumers. Preference is social, religious or cultural norms and values that influence consumer demand for certain types of food (INGRAM 2011, p. 420).

Food utilisation

The nutritional value describes how much of the daily requirements of calories, vitamins, protein, and micronutrients are provided by the food people consume. The social value describes the social, religious and cultural functions and benefits food provides. Food safety deals with toxic contamination introduced during producing, processing and packaging, distribution or marketing food. Furthermore it describes the problem of food-borne diseases such as salmonella (INGRAM 2011, p. 420).

2.3 Food consumption

Food security is not only a question of having enough food; it is also a question of physical food consumption. So it is important that people have a good nutritional value. The Household Dietary Diversity Score (HDDS) is defined as the number of different food groups consumed over a given reference period. The number of different food groups consumed implies the diversity in both macro and micronutrients. In Household Dietary Score a set of use 12 groups is used to calculate the HDDS. These are: **A**. Cereals, **B.** Root and tubers, **C.** Vegetables, **D.** Fruits, **E.** Meat, poultry, offal, **F.** Eggs, **G.** Fish and seafood, **H.** Pulses/legumes/nuts**, I.** Milk and milk products, **J.** Oil/fats, **K.** Sugar/honey and **L.** Miscellaneous, (BILINSKY, SWINDALE 2006, p. 2). So the well-balanced ingestion is also an important issue.

2.4 Coping strategies in food insecure times

In terms of physical and economic access to food there are different stages of coping strategies. The coping strategies are categorised into four distinct stages of food insecurity (RAHMATO 1991).

Stage 1: Insurance strategies

The first stage of household food insecurity is marked by the initial shortage of food, or inability to provide sufficient quantities of food to all members of the household. It includes: Diet change (consuming less preferred foods such as corn instead of rice), meal frequency (reducing the number of meals per day), collection of wild foods, inter-household transfers and loans, increased petty commodity production (firewood, charcoal, etc.), seeking daily labour and diversifying activities and working for long hours (RAHMATO 1991).

Stage 2: Crisis strategies I

The second stage of food insecurity is marked by the sale of assets, specifically non-productive assets. Sales of non-productive livestock, sales of jewellery, insurance assets, credit or loans from merchants, temporary migration for work or land (days/week, days/month), skipping meals for entire days and withdrawing children from school (school dropout). Adult males migrate temporary for reasons of finding an employment (RAHMATO 1991).

Stage 3: Crisis strategies II

This stage includes the sale of productive assets and the shift of the number one priority from asset preservation to food consumption. Furthermore it includes the sale of all livestock, sale of productive equipment, sale or mortgage of land, redistribution of children (rare) and migration (RAHMATO 1991).

Stage 4: Distress strategies

Stage four is the last in the line and represents complete destitution. Permanent migration, begging for food/resources and complete dependence on external aid are symptomatic (RAHMATO 1991).

The first stage includes both, physical and economic coping strategies. But stage two till four just focus on coping strategies in reference to economic criteria.

2.5 Export-Base-Hypotheses

To earn money the existence of a sales market is very important. The farmers in the Mount Kenya region participate in different sales markets. Selling crop provides the farmers money from which they could buy food. Not every farmer exports the crops, but exporting gives the region economic growth. North defines 1956 the Export-Base-Hypotheses as: The export base model distinguishes two types of sectors. "Basic" sectors produce solely for export from the region, and "non basic" sectors provide goods and services that support export sectors and the households employed in them. The hypothesis is that exogenous growth in export demand is sufficient and necessary for economic development. Increased investment in residentiary activity is primarily induced investment as a result of expanded income received from outside the region, and, correspondingly, expanded employment in locally oriented industry, trade, and services primarily reflects long-run changes in income received from the export base (NORTH 1956, p. 166). For the rural region in Kenya it is fundamental to produce for exports. Through exports the farmers can earn more money and so invest in infrastructure and education. Therefore food insecurity decreases. And if so, the usage of coping strategies also decreases. But for small scale farmers it is hard to keep up and fulfil the demanded standards.

3. The field research

The field work was located around the Mount Kenya region. The field research took place from February till March 2015. The source of the data is quantitative. The preparation contained a previous seminar and a comprehensive literature research. A standardised questionnaire was provided to question 88 small scale farmers. The farmers were questioned about household characteristics, income levels and generation, farming resources, social embeddedness, buying habits, food consumption and food security. The results of the questionnaire are analysed with SPSS and Excel based on the 88 questionnaires. The reason that the data are collected with as standardised questionnaire is the better comparability as if one interview would have been chosen.

The enumerator was supported by students of the University of Karatina. They translated if necessary. Sometimes the language was a small barrier to undertake the research. The farmers were picked by contacts from local groups like the Horticultural Crops Development (HCD) or by coincidence, as already questioned farmer have conveyed neighbours who are also farmers and thus these farmers have been also questioned. Due to the fact of the cultural background it can be assumed that the questions about the income levels and generation were answered not quite honestly. Hence, this data is not used for this report.

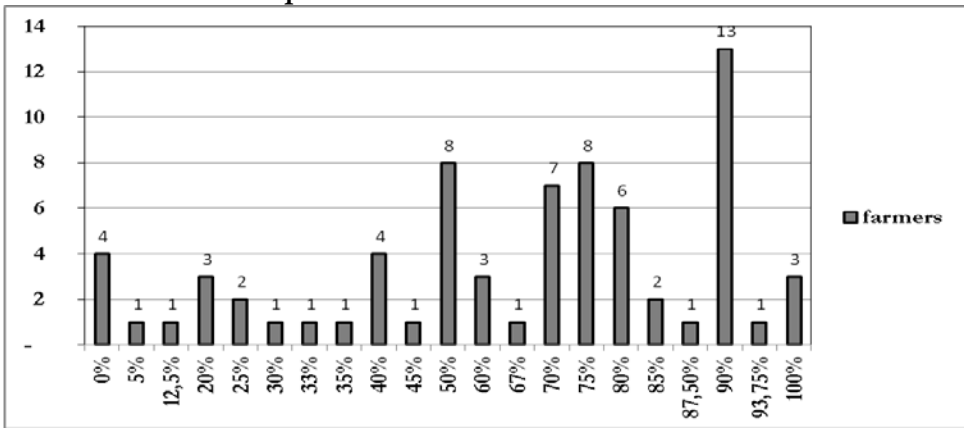
The last part of the questionnaire provides the answers for this research question. The topics "buying habits, food consumption and food security" are the basis for the results of this research question. The question: "How good is the access to food in the rural region of Mount Kenya and what possible coping strategies are used in times of food insecurity?" should illuminate the main part with the entry barrier to food access in the Mount Kenya region. What reason exist until now for food insecurity?

4. Empirical findings

4.1 Farmer characteristics

In order to present the results in a better way the farmers are categorized and characterized as followed. Table1 illustrates the average share of the harvest which is used for the own food consumption is 54.70 percent. So, most of the farmers use more than 50 percent of their own harvest for the own food consumption. The information comes from the SPSS data set.

Table 1: How much percent of the total harvest is used for the own food consumption



(Source: own illustration.)

Vegetable gardens are a common intervention that aims to increase consumption of Vitamin A-rich fruits and vegetables and increase income through the sale of produce (BILINSKY, SWINDALE, 2006, p. 8).

As shown in Table 2 during the research process the awareness emerged that three different types of farmer exist. Their differentiating factor refers to their sales- and procurement strategy as follow:

Type A

4.5 percent of the interviewed farmers produces exclusively cash crop for the export. He earns more money with the cash crop. So it is cheaper for the farmer to buy all the things for his daily use at the local market / super market instead of producing food for subsistence.

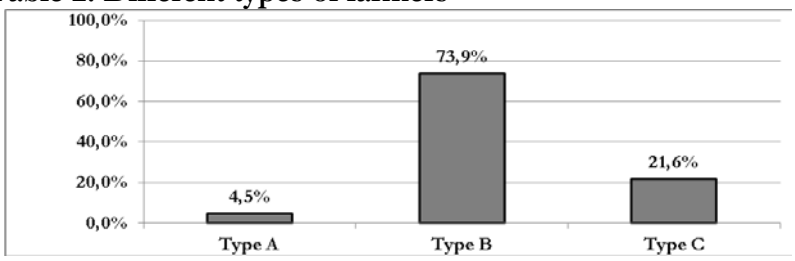
Type B

This farmer produces cash crop for the export and the local market. He buys food at the local market and he also has a kitchen garden.

Type C

This farmer sells staple crops only at the local market and is a main-food-farmer for personal requirements.

Table 2: Different types of farmers



(Source: own illustration.)

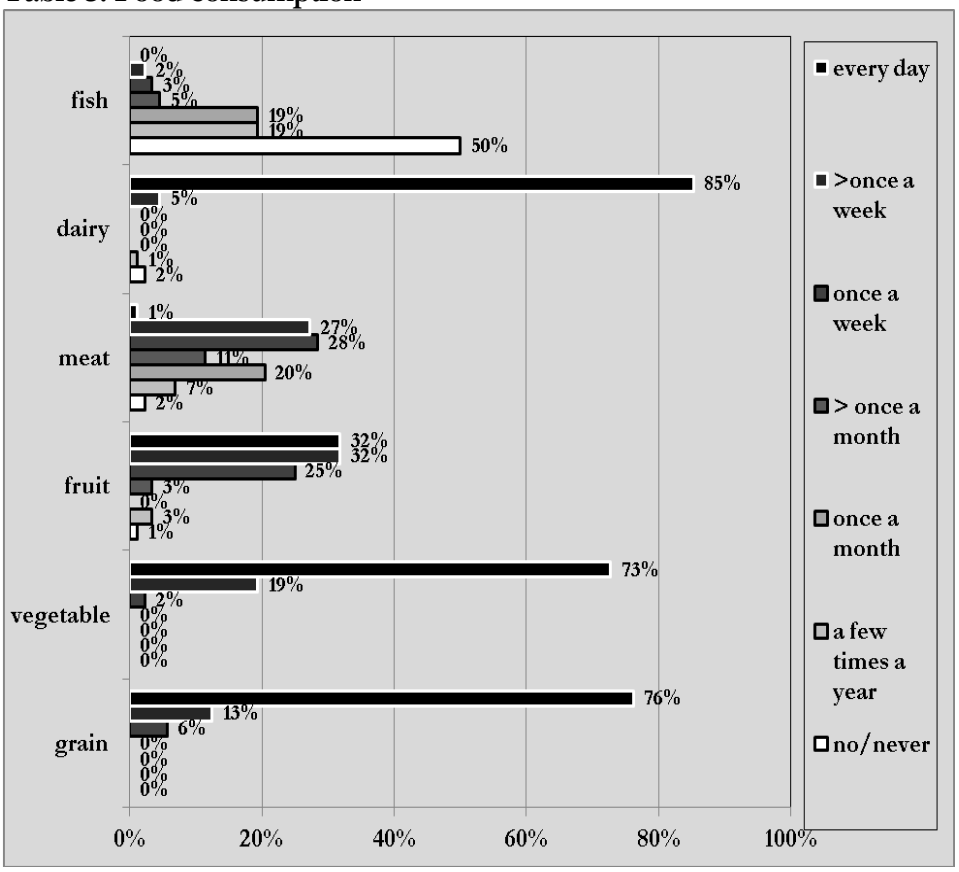
Combining the Export-Base-Hypotheses with the different types of famers shows that farmer type A participates in the gained profits which are achieved from exports. Hence the farmer type A has no need to grow crop for his personal requirements as his buying power is big enough.

4.2 Food consumption

As described in the theoretical part of this report a good nutritional value is important for food security. The questionnaire provides information if the farmers do have a well-balanced nutrition and asks for their food consumption. All respondent of the survey answered that they eat mostly grains. 76 percent eat them daily. The most grain they eat is maize. They are making *ugali*, so they don't feel hungry but it is not enough for health nutrition. It looks just the same with the consumption of vegetables. A good nutrition needs Vitamin -A from fruits. The fruit consumption is not so constant, 64 percent of the respondents eat fruits more than one time a week. But the rest eat less fruits. One farmer answered that he has only fruits for his children but not for himself. 94 percent of the farmer owns livestock, they don't eat the meat but they produce dairy products. That is the reason why 85 percent of the farmers could consume milk every day. 60 percent of the households in western Kenya are dependent on fish as a source of protein. The Kenyan government has responded by building fish ponds and promoting fish farming. Farm Africa is supporting the government's policy by establishing a

network of aqua shops, which are an invaluable source of quality support and training for Kenya's new fish farmers (FARM AFRICA 2015). Because of the dry seasons a lot of fish farms closed in the last years. The survey shows that most of the framers in the Mt. Kenya region do not eat fish.

Table 3: Food consumption

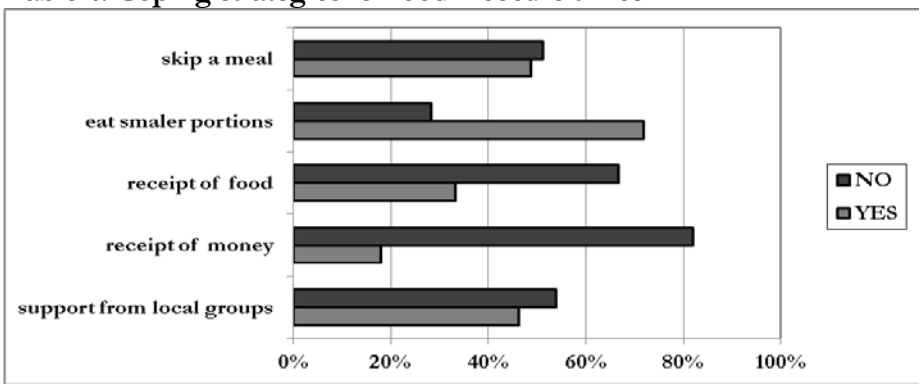


(Source: own illustration.)

4.3 Coping strategies in food insecure times

The access to food in Kenya is mostly not stable. The dry season in Mt. Kenya region is from December to March. It becomes harder to irrigate the farm. The farmers use sprinkler or use drips for the irrigation. Some farmers wait for rainfall, though this strategy is very risky. Therefore, in the dry season it could happen that the farmers do not have enough food. They need coping strategies to survive this period. Table 4 shows the results of the questionnaire in terms of coping strategies in food insecure times. More than 70 percent of the farmers surveyed eat smaller portion in times of food insecurity. A lot of farmers are organised in local groups and in times of food insecurity almost 50 percent of the main unit get support from this local groups. Skipping a meal is also an alternative coping strategy for the farmers. All these mentioned strategies belong to the first stage of Rahmato's coping strategies. Therefore the farmers only use the insurance strategy. The last three coping strategies do not find any application for the farmers.

Table 4: Coping strategies for food insecure times



(Source: own illustration.)

5. Conclusion

"How good is the access to food in the rural region of Mount Kenya and what possible coping strategies are used in times of food insecurity?" is the main question of this report. The results of this report show that most of the farmers in this region of Mount Kenya are not suffering from food insecure times. They have a good access to food, either they use coping strategies or they have enough money to overlap the dry season. Local groups contribute that framers get more information about the several coping strategies. This study confirms the Export-Base-Hypotheses as it shows that the type-A-farmer who exports his harvest earns more money than the type-C-farmer which only produces for subsistence. So the type-A-farmer does not suffer from food insecurity. To cope the dry season the type-C-farmers need more savings. It is not only a question of quantity of food. The farmers have to diversify the food consumption including a diet that is not exclusively characterized by two meals of maiz *ugali* per day. Building up a kitchen garden with intercropping for more nutritious food crops (vegetables and fruit trees) will help in improving the nutritional status of the household (IDALINYA 2012. p. 211ff.). This study has shown that the Mount Kenya region has a good chance to become an area without food insecurity. But on the other hand it is possible that the food insecurity in the area of Mount Kenya is more intensive in the future. So, the farmers could apply one of the stages two till four of the coping strategies if the current used strategies do not help anymore.

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Dealing with non-climate-related crisis and shocks

The example of the Kenyan horticultural sector

Sebastian Christoph

(Source: SEBASTIAN CHRISTOPH)

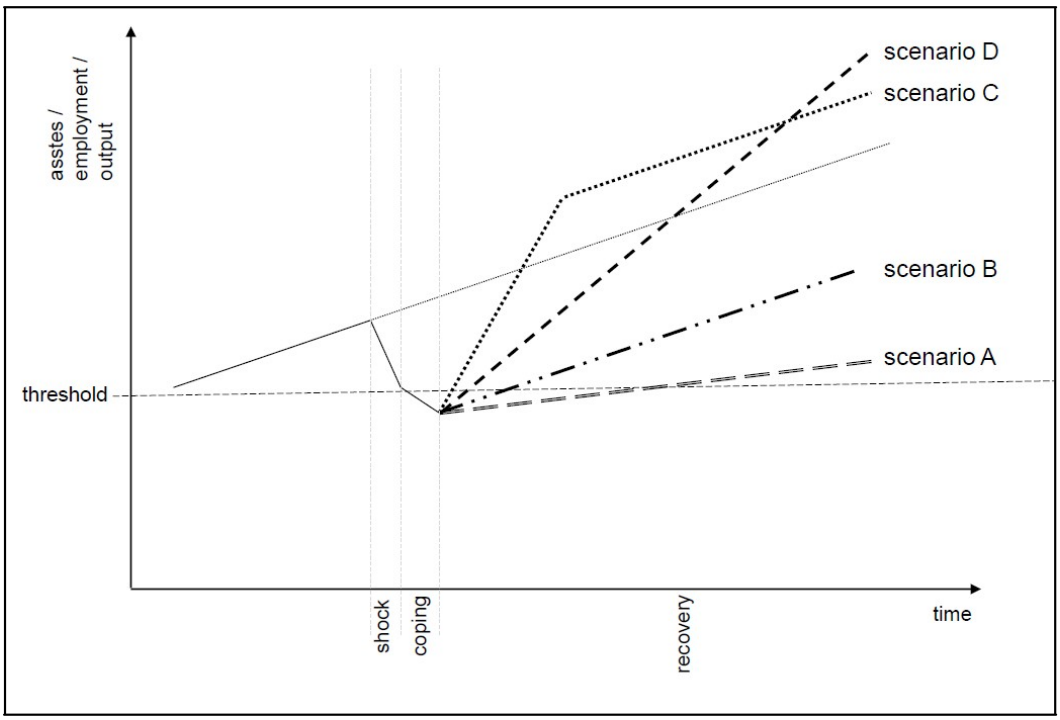
1. Introduction

According to various studies and sources it is more lucrative for small-scale farmers in Kenya to grow High Value Agriculture Crops than so-called staple crops like maize (DANNENBERG 2014, OXFAM 2015). Small-scale farmers in Kenya earn mostly more than the average income and may generate one to seven times higher income if they participate in the highly export-oriented horticultural sector (MCCULLOCH 2002, DANNENBERG 2014). However, due to the strong export orientation there is also an increased dependence on the purchasers of cash crops (TREBBIN 2011, OXFAM 2015) and the fluctuating global economic markets (FAZEY 2010). In 2010 the Icelandic volcano Eyjafjallajökull erupted, aircrafts did not start and goods could not be exported from Kenya (WADHAMS 2015). It became apparent how vulnerable the agricultural export system in Kenya is due to the high dependence on the US and EU market. Some of the Kenyan households and companies could deal better than others with this state of shock - they were able to demonstrate a higher resilience (FOSTER 2007). In the literature the topics shocks and resilience in the agricultural sector are discussed almost exclusively under climate-induced changes (e.g. tsunamis, droughts and hurricanes) (cf. IFPRI, JANSSEN 2006, MARTIN 2011, OXFAM 2015). The example above shows that shocks can be induced by external economic factors, but also by war or civil riots (cf. HILL 2008, p. 3; FOSTER 2007, p. 10; HCD lecture 2015). The aim of this paper is to show how the Kenyan horticultural sector deals with no-climate-related crises and what might be possible preventative and adaptive options for individual households and local economies. For this purpose I will explain the current academic discourse on resilience in the second chapter and I will present how a shock can also lead to a long- term positive development. The third chapter describes the methods and considerations of how I collected the empirical data in Kenya. In the fourth chapter I will present my results. The work ends with the fifth section which summarizes and reflects my results and embeds it in the scientific and theoretical context.

2. State of research

In the literature, the impact of shocks are discussed in two dimensions: effects on an individual farm/household (IFPRI 2015, LITTLE 2002) and the impact on a regional economic system (HILL 2008, FOSTER 2007, MARTIN 2011). The ability to respond to such shocks, to adapt and regenerate is called *resilience*. FOSTER describes resilience 'as the ability of a region to anticipate, prepare for, respond to, and recover from a disturbance' (FOSTER 2007). The capacities of the involved system play an especially crucial role in the agricultural sector (FOSTER 2007, MARTIN 2011). These capacities can influence the way a system reacts after a shock. Resilience in a regional economic context refers to the ability of a system to maintain a pre-existing state (also described as ‚equilibrium', IFPRI 2015, HILL 2008) in the presence of some type of exogenous shock (HILL 2008). The idea of 'regional economic hysteresis' describes how an economic system or a single household can evolve into different developmental paths after a shock. In studies four main scenarios (hysteretic outcomes) are described (cf. Figure 1).

Figure 1: Different hysteretic outcome scenarios



(Source: own version based on MARTIN 2011, IFPRI 2015, FOSTER 2007)

Most scientific discussions are about negative effects and impact of shocks on economic systems and households (MARTIN 2011, IFPRI 2015, HCD lecture 2015). However, there are also two positive hysteretic reactions (scenarios C and D, cf. Figure 1). Factors and reasons for an increased resilience to shocks and crises are: access to markets, membership in social- or export-groups (IFPRI 2015), 'the availability of spare capacity to expand', 'an initial wave of new firm formation' (MARTIN 2011, p. 9), the innovativeness of existing firms and their ability and willingness to shift into new sectors and product lines, 'the relational linkages of firms with networks of other producers and customers in other regions and other countries' (MARTIN 2011, p. 10/13), the existence of a 'back-up system' and extensive linkages within the supply

chain (FOSTER 2007). If a system can adapt and respond to a shock through innovations and networking with other companies and institutions, it may be possible that this shock leads to a positive hysteretic outcome. According to MARTIN not only the linkages of companies with each other are making a regional economic system more or less vulnerable to shocks, but also 'how local institutional, cultural and political conditions mediate and respond to those reactions, about how national policy may help or hinder a region's recovery (…)' (MARTIN 2011, p. 13). He admits that this field is a largely unresearched issue (MARTIN 2011, p.11). This issue will be the main focus of this paper. The aim of this paper is to answer the following questions:

a) What is the relationship between the capacities of the individual actors and the resilience of households and agricultural economic system?
b) Which strategies provide institutions like the Horticulture Crops Directorate or the Ministry of Agriculture to coordinate crisis and to make the Kenyan horticultural sector less vulnerable (Vulnerability is defined in different ways, but it generally includes the attributes of persons or groups that enable them to cope with the impact of disturbances (JANSSEN 2006)?

3. Methods

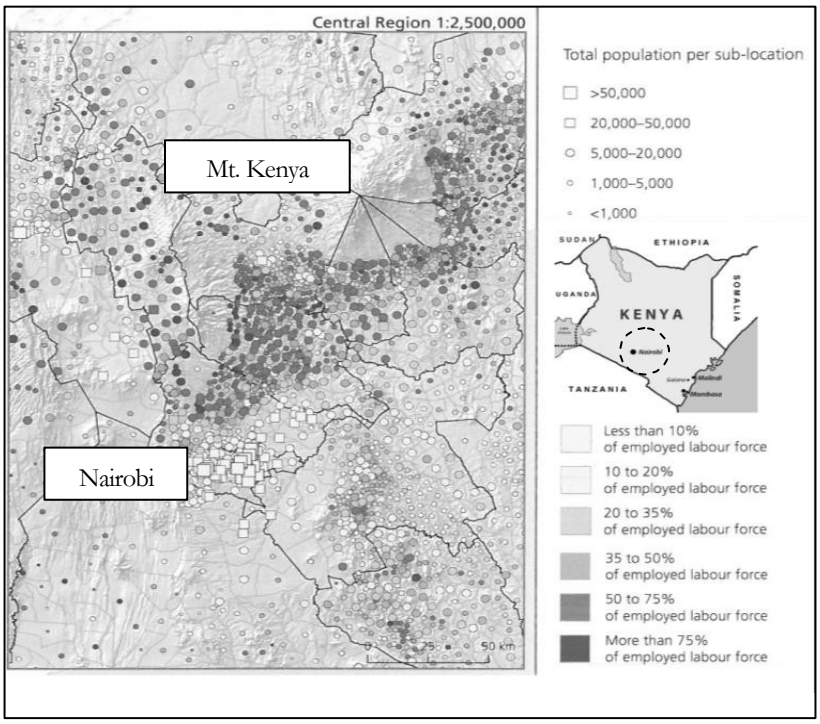
As part of a field research on which this paper is based, the horticultural sector in the Mount Kenya region was examined in March 2015. As shown in Figure 2, the Mount Kenya region is characterized by high small-scale agriculture and pastoral activities. Thereby the region is ideal for a field research. The study area includes the counties Kirinyaga, Tharaka Nithi, Embu, Meru und Nyeri. The percentage of employment labor force in small- scale agriculture in these counties is an average of 40% (WIESMANN 2014).

As vulnerability, adaptation and resilience are difficult to quantify (SCHWARZ ET AL. 2011, MARTIN 2011), different actors in the investigated production network (including farmers, export groups, exporters, technical assistants, representatives of the HCD and the Ministry of Agriculture) were interviewed to collect qualitative data. Although these interviews do not reach representativeness (in a statistical way) but they are suitable to detect differentiated intensive investigations of individual cases (GEBHARDT 2011).

In addition a quantitative survey of small-scale farmers was conducted by using a questionnaire of LAURA PARGEN (N = 88). Selected results are presented in the 4th chapter.

The selection of interview partners and lecturer was almost done by the HCD which entails a certain bias in the results. Nevertheless I think the answer to my research question is possible because of the wide selection of interview partners (exporters, farmers, HCD etc.). Although there might be some issues of representation this paper does provide a good first impression of a regional economic system that responds to shocks and crisis. This paper does not focus on large-scale farmers which account for about 60% of the horticulture harvest (OXFAM 2015) because there were not part of the interviewing process.

Figure 2: Small-Scale Agriculture and Pastoral Activities



(Source: WIESMANN 2014, p. 34)

4. Empirical findings

This section presents some preliminary empirics for the horticulture sector in Kenya. In terms of the different dimensions of resilience summarized in chapter two, the main aim is to answer the questions in chapter two. Other topics and issues are not discussed because a complex analyses of resilience in the Kenyan horticulture is not possible here.

a) What is the relationship between the capacities of the individual actors and the resilience of households and agricultural economic system?

In interviews with three different exporters it became clear that the biggest problem that comes with exogenous shocks is the cooling of the vegetables. It has been made obvious that the larger and more connected an exporter is the more capacity he will have to respond to a shock. *KHE*, the largest interviewed exporter (four pack houses, 300 employees per pack house), bridged the temporary crisis of the volcanic eruption of 2010 because it has four cold stores and a cooling system that cools up the vegetables up to seven days (cf. Figure 3). A smaller exporter, such as *InstaVeg* or *sk Fresh Produce*, does not have this possibility and therefore they had to discard the vegetables after a maximum of two days. A representative of *InstaVeg* reported in an interview that they found a neighboring exporter which could deep freeze the vegetables during the volcanic eruption in 2010.

Interviews with farmers show that a membership in social groups has a positive impact on dealing with crisis and shocks. 50% of the surveyed small-scale farmers are members of an export group (questionnaire by PARGEN). The farmer in groups are connected with each another, can help out in times of crisis and pass on new contacts to each other.

The capacities of the exporters are also crucial for the payment of the small-scale farmers. The smaller exporters, *InstaVeg* and *sk Fresh Produce*, reported that during the volcano crisis

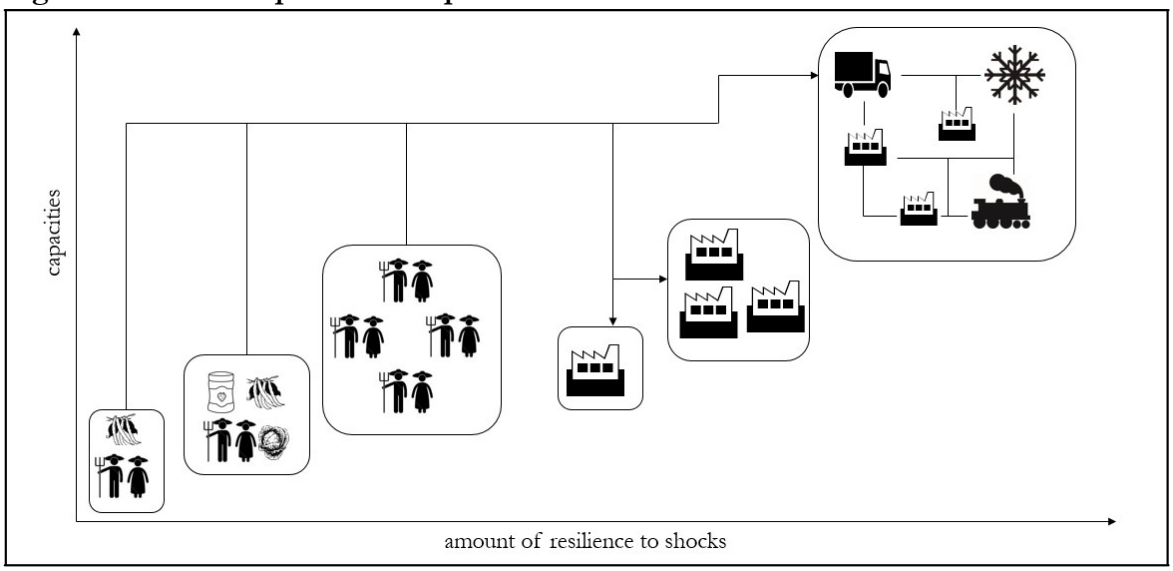
and during (and days after) the fire of the Nairobi airport vegetables from farmers could not be accepted. Therefore the farmers received no money and were not able to obtain any income. The largest exporter, *KHE*, reported that farmers always get their money even in times of crisis because the export process is alone the work of the exporter and farmers will not be affected.

It's obvious that the capacities of the purchaser, in this case the exporters, play a much more important role than the capacities of individual households or groups. Even if the farmer runs a diversified farming business, produces enough food for his own consumption and gets a better economic access, the capacities of the contract-exporter will decide whether the produced crops achieve the target market after all. The results of my empiric results are shown in Figure 4.

Figure 3: cooling system of KHE (Nyamindi River Farm)

(Source: own picture)

Figure 4: Relationship between capacities and resilience



(Source: own figure)

During the fieldwork it was shown that the ability to respond to shocks increases the more networked and diversified a household, but even more an exporter is. In almost all interviews the key to respond successfully to a shock and to maintain a pre-existing state was determined by a combination of certain social networks, for example friends or the

integration within a group, and also economic links and cooperation with companies or the HCD.

b) Which strategies provide institutions like the HCD or the Ministry of Agriculture to coordinate crisis and to make the Kenyan horticultural sector less vulnerable?

To answer this question I distinguish between the two dimensions that I mentioned in chapter two: the resilience of individual households and an agricultural production system.

The HCD provides extension services to ensure appropriation by farmers of new practices. This happens in two ways: small-scale farmer should strengthen their economic access to increase household income, for example to respond to food shortages. Farmers were trained to grow export crops instead of staple crops to generate more money per acre. These trainings were established as a part of (for example) the SDH-Program (SDH 2015) or the 'Agriculture Productivity and Income Generating'- Program. The data shows that small-scale farmer who also grow export crops plant a smaller area for their own food consumption then farmers who produce only for the local market (cf. Table 1). The percentage of land used for production for the local market is significantly smaller than for farmers who produce only for the local market. The relationship between the cultivation of horticultural crops and the share of production for their own consumption and the share of production for the local market is significant. Farmers who grow export crops buy food an average of once a week. Small- scale farmers who produce for the local market only buy food an average of once a month. There is no significant difference in the buying behavior between export and local farmers - except that export farmers buy meat more often than local farmers.

Table 1*:* Differences in production and the frequency of purchase

	small-scale farmers growing horticultural crops for export	
	yes	no
share of production for own consumption (mean)	17%	29%
share of the production for the local market (mean)	56%	73%
frequency of purchase food (mean)	once a week	once a month

(Source: questionnaire by Laura PARGEN, N=88, significant correlation (0,008))

At the same time the HCD trains small-scale farmers to get a better economic access, it trains small-scale farmers in mix-production and food preservation (e.g. jam-producing, conservation or fruit-drying). In addition the HCD encourages farmers to form groups or organizations (SHE (Small Holders Horticulture Empowerment Program)-Program, SHoMa (Small Holders Horticulture Marketing Project)-Project). According to HCD Nkubu Depot the HCD provides 'market linkages through contacts' and 'access to market information' for cooperatives.

The data shows that 66% of the small-scale farmers who grow export crops are member of at least one cooperative. Only 16% of the small-scale farmers who produce for the local market only are in at least one cooperative. Both relations are significant.

Table 2: Differences in the memberships in different groups

	small-scale farmers growing horticultural crops for export	
	yes	no
member in at least one self-help-group	48%	52%
member in at least one cooperative	66%	16%

(Source: questionnaire by Laura PARGEN, N=88, significant correlation (0,000))

All described strategies should lead to secure the food and economic access for individual households to respond to crisis. In a national Kenyan agricultural context the HCD represents rather a coordinating and controlling function during a crisis. A representative of the HCD made clear that the level of institutional capacity is a key determinant for the attainment of food security. During the volcanic eruption in 2010, the HCD coordinated (with the help of the Airport Management Systems Nairobi) a) a chilled transport of export goods to Mombasa, where the goods have been exported and b) the shipment of export goods over the Nile. During the fire at the Nairobi Airport in 2013 the HCD took over the coordination between farmers and exporters and organized the transport of export goods to Mombasa.

None of the surveyed farmers had an insurance or risk management for the event of non- climate-based harvest losses or income gaps in times of crisis. Zakayo MAGARA, Head of Directorate of the HCD, admitted in an interview that even Kenya does not have any kind of risk management or insurance in times of crisis. So far, the HCD only plans to draw up an insurance for times of crises. MAGARA emphasizes that the HCD focuses mainly on:

- Increasing stability of food by strengthening sustainable management of the food value chain
- Supporting improvement governance of food systems for increased coherence, coordination and accountability on food security issues at the national, regional and international levels.

5. Conclusion

The aim of this paper was to give an overview of how the Kenyan horticultural sector responds in times of crisis. It became clear that the capacities have a main impact on the resilience of a household or an agriculture system, as described by FOSTER and MARTIN. The capacity of the exporters and their network among themselves is the main factor for a resilient agricultural system (cf. Figure 4). The coping of exporters and small-scale farmers during the volcanic eruption crisis showed that a membership in social groups, the networking of farmers among each other and with members of the whole agricultural value chain can increase the resilience level, as described by HILL. As described in chapter two, institutional conditions and national policy influences the adaptability to crises and shocks, too. With the foundation of the HCD by the Act of Government in 2013 a milestone has been set. With trainings by the HCD small-scale farmers and groups can strengthen their economic access and their food security, for example by adding mix-production or preservation, and can bridge temporary times of crisis. Due to programs like the SHE-Program farmers are encouraged to form groups to get a better market access and to link up to each other. This forming of groups can enhance the resilience to shocks as described by IFPRI (cf. Chapter 2).

The data from chapter 4 shows that two-thirds of the surveyed small-scale farmers who produce for the export market are members in at least one cooperative, take less food for their own consumption from their fields and purchase food more often than farmers who produce for the local market only. This data suggests an improved economic access. A future study should examine whether this data is in a significant relationship associated with the trainings of the HCD and the forming of cooperatives.

However, none of the surveyed farmers or exporters had a risk management (or 'backup system' as FOSTER described) for times of crisis. The introduction of a risk management could lead to a positive hysteretic outcome as described in chapter two (cf. Figure 1). Due to more networking and linkages between the various actors the capacities could be increased, the agricultural system could become less vulnerable and the impacts of shocks could be minimized. Economic and political reforms can lead to a permanent increase in regional output as described in chapter two. Similarly the idea of resilience to non-climate-related shocks requires considerably more elaboration and time than offered here. Future research should consider the role of the HCD as a controlling and regulating authority in times of crisis. Furthermore it would be interesting to investigate the role of the *im*porters in times of crisis as already remarked by Oxfam (OXFAM 2015, p. 92). Also so the role of large- scale farms mentioned in chapter three as well as 'in house production' of exporters during a crisis would specify and enrich the analyses of this paper.

The issue of ICT (*I*nformation and *C*ommunication *T*echnology) is completely untouched in this paper. Since many farmers already use ICT for payments and contacts it would be highly interesting to examine a) the relationship between the usage of ICT and resilience in times of crisis and b) how ICT can enhance the resilience and make individual households, but also an entire agricultural system less vulnerable to shocks.

As mentioned in the introduction the Kenyan horticultural sector is highly dependent on the US and EU market. The strengthening of the domestic market and an increased export to neighboring countries would diversify the export market and make the Kenyan horticultural sector less dependent on Western markets. Research by VELTE, M. or KULKE, E. describe the supply chains by Kenyan farmers to Kenyan supermarkets such as Nakumatt or Uchumi. The pursuit of this research would enrich the value of this work.

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ICTs and knowledge exchange

An analysis of factors influencing the transfer of information for small-scale farmers in the Kenyan horticulture sector

Julia Pütz

1. Introduction

Innovative technologies have changed the conditions and circumstances of social interactions tremendously over the last decades. Information and Communication Technologies (ICTs) like mobile phones are therefore seen as a crucial factor to keep pace with the worlds' leading information economies. This is resulting in a strong support by the United Nations with their specific target to 'make available the benefits of new technologies, especially information and communications' (ITU 2014). Hence, coverage for mobile phones has been increasing to high rates, even in many parts of countries like Kenya (KNBS 2014). However, the linkage between access to mobile phones and development is not in a linear relationship. An effective usage of ICTs can provide a reduced transaction costs and an improved exchange of information and, thereby foster development. However, this requires the identification of success factors and potential barriers, which undermine the realization of the mentioned benefits. The present paper particularly focuses on the exchange of information and knowledge.

Indicating the determinants of knowledge exchange for the case of (1) simple information as well as for (2) complex knowledge of small-scale farmers leads first to the farmers' capability, which is resulting from a certain *level of education*. This might influence generating and processing information. In addition, the *organization of the farm* is expected to influence the capacity of ICTs to improve knowledge exchange. Finally, *trust* and its role within value chains is of importance with regard to knowledge exchange. In sum, the present paper aims to scrutinize whether the three presented variables have an influence on the knowledge exchange via mobile phones for small-scale farmers in the horticulture sector in the Mt. Kenya region.

The paper is structured as follows. First, a literature review is giving, indicating the influence of innovative technologies like ICTs on social relations and the economy, with special emphasis on mobile phones. In particular, the current state of research regarding the impact assessment of ICTs on businesses in the agriculture sector is discussed, identifying influencing variables on knowledge exchange and bringing existing research together towards a distinct framework. Following a brief discussion on the selected research area, the employed method-mix approach is expounded. Then, the variables are empirically examined by presented correlations, resulting from the survey analysis and derived hypotheses from the conducted interviews. The paper concludes with summarizing the key findings and by deriving implications for the implementation of ICTs.

2. State of Research

The introduction of information technologies has shaped our societal organization and created a so-called *network society* (CASTELLS 1996). Hence, CASTELLS claims that the global integration of economies was fostered by the use of ICTs, e.g. mobile phones. However, the diffusion of such innovations has proven to be unequally distributed across the world

(CASTELLS 2005). CASTELLS therefore postulates that development depends on how successfully societies integrate into the global economy and adapt to the network societies' principles. This leads to the new *informational model of development* which stresses that contemporary development is (largely) built upon the diffusion of ICT and the capacity to manage information (CASTELLS 2005). Hence, the dissemination and professional application of ICTs is considered to be a crucial means for development. This perception is embodied by the concept of ICT4D (ICT for development), which comprises various approaches and measures to utilize ICTs in order to achieve a broad array of development goals (UNWIN 2009). However, the diverse ICT4D community sees differences in the potential development impacts of ICTs regarding countries in the global south.

With particular regard to the agricultural sector in developing countries, mobile phones are generally perceived to have a positive impact on the productivity of small-scale businesses due to a reduction of transaction cost and better access to information and markets (e.g. AKER & MBITI 2010, UNCTAD 2005, UNDP 2005). However, the tremendous attention given to the impacts and role of ICT to foster development, which was also pushed by companies seeing new markets in prospect (PIETERSE 2009), was never underpinned by a broad conceptual framework and empirical evidence specifying the relationship between ICTs and the improvement of livelihoods (HEEKS 2010). With an ongoing, widespread diffusion of ICTs in the global south, some more skeptical voices arise contesting the power of ICTs to initiate economic as well as industrial transformations. Contrary to some expectations, market structures have not changed in most cases since the introduction of ICTs (e.g. CARMODY 2012, MURPHY ET AL. 2014). Moreover, some skeptics claim that ICTs can even reinforce existing structures like the distribution of poverty, inequalities, or lead to a further exclusion of the poor (ALZOUMA 2005, LEYE 2007, WADE 2002).

Applied research on ICTs, particularly conducted in an agrarian context, tries to improve the understanding about the impacts of ICTs. However, results have proven to be mixed and are highly context-specific. A study supporting the positive development impact of ICTs is provided by JENSEN (2007). He investigated the influence of mobile phones on the welfare of South Indian fishermen and found that the introduction of mobile phones increased the welfare of consumers as well as producers by reducing price dispersion and expanding the market size. A better price realization and improved market connectivity through mobile phone usage by farmers was also demonstrated among others by MASUKI (2010) for rural Uganda and by MITTAL (2012) for India. Furthermore, OVERA (2006) detected that ICTs reduce transaction costs and asymmetric information for Ghanaian traders. Hence, ICTs increased the efficiency in communication, strengthened the trust-building processes of trade networks and, thus, had a positive impact.

However, there are also various studies that show no or even negative impacts of ICTs. KAMESWARI (2011) concluded that farmers in the Indian Himalayan region were not able to leverage ICTs. Neither did they realize tangible benefit from the facilitated access to information (in terms of improved income or increased productivity) nor did they profit from a change in the producer-seller relationship. Particularly in rural areas, existing patterns, such as the involvement of middlemen, tend to persist even after the diffusion of ICTs, indicating that value chains and organizational structures might affect the effectiveness of ICTs. Also, FAFCHAMPS & MINTEN (2011) conducted a randomized control trail experiment, which showed that SMS-based agricultural information did not have a significant positive impact on the Indian famers' livelihood, price realization or cultivation practices. One the one hand, this could be explained to some extent by the fact that the study was based in a relatively developed, wealthier state of India, where only smaller information gaps exist and therefore returns of such a service are smaller (MITTAL 2012).

The mixed results for the impact of ICTs from a development perspective can be explained by various factors. One important variable, though, that is inherent to ICTs, is the

flow of information or knowledge exchange. When dealing with the general issue of knowledge exchange, it is useful to apply the categorization of LUNDVALL and JOHNSON (1994) who distinguish between *simple information* (e.g. information about weather; prices etc.) and *complex knowledge*. (e.g. knowledge regarding standards). Only if ICTs facilitate the exchange of either simple information or complex knowledge, they can function effectively. However, context specific circumstances can foster or prevent the effective flow of information or can limit the necessity to gather knowledge. This, in turn, will eventually influence how the knowledge exchanges, facilitated by the dispersion of ICTs, can translate into development impacts. This, however, is still an under-researched issue.

The present state of research leads to at least three variables affecting the knowledge exchange function of ICTs. First, one important factor influencing the knowledge transfer and effectiveness of ICTs might be *education* which is one of the possible results of the MITTAL (2012) study. Educational levels might influence the ability to generate and process information. A positive relationship between both variables might be expected, which should be empirically tested.

A second factor might be found in the *organizational structure* the respective farmer is embedded in. Different peculiarities of organizations might require different levels of information transfer and, thus, might react differently to the dispersion of ICTs. For instance, farmers cultivating internationally traded products are integrated into global value chains (GVC) which i.a. requires adhering to international standards. Therefore, they usually face different organizational structures compared to farmers selling to local markets. The Integration into GVCs influences various key-factors such as the information asymmetries or coordination mechanisms (GEREFFI ET AL. 2005). Since ICTs can generally increase information exchanges, they can have an influence on the organizational structure (HUMPHREY 2002). However, even though it is frequently argued that the structure of information flows determine the structure of an organization, ICTs enter already existing structures. Therefore, their effectiveness might be determined by the particularities of existing patterns. It has to be investigated, how already existing types of organizations in the farming business cope with these new technologies. Therefore, it has to be questioned whether the influence of farmer groups, middlemen, and export companies on the organization of the farm, also affects the information exchange provided by ICTs. Compared to other studies, this approach is somewhat unique since it is mostly assumed that information technologies determines the organizational structure; here, however, persisting organizational structures are assumed to affect the exchange of information and knowledge and therefore the effectiveness of ICTs.

Finally, a third influencing variable might be the level of *trust* in the respective context which was highlighted by the OVERA (2006) study. The concept of *trust* (based on HUMPHREY & SCHMITZ 1998) and its role in business relations and networks might be a relevant parameter. Trust refers to the expectations about choices made by other market participants whose actions eventually will affect own actions in the future (DASGUPTA 1988). The predictability of others' behaviors decisively influences how actors make choices and therefore shapes market and business interactions. MURPHY (2002) showed that trust is an important mechanism in social relations and affects the transfer of information and therefore affects dealing with innovations. Hence, it can be expected that the level of trusts affects knowledge exchange and the effectiveness of ICTs.

Bringing all this together sets the framework for this study. This paper tries to indicate the determinants of knowledge exchange for the case of (1) simple information as well as for (2) complex knowledge of small-scale farmers in the Kenyan horticulture sector. The provided literature review leads to the assumption of some influencing variables. Hence, (i) level of education, (ii) organization of the farm and (iii) trust are variables that might have an influence on knowledge exchange and that will therefore be analyzed in the following.

3. Methods

This research project is based on a method-mix approach, using quantitative surveys and qualitative interviews, examining the Kenyan horticulture sector in the Mt. Kenya region. This region - being one of the main horticulture producers in Africa - was selected because of its high production contribution to the Kenyan fresh fruit and vegetable (FFV) industry, due to its advantageous climatic conditions (DANNENBERG & LAKES 2013). In addition, a high level of diffusion regarding the usage of mobile phones is recorded in a region with mostly small-scale farmers who are to a large extent export-orientated (DANNENBERG & LAKES 2013). Samples were taken in the entire area surrounding the Mt. Kenya in order to get a (representative) overview of the status-quo in the region regarding differences in climatic conditions, geographic distances to urban areas and products.

As for qualitative analysis, interviews were conducted during a field research period with translation assistance in cooperation with Karatina University (Kenya) in March 2015. Semi-structured interviews were used, so that there was a given framework with the additional possibility to ask individualized questions. As sampling method the gatekeeper approach in combination with snowball sampling (BIERNACKI & WALDORF 1981) was used. Interview partners were chosen along the horticultural value chain, with a strong focus on the production side, i.e. small-scale farmers. In addition, other stakeholders like middlemen, exporters, cooperatives, external experts (agricultural extension officers, scientists) were interviewed. In total, 21 interviews were conducted, thereof with 8 farmers. The field research was accompanied by memos (ROSENTHAL 2011) generated from field notes and a research diary, which set the base for the qualitative analysis.

Quantitative data were collected through standardized surveys financed by a BMBF study in 2013. The study region and sampling method was the same as described for the interview sampling. Data generated were processed with SPSS. Frequency distributions, cross tabulations and different correlation analyses, including Chi-square, Kendall-Tau-b and Spearman test were run. Moreover, qualitative interviews were used in order interpret results coming from the quantitative data and to investigate possible causalities. Qualitative interviews were applied to improve the understanding of the research question and to overcome limitations by survey-based research.

4. Empirical Findings

The usages of ICT within the study area mostly concern simple mobile phones, as survey data show that only 13.5 percent have a multifunctional phone, as well as by the results of the qualitative interviews with farmers of who the majority owned a simple mobile phone. Evaluating the farmers' perceptions about their access to simple information (e.g. on prices, weather etc.) and to complex knowledge (e.g. on standards or production methods) show that the largest share of the sample perceive their access to simple information as very good (*33.5 percent*). Whereas for complex knowledge the perception is a little less optimistic, as the majority of farmers estimates their access to complex knowledge as good (*29.6 percent*). This more asymmetric distribution in the case of simple information indicates that the farmers see in most cases their access to simple information more positive compared to complex knowledge.

4.1 Influence of the Educational Level on Knowledge Exchange

The level of education in the study area was examined by the survey in 2013, finding that 'primary school' education takes the largest share of the farmers (*40.6 percent*). This fact can be validated by the conducted interviews in 2015, in which farmers exhibited mainly primary school level. Testing the influence of the farmers' educational level on knowledge exchange shows that there was no significant correlation found for the case of simple information (*Chi-squared test*, *p=0.181*). Like already assessed, the fact that every farmer, whether in the survey sample or as part of the interviews, has access to a mobile phone, we can conclude that independent of the farmers' educational level he/she is able to utilize at least simple information via this medium[5]. This was confirmed by all interviewees and their statements, as they were utilizing mobile phones to coordinate for meetings, ask for market information (especially prices), weather information and or call i.e. technical advisers for problems regarding their businesses.

When looking at the exchange of complex knowledge, a significant positive correlation (*Spearman Rank, p<0.001*) of the farmers' educational level and the exchange of complex knowledge can be found. This means that the higher the respective educational level is, the higher is the probability to exchange complex knowledge via a mobile phone. According to the conducted interviews, the exchange of complex knowledge is less common because of a "*Lack of knowledge*" (technical adviser, 19.03.2015). The information exchange about standards, production methods or problems are complex and profound understanding and knowledge which goes along with the educational level, as an expert (HCDA) stated: "*It becomes tricky to explain to the farmers*" (20.03.2015) or also a farmer stressed that "*Sometimes the farmer does not understand, then he has to go to the office*" (20.03.2015). This can be further confirmed by the fact that interviewees stated that if complex knowledge has to be exchanged, simple information are exchange in advance in order to coordinate a meeting for exchanging complex knowledge face-to-face, as "*they* [the farmers] *call and explain their problem and then they will send someone*" (technical adviser 19.03.2015). All interviews showed the same pattern, that there was almost no exchange of complex knowledge, which goes in line with a non-correlation of the exchange of simple information and the level of education but with a positive correlation of the exchange of complex knowledge and the farmers' education.

4.2 Influence of the Organization of the Farm on Knowledge Exchange

Studying a rural area which is primarily characterized by small-scale farming, it is not surprising that most farmers try to coordinate and generate synergies through self-help group or cooperatives. Information regarding production methods or standards is often provided by chairmen within group meetings, which are announced by calls or are scheduled on a regular basis. Therefore, members of cooperatives particularly use their mobile phones for coordination and, thus, especially exchange simple information in order to arrange meetings. A significant difference between independently operating farmers and those organized in a group is found with regard to the exchange of knowledge via mobile phone. As already detected, the access to and exchange of simple information via ICT does not face strong obstacles, whereas the exchange of complex knowledge does. Hence, this explains why the survey data show no significant differences with regard to the exchange of simple information

[5] Due to the fact, that no non-user were in the sample, we cannot make any conclusion whether ICTs actually improved the transfer of simple information. Though, the statements within the interviews, which were already mentioned earlier, indicate that the exchange of information has been improved with the dispersion of ICTs.

via ICT for independently operating farmers and for farmers organized in specific groups. For complex knowledge, however, differences for both groups are also shown in the quantitative data, as self-help groups exhibit a negative influence on the exchange of complex knowledge via ICT (*Kendall-Tau-b value: -0.330*), while individual farming shows a positive influence (*Kendall-Tau-b value: 0.275*) (*both p<0.001, two-tailed*). Since the exchange of complex knowledge is relatively difficult and requires more explanation, group-organized farmers rather exchange this information within their meetings. Individual farmers do not have this possibility and therefore also have (to some extent) to rely on their phones.

If we look at the organizational structure of farmers producing for the export market and having a contract with an exporter company – therefore exhibiting different business characteristics than independent or group-organized farmers producing for local markets - we see lesser exchange of knowledge via mobile phones. As an exporter stated: "*it is our task to call them, we only need their land, everything else is coordinated by us*" (18.03.2015), implies that communication and actions are mostly hierarchically organized. Almost no information is exchanged via phone because meetings are set on a regular basis and, i.e. seeds are chosen by the export company and brought to them automatically. Therefore, we can see through qualitative analysis that there is a negative relationship for the exchanged information. This can be also confirmed by the survey data, which also shows a negative relationship (*Kendall-Tau-b value -0.191*) on a significance level of 0.05. The negative relationship is even stronger for complex knowledge as the dependent variable (*Somers-d. (i) sell to exporter [dependent variable]: -0.151; (ii) complex information [dependent variable]: -0.241*). This is caused by the fact that there is no further need for the exchange of information because everything is already set by the company and requires only little specification during cultivation. With regard to the exchange of simple information, prices are set for the contract period. Complex knowledge, in turn, is processed and exchanged within the export company or undertaken by technical advisers and will be communicated by certain actions or procedures affecting the farmers' behavior but not by knowledge exchanged via phone. Therefore, the hypothesis is obvious that with an increasing level of integration within the global value chain the usage of ICTs to exchange knowledge lessens.

In the case of an organization producing for the local sales market, the broad consensus by the interviewees underlined that usage of mobile phones for the purpose of exchanging information is more important than for export-oriented farmers contracting with an export company. This is due to the fact that the production for local markets require more bargaining because prices are not fixed by long-term contracts with large companies. Farmers rather contact with different brokers (middlemen), buyers or other traders in order to get market information. Data analysis therefore shows exactly a positive relationship, as farmers interacting with brokers require a higher exchange of information. This relationship is significant (*Kendall-Tau b value 0.214, p<0.001*) and is again stronger if the information exchange is the dependent variable (*Somers-d. (i) sell to broker [dependent variable] 0.165; (ii) complex information [dependent variable] 0.279*). A farmer, who produces for an export company as well as for the local market, summarized these findings, as he stated "*there is no use of mobile phones for the export market, because everything is done by the company; we only use the mobile phone for the local market to get information*" (21.03.2015).

4.3 Influence of Trust on Knowledge Exchange

Trust was already identified as an important determinant, influencing business relations. A cooperatives' chairmen pointed out that "*there is a lack of trust*", (18.03.2015) especially in risk-averse groups, why building trust is a main challenge a cooperation is facing. Trust also partly explains the organization of local commerce. Instead of selling directly to buyers, a large proportion of farmers in the study area engage with middlemen, as they "*prefer broker because they are locals who know the area and our problems*" (farmer 21.03.2015). Thus, the lack of trust

results in fewer interactions with business partners outside of the farmers' (micro-) geographical region, which consequently leads to fewer knowledge exchanges. Instead, the collection of relevant information is partly delegated to the middlemen. On the other hand, a lack of trust can even affect local relationships when farmers do not believe broker prices. It was recorded that ICT were often used in order to compare prices of different brokers. However, findings show that with a smaller distance to market places, the probability of exchanging information through face-to-face meetings increases while an exchange via mobile phones decreases. In addition to that, farmers revealed that "*we go to Nairobi to know the prices; we don't call because we maybe don't get the correct information*" (24.03.2015). Hence, the trust problem might not always be mitigated by the use of mobile phones.

If there would be no lack of trust, farmers would try to avoid middlemen and sell directly to the buyer in order to save the brokers' courtage, as they realize "*the solution would be selling directly to the buyer*" (24.03.2015). However, the barrier of trust translates into an avoidance of knowledge exchange via a mobile phone. In this regard, minimal trust (see HUMPHREY & SCHMITZ 1998), which is referring to basic market transactions, does not necessarily translate into a reduced use of ICTs to exchange basic information. Mobile phones facilitate the consultation of various sources so that the verification of obtained information is relatively easy. In contrast, extended trust, which concerns complex interactions and highly interdependent relationships (e.g. along value chains), mostly relates to the exchange of complex knowledge, which we have already seen is less frequently transmitted via phone. A lack of extended trust might additionally hamper the exchange of complex knowledge via phone. Depending on the type of the prevalent trust problem and the type of information that needs to be exchanged, mobile phones might improve the exchange of knowledge (in the case of simple information and minimal trust problem) or show only little potential for improvements (complex information and extended trust problem).

5. Conclusion

The present paper demonstrates results of a field study conducted in the rural area of Mt. Kenya. The emphasis was put on three variables affecting the knowledge transfer function of mobile phones, which, in turn, impinges on their potential development impact. In general, study results showed that mobile phones are more effective with regard to the transfer of simple information and are often used for coordination purposes. Educational attainment proved to have no effect on the transfer of simple information while being positively correlated with complex knowledge. Since simple information is relatively easy to formulate and process, it is decisively more difficult to accurately articulate and comprehend complex knowledge about standards or production methods, which therefore requires more acquirements. This finding complies with the intuition but still provides some fundamental implications: ICTs facilitate the transmission of simple information and reduce the transaction costs of coordination, regardless of the level of education. They are therefore suitable to improve the situation of (all) rural farmers, requiring basic information and better coordination and who face high transaction costs (due to the distance to markets or relevant institutional facilities). In contrast, mobile phones are not suitable to exchange more complex information so that face-to-face meetings remain crucial for the business practice.

It was also shown that the knowledge transfer via ICTs depends on the organization of the farm. Farmers organized in self-help groups as well as farmers contracting with export companies primarily use mobile phones to exchange simple information concerning the coordination of meetings or to receive instructions. Complex knowledge is rather exchanged within assemblies or is provided by advisors. In contrast, apart from gathering simple information about prices or weather, individual farmers also (have to) use their phones to

acquire more complex information. The engagement of middlemen also increases the usage of mobile phones as farmers are interested to compare different middlemen and coordinate with them. A key finding was the fact that farmers producing for export companies showed only a little information exchanges via ICT due to organization by the company. Hence, it can conclude that there is a negative relationship for the integration into the GVC and knowledge exchange via mobile phones.

Finally, the prevalence of trust also seems to affect the knowledge transfer function of ICTs. One the one hand, an environment of low levels of trust seems to foster the demand for ICT services in order to check alternatives and reassure the adequacy of prices, etc. On the other hand, it can foster the delegation of certain tasks to trusted middlemen when dealing with large, unknown buyers. The usage of ICTs depends on the information needed and the type of trust that is prevalent. This finding shows that it is necessary to also consider the wider socio-cultural backgrounds farmers are embedded. The level of trust and available solutions to mitigate the trust problem, will affect the effectiveness of ICTs. While mobile phones might be used to double-check certain information, this task could also be delegated to other actors. However, this seems not to limit the overall effectiveness of mobile phone usage and its development effectiveness.

In general, the study – even though being limited to three influencing parameters – showed that knowledge exchange via mobile phones depends on various variables, which are highly context-specific. The variables' impact partly depends on how they facilitate the provision of relevant information for the respective target group. Hence, it is necessary to assess various factors, including education, organization and trust, before promoting certain policy options regarding ICTs. Depending on the context, they can become a powerful tool for development, which was acclaimed during recent years. However, for some cases their impact is limited or other tools are more (cost-) effective. In order to better understand the exact influence of the presented parameters and to detect other influencing factors, further empirical research is needed.

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What is the role of ICT for small-scale farmer groups in the Mt. Kenya region?

Findings from a German-Kenyan study project

Oliver Röwer

1. Introduction

In March 2015 a mixed research group of professors, PhD, master and bachelor students from Germany and Kenya started a 12-day field trip to gather further information on different aspects of export-orientated small-scale fresh fruits and vegetables (FFV) farming in the Mt. Kenya region. Among the aspects were the proliferation of information and communication technologies (ICT), changes in global values chains, land use and food security, gender issues and the impact of climate change. The group visited farmers and farmer groups, middlemen, exporters and relevant government agencies. Agriculture is the most important sector of the Kenyan economy and its performance has a great impact on business, trade and livelihood of the population. Around 74% of the economically active population is employed in agriculture and 80% of the population working in agriculture are small-scale farmers (NYAGA 2012, p. 1).

Especially the FFV sector in the Mt. Kenya region is referred to as a "success story of African regional development" (DOLAN & SUTHERLAND 2002, p. 1) Even poorly equipped small-scale farmers are able to compete on a global scale due to the quality of their products and location-based advantages such as the favourable climate. At the same time African farmers are confronted with globalization and the proliferation of ICT (DANNENBERG & LAKES 2013, p. 55).

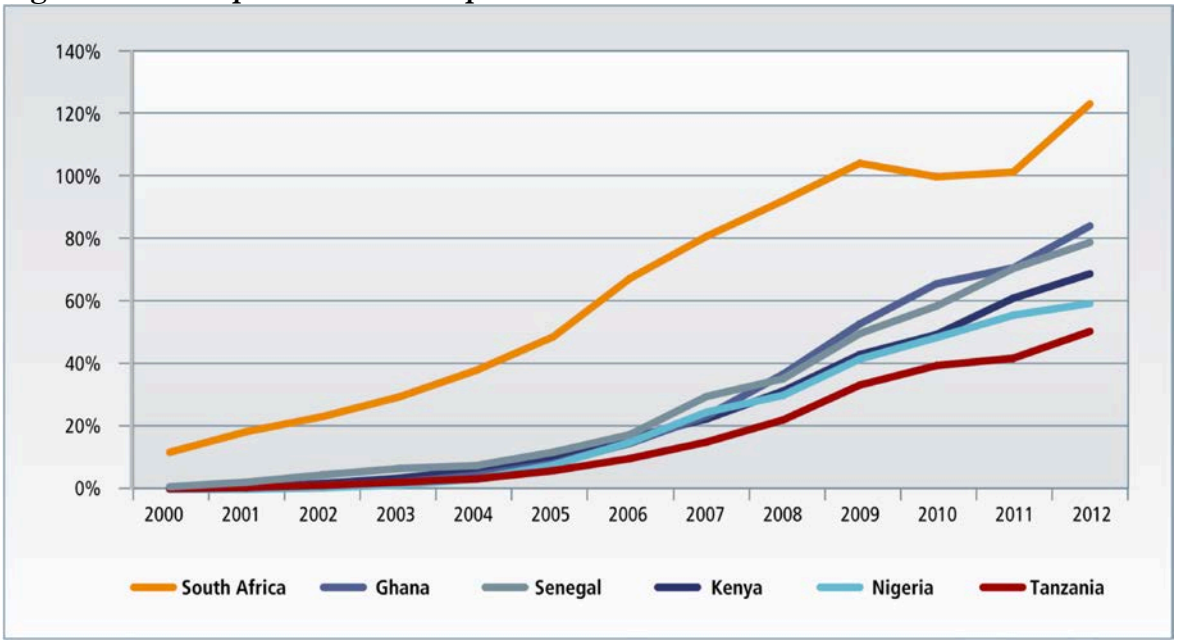
The aim of this paper is to investigate the role of ICT for FFV small-scale farmer groups in the Mt. Kenya region.

2. Diffusion of ICT in SSA

Mobile penetration rate (total amount of registered SIM cards divided by population) in Kenya rose from almost zero in 2000 to 69% in 2012 (Figure 1 and Figure 2) and as it is common in Sub-Saharan Africa (SSA) to share mobile phones or to use public mobile phones, mobile services extend far beyond actual penetration levels.

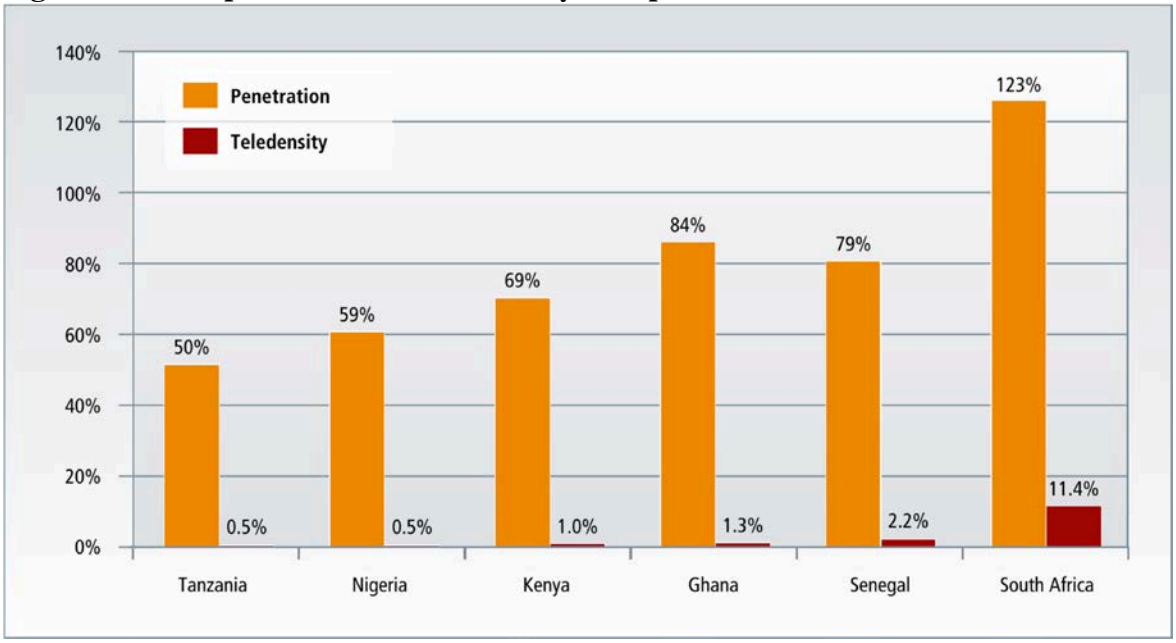
Fixed teledensity (fixed telephone lines per 100 people) is approximately 1% and mobile penetration rate in Kenya is 69% (Figure 2). The difference highlights the importance of mobile network infrastructure for voice, data and internet (DELOITTE & GROUPE SPECIALE MOBILE ASSOCIATION 2012, p. 9-10).

Figure 1: Mobile penetration in important markets of SSA



(Source: DELOITTE & GROUPE SPECIALE MOBILE ASSOCIATION 2012, p. 11)

Figure 2: Mobile penetration and teledensity in important markets of SSA



(Source: DELOITTE & GROUPE SPECIALE MOBILE ASSOCIATION 2012, p. 10)

Mobile telephony offers new possibilities. AKER and MBITI (2010) observe that mobile phones can provide economic benefits to consumers and producers in SSA. It is a tool that can improve access to and use of information, thereby reducing search costs, improving coordination among agents, and increasing market efficiency. In past urban-rural and rich-poor divides, mobile phones connect individuals to individuals, information, markets, and services. Mobile phones could transform lives through innovative applications and services

(AKER & MBITI 2010, p. 207f). Most of the Kenyan farmers have mobile phones and radios (NYAGA 2012, p. 246).

3. Methods

The research is based on field notes considering the setting of traveling with a numerous group interested in many different aspects. This kind of field trip leads to many situations with a small number of interviewees or just one expert and more than 20 researchers, that get a limited and unpredictable amount of time to ask questions concerning their area of interest.

Qualitative questions were used due to fuzzy characteristics of the research context, the limited time and number of interviewers.

The data was collected under many different circumstances. For instance a broker at the local market responded to questions of a small group. Several farmers gave personal interviews in the field or in their respective homes. A group of growers was met in their grading shed and answered to a large variety of particular questions from the researchers. Packaging facilities and HCD offices were visited and group discussions with exporters and governmental experts were led. Personal interviews with farmers were in English or interpreted to Swahili.

The field notes were reviewed to determine which observations and annotations are worthy (WOLFINGER 2002, p. 85 ff). Relevant notes according to the research question were put into an excel sheet. Important themes were identified to form columns and referring answers were categorized and sometimes coded to work with a reduced and useful dataset (SALDANA 2009 p. 4ff). Questions to the data were formulated and significant findings were extracted from the excel sheet (p. 14).

4. Results

4.1 The usage of mobile phones

The local farmer groups are mixed with a majority of middle-aged and older men. The organisational structure is mostly identical with split functions. A typical group has a chairman, a vice-chairman, a secretary, a treasurer, a members committee and members. Meetings and mobile phones play a key role for the information exchange within farmer groups.

The frequency of regular meetings ranges from weekly to twice a year. Often farmers are informed via SMS and illiterates via calling or following meetings proceed at same time and place. General means of communication are face-to-face contact, SMS and calling, posters, announcements via churches and local radio stations and letters.

Almost all mobile phones are simple and non-multifunctional, and mainly used for SMS and calling or mobile-money transfer (Table 1). Only very few growers have access to or make use of the Internet.

Table 1: Overview on the farmers' use of mobile phones

SMS	Calling	Mobile-money transfer
- Organise with others - Spread information - Inform other farmers about: appointments, meetings, prices, useful chemicals	- Reach illiterate farmers, family, buyers, vets, workforce, brokers - Inform about market prices, quality and quantity - Control outside selling, personal health - Coordinate harvest	- Transactions to/from far away - Avoid carrying money while traveling - Pay labourers - Withdraw cash

(Source: own results)

4.2 The influence of ICT on transaction costs

With the usage of ICT farmers have new opportunities such as calling someone to find out prices at the market without travelling there. The collected data indicates a reduction in transaction costs in business activities for farmers using ICT. Transaction costs are observable and unobservable costs of market exchange, which can be distinguished in fixed and variable transaction costs. Fixed transaction costs result from: (I) the costs of searching for a trading partner with whom to exchange goods or services, (II) negotiating a price or bargaining and (III) screening, enforcement and supervision. Variable transaction costs differ with traded volumes and transport to destination (FISCHER & QAIM 2012, p. 1256). The extent of transaction costs is influenced by three factors: (a) the frequency at which transactions between the parties take place, (b) the uncertainty involved in the transaction, and (c) the asset specificity in relation to the transaction (GARCIA MARTINEZ et al. 2006, p. 97). These costs can prevent or reduce market exchange. Information asymmetries, imperfectly specified property rights and risk impair market failure (FISCHER & QAIM 2012, p. 1256).

4.3 The advantages and disadvantages of using ICT

The farmers named advantages and disadvantages of ICT usage in groups that refer to transaction costs (Table 2). For instance simply calling others instead of looking for them on their farms is one the explanations for time saving. Receiving information about product price and availability faster and at the right moment is crucial to reduce information asymmetries with brokers: "Farmers are well informed now. They just call someone at the market and ask how much. Mobile phones uplifted farmers not brokers!" (MIDDLEMAN 17.03.2015)

Table 2: Overview on the farmers' advantages and disadvantages using ICT

Advantages of ICT usage	Disadvantages of ICT usage
- Time saving - Receive information faster and timely - Enables and facilitates communication - Find people - Organise transport, inputs, workforce - Safer and easier money transfer	- Cost for charging, credit and mobile phone - Loss of mobile phone - Educational and literacy barriers of usage - Information breakdown - Fraud via treacherous calls

(Source: own results)

In case of significant distance between farmers modern technology facilitates communication. As well it is easier to organize inputs, harvest labourers, money transfer or transport, thereby reducing costs of market exchange. "Before I had to go there and carry money. Now I just call Agrovet and get the chemicals, this saves time and money for transport..."(FARMER 20.03.2015) "I call, the supplier brings the seeds, and in the meantime I can call the labourers. Before I had to visit the labourers at their homes, now we meet directly in the farm." (FARMER 19.03.2015) "I harvest and then call the buyer and they send someone to transport." (FARMER 19.03.2015) Cooperatives can use mobile money transfer to send small sums to members and avoid storing large sums of cash with no proper safe.

Negative aspects are especially the costs of buying and charging the device. Some farmers have no electricity and have to go elsewhere to charge the battery. Potential loss of the mobile phone is a problem. "If you carry it while working in the fields you can easily lose it. I need three month of saving to buy a new one." (FARMER 17.03.2015) Not all farmers are able to read or understand text messages. In certain areas network is not functioning and causes information breakdown.

Many of the gathered answers about the advantages and disadvantages of ICT usage can be linked to transaction costs.

4.4 The advantages and disadvantages of farmer groups and the influence of ICT

The existence of cooperatives is explained by the lower transaction costs that farmers face when dealing with this market institution. A farmer group is created to counteract market failures or depressed prices (GARCIA MARTINEZ ET AL. 2006, p. 97). The formation of a cooperative involves ex ante transaction costs related to search and screening of members. Negotiations over the size, membership fee, leadership, penalties cause further costs (NARROD ET AL. 2009, p. 13). After the process of group formation more transaction costs emerge and explain some of the named disadvantages (Table 3).

Table 3: Overview on the advantages and disadvantages of farmer groups

Group advantages	Group disadvantages
- Buy or sell bigger quantities at better prices - skip brokers - Learn from other members - Better marketing and introduction of new technologies - Better access to information, inputs or loans - Meet requirements of Global GAP - Shared infrastructure - grading shed, irrigation, community store	- Management needed - Mismanagement and corruption - Delay of export due to accumulation of produce - Lack of motivation and contribution, absenteeism, lateness, side-selling - Sometimes cheaper to buy individually, lock-in - Financial issues - some members do not return credits and or pay fees - Some exporters avoid farmer groups

(Source: own results)

For example the activities of group members need coordination to create advantages e.g. the accumulation of produce to sell bigger quantities. In case of mismanagement the accumulation takes too long and products lose too much quality and quantity. Using ICT facilitates information exchange among members and can improve organisation. As a consequence of the effects of ICT usage certain advantages or disadvantages of farmer groups can change significance either uplifting or devaluating group formation.

The usage of ICT is important to control that members comply with the groups' rules. "I call the farmer in the morning and ask how much he thinks he will harvest. Later I call his neighbours and ask them how much he harvests and in the evening I check how much he delivers. So I can control side-selling." (CHAIRMAN 18.03.2015)

As well buying and selling a bigger quantity at better prices increases profits and can be explained by improved price negotiation and higher volumes that reduce transaction costs. In this context the use of ICT simplifies direct contact and sale to exporters and helps to sell without costly brokers.

The motivation to join a group for better access to information or learning from other members could drop as the use of ICT decreases information asymmetries. The significance of access to small loans for example for inputs might be lowered as mobile-money transfer service facilitates small credits.

5. Conclusion

Simple non-multifunctional mobile phones are widely spread and important for the communication within farmer groups. Using ICT is crucial to reduce farmers' transaction costs by allowing timely and affordable communication. The use of Internet, innovative applications or services apart from mobile money transfer is rare. Face-to-face communication and group meetings are still central for complex information exchange. So far many-to-many communication via ICT is not taking place among the FFV small-scale farmer groups of the Mt. Kenya region. Large-scale farmers serving exporters already use smartphones with applications such as WhatsApp to send actual pictures of their crops. It is possible that exporters will try to force small-scale farmer groups to follow. Moreover applications like WhatsApp enable many-to-many communication within in groups that could replace meetings. The usage of smartphones with Internet offers many opportunities to further lower transaction costs. So far, certain aspects like price, short battery time, handling or network

hinder small-scale farmers to use smartphones. The real transformative power of ICT through innovative applications and services has not really arrived FFV small-scale farmer groups, but mobile phones are must-haves to support complex information exchange although traditional means of communication still exist: "It is still possible for farmers not to have a mobile phone, but it is very hard." (CHAIRMAN 18.03.2015).

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Support networks and mobile communication of small-scale farmers in the Mt. Kenya region

An empirical research within the livelihood framework

Mareen Hüls, Anna Wanetschek

1. Introduction

The aim of this paper is to analyse the support networks of small-scale farmers in the Mt. Kenya region within the livelihood approach by seeing the farming support networks of individuals as part of their social capital – included in the pentagon of capitals of the livelihood approach. An additional focus is on the impact of mobile communication, and hence on mobilising this support within the farmers' social networks.

The livelihood framework is a well-known and often applied concept in development research and application taking into account assets of the actors as well as the external context which influences the livelihood outcomes. Due to the fact that geographical development research increases its focus on action, development actors, their key resources, and active responses to difficulties in their way of making their living are the centre of this research.

Therefore, social capital, which is an intrinsic element of the livelihood framework, is of certain relevance for geographical development research which aims to understand development processes and problems. It is one of the key resources that play an important role in shaping the agency of individuals (BOHLE 2005, p. 78). Still, not often the concept of social capital is included in geographical analysis, for which reason BOHLE (2005, p. 77) describes social capital analysis as a new working field within geographical development research.

Even less attention is payed to networks in geographical work, although they are seen as an important part of one's social capital (DUNCOMBE 2006, p. 85-86). Network analysis - popular inter alia in sociology, psychology, anthropology and economic and political science (GAMPER & RESCHKE 2014, p. 37) - is rarely included in geographical work, although they might reveal an effective new way of looking at targeted persons, especially in geographical development research. As a matter of fact this paper aims to fill this research gap and to link network analysis and the livelihood framework for the purpose of understanding how farmers are able to gain social capital by mobilising support via their networks and the way this influences livelihood outcomes.

Additionally, the authors believe that the role of mobile communication within the network structure and support mobilisation is an important factor to be analysed. Therefore, the conceptual framework of the research is meant to contribute to the information and communication technologies for development (ICT4D) debate - especially in the field of agricultural development - with focus on mobile communication. Due to this, the paper hopefully not only contributes to marking the importance of the new theoretical and empirical link of concepts for geographical development research, but also to the understanding of global and local value chains. Those are usually analysed by their structure as well as economic or political parameters. In contrast this paper gives a bottom-up analysis as part of the livelihood context of the actors on the basis – the small-scale farmers. This context influences the way in which they are able to participate and alter global and local agricultural value chains.

Using the case study of small-scale farmers in the Mt. Kenya region this paper tries to answer the following research questions:

- How are support networks of small-scale farmers structured and (how) are they affecting livelihood outcomes?

- How does mobile communication influence the support networks and the way in which farmers are able to mobilise social support?

To answer these questions, while also giving a theoretical understanding of the applied concepts, the report is structured as followed. First, the relevant concepts of livelihood, social capital, social support and networks, and the literature that applies or describes those concepts are discussed. At the same time the conceptual framework of this paper is presented. Second, the applied methods of the empirical research and analysis of the data are described. Third, the results of the empirical research in the Mt. Kenya region are summarised and discussed with reference to the conceptual framework and state of research given before. Last, a conclusion follows to answer the research questions and to present an outlook for further research.

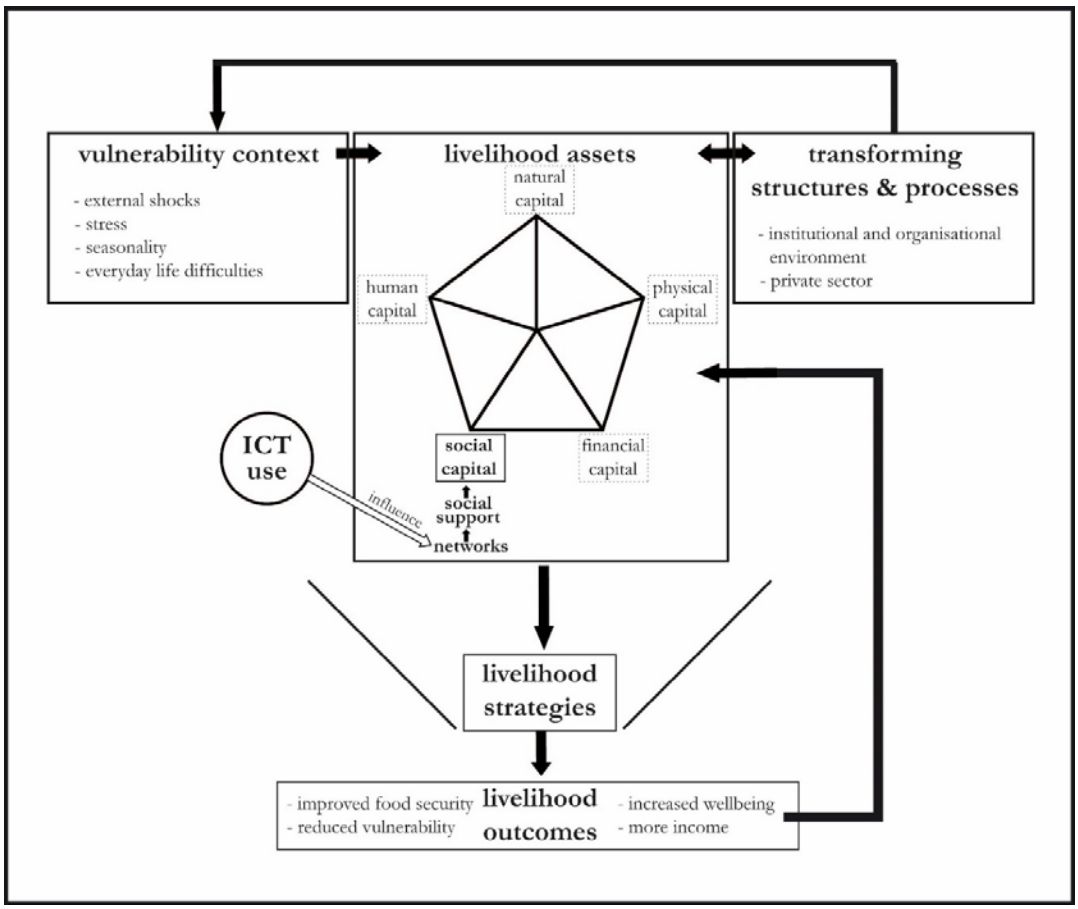
2. State of research and conceptual framework of the paper

The following chapter aims to give an overview of the state of research concerning the concepts combined in this paper and a clear picture of the background and make-up of the applied research framework.

The (sustainable) livelihood framework, which was created due to the criticism of the former analysis of poverty being too narrow, is now used as an analytical tool of both researchers and practitioners in the field of development planning and related areas such as geography (KRANTZ 2001, p.1). Using the most commonly used definition of sustainable livelihood given in the influential article of CHAMBERS AND CONVEY (1991) *Sustainable rural livelihoods: practical concepts for the 21st century* "a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets" (CHAMBERS & CONVEY 1991, p. 10). To get an overview on the applied framework of the livelihood approach with focus on the influence of networks on social support as part of the social capital - including the impact of the usage of ICT/mobile communication - see Figure 1.

Applying the concept, it should be kept in mind that it also has considerable weaknesses. To identify key factors within the livelihood systems that could be improved in theory the approach demands "a broad and open ended analysis" (KRANTZ 2001, p. 4), which is hardly ever possible due to practical constraints. Therefore, practitioners and researchers usually only focus on one predetermined field, although they try to include others in their analysis. For example, in this field support networks are on focus of analysis and other factors are only considered with reference to networks. This means that the aim to get a full picture of the livelihoods of a group can only be achieved partially and there is always danger to miss important factors in the system. Thus, this study does not have the pretension to explain the full livelihood systems of the interviewed farmers and even less of the whole group of farmers in the region. Another often named weakness is the lack of analysis of and explanation for the occurrence of beneficial or precarious livelihood systems (RAUCH 2009, p. 319). Although this study cannot respond to the criticism completely, especially due to the above named constraints, it does provide some explanation for the formation of beneficial or unfavourable networks as part of livelihood systems.

Figure 1: Livelihood framework



(Source: HÜLS & WANETSCHEK 2015, based on Department for International Development 1999)

While taking into consideration the above named constraints, most researchers do agree on the following strength of the livelihood framework making it a useful approach for research. By applying a bottom-up approach - starting from the micro-level - the framework emphasizes constraints, needs, and strengths of the targeted individuals (DUNCOMBE 2006, p. 97). "Thus, it recognizes that the poor have their own portfolio of assets and strategies to cope with vulnerability, while also acknowledging the importance of the external structures and processes that can transform the lives of the poor" (DUNCOMBE 2006, p. 83).

The 'portfolio' of actors is described as a pentagon of assets that - depending on its make-up - enables or constrains the actor's pursuit of favourable livelihood strategies. The components are human, social, natural, physical, and financial capital. Human capital includes - for example - skills, education, knowledge, and good health. Represented by social capital are the social resources such as networks, participation in groups and trust. Social capital is focused on in this paper and hence will be discussed in detail later. Natural capital describes natural resources like land, soil fertility, climate etc. Infrastructure and technology are subsumed under physical capital. Financial capital describes financial resources such as possession, income, remittances or access to loans (CHILIMO & NGULUBE 2011, p. 147; DUNCOMBE 2006, p. 85-86).

Summarised under external structures and processes which enable or constrain the possibilities of the poor to maintain or improve their livelihood outcomes is usually the institutional and organizational environment. This can be governmental, non-governmental or

private - at all levels -and including the actions taken by actors within this environment (DUNCOMBE 2006, p. 97).

The context of vulnerability typically encompasses (mostly unpredictable) shocks like natural disasters or epidemics and stresses like seasonal shortages, declining resources and so forth that are often cumulative and continuous. (KRANTZ 2001, p. 7) What could be subsumed under stress, but is less extreme and not necessarily external, are what the authors name 'everyday life difficulties', experienced on a daily basis. This component should be included in the research framework, because it does influence peoples' lives and most often it is the most common vulnerability context people have to respond to. 'Everyday life difficulties' vary extremely according to the livelihood activities of a person. Concerning farm work this might be shortage of labour, crop diseases, and transportation problems or lacking knowledge about market prices and so on.

"Any definition of livelihood sustainability […] has to include the ability to avoid, or more usually to withstand and recover from such stresses and shocks" (KRANTZ 2001, p. 7) and cope with 'everyday life difficulties'. Within this vulnerability context and influenced by the given external structures and processes actors use their capitals in their attempt to create favourable livelihood outcomes. Livelihood outcomes can be measured by the decrease, maintenance, or improvement "in peoples' economic (e.g. assets, income, and expenditure) and social/human dimensions (e.g. skills and knowledge, social networking, communicating in emergencies)" (MIRORO & ADERA 2014, p. 57).

Within this framework the focus of this paper are the support networks of small-scale farmers (possibly influenced by mobile communication) that are considered as part of their social capital. This is done to close a research gap and to achieve a better understanding of people's livelihood systems, because, albeit social capital forming one "component of the asset pentagon of the sustainable livelihood framework" (ABENAKYO et al. 2007, p. 539) and social networks being seen as one important source of social capital the combination of social network analysis and the livelihood framework is rare. One example of closer analysis of networks as social capital within the livelihood framework is the geographic dissertation of KÖBERLEIN (2003) titled *Living from waste. Livelihoods of the actors involved in Delhi's informal waste recycling economy*. In his case study social capital is considered the most important determinant of livelihood and social support, focused in this study and included in KÖBERLEIN's definition of social capital is seen as very crucial. Moreover, he emphasises the possibility to convert intangible assets like social capital to other capital forms like material resources. Even though the author's object the wording transformation this study also analysis the improvement of tangible assets through access to intangible assets, here, support networks (BOHLE 2005, p. 73).

The purpose of the following study is therefore to combine those approaches theoretically and in empirical research to contribute to a broader understanding of how supportive action enabled by personal networks may alter one's livelihood strategies and outcomes.

In contrast to the above named research-gap the link of the concepts of network and social capital is well established in the literature. The classics in literature about social capital (BOURDIEU 1983, COLEMAN 1991, PUTNAM 1995) already link social networks to social capital, although their approaches to social capital are diverse. PUTNAM 1995 describes social capital as a collective resource of a community, evolving from and including trust, norms of reciprocity and membership in voluntary groups (PUTNAM 1995, p. 66). BOURDIEU 1983 defines social capital as the total of resources that one owns because of membership in certain groups (BOURDIEU 1983, p. 191). According to him, social capital, as well as cultural and economic capital, leads to the maintenance of class structure and social inequality, because they are seen as partly inherited. (BOURDIEU 1983, p. 184) COLEMAN 1991 instead uses a functional definition of social capital (COLEMAN 1991, p. 392), which will also be applied in

this study. He defines the value of social structure for individuals as the way they can use their relations to meet their interest (COLEMAN 1991, p. 395). Although their definition and viewpoint vary, all of the three influential researchers focus on different aspects of what is defined as social capital in the livelihood approach (DUNCOMBE 2006, p. 86).

A newer discussion in the literature concerning social capital is whether social capital has positive effects on growth and development or if it is a strategy for risk and survival management. WOOLCOCK & NARAYAN (2000, p. 227 in BOHLE 2005, p. 70) distinguish these as two different functions, namely "go ahead" and "get by" (BOHLE 2005, p. 70).

This said, the following study focuses on the aspect of social capital that an individual holds because of the social support they can mobilise – to 'get ahead' or 'get by' - not because of membership in one community or group, but in an individual social network.

Concerning the definition and differentiation of social capital and social support evolving from the networks the literature often is vague and contradictory. Often social support and social capital is used synonymously, although there are considerable differences (see DIEWALD & SATTLER 2010, p. 689). Taking into account the focus of this study on networks in line with Bernhard (2010, p. 126) who argues that only the use of networks turns them into capital, here the social support is the use of the network through which the network owner receives social capital. Thus, networks are potential sources of social capital which allow the actors to mobilise social support (FENICIA ET AL. 2014, p. 310). Research combining the concepts of social capital, social support and network analysis is found for example in research of FENICIA ET AL. (2014) on migration and integration. Their work show that the link of social network theory and social support analysis, applied in this paper as well, give a detailed picture and explanation for the agency of actors and therewith for their livelihood systems.

From the many different forms of social support this study focuses on three forms which in the following are referred to as material and practical help and information, named among others in different classic categorization systems of social support such as COLEMAN (1991) (although he calls them forms of social support) (COLEMAN 1991, p. 401–403), BARRERA & AINLEY (1983) and DIEWALD (1991 in DIEWALD & SATTLER 2010, p. 691).

Since "livelihood in its simplest sense is a means of gaining a living" (CHAMBERS & CONVEY 1991, p. 9) here the focus lies on farm specific support, because farming is the most important livelihood activity in the case study by generating both income and food for home consumption. This might include practical help with farm work such as digging, financial help in the form of loans from a bank, self-help group or individual or advice concerning farm practices.

The social relations of an individual from which one can draw forms of social capital (in form of social support) is referred to as (potential) support network (REISENZEIN et al. 1993, p. 71) – although this study only deals with the support network from which the individual receives the three above names types of social support for their farming activities. In this study, support networks are defined as the persons (private as well as business contacts), groups, institutions, and companies that are used by an individual to enable, improve, or sustain ones farming activities.

Networks can be analysed by their structure and function. When looking at the structure besides size, multiplicity of the actors etc. (PROCIDANO & HELLER 1983, p. 2) one often considered dimension of analysis – based on the work of GRANOVETTER – is the differentiation of relations as strong (friends, family) and weak ties (acquaintances) (GRANOVETTER 1983, p. 201). Functional network characteristics include the here analysed provision of social support.

This broad definition of support networks as one source of social capital and its analysis is used to see the variation of the make-up of support networks and also to meet the goal of the livelihood framework not to focus only on one actor or action that influences the

livelihood of a person, but to try to understand the different available sources one actor can use.

Embedded in the above explained conceptual framework this study includes mobile communication as one component of analysis. Mobile technology forms part of what is intensively discussed in the development and research community as ICT (information and communication technologies) in the so called ICT4D (ICT for Development)-debate. Moving away from the general, mostly optimistic literature on ICT4D to research that is closer to the line of background of this study, research on the influences of mobile phones on agricultural development, summarized by DUNCOMBE (2012) is to be named. Moreover, research has been done on the impact of mobile phones within the same geographical area as this study (DANNENBERG & LAKES 2013). Different to this study, they focus on the impacts of mobile use on the business of export-oriented farmers whereas this paper specialised on impacts on networks and therefore on livelihoods of both export- and local-market oriented farmers. Furthermore, conceptual literature and literature reviews exist on the impact of mobile phones on livelihoods in developing countries (see DUNCOMBE 2014, DONNER & ESCOBARI 2010). Even country-specific literature for Kenya (WAEMA & MIRORO 2014), neighbouring Tanzania (CHILIMO & NGULUBE 2011) and Uganda (ABENAKYO et al. 2007) and literature on the East-African region (MIRORO & ADERA 2014) combining ICT use and livelihood analysis is available.

However, in those analyses of ICT embedded in the livelihood framework, ICT lies at the core of the analysis, whereas in this research ICT or more specifically mobile technology – being the most important ICT in the area of research – is being seen as only one variable on social capital by influencing support network structure and the way of mobilising social support. Furthermore, mobile technology is often seen as part of physical capital (DUNCOMBE 2006, p. 86) and although this makes sense when seeing it as a technical resource one owns or misses, when emphasizing the way it is used it is helpful to see the device as a cross-cutting component of the livelihood framework. As such it is influenced by and influences itself all capitals, although according to (CHILIMO & NGULUBE 2011, p. 152) mobile technology is most closely associated with social capital, which then might influence the other capitals.

When the focus is on the way ICT alters social relations and networks, most of the time there is no connection to the livelihood framework (HORST & MILLER 2006, LING 2004, MARSHALL & NOTLEY 2014, GREEN & HADDON 2009). This research focuses on different topics concerning the impact of mobile communication on social networks. Of interest to this study is the question how ICT may alter the structure of networks and how ICT influences the way social support is given. Concerning the structure there is disagreement if mobile use leads to new networks of work specific weak ties, which are less geographically defined (WELLMANN 2002 in DONNER 2007, p. 7) or to an intensification of already existing strong ties (GREEN & HADDON 2009, p. 92).

Another discussion examines if face-to-face contacts lose their importance because of ICT communication (OVERÅ 2006), which GREEN & HADDON (2009, p. 91) answer as followed: "[S]ocial capital now appears to be maintained on the basis of multiple ICT technologies as well as in face-to-face relationships." On the impact of mobile communication on social support the majority of literature agrees that the ease of communication by mobile phones leads to better access to social support. "[C]ommunication channels are […] important to the exchange of information and financial and other help; the cell phone makes these exchanges comparatively quick and easy [...] by making it possible to ask relatives and friends (abroad) for help. The cell phone helps to maintain relations of social and economic significance and is effective in dealing with crises and immediate needs" (BEER 2009).

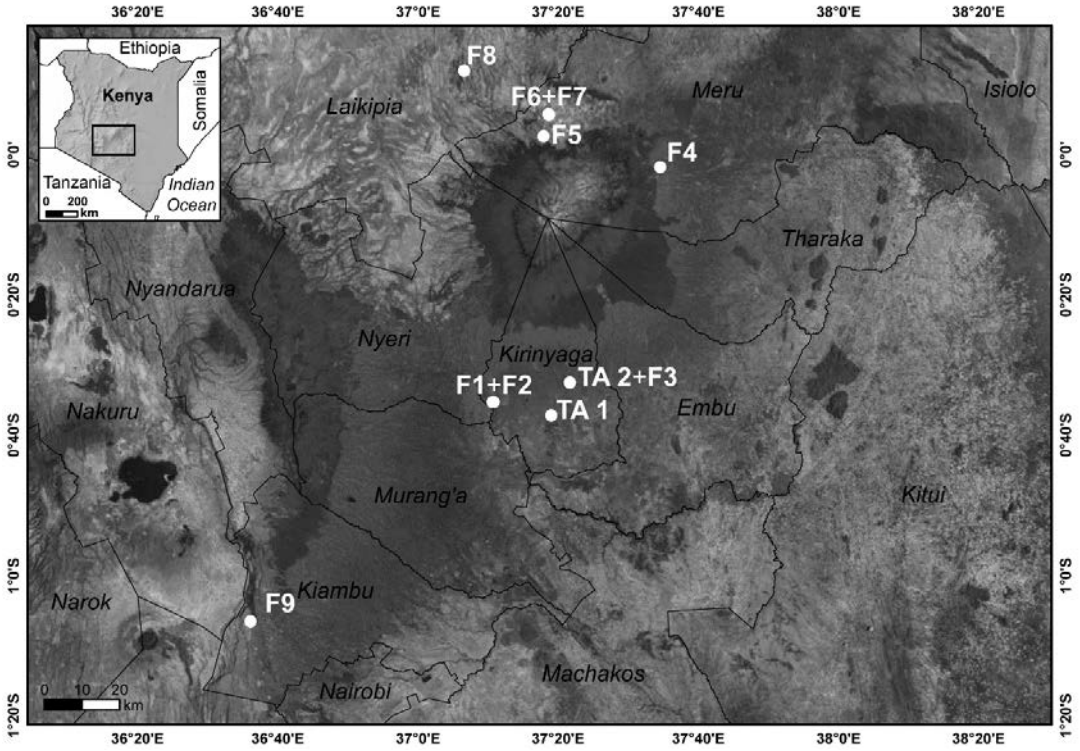
To sum up the conceptual framework of this study that derives from different concepts and debates in the existing literature linked by the authors, Figure 1 shows the adapted livelihood framework. The main focus of this study are the networks of small scale farmers.

They are seen as social capital by giving farmers access to social support. Mobile use is seen as a variable that might influence the make-up of network and therefore the social support and social capital structure of individuals. The composition of available social capital is believed to have an impact on the livelihood outcomes. Moreover, the vulnerability context as well as external structures and processes that have an impact on livelihood strategies of farmers – directly and by influencing support networks – are also included in the conceptual framework to meet the requirements of the livelihood framework not to concentrate on one component, but to take into account the interdependent system in which the individuals act.

3. Methods of empirical research and data analysis

The research was conducted in March 2015 in three counties of the Mt. Kenya region (Meru, Kirinyaga, and Laikipia). For the exact locations of the conducted interviews see the map in Figure 2 (where farmers (e.g. Figure 1) and technical assistants (Table) are displayed). The region's structure provides multiple opportunities to answer the key research questions. The main economic income in the research area is farming and the Mt. Kenya region shows differing farming systems (subsistence or export oriented commercial farmers, extensive large scale to very intensive small scale farming), whilst in this study the focus will be on the small-scale farmers (VAN DE STEEG 2010, p. 240), which are integrated in global and local value chains.

Figure 2: Research area with locations of the conducted interviews



(Source: Cartography and layout: HÜLS & WANETSCHEK 2015. Data source: Basemap by ESRI world imagery.)

The strongly weathered volcanic soils are very fertile and the growing conditions are stable. With these growing and tropical climatic conditions cultivation and harvest of crops is possible several times a year (DANNENBERG 2012, p. 62). The soils are used for the cultivation of tea, coffee, french beans, snow peas, cut flowers, and wheat which are produced as cash crops. Maize and local vegetables are staple food crops (VAN DE STEEG 2010, p. 240).

The rainfall distribution in the research area is bimodal, with a short and long rainy season from March to June and October to December (MAIRURA 2007, p. 78). However, the rains are not reliable and predictable in terms of onset, duration and termination. Due to relief rainfall mostly on the eastern and southern side of the Mt. Kenya, the north-western part of the research area is characterised by a lower amount of rainfall. In addition, there are seasons with total rain failure (ULRICH 2012, p. 242). The different climatic zones in the Mt. Kenya region enable a high variety of fruits and vegetables cultivation. This natural diversity leads to different livelihood strategies.

3.1 Semi-structured interviews and ego-centred network analysis

To answer the above mentioned key research questions semi-structured interviews were conducted to gain a deeper qualitative understanding of the support networks of small-scale farmers. Semi-structured interviews are directed by a predetermined guideline with given topics and questions. However, flexibility in the order or form of questions is encouraged to point out a deeper insight into the interviewees experiences. Furthermore, "people's own words do tell us a great deal about their experiences and attitudes, but they may also reveal key underlying social structures" (WINCHESTER & ROTE 2010, p. 13). Difficulties with the semi-structured form of an interview may occur when conversation has moved too far from the research topic, so the researcher is in need to act more as an interventionist than in structured interviews to redirect the conversation (DUNN 2010, p. 110).

With the livelihood framework encouraging a bottom-up approach, the main focus was on farmers' experiences, while also fulfilling the request to take into account the context and structure of the environment within the farmer's manoeuvers to improve his/her livelihood outcomes.

Analysing social networks of the participating farmers by means of the software VennMaker was an aim while creating the research concept and design. It was planned to draw ego-centred network maps of and with the informants. These network maps visualize not only the persons within the network of the informant (*Ego*), but also the role of these persons (family, friend, and business partner), their distance, importance, the use of information and communication technologies. As a further advantage network maps demonstrate who gives support and/or information to whom and if the persons in *Egos* network know each other (*Alter-Alter*-relations). During the research process it was realised that in the first conversation with the interviewee – especially in another cultural environment and with the existing language barriers - it is very difficult to gain satisfying results. Also due to the shortage of time during the study project this time-consuming method was just applied explorative for further research.

It was difficult to reach an understanding of the institutional and organisational environment because it differs considerably from place to place. Responding to this weaknesses the authors conducted further long-term research after the study project focusing on one and two study areas.

3.2 Data analysis

The collected data in form of semi-structured interviews was analysed and presented as "a literal description of the themes that emerged in the interviews" (DUNN 2010, p. 126). Latent content analysis was applied to search in the transcribed interviews for themes. It "requires a determination of the underlying meanings of what was said. This determination of meanings within the text is a form of coding" (DUNN 2010, p. 125). For the coding, following categories were defined:

- Vulnerability context
- 'Everyday life difficulties'
- External structures and processes
- Farmers' support networks
- Influence of mobile communication
- Livelihood strategies and outcomes

These categories were established for three different purposes: (i) to get an input for answering the key research questions (ii) to integrate the concept of social network analysis into the framework of the livelihood approach and (iii) to test the influence of the use of mobile communication on support networks. The results are presented and discussed in the following chapter based on the given coding.

4. Empirical findings

During the study project semi-structured interviews were conducted individually in the Mt. Kenya Region with ten small-scale farmers and two technical assistants (one from an export company, the other from a farming cooperative). Additionally, there were several group discussions with governmental institutions (different departments of the Ministry of Agriculture and Horticulture Crop Directorate and Kenya Agricultural Research Institute, export companies as well as farmer self-help groups) to get an understanding of the geographical environment and the institutional and economical structures that influence the livelihood strategies of farmers.

In this chapter the support networks - as part of the social capital - of small-scale farmers are analysed including those in the livelihood approach (see Figure 1). This study concentrates on specific support for farming business, here differentiated in practical and material help as well as information. As explained in the second chapter, the context of vulnerability in literature contains shocks as natural disasters and stress like seasonal shortages. This research also includes 'everyday life difficulties' as an analytical category because it is often the most widespread vulnerability context farmers have to reply to. To answer the research questions this chapter is structured in succeeding analysing categories: First, the vulnerability context, the institutional and organisational structures are presented to gain a better understanding of the general situation of the farmers. Second, it is followed by a description of the findings on farmers' support networks (including the forms of support and the actors within). Third, the influence of mobile communication on these support networks is displayed, as well as the way in which farmers are able to mobilise social support through the mobile phone usage. This chapter closes with findings on the effects of support networks (possibly influenced by mobile communication) on livelihood strategies and outcomes.

4.1 Vulnerability context

The lives of farmers are strongly affected by external factors that make them and their assets vulnerable. In this case the interviewees emphasise the problem of changing climatic conditions with both seasonal unreliable water supply, as well as too heavy rains. "[The rain] is not reliable. Years ago it was raining from 15th of March on, but now it's late, maybe 15th April. We cannot plant right now, we are waiting for the rain" (FARMER 2). For farmers located in the rain shadow of Mt. Kenya "water is a problem: [because] it's too expensive to buy a tank to store the water, or to buy an irrigation system" (FARMER 8). Concerning farming, the interviewees mention that during seasonal heavy rains the vehicle for collecting their products cannot reach the farms due to bad road conditions. The interviewed farmers

also complain that the costs for production and fuel are increasing constantly. Additionally, seasonal variations in prices, production and economic opportunity may also occur.

4.2 Everyday life difficulties

As mentioned above this study considers everyday life difficulties as an important point to focus in the vulnerability context. Most of the interviewed FARMERs refer to recurrent crop diseases that they have to handle. Moreover lack of knowledge and the absence of advices by organisations and institutions was mentioned as the major problem, because they have no contact to the latter named or sometimes even if they requested support: "None of them [Ministry of Agriculture] had advised me, I wait and wait until I was tired…." (FARMER 4) makes it very hard to respond to these diseases, they say. Another difficulty they mention is the missing knowledge about market prices for their produce. This causes a dependency to the so called brokers, who can determine the prices themselves with no bargaining power of the farmers against them. The lack of financial support by the government is also a commonly reported problem of some farmers: "Small-scale farmer doesn't have money, doesn't have anything" (FARMER 4).

4.3 External structures and processes

As mentioned in chapter three a deeper understanding of the institutional and organisational environment, which differs considerably from place to place was difficult to get. Nevertheless, in this explorative phase of the study it was already possible to turn out the following general patterns. In the research area governmental organisations, private companies, and farmer groups are forming the structures the farmers' livelihoods strategies and outcomes.

The 'Ministry of Agriculture, Livestock and Fisheries' (MoA) "has its fundamental goal and purpose of conserving protecting and managing agricultural livestock and fisheries resources for socio-economic development. Its aim is to improve the living standards of people by ensuring maintainance of agricultural livestock and fisheries resources" (MoA 2015) Operating on county level, the different departments have district agricultural extension officers providing "extension on demand" (head of MoA department in Naro Moru). In particular, farming cooperatives or self-help groups can get trainings by the field extension officers on their specific needs - "sometimes we as farmers request" (FARMER 5) - or according to the program of the MoA, but there is also the possibility to visit the MoA offices or call the officers to ask individual questions without being in a group. But mostly groups or cooperatives ask for trainings from the ministries, "but even I can ask them, […] but usually because of reduction of cost I use institutional channels: I go to the chairman and propose what I was thinking" (FARMER 5). The chairman of the group or cooperative consults other farmers and when more have the same needs, a training is organised.

Another important governmental organisation is the 'Horticultural Crops Directorate' (HCD), former 'Horticultural Crops Development Authority', with the mission "to promote, develop and coordinate the production and marketing of horticultural produce" (HCD 2015). It is subordinated to the state corporation 'Agriculture, Fisheries and Food Authority' (AFFA). The HCD has depots on county level, and sends horticultural production officers to gather information from researchers, farmers and companies and to organise trainings for farmers. Their vision is to have a competitive horticultural industry sector in Kenya and to link farmers in groups to the domestic and export markets. Also they are responsible for licensing export companies and supporting small-scale farmers in supervising conclusions of contracts between farmers and exporters, and "because most farmers don't know what they sign, we regulate" (staff of HCD depot Nkubu, Meru).

Not all farmers agree with this positive self-presentation of the governmental organisation and their services: "[The] government seems not interested in our problems. Small-scale farmers don't have money, or know-how for the export. We ask the institutions for advice and support […] but the information is lacking, totally missing. We've been left on our own" (FARMER 4).

Private companies form part of the livelihood structure of the small-scale farmers, when they grow crops like snow peas, french beans or baby corn for export. An exporting farmer gets field visits by technical assistants or agronomists of the export company. They advise in the interest of the company on the demand and desired quality.

In many cases so called "brokers" or middlemen are in between farmers and markets. They buy from farmers and sell to domestic markets or export companies. The brokers have no contracts with the farmers, and the prices are determined by them. Although the farmers have no power to bargain for better prices, they still have to sell to the brokers: "You know, I sell to brokers, what shall I do? Unless the government assists,... we are really suffering" (FARMER 4). The brokers seem to be aware of this great dependency and are therefore able to exploit the farmers for their own profit.

Supermarkets established a structure for their supplying farmers in form of regularly quality checking. The supermarket companies send their field staff "[…] rarely and they don't know much about farming. Those people who buy, they are not interested where and how you grow them [the crops], they are interested in the quality" (FARMER 9).

4.4 Farmers' support networks

The above displayed structure affect support networks of farmers, now divided and presented in the three here defined forms of social support: material support, practical help and information, derived from DIEWALD (1991, p. 179f). As defined in chapter two, support networks in this study are persons (private as well as business contacts), groups, and institutions that are used by ego to enable, improve, or sustain ones farming activities.

The actors within the network of farmers vary markedly by presence, absence, number and intensity of relations to network members from the varying above named categories. Here different individual, geographical and social factors, but also the external structure described earlier have an influence. Therefore, the in the following presented forms of support vary according to the make-up of the network of an individual and therefore should be seen as potential sources of support of farmers, with most farmers only having access to some of them.

For the authors it was sometimes difficult to differentiate if a person is a weak tie or strong tie, because of lack of information on the intensity of each and every named relation. Therefore, weak ties are defined as relation to staff of institutions and organisations and farmers which whom one doesn't have regular contact. Family members, friends, neighbours and group members of the same group are considered as strong ties. Moreover, it was difficult to determine the role of a person within the network, because of multiple roles of one network member: "She is a family member. She is a farmer, ok? She is also a friend. They are neighbours" (Interpreter with FARMER 2).

4.5 Practical help

Practical help is here defined as physical support, for example work directly on the farm, or eased conditions in producing and selling crops. This kind of support to small-scale farmers in this research area is given for example by export companies or the farming cooperative, mainly appearing as help with chemical spraying on the farm. (Table 1, FARMER 1). The cooperative also ensure an easy money transfer for the farmers (Table 1).

Moreover, cooperative members also help each other during production as well as with transportation to the grading sheds as they share cars. Another often named form of practical help is when neighbours and friends are supporting each other in terms of labour for example help with digging or planting, when there is need (FARMER 1), in some cases this support is being payed. In cases of practical support among individuals where no money is involved, according to COLEMAN, this can still be seen as a rational activity leading to mutual benefit, because the one helping can expect to receive support in response when he is in need. Therefore, COLEMAN sees the reciprocal help as kind of an insurance system, evolving especially where governmental welfare and insurance systems are absent or less developed (COLEMAN 1991, p. 401-402).

In addition, some small-scale farmers "sell [their products] through the group" channels (FARMER 6). Especially the Dairy Societies and Cooperatives "help wonderfully good and enough" (FARMER 4) with their provided services.

4.6 Material support

In this study, the authors understand forms of allowance and financial aid as material support. There are different sources of material help. It may originate from the government, the export companies, the cooperatives or groups, as well as from individual neighbours. The farmers have the possibility to get subsidised fertilisers for a cheaper price from the Ministry of Agriculture. Furthermore, the government supports in renovating the irrigation infrastructure (Table 1). Material help by export companies can be in form of handing over certified seeds, seedlings, pesticides and other chemicals usually by deducting the money from the farmer's earning after harvest (FARMER 1). An amicable form of material support occurred in way of sharing chemicals or lending money with friends or neighbours, when there is need (FARMER 2). Another kind of material support is provided by banks and some farming groups in form of loans one can get. "Every week every member puts 200 Kenyan Shillings (KSH) [which is converting in Euro about 2€], and when there is need you can get a loan 30.000 KSH [~250€]" (FARMER 8). Also some export companies offer financial support in terms of "financial assistance to hire casual workers" (Table 2). These examples confirm KÖBERLEIN's findings that intangible assets in form of networks can lead to access to tangible assets, like material and financial capital (BOHLE 2005, p. 73).

4.7 Information

The form of support within the small-scale FARMERs' networks that was considered most important by many interviewees is giving and receiving information. According to one of the farmers, the "most important thing is knowledge" (FARMER 4). Especially in this form of support, the governmental structure provides different sources of support. The agricultural extension officers are advising the farmers on different crops and farming activities for free. This is very important "because he is giving information on whatever we are growing" (Table 1). Furthermore, the production officers of the HCD provide trainings and information on horticultural crops and the marketing of them. If the farmer has the possibility to get in

regular contact with one of them, he or she can gain important knowledge, because "when you have a problem, you call the agricultural officer, and he comes to help directly to the farm" (FARMER 8). Nevertheless, the availability and access to governmental support vary markedly from location to location. In some cases, one officer from either the Ministry of Agriculture or the HCD has a very large area of responsibility and can therefore not consider all farmers satisfactory equally. This happens augmented to small-scale farmers who are not farming for export which seem to be focused by the governmental organisations. This leaves only little capacity to support farmers integrated in local value chains. Furthermore the "extension on demand"-system is not well known in every place, and hence cannot reach every farmer. Therefore some farmers complain: "We are really frustrated with your company [HCD] and the government at the same time, because you don't seem to have an interest on our small-scale farm. Small-scale farmers […] even doesn't have know-how or the knowledge of exporting anything." (FARMER 4 talks to officer of HCD).

Another source of information are the self-organised farming groups such as cooperatives, societies and self-help groups. The chairman of one group states that during their regular meetings the members are very well informed on cultivation, production, marketing and pricing. They also organise trainings taking into account farmers' specific needs. Another group is organising record keeping training for their members. However, this group effort varies and is not appearing like this supportive everywhere else.

The exporting companies also share information with their suppliers, "but [they give] support only for french beans" (FARMER 2) or other export crops. Trainings organised by the exporters contain principally company interests on the quantity and quality of the crops and the use of allowed chemicals to fulfil their producing standards. The farmers get "information and teaching through the agronomist [of the export company]" (FARMER 7). Agronomists are also advising the technical assistants of cooperatives on "how much and when to produce, problems. He is giving advices, and I also give him information about the situation of the farmers. When there is an outbreak of a disease, I can call him and he helps directly, and once per month he comes in person" (Table 1). Moreover, the export companies also have their own technical assistants working directly with the farmers and visiting their fields. "We give them advice on which crop to grow. We give them certified seeds, and take care of water supply, give advice on irrigation systems, and advices on which pesticide in which state. […] picking advices…" (Table 2). As a supplying small-scale farmer for an export company, the support of their technical assistants is of great importance, because he literally is "the one who is closer to the farmer than anyone else" (Table 2).

Small-scale farmers who supply to supermarkets can get additional information from their buyers. As mentioned previously, also in this case "someone comes around to the farms, tell what the market wants, but they don't know much about agriculture" (FARMER 10). Nonetheless, if supplying directly farmers have the chance to meet distant other farmers to exchange information. In a case, some neighbouring farmers then organised themselves to "visit the other farms [even in other counties], and we see how they do well, they give us advice. We exchange the ideas every three month […] because if you want to have a good chance on the market you need to sell unique things" (FARMER 9).

Beside the displayed organisational sources of information private informants such as neighbours, friends and other farmers also play an important role in the access to information and advice. If a farmer has a limited or no access to formal sources, the information he/she gets from another farmer may be a very significant input. "She [a friend] is very important, a source of information, of market prices" (Interpreter with FARMER 2). The "neighbouring farmers are within a five to ten minutes walking distance. They visit each other first, when there is a problem with insects or pests. Then they may call the agricultural officer" (Interpreter with FARMER 2).

To link the finding of this study to the state of research, the authors partly agree with GRANOVETTER (1973), that specialist information and knowledge are existent in social networks consisting predominately of weak ties. In this case – with weak ties being predominantly institutions and companies – they also have better resources to support the farmer especially in material and informational ways. "Weak ties […] are here seen as indispensable to individuals' opportunities [in this case receiving support]" (GRANOVETTER 1973, p. 1378). In summary, it can be stated that the farmers' ability to gain an encouraging and supporting social network is partly an outcome of the *Strength of weak ties* (GRANOVETTER 1973). But the results of this study suggest that strong ties are also of considerable importance for the access to support, but most time to other forms than weak ties, such as transferring simple information such as market prices and giving reciprocal practical and material help. Moreover, if farming groups are formed, which is most of the time done by a few strongly related farmers, other farmers join because of their strong ties. Already being in the group, this strong ties can also facilitate the access to weak ties and therefore to the above named benefits.

4.8 Influence of mobile communication

The use of information and communication technologies has a great impact on the farmers' livelihood strategies. In this study the authors focus on the influence of mobile communication on the support networks of small-scale farmers and the way in which they are able to mobilise social support and therefore indirectly influencing livelihood outcomes. Each of the interviewees in the research area owns a mobile phone, and some were even able to access internet with it. "It is very difficult to find someone without a mobile these days" (FARMER 2), applicable with WIESMAN et al. 2014 who say that in 2009 two-thirds of Kenyan households own a mobile phone.

With the possibility of mobile phone use, communication becomes a very easy and quick medium to mobilise or give social support. "Before the phone, I had to walk a lot, and had to give reports to the neighbours when I couldn't reach a farmer, nowadays it is more easier" (Table 1).As discussed in chapter two there is still a disagreement in literature if mobile communication leads to new networks of work specific weak ties, which are less geographically defined (WELLMANN 2002) or to an intensification of already existing strong ties (GREEN & HADDON 2009). The results in this study show that "both the maintenance of kinship networks and [networks for] agricultural purposes" (MARTIN & ABBOTT 2011, p. 22) can occur. Often the frequency of contacts to weak ties like the MoA or companies increased, though it is also used to keep in touch with friends and family members, which is important for possible present or future need of support. According to some of the interviewed farmers, the general communication increased through to the use of mobile phones, and they have intensified the contact to existing ties as well as increased the number of contacts with an even wider geographical distribution, similar to the findings of KRONE et al. 2014.

According to the interviewed farmers, they use their mobile phones mostly to call neighbouring farmers, friends, and field extension staff of the ministry, the HCD, the export company or the cooperatives. Especially in urgent cases like the sudden emergence of pests: "farmers are calling each other, mostly in phone, because 90% of the farmers have a mobile phone" (Table 1). Most of the times, the call is used to arrange a meeting and solve the problem on site. As mentioned before there are ongoing discussions if face-to-face contacts lose importance due to the use of the mobile communication (OVERÅ 2006). This is opposed by the fact that most of the calls were operated to arrange face-to-face meetings because they are still more important. Agreeing with KRONE ET AL. 2014: "With calls to arrange meetings, mobile phones provide the opportunity for farmers to access complex knowledge by enabling the personal communication process needed, but not for the knowledge exchange [in this

case: information as a form of support] itself." (KRONE et al. 2014, p.160). This proves that contact face to face is still very important to the farmers since not every problem can be solved through the mobile phone: „I don't talk on crops on the phone" (Table 2). Furthermore, "whenever a problem arises, she calls them [technical assistants of export company] and they come" (Interpreter with FARMER 2). Between neighbouring farmers living within a walking distance, "they visit each other first, when there is a problem with insects or pests. Then they may call the agricultural officer" (Interpreter with FARMER 2).

These findings assent BEER 2009 who said that "the cell phone helps to maintain relations of social and economic significance and is effective in dealing with crises and immediate needs." (BEER 2009). Additionally, some small-scale farmers use their phone to communicate with costumers, if they grow a certain crop or to ask when the produce is mature (FARMER 8). The outputs for calling may include "the abilities to access financial information, and to efficiently coordinate meetings and consult with agriculture extension agents or farm group members" (MARTIN & ABBOTT 2011, p. 22).

Additionally, "using mobile phones for the exchange of simple knowledge improves the marketing of produce by allowing the farmers to make better-informed decisions" (KRONE et al. 2014, p. 160). Agreeing with that study, the authors found in their case farmers who are going to the market to check the prices there themselves, communicate their findings to other related farmers in their network, like group members, neighbouring farmers or friends by mobile. Agreeing with MARTIN & ABBOTT (2011, p. 22): "the findings suggest that mobile phones are being adopted for agricultural purposes, such as accessing market information, increasing job opportunities, gaining agriculture advice, and saving valuable time and money through increased consultation and coordination". And therefore summarising, the use of mobile communication leads to beneficial changes of network structure (number and intensity) and to easier mobilisation of social support through support networks.

4.9 Livelihood strategies and outcomes

According to the livelihood framework the access to livelihood assets is a major influence on the people's choice of livelihood strategies (DFID 1999). This study focuses on the importance of support networks for the social capital. "Livelihood strategies include approaches that people adopt using assets [here: support networks] that they have access to in order to secure livelihoods outcome" (CHILIMO & NGULUBE 2011, p. 153). Social support which they receive through their social networks might enable farmer to improve or change their livelihood strategies to receive more positive outcomes. Also the transforming structures and processes effect livelihood strategies directly and indirectly as they influence the support networks. These strategies achieve livelihood outcomes, which let the authors understand the influence of the assets within the research framework, in this case the influence of the support network on the social capital (CHILIMO & NGULUBE 2011, DFID 1999). According to the authors' findings, the potential access to support gained through networks varies as explained before, also the therewith connected livelihood strategies and outcomes differ from place to place and person to person. Hence, the strategies and outcomes presented hereafter reveal the potential influences the usage of networks might have, with the individual farmers only experiencing some of them and to varying degree.

Like stated before, the structure of a network determines the access to support, for example if a farming group is part of the network. A first potential positive outcome of having a group in ones' network is that "through the group the farmers can get a loan, microfinance, we are organised as a self-help group." (FARMER 9), which might help them to invest in their farming business which they otherwise wouldn't be able to most of the time, because access to bank loans is hard and the conditions unfavourable.

As a group the "members check prices on the market in Karatina. You get information about what is sold and for which prices. Before going to market, maybe communicate through phone and check, try to get contacts at the market, and check the demand" (FARMER 8). All members benefit from this gained information; either they get informed in group meetings or directly through phone call. The farmers organised in groups have better access to price information and therefore have more bargaining power. Moreover, they benefit from better access to governmental support especially direct or indirect information and knowledge access. Summarised by a technical assistant of a cooperative, there are different support sources for each need, which he can access in order to help the farmers: "In the problem of money or contract I contact the County government [Horticulture Crops Directorate]. If I have a problem with the produce, or the production I call the agronomist [of the export company]. When I have a farm problem, I call the extension officers [of the Ministry of Agriculture]" (Table 1).

Also they receive information directly from governmental institutions, for example via trainings, which help them to improve their farming activities. "We have been taught on how to capture all expenses through a farming period. After selling we do know now if business is doing well" (FARMER 8). As mentioned in the previous chapter, sometimes also neighbouring farmers organise themselves to improve their knowledge, for example by visiting farmers in other counties to exchange important ideas and therefore gain a better position at the market with the supply of "unique things" (FARMER 9).

To sum up, being member of a farming group or supplying for an export company or a supermarket provide easier access to support through their offered networks and therefore facilitate professional farming. Moreover, regular contact to the governmental organisations like the MoA or HCD feature better input of farming related information. Again, it can be observed that the structure of the network (for example contacts within and their intensity) does have an impact on the access to different forms of support and the use of mobile phone is one influencing variable on this structure as explained earlier and therefore also affects livelihood outcomes indirectly. However the network is structured, it is possible to assume that social capital in form of social support through networks is very important for positive livelihood outcomes, both in handling difficulties – 'getting by' - and 'getting ahead' in form of improved agricultural business. Especially "in the absence of other assets, poor people rely on their relationships, associations and networks to survive on a day-to-day basis – for example, sharing and reciprocating labour, cash, food, information, friendship and moral support. "In times of crisis […] social capital is one of the few resources upon which poor people can draw" (PHILLIPS 2002, p. 134).

5. Conclusion

To conclude the findings of this study, networks do influence livelihood outcomes of small-scale farmers within the research area by giving them access to various kinds of support for their agricultural business from different actors of their support network, which helps them to get by or even get ahead. The varying make-up of support networks of different farmers influences the quantity, quality and forms of their support structure. Mobile communication has an impact on the support networks of farmers mostly because it enables them to strengthen the contact with already existing strong and weak ties but also by facilitating contact to new weak ties. Like this and by allowing easier communication with actors within the network mobile use improves the possibilities for support mobilisation.

The results show that networks and the thereby possible mobilisation of support is an important source of social capital and therewith an important category to analyse within the livelihood framework because it influences livelihood outcomes. Therefore deeper network

analysis and social support theory should be included in the livelihood framework in further research. This link of analytical concepts is of value for example for geographical development research because it draws attention to the agency of actors on the micro-level, without neglecting the context they act within. Moreover, research of support networks could also be embedded in wider livelihood analysis, for example by also analysing the other assets and the interdependence for example of networks and financial or human capital. Furthermore, also the analysis of mobile use within the framework could be enlarged to mutual influence of mobile use and other capitals. To get a better understanding of the possible links between the different components of the livelihood framework as well as the here added analytical categories of support, networks and mobile communication short-term, comparative studies in different research areas are fruitful.

In contrast, to respond to the request of the approach to be action oriented, detailed long-term studies that focus on a smaller geographical area or a more homogenous group are needed to get a full understanding of the functions and structures of networks, influence variables and the structures and processes as well as the vulnerability context within they are formed and used. Only then it is possible to give detailed recommendations for action to the involved actors, like government and non-government institutions, companies and self-help groups as well as individuals themselves, which could lead to better support mobilisation.

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Interviews

FARMER 1 (Interviewed on 16.03.2015)
FARMER 2 (Interviewed on 16.03.2015)
COOPERATIVE (Group discussion on 18.03.2015)
TECHNICAL ASSISTANT 1 (OF A COOPERATIVE) (Interviewed on 18.03.2015)
EXPORT COMPANY (Group discussion on 19.03.2015)
TECHNICAL ASSISTANT 2 (OF AN EXPORT COMPANY) (Interviewed on 19.03.2015)
FARMER 3 (Interviewed on 19.03.2015)
HCD NKUBU DEPOT (Group discussion on 20.03.2015)
MOA IMENTI SOUTH (Group discussion on 20.03.2015)
FARMER 5 (Interviewed on 20.03.2015)
FARMER 6 (Interviewed on 21.03.2015)
FARMER 7 (Interviewed on 21.03.2015)
FARMER 8 (Interviewed on 22.03.2015)
MOA NARO MORU (Group discussion on 23.03.2015)
SELF-HELP GROUP (Group discussion on 23.03.2015)

FARMER 9 (Interviewed on 23.03.2015)
FARMER 10 (Interviewed on 24.03.2015)

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The impacts and determinants of information and communication technologies on small-scale farmers bargaining power in Kenya

A case study in international and domestic horticultural value chains

Joy Heitlinger

1. Introduction

In the prevalent literature on small-scale farmers in the Global South two major effects, due to progressing globalization, can be identified. One is the agricultural commercialization of farmers produce and the integration of small-scale farmers in global value chains (GVC) – even if available land and resources are small. The accessibility to international markets and trade offers chances for the development and reduction of poverty through increased production and export of agricultural goods (HENSON & LOADER 2001, HUMPHREY 2005). At the same time, new challenges arise and produce certain structures, which can be explained with the help of GEREFFI'S approach of GVC through degrees of coordination and power asymmetries (GEREFFI et al. 2005). Secondly, proliferation of Information and Communication Technologies (ICT) has spread tremendously in the past 15 years on the African continent (VERNE 2014). Even in rural areas, a large number of farmers and people own and use mobile phones (KIRK et al. 2011). According to the latest official numbers for Kenya, 63 per cent of all households own a mobile phone, reaching all social strata with the proportion still rapidly increasing (KNBS 2014, p. 20). To date many studies were conducted weighing the pros and cons of the impacts for small-scale farmers. For an overview, see NAKASONE et al. 2014. Out of these, the theory of ICT for Development proclaims the transformative potential of ICTs. It states that ICTs foster development, support the eradication of poverty and enhance market access for smallholders. Yet, research gaps on the exact contribution of ICTs still exist. It needs to be examined if through the usage of ICTs actually new radical structures evolve or if they rather strengthen existing structures (DANNENBERG & LAKES 2013, DONNER & ESCOBARI 2013). Hence, this empirical study in the horticultural sector in Kenya aims at contributing to the discourse. This is achieved through the linkage of the theoretical concepts of value chains and ICTs and the consideration of smallholders' perceived bargaining power towards their buyers.

The overall research questions is defined as: *To what extend and how does the usage of ICT within small-scale farmers influence their bargaining power.* Answering this question will require first to depict the mobile phone usage in the research region around Mount Kenya. Then it is elaborated on the perceived bargaining power of farmers and how they use phones in negotiations. As there might be other factors influencing negotiation power, attention is also drawn on the value chain integration of farmers and their degree of organization.

To integrate the results in the discourse this paper begins with a literature review of latest research on ICTs in agricultural value chains. Concurrently an assessment of the specific implications of ICTs for famers is undertaken. The third chapter elaborates on the methods applied and the data collection in the field. It is followed by the presentation of the empirical

findings in the fourth chapter answering the research question. In the last part, the results are discussed and arranged into the context of the research on the impacts of ICTs.[6]

2. State of research

Simultaneously with the increasing distribution of ICTs in many developing countries, numerous studies on the role and changes ICTs induce on small-scale farmers' livelihoods were conducted (e.g. CHAPMAN et al. 2004, JENSEN 2007, QIANG et al. 2011). The notion that ICTs promote economic development and support the eradication of poverty was manifested in the theory of ICT for Development (ICT4D) and was accompanied by various studies stating that the usage of ICT improves market access, knowledge accumulation and exchange for farmers in Africa (UNWIN 2009, AKER & MBITI 2010, KIRK ET AL. 2011, CARMODY 2012).

Earlier studies highlighted the potential of ICTs for famers to generate more income, improve marketing possibilities, lower costs for information and transport, increase knowledge and build networks (AKER & MBITI 2010, WB 2011, QIANG et al. 2011). More recently, critical assessments of the effects of ICT were discussed. These entail the exclusion of farmers without mobile phone or possible pressures from the world market on smallholders (CARMODY 2012, DANNENBERG & LAKES 2013, NAKASONE et al. 2014).

In the Kenyan horticultural sector, we find many farmers being integrated in international value chains. The exporting business is attractive to smallholders as an up to seven times higher income can be generated in comparison to small-scale farmers who are not exporting (MCCULLOCH & MASAKO 2002, DANNENBERG & KULKE 2014). The stated effects in the ICT4D debate can be linked with the concept of Global Value Chains introduced by GEREFFI et al. (2005). The theory explains value chains through the degrees of coordination and power asymmetries. As access to knowledge through phones reduces asymmetries in negotiations, e.g. having information on prices, asymmetries are reduced (HUMPHREY 2002). At the same time the bargaining positions of farmers is strengthened (CARMODY 2012). "Limitations associated with information imperfection" (CHOWDHURY 2002, p. 2) can be overcome by the usage of ICTs and have an impact on the governance and coordination structures in the chain. This is supported by latest research on phones and their impacts on income and marketing as several studies indicate changes in farmers bargaining power and stress the access to markets through acquired knowledge as one of the powerful effects of ICTs. A review of studies by the World Bank presents the impact of ICTs on farmers' incomes with surpluses ranging from 8 - 36 per cent (WB 2011, p. 208). Information and knowledge delivered through phones will put farmers in a more powerful position allowing them to use mobile phones as a strong marketing tool and reach new markets, traders and buyers (WB 2011, p. 205f.). LABONNE and CHASE (2009) show improved negotiation power of farmers in the Philippines, particularly with traders and a rise of incomes of 11-17 per cent. Yet, the largest benefits were realized by commercial farmers and not by small-scale subsistence farmers.

Phone usage can link buyers and sellers and cut out middlemen so more farmers benefit from selling directly (CARMODY 2012). The power and information advantage of middlemen towards small-scale farmers is discussed in DANNENBERG and LAKES (2013). Alternative selling possibilities put farmers in the place to confront the middlemen with actual information on prices and can enhance their negotiation position (IBID, p. 70). Still, middlemen have greater power if they are the only buyer and act as a monopolist in the region (IBID, p. 58).

[6] In this paper, when ICTs are discussed, it is referred to mobile phone usage only. The research and analysis of all forms within the information and communication technologies (broadcasting media, internet, audio and video processing) would exceed the scope of the study. Secondly, in the respective research area other forms of ICT were not much proliferated.

To date the export-oriented horticultural sector in Kenya has experienced structural changes leading to the elimination of all middlemen, also called brokers, in the export chain. Exporters and farmers now have a yearlong lasting contract with fixed prices where exporters buy directly mostly on a weekly basis (MAGARA 2015). Since these events just occurred in the past two years research is missing on the effects for farmers and their bargaining power. In the domestic market, however, the use of middlemen is still wide spread (KÖNIG et al. 2011, MAGARA 2015). In this context, the relevance of personal face-to-face contacts in business has to be regarded as a possible source of trust and expertise, which also comes into play when dealing with middlemen and price negotiations (BIGLAISER 1993, DANNENBERG 2012).

In addition, already very early in the debate it has been stated that mobile phones are no panacea and that "the solutions to poverty are generally known and often require action in matters that have little to do with technology" (PROENZA 2002, p. 23). For this reason, in the following presentation of the field work results attention is also drawn to other factors which are seen as relevant when discussing negotiation power and market access for smallholder farmers: The form of organization of farmers and the choice of the targeted marketing channel domestic or international (HUMPHREY 2002, CHAPMAN et al. 2004). As CHOWDHURY puts it very simple "producer's choice of marketing channel changes the negotiation costs as it changes his/her bargaining power" (2002, p. 5). Thus, the characteristics of domestic and international value chains in Kenya are assessed and it is analyzed how bargaining power is influenced in the respective chain. In terms of farmers organization it has been shown that collective action and active membership in groups implies positive income effects of farmers in Kenya (FISCHER & QAIM 2012) and allows farmers to participate in high value markets (KAGANZIA et al. 2009). These effects are examined in the context of bargaining powers of farmers organized in groups.

The literature review shows that studies on ICT and bargaining power are still limited. A deeper look into the studies revealed that the generated higher income often depends on the crops produced, especially its perishability, the size of the farms and its distance to markets (JENSEN 2007, KAGANZIA et al. 2009). Therefore, it is relevant to understand the connection of ICT and the bargaining power, which follows in the next sections.

3. Methods

This study uses a mixed method approach combining qualitative and quantitative data sets from the Mount Kenya region. The region is well known for its big and flourishing export horticultural sector (DANNENBERG & KULKE 2014). Many small-scale farmers grow fresh fruit and vegetables (FFV) for export. This study focuses on small-scale farmers growing vegetables for the export to European markets such as French beans, snow peas or sugar snaps and on the other hand on farmers producing for the domestic market cultivating e.g. kales, potatoes, mangoes or avocados.

The quantitative data is taken from a previous study tour in 2013. The sample consists of 192 interviews with commercial small-scale farmers (95 percent owning less than 10 acres, with the majority of 25 per cent owning < 0.5 acres of land)[7] based in the export-oriented horticultural sector. The statistical data analysis with SPSS provides information on the usage of information and communication technologies (ICT), particularly mobile phones and their relevance in the market. Furthermore, farmers perceived bargaining power is assessed and put in relation with the mobile phone use. The qualitative data was collected in March 2015 through 24 guideline-based interviews with different stakeholders along the horticultural value chain. The interviewees were family farmers, exporters, brokers, agronomists and technical

[7] Conversion rate: 1 acre equals 0.4 hectares

assistants; as well as researchers and representatives of the Horticultural Crop Directorate (HCD) and the Kenyan Agricultural Ministry. The analysis of the interviews was done through field notes according to BERNARD (2006). Additionally, the perspective of farmers selling FFV on the domestic market supplements the analysis. Their evaluation of the impacts of their usage of mobile phones and their possible influence on the bargaining power are also regarded.

The study aims to detect and understand the relevant factors, which have an influence on the bargaining power of smallholder farmers. Bargaining power here is defined as the ability of one party to influence the terms and conditions in a contract or subsequent contracts in its favor due to its possession of unique and valuable resources (ARGYRES & LIEBESKIND 1999).

4. Empirical findings

In this section, the findings from the field trips in 2013 and 2015 answering the question on the impacts of ICT on bargaining power are presented. The descriptive results from 2013 are shown and enriched by the qualitatively held interviews to give explanations and enhance further understanding. First, an overview of the ICT usage is given, followed by the statements on the self-esteemed bargaining power. Through statistical tests, the linkage between ICT and bargaining power is examined. A differentiation of farmers acting in the export and domestic market[8] is undertaken to see special differences, challenges, used marketing channels and effects on bargaining power with regard to the ICT usage. As shown in the literature review bargaining power is influenced by various factors so the results will present also a special finding in the organizational form of farmers.

4.1 Role and usage of mobile phones

Mobile phones play a huge role in doing agricultural business in the horticultural sector around Mount Kenya. In 2013, 86 per cent of farmers used their phone for business and only two years later every farmer reported having a phone, which was used for business purposes. A farmer put it that way: *"The phone is the only way to get information. I use it constantly. To ask for prices, order seedlings, call my chemical company for advice on diseases, arrange the pickup of my crops and organize the water use of our shared water system. In fact, before I had a phone I couldn't do anything"* (17.03.2015). Until today internet and smartphones play a subordinate role, in 2013 being in use by only 15 and 10 per cent.

The main advantages for phone usage mentioned correspond with those described in the literature. These mainly being communication, information exchange and coordinating purposes, which save farmers' time and money since calls can replace time-consuming and costly journeys. A large majority of farmers evaluated the induced changes through mobile phones as major (81 %).

Table 1: Changes of mobile phones in horticulture

How do you judge the changes that the usage of cell phones has done to horticulture?		
Major changes	Minor changes	No changes
81	15	4

(Source: author)

[8] It has to be noted that all interviewed farmers who export FFV also produce goods for the domestic market.

Most popular ways of using the phone is through calls and applications, like the money transfer (m-Pesa) which is used by 65 per cent. Overall, 11 per cent of farmers did not use applications at all. For the interviewed farmers market access is exploited through mobile use. In fact, all contact to buyers is nowadays upheld and organized through phones. The interviewees stressed that through communication via mobile phones timely production and collection of goods is organized better than without using a phone. *"If my broker does not come on the agreed date and time, I call him up immediately and say: Why are you not coming picking up my paw paws?"* (FARMER 17.03. 2015). Another farmer supports this statement: *"Before [there were mobile phones] it was very hard if the broker did not come. Sometimes I walked there to see where he is. In fact, I had to walk everywhere"* (FARMER 18.03.2015).

Phones can reduce uncertainty about prices since famers call each other and exchange information on prices received. *"If a broker comes by and tells me the price he will pay for my product and I find is not enough I call my friends and ask what prices they get for their produce*" (FARMER 21.3..2015). Such and similar statements were articulated by farmers very often. Another farmer argued, *"I call several brokers to find out what the prices are and compare them. If I am not satisfied I can also sell directly to the market"*. These results support findings from previous studies that the use of a mobile phone can be beneficial for farmers business in terms of enhancing knowledge exchange between farmers, buyers and sellers and diminish information symmetries between traders and producers. Likewise a better quality of the goods when they reach markets can be achieved as they can be harvested and picked up at the right timing and can therefore get better prices for better produces. (QIANG et al. 2011, WB 2011).

4.2 Bargaining power and mobile phone usage

Connecting these first results with the analysis of farmers generally perceived bargaining power towards their buyer presents a mixed picture. Whereas 30 per cent of farmers self-esteem their bargaining power as superior or slightly superior, 47 per cent rated it at inferior or slightly inferior.

Table 2: Perceived bargaining power

How do you consider your bargaining position in relation to your buyer?				
Superior	Slightly Superior	Equal	Slightly Inferior	Inferior
18	12	23	17	30

(Source: author)

A chi-square analysis of the questions "using a mobile phone for business" and bargaining power presented a significant link between the two variables. The tested hypotheses were:

H0: The use of a mobile phone has no effect on bargaining power and

H1: The use of mobile phone has an effect on bargaining power

Hypothesis H0 could be rejected, showing a connection between the perceived bargaining power and the usage of a mobile phone. Linking this with the answers from interviews to find out how the phone influences the different perceptions on bargain power remain. Statements like *"We as famers have the power and I set the price"* (FARMER 21.3.2015), and *"I give my price and the broker gives his price. We will rather have our own price and not be dominated by the broker since we know all the work we put in it"* (FARMER 24.03.2015) are contradicted by statements like *"I don't feel any bargaining power. Market prices are so unstable, I am happy if I get some money at all"* (FARMER 17.3.2015) and *"I know if I organize in a group I can get more money when we sell together but when I urgently need money I sell my crops for any price"* (Farmer 20.03.2015). These different opinions and perceptions may be explained through the location of farms and farmers respective distance to markets. As this was not accessed separately further research is needed

to analyze those interrelationships. Asking farmers on negotiations via phone and impacts of it, their statements are "*I talk to broker about prices on the phone – but it is a different story when he comes to my farm"* (FARMER 17.03.2015) and "*Brokers don't negotiate about prices on the phone. They are interested in the quality of my product and want to see it before they agree on a price"* (FAMER 21.03.2015). This gives a hint that empowerment of farmers through phones cannot be traced back on the bargaining itself but on other factors.

4.3 Bargaining power in international and domestic value chains

Distinguishing between the domestic and the international markets, a big structural divide can be detected. Since the abolition of intermediaries from the export business, all farmers have individual, or sometimes group contracts with the exporters.[9] Without exception farmers stated that with the contracts, bargaining power is not an issue. All the agreements are set in the contract and both parts are liable to fulfill them.[10] As a farmer states: *"There are no negotiations via phone. It is [prices and amounts] all in the contract and that is the best way"* (FARMER 18.03.2015). A technical assistant of an exporting company supported the same statement: *"I call farmers for coordination reasons and how things are setup but, there are no negotiations on prices. All the relevant information is in the contract"* (18.03.2015). All information, including the proposal for the prices paid per kilogram, are regulated in a contract, which is normally prepared by the company. Throughout the entire research region and according to exporters the prices paid for farmers differed only very slightly. Farmers in the same districts normally had same price agreements. Most farmers saw this procedure as a positive constitution, because stable prices throughout one year give them planning security. *"I know already in January what I get throughout the year. Not like the domestic market where prices change often within a day. I can plan my business a lot better now"*. Yet, in this context, the usage of a mobile phone is irrelevant for the price agreement.

In the domestic market, prices are more volatile and depend on seasonality of the products. After the rainy seasons, all farmers sell their crops at the same time so prices paid for their produce can fluctuate extremely. In the case for beans, this means a difference of up to 500 per cent of Kenyan Shilling (KSh) per kg, whereas exporters pay a stable price for one year. The volatility of prices in the domestic market can be beneficial if farmers sell at the right time. Depending on the location of a farm, farmers address different marketing channels. This gives them the opportunity to receive higher prices than more remote farms who are dependent on intermediaries. *"I can decide if I sell to a broker or go to the local market depending on how the prices are"*. (FARMER 17.03.2015). Interestingly, less accessible farmers stressed the importance of local middlemen who know the area and the farmers and the quality of their products. *"I trust my broker a lot. He knows that I have good quality and pays a good price. Even if sometimes my harvest or quality is lower than usually he buys from me because we trust each other"* (FARMER 21.03.2015). Trusting brokers is crucial in making business with them as another farmer says *"I don't sell to middlemen I don't know. They first have to prove they are good"* (FARMER 21.03.2015). Since many farmers rely on brokers who come to their farm and buy their products for further resale, phones and call arrangements allow them to choose their respective middlemen of trust. Nevertheless, they can contact traders and local market or shop owners themselves to sell directly at even higher prices, as farmers explained. The relationship between small-scale farmers and the brokers who often provide farmers the only access to markets is in the literature not very well researched (BIGLAISER 1993, GADDE & SNEHOTA 2001). As they are

[9] Some farmers say that middlemen are still used by exporters to additionally source from farmers if demand is high and contracted amounts are not sufficient.

[10] However, cases of exporters not paying timely are reported quite regularly and farmers who are not supplying the contracted amount leave room for discussion on the new setup of the contracting scheme.

important players, there should be drawn more attention on the role of trust which cannot be provided in this paper as it would exceed this work.

Recent changes in the expansion of Kenyan supermarkets from urban in also rural areas allow some farmers to sell their produce directly to them. Registered farmers make arrangements with supermarkets or their intermediaries about amounts, prices and delivery or pick up dates via phone. As this sector is growing, market access is increasing and the usage of a phone makes participation possible. Yet, it has to be considered that the requirements of the supermarket are sometimes difficult for farmers to achieve. Furthermore, the existence of a local open market and the infrastructural conditions as the remoteness of farms are influencing factors, which have an effect on participation to market channels (DANNENBERG 2012, FISCHER & QAIM 2012).

4.4 Bargaining power on organizational and group level

One remarkable event in terms of negotiation stood out of the ordinary in the fieldwork. Even more, it gives an explanation for enhanced bargaining power. The chairperson of a cooperative reported that in negotiations with the exporter the prices in the new contract could be raised by 10 KSh. This was 10 KSh more than the year before. It was also more than farmers in the same region received for their sugar snaps. According to him, the big group in the cooperative could ask for a higher price than a single a farmer could (Chairperson 21.03.2015). A farmer from another cooperative confirms the strength of groups by stating that *"The cooperative bargains for us. We as farmers have the power*" (FARMER 18.3..2015) and the chairperson adds, *"We as a cooperative are in a good position when bargaining. We negotiate prices with companies and have the advantage of being so many and can produce big amounts*" (CHAIRPERSON 21.3.2015). The same cooperative negotiated for a price, which is rising by two KSh every year for the French beans they sell to an exporting company.

5. Conclusion

Bringing the findings together to assess the implications of mobile phones on smallholders' bargaining power, following results can be drawn. The quantitative analysis showed an existing link between perceived bargaining power and mobile phone usage. However, the perceived bargaining power varies between the farmers and cannot be fully explained by the phone use. Although the interviewed farmers were structurally similar, they had different positively influencing factors as a big social network and memberships in cooperatives, which allows them to use ICTs for a better bargaining position.

It has to be distinguished between farmers selling for export on a contracted basis and farmers selling on the domestic market to middlemen and brokers. In the export sector, individual farmers perceive no explicit bargaining power via phone since prices are settled within the contract, which can be annually renewed. Farmers valued the stability of prices and since prices usually do not differ between the farmers, the contracting scheme is assessed positively. In the domestic market, bargaining power was perceived very differently by farmers. Although the contact with the buyer is organized via phones, they are not assessed as an advantage in negotiations on prices. It is rather the coordination, which is done via phones allowing a timely selling. At the same time, mutual trust between the brokers and the farmer was seen as crucial in the negotiations.

From the interviews, influencing factors in bargaining may be traced back to the location of a farm, which allowed access to different marketing channels. Additionally, seasonality and quality of a product seem to have a strong impact on the farmers bargaining position. As these variables, however, were not part of this research design they need to be accessed specifically.

A difference can be spotted in the organization of farmers. Since group and cooperatives support farmers and negotiate prices with markets and exporters, substantial price changes could be realized. Yet, those price negotiations take place in person and not via phones. Adding to the discussion on ICT4D and the poverty eradication through mobile phones usage, the conclusion of this work is that the supportive nature of ICTs can improve farmers' market access and influence their competitiveness. Transforming structures through the ICT usage could not yet be found, neither in the export sector nor in the domestic market. The self-estimated bargaining position of farmers using a phone can rather be explained through better coordination and organization. Further research on bargaining power should take into account the factors of seasonality, farm location and the role of brokers more thoroughly.

Undoubtedly, ICTs support information flows and access to information for farmers, but it is no automatism of putting farmers in better bargaining positions.

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The integration and influence of mobile money transfer (especially m-pesa) in comparison to other payment systems in the agricultural value chain in the Mt. Kenya Region

Frederic Becker, Kira-Sophie Schettler-Köhler, Fiona Schubert, Isabel Stiebner

1. Introduction

The increase of ICTs (Information and Communication Technology) - especially mobile phones - had an enormous impact on economic and social aspects. This progress is particularly in Sub-Sahara Africa very intense because of the poorly developed land line and transportation infrastructure (JACK & SURI 2011, p. 3). In 2008, the mobile phone coverage of the population was 60%. In 2007 the mobile phone subscriptions were 49% higher than in 2002. This growth is large compared to the 17% increase in Europe. This development provides new possibilities not just for the urban population but for the rural as well. The reduction of the communication costs and the new possibilities to share information quick and cheap opens new chances concerning economic, social and political topics. An important issue for the research on ICTs is the linkage to chances for the economy, for advancing the agricultural and the labour market efficiency and - coherent to that – for a general improvement of the positions and well-being of producer and consumer (AKER & MBITI 2010, p. 207f.).

As an outcome of the fast increase of the coverage of mobile phones the users started to use the mobile phone system transfer money. That worked through buying airtime and sending it to other users as payment for goods and services or in return for cash. In this way the possibility arose to transfer money over long distances. To organise this process the major mobile service provider in Kenya, Safaricom, introduced the money transfer system m-pesa in March 2007 (more information about the function of m-pesa is given in chapter 4.1). That system was accepted very well and was used by 65% of all households in Kenya at the end of 2009. In the current literature m-pesa is mostly seen as a success story and as an innovation with the potential to improve many domains of the economy (JACK & SURI 2011, p. 3).

This study principally deals with the small scale farmers in the Mount Kenya region. Among these farmers, mobile phones are very common and m-pesa is well known. Especially according to the current literature m-pesa is a very good and developing invention, but is this also verifiable for the small scale farmers and the value chain (see chapter 2.3) of the Fresh Fruit and Vegetable industry?

The question arose which role m-pesa plays in the horticultural value chain in comparison to other payment systems. The main research questions are:

- Which payment system is most common in the horticultural value chain and for the farming business in the Mt. Kenya Region?
- Does m-pesa have any impact on the value chains of the Fresh Fruit and Vegetable sector in the Mount Kenya region? And if it has, does the use of m-pesa imply a better inclusion/integration into the value chain or means not using m-pesa maybe an exclusion?
- Where are advantages and disadvantages of m-pesa and what are problems with using it.

The following paper will first provide a general overview about the spread of ICTs (especially m-pesa), the current literature about m-pesa and the Fresh Fruit and Vegetable Sector of Kenya, before the own research methodology is explained and the own research and results are described. Some chapters are dedicated to the own research in the Mt. Kenya region where

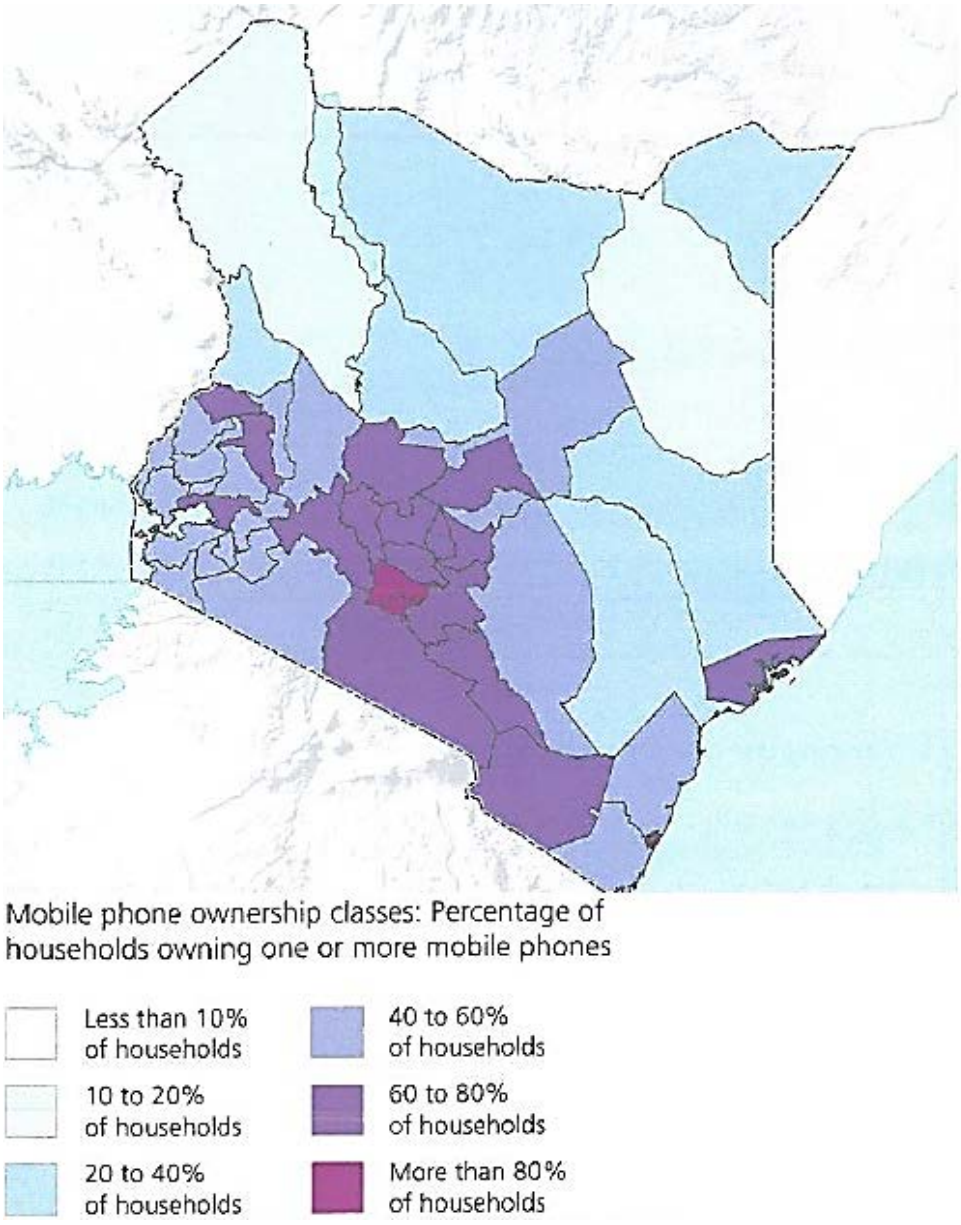
several qualitative interviews with small-scale famers (often export orientated and also growing for the domestic market) were carried out. Later parts of this report present the own results and try to compare them to the state of the current literature.

2. Overview: The Economy of m-pesa (State of the Art)

2.1 The spread of mobile phones and mobile money transfer services

In Africa and especially also in Kenya, the mobile phone technology developed very fast. The first mobile phone providers in Kenya started their business in the mid-1990s. They were public owned and operated on a small-scale. But with the enormous adaption, mobile phone use soon practically replaced the use of landline phones. The landline system was characterised by limited reach, reliability and access. The coverage of mobile phone use in Africa was once at 7% and rose to 32% in 2008. In 2012, the mobile phone coverage was already at 59.8 phones per 100 people in Sub-Sahara Africa. In contrast to that, the land lines were at 1.4 per 100 people (JACK & SURI 2011, p. 5; VERNE 2014, p. 43; KNBS 2014, p. 96).

Figure 1: Average mobile phone coverage by county in 2009



(Source: KNBS 2014, p. 96)

This figure shows households who own one or more mobile phones by counties in 2009. This amount is highest in urban areas like Nairobi or Mombasa. Lowest rates appear especially in the arid or semi-arid parts of the country due to the higher poverty. The amount of mobile phone users in the Mt. Kenya Region is about 60 to 80 %. Overall in 2009 63% of the Kenyan population owned a mobile phone (KNBS 2014, p. 96).

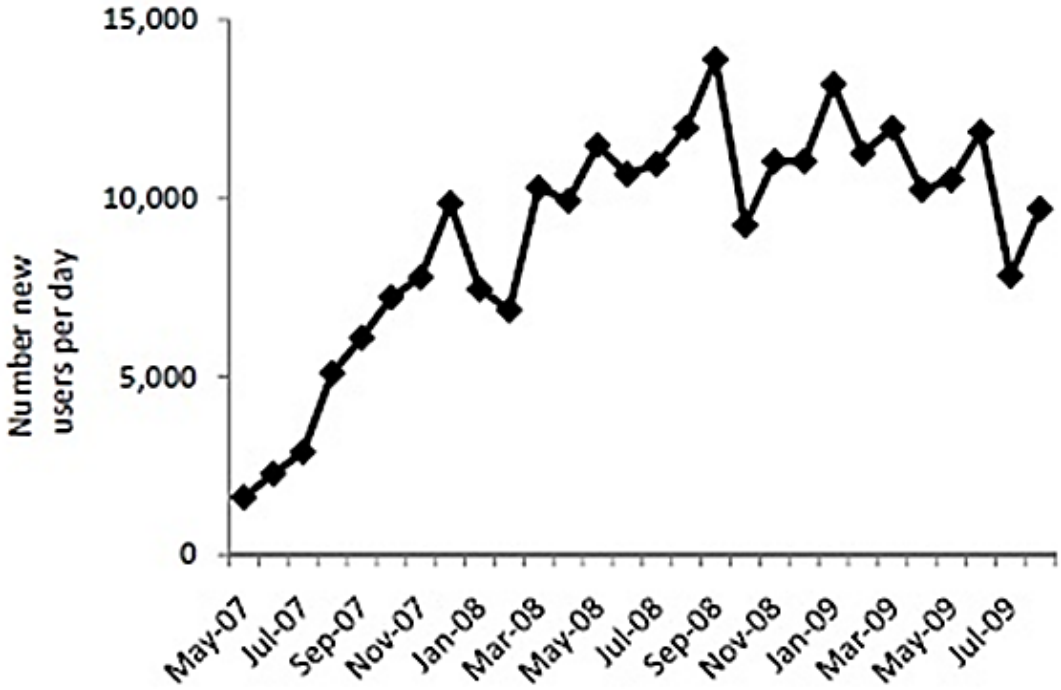
Before MMT services came up, people often used informal money transfer systems or normal bank accounts. Without a bank account people had to transfer money to carry it themselves to other destinations or to send transmitters like other people or letters for this purpose. This wasn't a very convenient way because of the high risk of robbery and thefts. Another risk was the reliability of the transmitter. When people sent the money through friends or relatives the trust of the sender was sometimes misused and the money never reached the intended receptor. The way to send money with letters and parcels was insecure as well, because the money was often stolen. Therefore the informal and semi-formal ways to send money where not very safe (KIRUI et al. 2012, p. 141f). Other problems with money transfer without MMT services were the time it took to overcome the distances, communication problems and related to this: misdirected remittances. With the introduction of MMT services a whole new possibility to transfer money was given to the people. The term MMT is very broad and not clearly defined because the service includes the transfer of long-distance remittances, payments of a very small amount of money and other functions that enable unbanked people using mobile financial services. Thus the MMT services are primary supposed to reduce the costs of money transfers over long distances (KIRUI et al. 2012, p. 141f).

In 2005 several mobile service providers, banks or partnerships of both launched m-money and MMT services. With these services it is possible to pay bills, buy airtime, transfer or deposit money via mobile phone and text messages without a conventional bank account. In Kenya the four mobile phone service providers are Airtel, YU, Orange and Safaricom. Safaricom, owned by Vodafone, as the leading mobile service provider owns approximately 80% of the market and was the first provider who offered MMT services in Kenya. Its mobile money transfer service m-pesa (pesa means money in swahili) was developed together with the Commercial Bank of Africa and a micro-finance company (Faulu Kenya). It is recognised as the "most successful mobile phone-based financial service in the developing world" (JACK & SURI 2011, p.6; AKER & MBITI 2010, p. 19; HAYES & WESTRUP 2012, p. 29; KIRUI et al. 2012, p. 143).

After launching m-pesa in March 2007 it spread so quickly that in August 2007 the new registrations per day where higher than 5000 and even almost 10000 in December 2007 (Figure 2) (JACK & SURI 2011, p. 6).

In 2009 7.7 million m-pesa accounts existed, in more than 66% of all Kenyan households at least one member uses m-pesa and approximately 23000 m-pesa agents are spread in the country. In contrast, there are just 491 bank branches, 500 postbank branches and 352 cashpoints in Kenya. Since the beginning of m-pesa the amount of transferred money totals US$ 3.7 billion, which constitutes 10% of the annual GDP in Kenya (JACK & SURI 2011, p. 6; AKER & MBITI 2010, p. 20; MBITI & WEIL 2011).

Figure 2: Average daily registrations per month (m-pesa)



(Source: JACK & SURI 2011, p. 6)

By now the terms MMT services and m-pesa are used synonymously by the people in Kenya. M-pesa is not the only MMT service in Kenya, but the most famous one; the three other mobile phone service providers launched own MMT services as well. Airtel is the second largest provider in Kenya after Safaricom and launched its MMT service called Airtel-Money in early 2009. After that YU presented YU-Cash in December 2009 and the Company Orange launched Orange Money in November 2010 (KIRUI et al. 2012, p. 143).

2.2 Possibilities for the economic development

ICTs and mobile money transfer are widely discussed issues in the current literature. The following chapter presents a selection of studies which deal with different aspects of ICTs.

SMITH et al. (2011, p. 79) point out, that especially poor and rural areas benefit from mobile phones. In this context they refer to poverty that is based on geographical isolation. Here the mobile phone represents a tool which links the continent on the one hand internationally and on the other hand internally (within the country). In addition SMITH et al. (2011, p. 79) underline that especially mobile services (so called m-services) are very important for the economics of a nation. Those m-services often have a transformational effect (CARMODY 2012, p. 9). HEEKS and JAGUN (2007, p. 1) also evaluate the impacts of mobile phones, therefore they define three categories

1. incremental impacts, which describe that ICTs improve the speed and efficiency of what people already doing
2. transformational impacts, which describe that ICTs create something new
3. production-related impacts, which mention the disposal of mobile phones and services (CARMODY 2012, p. 9).

HAYERS AND WESTRUP (2012, p. 31) underline and partly criticize Vodafone, the partner and investor of Safaricom respectively m-pesa. Originally m-pesa was funded through Vodafone and the UK Government. With the implementation of m-pesa in 2007 and the increasing number of subscribers Vodafone assumes a different role. Today Vodafone has a stake of 35% in Safaricom,

so the company is a member of a profitable system which rethought the poor population as customers. Vodafone sees m-pesa as a competitive payment service that can be an example for other countries.

JACK & SURI (2011) built several key assumptions about the potential economic impacts of m-pesa. M-pesa makes trading easier. It offers more convenient ways to send or receive money for things and services. With m-pesa it is possible to transfer money in less than 5 minutes, without travelling with cash which is also very dangerous. Furthermore m-pesa provides a safe depot for money, whicht could result in saving increments. Making the transfer of money over long distances cheaper and easier can have impacts on investments in human and physical capital. High educated family members could be send more often into towns where they can work in jobs that are well paid to send remittances to the household back home. This could cause households to invest more money in building human capital (JACK & SURI 2011, p. 11f).

In addition to these effects, m-pesa can have impacts on risk management of households. With m-pesa people get the possibility to share even small amounts of money for small charges. The charges depend on the amount of money that is transferred (Table 1). With these options people have the possibilities to share risks. Informal risk sharing can increase through m-pesa because the network can work better now even across long distances, furthermore households can cope better with little shocks because even the small amount of money that is needed after that shock can be transferred fast (JACK & SURI 2011, p. 11f).

Table 1: Customer Charges in Ksh (Kenyan Shilling)

Transaction Range (Ksh)		Transaction Type and Customer Charge (Ksh)		
Min	Max	Transfer to other m-pesa users	Transfer to unregistered users	Withdrawl from m-pesa agent
10	49	1	N/A	N/A
50	100	3	N/A	10
101	500	11	44	27
501	1,000	15	48	27
1,001	1,500	25	58	27
1,501	2,500	40	73	27
2,501	3,500	55	110	49
3,501	5,000	60	132	66
5,001	7,500	75	163	82
7,501	10,000	85	201	110
10,001	15,000	95	260	159
15,001	20,000	100	282	176
20,001	25,000	110	303	187
25,001	30,000	110	303	187
25,001	35,000	110	303	187
30,001	40,000	110	N/A	275
40,001	45,000	110	N/A	275
45,001	50,000	110	N/A	275
50,001	70,000	110	N/A	330

(Source: Own figure according to Safaricom)

2.3 Conceptual Framework

The conceptual framework of this study deals with two concepts, on the one hand we refer to the concept of "ICT for development" (ICT4D) on the other hand we refer to the concept of the global value chain.

In general the concept of "ICTs for development" describes that the development of a country (and especially the development of countries in the global south) can be influenced and supported with the usage of information and communication technologies, like mobile phones. In comparison to the global north the access to ICTs is limited in the global south for example because of a lack in infrastructure (chapter 0). This aspect is described with the term digital divide (HEEKS 2009, p.1; AKER & MBITI 2010, p. 11; BAELDEN & AUDENHOVE 2015, p. 844).

JEBESSA & ALEMAYEHU (2014, p. 1) emphasize that the understanding of the prosperity of a nation changed in the last years. In the past, especially natural resources, the labor force and the capital base were responsible for the prosperity of a nation. Nowadays the "contemporary" prosperity of a nation concentrates on different kinds of knowledge and information.

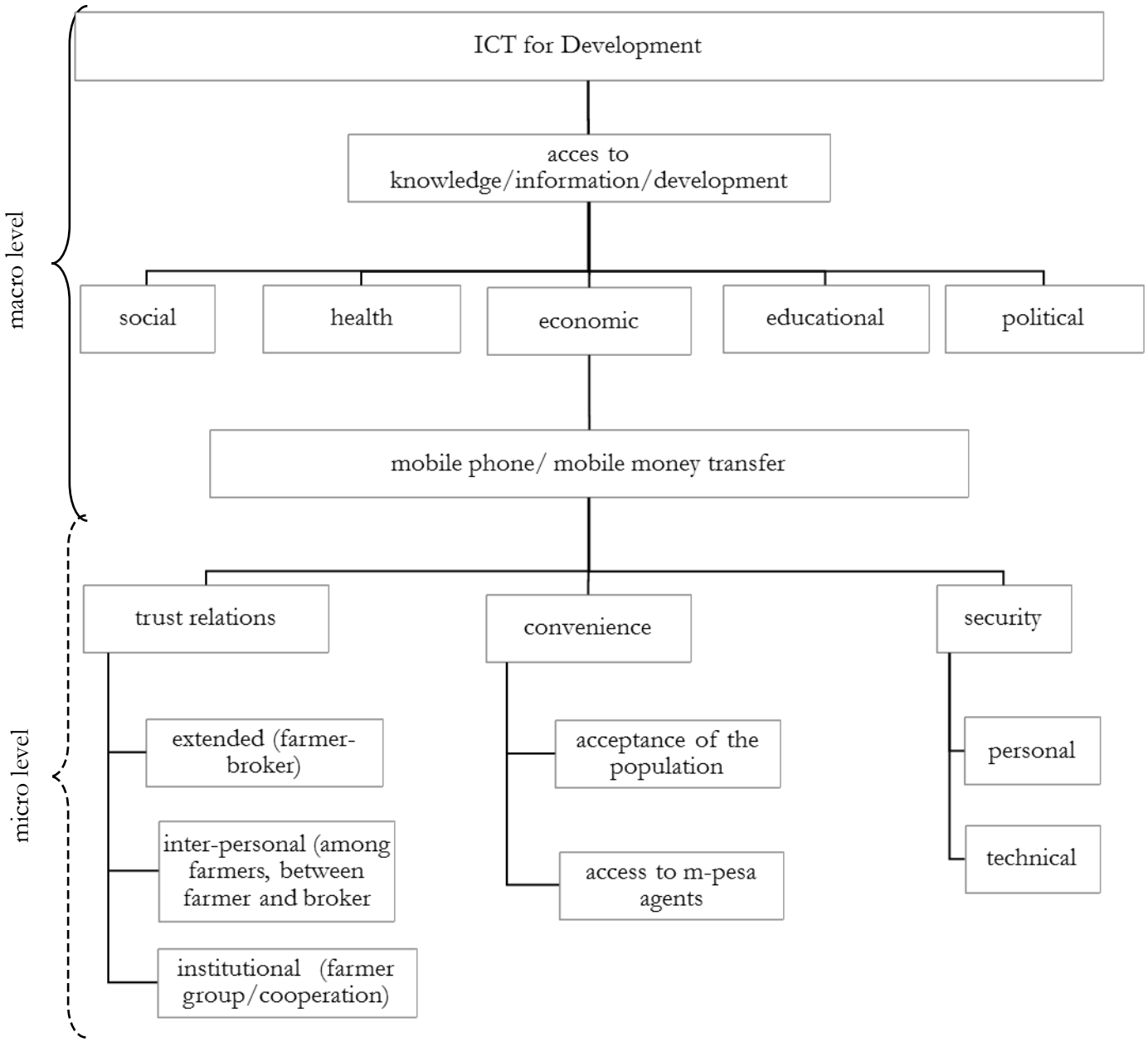
According to this, the question arises why especially ICTs lead and support development. HEEKS (2009, p. 2) mentions that the political, social and economic life in the 21st century is mainly based on technologies. Of course the satisfaction of basic needs, for example the access to water, can also lead to development, but the first step to such an improvement is technical. So the usage of ICTs can facilitate the access to knowledge and information. On HEEKS' (2009, p. 2) point of view the investments for development should include both, ICTs and the satisfaction of basic needs (JEBESSA & ALEMAYEHU 2014, p. 1, BAELDEN & AUDENHOVE 2015, p. 843).

According to our research new services like the mobile money transfer service m-pesa are evolving and supporting the population. This service necessarily fills a gap since in Kenya a lot of people are unbanked (AKER & MBITI 2010, p. 20, BAELDEN & AUDENHOVE 2015, p. 842).

The concept of ICT for development is divided into three phases which refer to the chronological appearance of the different ICTs. The three phases may overlap and can't be clearly distinguished from each other. The first phase of ICT for Development is called ICT4D 0.0 (1950s-1990s) which describes the involvement of ICTs, and especially computers, in the developing world. At this time ICTs were mainly used by the government (HEEKS 2009, p. 1ff.).

The next phase ICT4D 1.0 establishes in the 1990s. Here the availability of the Internet and the Millennium Development Goals (MDG) were combined and should reduce poverty in the developing countries. The last phase (ICT4D 2.0) established in the 2000s. Here ICTs focus mainly on the existing resources (for example mobile phones and their functions SMS and phone calls) and the demand of ICTs in developing countries. So this phase is user-centered because the needs of the poor population are regarded (HEEKS 2009, p. 2ff.; BAELDEN & AUDENHOVE 2015).

Figure 3: Conceptual framework - ICT for Development



(Source: Own illustration according to MORAWCZYNSKI & MISCIONE 2010, p. 160. and BAELDEN & AUDENHOVE 2015, p. 842)

ICTs are often linked with changes and improvements on the macro level as you can see in Figure 3. Here ICTs can influence for example social, health, economic, educational and political domains (BAELDEN & AUDENHOVE 2015, p. 842). Concerning our research we concentrate on the economic domain and analyze whether mobile money transfer services have a positive effect on the integration of farmers into the agricultural value chain. Leaving the changes of ICT for development in the macro level behind, we focus on ICTs and their influence at the micro level. Therefore the concept of ICT for development serves as a basis where the aspects trust, security and convenience are added for the micro level (MAS & MORAWCZYNSKI 2009, p. 78; MORAWCZYNSKI & MISCIONE 2010, p. 161; THUO 2014, p. 19).

We chose "ICT for development" as conceptual framework, because it concentrates on mobile technology, and the mobile money transfer represents are one example of this. With regard to our research question we transfer the concept of ICT for development to the usage of mobile phones by small scale farmers and especially mobile money transfer in the Mount Kenya region.

After focusing on the macro level of the conceptual framework, we now have a closer look on the micro level. The first aspect we add to the concept, is the aspect of trust. In this context the definition of trust is based on the understanding of MORAWCZYNSKI and MISCIONE (2010, p. 161). On their point of view trust represents a relationship between at least two (or more) actors which include for example persons or institutions like cooperation's. Those actors cooperate and presume a special (opportunistically) behavior of the other actor. In our research the different actors are farmers, middlemen and exporters (OVERA 2006, p. 1302).

Furthermore the aspect of trust is very complex, because several categories of trust relations exist between different actors (Figure3). On the one hand, there is inter-personal trust, which describes transactions between people who know each other, for example remittances to family members through m-pesa. On the other hand transactions take place between people who don't know each other personally, this type of trust is called extended trust. This form of trust describes for example the relationship between a farmer and a middleman. In addition, trust can emerge between individuals and institutions, which is described with the term institutional trust. These different categories of trust can be transferred to the trust relations according to the usage of mobile money transfer because here the trust relation is on an economic and commercial basis. So we add this aspect of trust to the micro level of our research. There is a risk of cheating between the business partners (MORAWCZYNSKI & MISCIONE 2010, p. 161).

STRASSER et al. (2013, p. 410ff.) describe the trust relation on a commercial level based on the case study of Bangladesh. In general, they address the global value chain of raw hides and skins (RHS) in Bangladesh. Once a year, a special Muslim Festival leads to an oversupply of RHS because many animals are sacrificed. During the three-day festival temporary middlemen are included into the value chain. One main aspect of the study of STRASSER ET AL. represents the trust between the producer and the temporary middlemen, because there are special religious requirements concerning sacrificed animals.

MURPHY (2013, p. 74) points out that individuals who are located further down or at the bottom of the value chain often refer to face-to-face contacts. In this context ICTs support inter-personal relationship, which have first started with meeting in person.

Another aspect, which we add to the micro level of our conceptual framework is the aspect of convenience (the way of functioning will be presented closer in chapter 4.1). The amount of m-pesa subscribers reflects that the mobile money transfer service m-pesa is widespread and not complicated.

Concerning to the aspect of convenience THUO (2014, p. 19) mentions in her paper two main aspects why a new technology gains acceptance by the population. From her point of view a new technology gains recognition if the utility and the handling are simple (AKER & MBITI 2010, p. 20; THUO 2014, p. 19).

The third and last aspect, which we add to the micro level of our conceptual framework is the aspect of security (Figure). On the one hand we define security as personal safety, which describes that the probability of thefts is lower when farmers use m-pesa. In m-pesa the storage and deposit of money is possible so the users don't need to store their money at home. In addition previous "old" money transfer possibilities, like sending money in person was very risky because of robbery or misusing, so the money sometimes never reached its final destination (MAS & MORAWCZYNSKI 2009, p. 78). On the other hand we define the term security on a technical level. Here we are referring to uncertainties to the usage of m-pesa, for example the retransfer of money (cheating).

Beside the positive effects of the concept ICT for development, there are also some critics against the support of the development of the global south by ICTs. DANNENBERG & LAKES (2013, p. 71) argue that ICTs can exclude farmers who don't use this technology. This exclusion

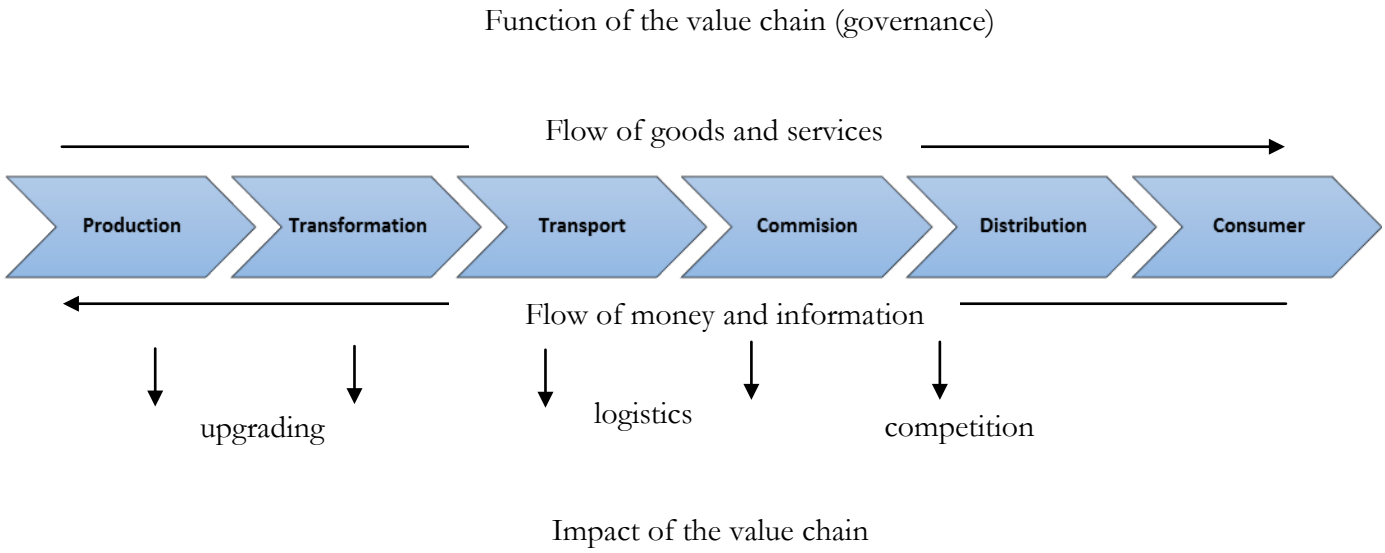
can be based on financial aspects, that farmers can't effort a mobile phone because it's too expensive.

KLEINE and UNWIN (2009, p. 1048ff.) sum up three main critics against the concept of ICT4D. First, they mention that development funds are often limited, so the provided financial resources for developing countries should be used where they are needed the most. Here the authors refer to the assurance of basic needs like the access to water and sanitation, food security or electricity. Second, the access to ICTs (and especially unsuitable technology) can lead to new forms of dependency to industrialized countries. Third, as mentioned above, the unequal spread of ICT leads to the digital divide.

The second concept we refer to is the concept of the global value chain which is also a part of our research topic (the integration and influence of mobile money transfer (especially m-pesa) in comparison to other payment systems in the agricultural value chain). In general the global value chain […] "provides an analytical framework for a deeper understanding of different variations of co-ordination, governance and organization of supply chains" (DANNENBERG & NDURU 2012, p. 42). Figure 4 illustrates the concept of the global value chain which developed in the 1990s. The value chain consist of several components which describe the production process of a special crop (in our case fruits and vegetables) until it reaches its final destination, the consumer. Due to low costs, the production within a value chain only takes a small amount.

We connect the concept of the global value chain and ICT4D because we want to analyze whether farmers who use m-pesa become more integrated within the value chain. The term "integration in the value chain" refers to the participation of the farmer either in the domestic or the international value chain. Connected to this is our question if a farmer could benefit from a special payment system.

Figure 4: The global value chain



(Source: Own illustration according to SCHAMP 2008, p. 4)

3. Own Research and data

3.1 Research area and the FFV

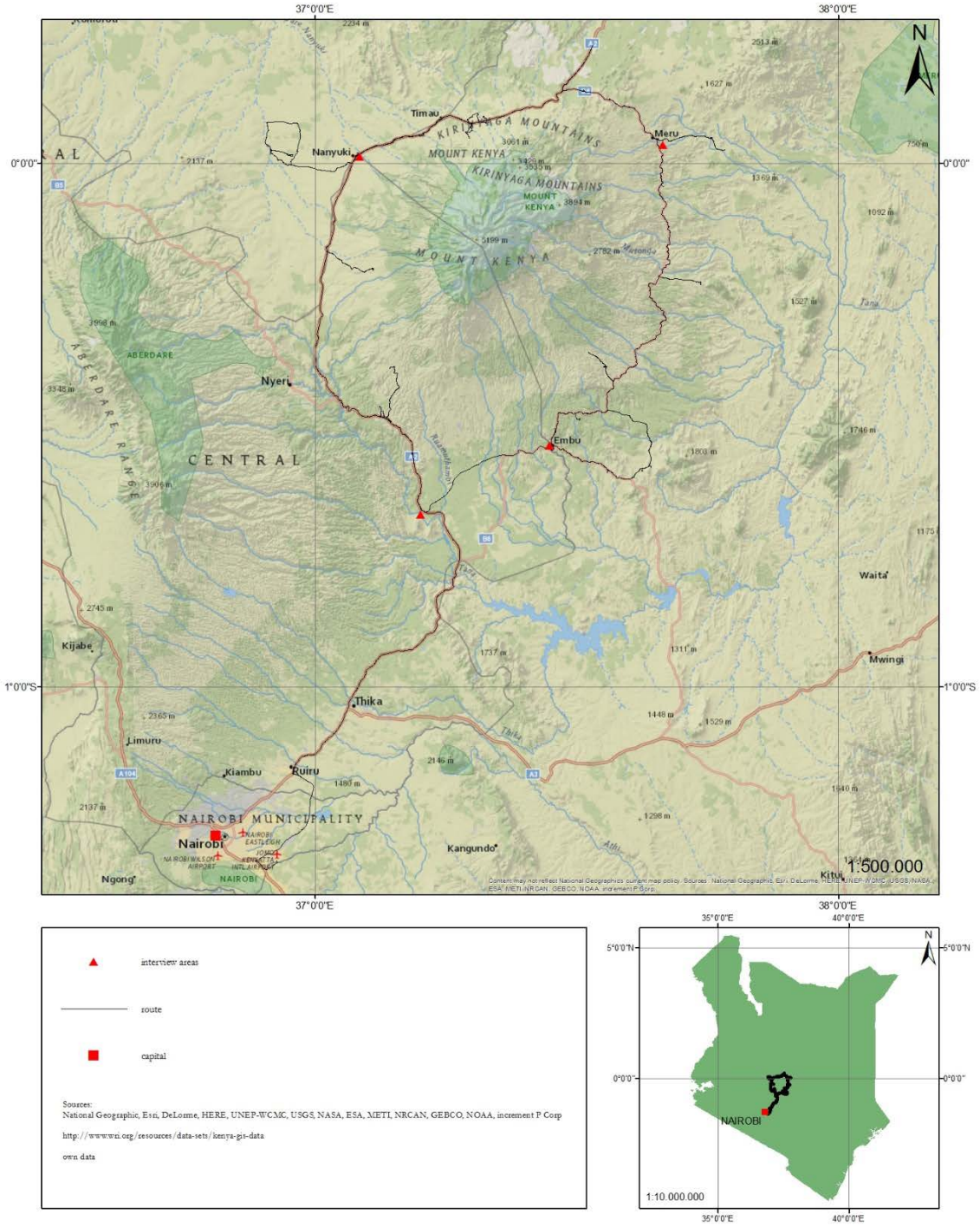
About 75% of the Kenyan population depends directly or indirectly on the agricultural sector, which equates 24% of the Kenyan GDP (ORODHO 2006, p. 5). One part of the agriculture in Kenya is the horticultural sector, which experienced a great boom in the last ten years. The main constituents of the horticultural sector in Kenya are the cut flower, fruits and vegetable production (EXPORT PROCESSING ZONES AUTHORITY 2005, p. 1). This study concentrates on the Kenyan fresh fruit and vegetable (FFV) sector, a part of the horticultural sector. In 2010 the FFV sector was one of the biggest exporters of horticultural products to the European Union, with total earnings about US$922 million (DANNENBERG & LAKES 2013, p. 56). Reasons for the FFV industry being this successful are cheap workforce, advantageous climatic conditions and the historical background of growing horticultural crops for the export market and the linkage to the European value chain. The climate conditions in Kenyan regions vary a lot. This makes it possible to grow many different crops in the different regions. Most of the farms have rain-fed farmland but some farms, mainly the ones who are export orientated, use irrigation. The Kenyan horticultural export market concentrates on Europe. The main importing countries are the United Kingdom, Germany, France, Switzerland, Holland, Italy and Belgium. Non-European importing countries are South Africa and Saudi Arabia. (EXPORT PROCESSING ZONES AUTHORITY 2005, p. 1; DANNENBERG & LAKES 2013, p. 56)

Big Kenyan exporters, who had the financial and managerial resources to work with the standards of the European Union developed by the industry with support by the Kenyan government (financial or trough shared ownerships), the improvement of the infrastructure and the developing technology (for example in packaging) (DANNENBERG & LAKES 2013, p. 56)

This development affects small-scale farmers in Kenya who compete large-scale and small-scale farmers in Europe through the vertical integration in global value chains. Export-orientated small-scale farmers have to organize groups and cooperatives to fulfil the standards, produce the requested capacities and get a contract with the exporters (DANNENBERG & LAKES 2013; JAFFEE 1994, p. 98).

Exporters from Kenya use different supply routes. Some of them have their own farms and quality management systems (QMS), others have contracts with the organized groups of farmers or individual middlemen. Because of trust issues the exporters in our study did not work with middlemen anymore. Middlemen usually have no professional qualifications but often have an agricultural background and are well informed about the market and the exporters. For some small-scale farmers they used to be the only way to receive information and to get in contact with exporters. The farmers were often not well-informed about the market and prices, so the middlemen had a powerful stand. Certainly their bargaining position is shattered since the impact of ICTs in the developing world and therefore in developing countries like Kenya too. The farmers are able to improve their bargaining position with mobile phones and related to this their possible access to information. The contracts of the exporters with the farmer groups endure one year and determine the quality, the quantity and the price of the goods. These exporters are linked with individual importers who sell the products directly to the European supermarkets (DANNENBERG & LAKES 2013, p. 57).

Figure 5: The research area around the Mt. Kenia



(Source: Own figure)

3.2 Methodology

The data of this research is based on a fieldwork from the 14th to 25th March 2015 in the Mt. Kenya region. After the start in Nairobi the first stop was Karatina and then the route followed around the Mt. Kenya with stops in Embu, Meru and Nanyuki. The interviews were taken around the counties and contiguous areas (Sagana area, Mwea area, Timau, Naro Moru). After travelling around the Mt. Kenya we had a stop in Nairobi where we visited the HCD office (Figure 5). Our research deals with the integration and influence of mobile money transfer in the agricultural value chain. The analysis was mainly based on qualitative interviews which were semi-

structured (see appendix 1). During the interviews some questions were added or removed and there was the possibility for narrative descriptions.

In total we interviewed 28 small-scale farmers who grow fruits and vegetables. Principally two groups of farmers can be distinguished among the interviewees. On the one hand there are farmers who grow crops either for the local or for the export market, on the other hand farmers grow crops for both markets, local and export. During our interviews we asked questions concerning the use of mobile money transfer in the farming business as well as in the private life.

Mobile money transfer can be used for selling or buying. To capture all possible usage of m-pesa we asked questions on how the farmer sells his produce and on how he pays for farming supplies like seeds and fertilizers. If the farmer had employees we also asked how they get paid. To conclude our research we asked about possible reasons for the use of m-pesa or the non-use as well as the effect of m-pesa on the farming business. Some farmers also belong to a farmer group or a cooperative, which sell their crops directly to an exporter. In this case we asked the farmers how they get paid.

The farmers to be interviewed were chosen in a way to facilitate a comparison between the local and export market. The snowball system was very helpful to get to know more farmers during our field work. So, our interview partner introduced us to another farmer (for example a friend or neighbor) after we finished an interview. This builds up bonds of trust between us as researchers and the interview partner (MURPHY 2013, p. 72).

In addition to the qualitative interviews with the farmers, several meetings took place with exporters, institutions and a middlemen at a local market. Table 2 illustrates different actors of our field work. The table is divided into three parts, 1. semi-structured interviews, 2. meetings and presentations together with discussions 3. guided tours with short interviews.

Official appointments with exporters (see 2nd column of Table 2) include for example the Kenya Horticultural Exporter (KHE) or Instaveg. In addition, institutions like the Kenya Agricultural and Livestock Research Organization (KALRO) and the Horticultural Crops Directorate (HCD) were visited as well.

Table 2: Interview partners in the Mt. Kenya region

Semi structured Interviews around the Mt. Kenya region	Meetings including presentations & discussion	Guided Tours & short interviews
Local farmers (access middlemen/access to exporter)	Exporters (Instaveg, Kenya Horticultural Exporter (KHE))	Kenya Horticultural Exporter (KHE) packing facility (key informant)
Local farmers who are a member of a cooperative (for example Mt. Kenya cooperative society)	ICIPE (African Insect Science for Food and Health)	HCD (Horticultural Crops Directorate) (key informant)
Local farmer who produce for supermarkets	KALRO (Kenya Agriculture and Livestock Research Organization)	
Middleman (key informant)	HCD (Horticultural Crops Directorate)	

(Source: Own figure)

During our field work we were faced with some difficulties which are presented in the following. First, the communication between the interview partners became difficult because of language problems. Sometimes the farmers used a combination of English and Swahili (or other African languages like Kiswahili or Kikuyu). Here especially the Kenyan students supported the

qualitative interviews while they translated our questions and the answers of the interview partners. At this point we want to underline that during a translation some information get lost. That is why we have to regard the aspect of translation for our results. We depend on the quality and validity of the translation of the Kenyan students. Concerning to this it was very helpful that some interviews were recorded because we could repeat the interview and there was the possibility of request also when some time has passed. In consideration of the translation our results have to be viewed critically (BOGNER et al. 2014, p. 43ff.).

Second, a special problem arose in connection with the term "mobile money transfer", which was not very common. Some farmers were not used to this term, that's why we often used "m-pesa" as a synonym and an example for mobile money transfer. Here the problem of "negative influence" can arise because you have to be careful that you don't mention too many examples so that the answer is already predefined. While m-pesa is the most popular mobile money transfer service there also are some more from different providers.

In addition the amount of qualitative interviews is not representative enough to draw general conclusions from the results concerning to the development of m-pesa or ICTs in the Mt. Kenya region. Every single qualitative interview has its own results which are specific. Nevertheless the results can give an idea for further research (SCHNEIDER 2002; BOGNER et al. 2014, p. 93).

4. Results of own research

4.1 Structure of m-pesa and how it works

In our research we were interested in the function of m-pesa as well as the importance of it in the horticultural value chain.

With m-pesa it is possible to send money from one account to another. In this account it is possible to store a limited amount of money, which can be transferred. It is also possible to buy airtime for oneself or for others with the money in the m-pesa account and to withdraw cash at an m-pesa agent. Transferring money or airtime works with text messages and phone numbers. After choosing the option to transfer money or airtime it is necessary to quote the amount of it and the phone number of the receiver. To complete the transfer it is required to give a personal pin code. In the case of a mistake the money transfer is reversible for 24 hours. For example if there is an error with the phone number of the receiver or the amount of money it is possible to freeze the money and transfer it back to the owners account. But this regulation to safe people from wrong transfers can also be a problem because of misuse (see chapter 0).

Another service Safaricom offers in relation with m-pesa is m-shwari and Lipa m-pesa. M-shwari is primary used to store money safely. But with m-shwari it is also possible to link a bank account with m-pesa. This gives the possibility to transfer money from a bank account to an m-shwari account and from the m-shwari account to m-pesa. There is no fee to store money in an m-shwari account and there is also no limit contrary to the m-pesa account. The costs to transfer money from a bank account to an m-shwari account depend on the bank. For the farmers these costs are often cheaper than to spend money and time on travelling to the next bank. The problem of these services is the necessity of the usage of a smartphone running with an operation system.

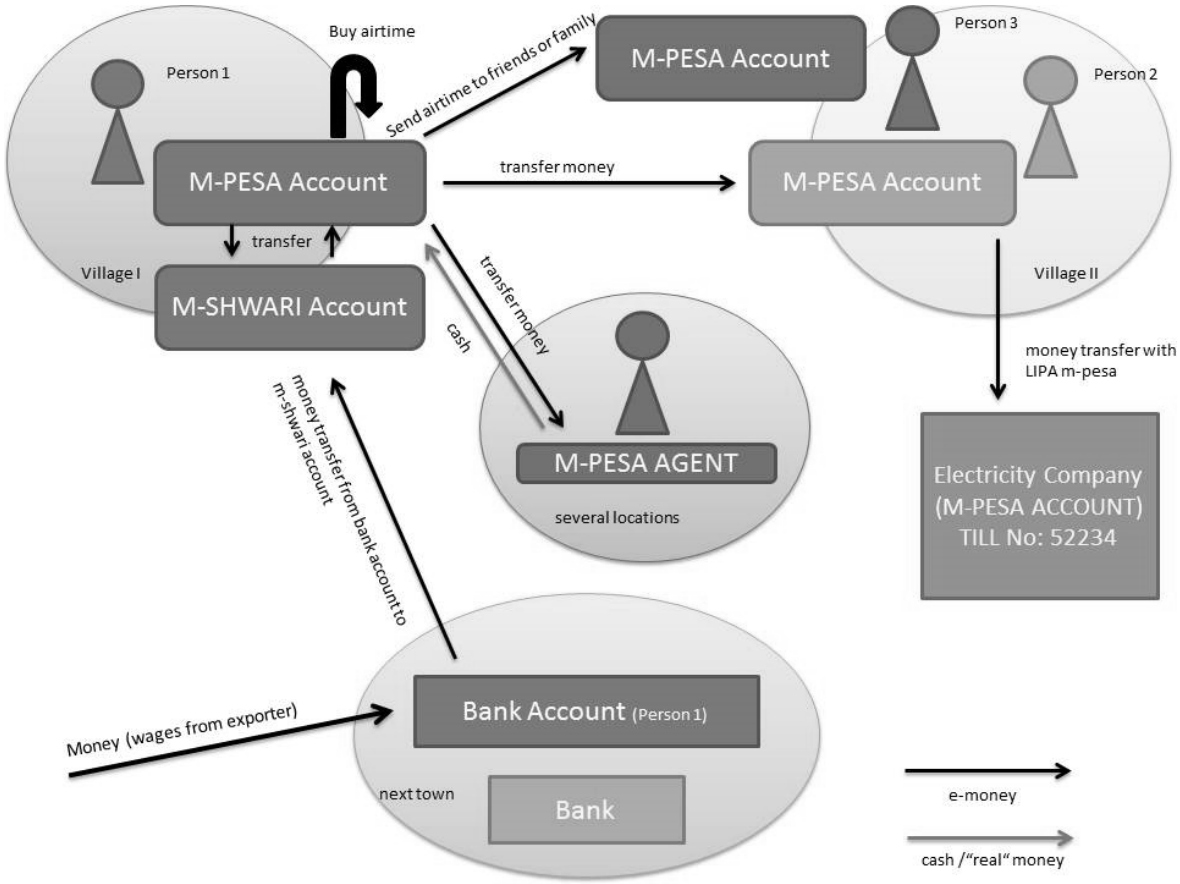
Lipa m-pesa can be used to pay bills directly, for example school fees, electricity bills or in the supermarket. To pay school fees or electricity bills the certain amount of money must be transferred with Lipa m-pesa to the Till number of the school or another Institution. At the checkstand in the supermarket, the amount of money also must be transferred to the Till number of the checkstand. Then the cashier can see on the display of the checkstand, and the customer on the display of his mobile phone that the bill is paid. All these functions and structures are represented in the following figure. Figure 6 makes clear how m-pesa works and how it is linked to a bank account. The picture shows the possibilities of m-pesa schematically and contains the

level of distance (people from different villages or even different regions can transfer money without the need to travel), convenience and the ability to store money.

The registration for an m-pesa account is very easy and the only thing the person needs is an identification card, like a driver's licence or something comparable that is given to the m-pesa agent, who registers the electronic account and links it to the phone number of the customer. The activation ensues as soon as money is deposited on the account. The m-pesa agents get a mobile phone from Safaricom with a different menu, which allows them to get in contact with m-pesa service center via text messages. In addition, the interface is also easy to use and the transactions work step by step (HAYES & WESTRUP 2012, p. 29f.).

The mobile money transfer services Safaricom offers are very convenient, since the alternative of travelling in order to make payments would need time and money. For the most farmers in the rural areas of Kenya it is not very easy to get to the next town or to travel in general.

Figure 6: Functions of m-pesa



(Source: Own figure according to HAYES & WESTRUP 2012, p. 30)

4.2 Forms of payment for FFV

The first aspect on how the farmer is paid for his produce cannot be answered simply. As our research shows the form of payment depends on whether the produce is distributed on the local market or sold for export.

Concerning our main research question there is evidence that the use of m-pesa in the domestic value chain may lead to exclusion of farmers who do not use this service. Some farmers stated that the form of payment in the horticultural value chain is determined by the middlemen. On the other hand, the current literature suspects a better bargaining position of the farmers

because of ICTs and a connected better access to information. According to the literature the farmers are more independent from the middlemen then without the use of ICTs. But the research shows another form of dependency: On the one hand several farmers stated that they get paid in cash or m-pesa for their goods for the local market. The determinant between these two forms of payment seems to be the use of middlemen. According to most of the interviewed farmers the form of payment is chosen by the middlemen. For example a farmer from the area of Timau stated that the middleman determines m-pesa as the form of payment and he, the farmer, is in a poor bargaining position to change that because he is not in a group of farmers. This indicates that non-users of m-pesa are somehow excluded from the domestic value chain by certain middlemen.

On the other hand another farmer from the area of Timau stated that the middlemen pay him in cash but he would prefer m-pesa. Thus there are also cases where the middlemen chose the form of payment that fits the farmer best. A farmer in Mwea area stated that the middlemen use mobile payments if the farmers use them too. Else they use cash. The reason for the middlemen to use m-pesa instead of cash could be safety reasons. As one farmer from the Sagana area indicated most middlemen do not come with cash to the farmer's property.

In the cases where middlemen are not part in the value chain and the farmer distributes his produce by himself, cash is the most common form of payment.

Another form where the farmer's produce is distributed in the domestic value chain is, when the farmer sells his fruits and vegetables to a local supermarket. The farmers told us that the supermarkets pay either via m-pesa or via cash.

On the other hand the exported produce seems to be paid via bank account in most of the cases. A farmer from the Sagana area mentioned Instaveg und Frigo Can as exporters he regularly sells his produce to. According to him they only pay him via bank account. Another farmer from the Sagana area adds Sunripe to the list of exporters who pay via bank account. A farmer from Meru is selling to Ausmord which also pays via bank account. Apparently the exporters do not just chose the form of payment. As one farmer from the Sagana area mentioned they even determine the bank where the farmer has to have his bank account.

The fact that payment via bank account is the common form of payment among exporters is underlined by the interview with the exporter Instaveg. This is further elaborated in chapter 0.

However there are farmers who stated that they are sometimes paid via m-pesa by the exporters. A key informant at the HCD packhouse in Nkubu said that the exported produce is mainly produced by farmer groups. These groups are paid via m-pesa because of the lack of banks in rural areas.

A farmer from the area of Timau explained how he deals with the lack of banks in rural areas and the fact that the exporters pay him via bank account: He uses m-pesa to get his money from the bank. Apparently m-pesa is very convenient for that because the m-pesa agents are nearer to the farms than the banks (chapter 0).

The interview with the treasurer of a cooperative adds another viewpoint. She explained how the money the cooperative gets from the exporters is distributed among the farmers. The exporters pay for the produce via bank account. That means that the cooperative has one bank account to which they get the money for the whole produce. The treasurer than distributes the money to the farmers using mostly m-pesa. It is also possible to get the money from the cooperative in cash if the farmer does not have m-pesa. Therefore none of the farmers is excluded from the value chain. The reason for that form of payment in this case is the treasurer's own preference.

4.3 Forms of payment for farming supplies

For the payment of farming supplies it seems to be quite common to pay via m-pesa or cash. The supplies mentioned are chemicals i.e. fertilizers, seeds and food for livestock. The reason for the use of cash is mainly the advantages of cash or m-pesa: It is easy to use and to access.

Nevertheless some farmers stated that they pay via bank account for their farming supplies. One farmer in the Sagana area even said that it is not possible for her to pay her supplies through m-pesa. Due to lack of savings she only can pay the supplies after the harvest. That arrangement with the suppliers would not be possible with m-pesa.

4.4 Forms of payment for workers

The preferred form of payment for workers according to the interviewed farmers is either cash or m-pesa. In most cases the farmer decides which form of payment he uses to pay his workers. But there are cases in which the farmer uses different forms for different workers considering their preferred form of payment.

A farmer from the area of Timau makes another distinction: If he is at home he pays his workers in cash, if not he uses m-pesa. According to this a reason for the use of m-pesa is to bridge distances.

4.5 Effect on the farmers business

According to our conceptual framework of ICT4D m-pesa is a way for development for developing countries like Kenya. Most of the interviewed farmers confirmed that m-pesa improved their business. The reasons for that are mainly because it made their lives easier. A farmer from the area of Meru stated that it is more convenient than a bank. Another farmer who lives in the area of Timau explained that if he knows that a friend of his is currently in town and the farmer needs something he can simply call his friend to buy it for him. That is only possible because of the use of m-pesa. The farmer can just send the required amount of money to his friend. That is very timesaving and the farmer does not have to suspend his work on the farm.

Just like the reasons for not using m-pesa there are negative impacts on the farming business. One farmer from the Sagana area mentioned the negative effect of the transaction costs for his business.

4.6 Reasons for using m-pesa (advantages)

An important reason for the use of m-pesa seems to be the security. It seems to be the most common reason to use m-pesa apart from the convenience. One farmer in the Sagana area stated that the harvesting periods are well known amongst thieves. Therefore they are aware when the farmers have huge amounts of cash on their property. According to that it would be much safer to get paid for the produce via m-pesa. As mentioned in chapter 0 it is even possible to deposit money at an m-swari account. A farmer from the area of Naro Moru even said that he uses m-pesa especially for big amounts or at night because of security reasons. Before the use of m-pesa a farmer from the area of Timau used to send money in envelops to distant relatives. With m-pesa that is not only faster but much safer.

Several farmers mentioned that another positive aspect about m-pesa is that it is more flexible and simpler. One reason for that mentioned is the distance to banks in rural areas. The literature also mentions that m-pesa fills a gap in the infrastructure because a lot of people have poor access to banks. That is reflected in the research: The distances to the next bank are very high for the interviewed farmers. One farmer from the area of Limuru gave an example: The next m-pesa agent is 500 meters away from his farm while the next bank is 5 kilometers away. Another farmer in the area of Embu even spends one hour by matatu (a form of shared taxi) to get to the next bank but the next agent is still a 30 minutes' walk away. For one farmer from the Sagana area m-pesa is like a mobile bank where he can save his money. A farmer in the Area of Meru adds to that by saying that the use of m-pesa is instantly, it is easy to withdraw money, no cash is used and therefore distances can be bridged.

The development is also evident in the comparison of the previous money transfer system and the current one. As mentioned in chapter 4.1 the main form of money transfer before the

introduction of m-pesa has been cash. Although the payment with cash is still very common, it has been replaced by m-pesa for the transfer of money over long distances. Chapter 2.1 states that the transfer of money through transmitters like postal services or other people are very time consuming, risky and vulnerable to theft. Therefore the use of m-pesa demonstrates an improvement.

On the matter of convenience from our conceptual framework several farmers mentioned that they use m-pesa because it is time-saving, flexible, instantly, simple and easy. One farmer in the Mwea area stated that the use of m-pesa is cheaper than other forms of payment and less time consuming. Contrary to that are the transaction costs most farmers complain about (chapter 0). Another positive aspect in the opinion of a farmer from the area of Timau is, that it even works if there is no electricity for some time.

A key informant who explained all about the different possibilities of m-pesa summed up the advantages of m-pesa:

1. It is discrete and very confidential,
2. There are no fee charges on m-shwari,
3. It is fast and reliable for 24/7,
4. There is the possibility to transfer money from bank to m-pesa and the other way around and
5. It is very convenient; you have the possibility to send money to someone who's far away.

4.7 Reasons for not using m-pesa (disadvantages)

Apart from the already mentioned advantages of m-pesa, the interviewed farmers mentioned some reasons for not using m-pesa. As one farmer in the Mwea area explained the use of m-pesa is not always positive. Sometimes the transferred money can go to the wrong account. Another reason for non-users is trust issues because sometimes people do not pay. The transaction costs (Table 1) seem to be another disadvantage.

Some farmers do not use m-pesa for small amounts for example on the market because of these costs. A farmer from the Sagana area mentioned that with m-pesa the transaction cost gets higher the more money you send but the charges for transactions at the bank are constant. Some farmers from the area of Naru Meru even prefer to pay high amounts in cash because of the high charges. That thwarts the aspect of security which was mentioned in chapter 4.6.

According to the key informant from the exporter Instaveg another negative thing about m-pesa is the limitation of 140.000 Ksh per day. That is the main reason for the exporter to pay the farmers via bank account.

A farmer from the area of Timau stated that it is sometimes hard to convert money from the m-pesa account to cash because the m-pesa agents not always have enough money. Furthermore he mentioned that it is time consuming to get to an m-pesa agent.

A key informant from the area of Embu who had been a middleman mentioned the issue of trust. According to him the use of m-pesa is only possible if the two business partners know and trust each other. He explained that it is possible that one business partner, for example the middleman, transfers the money and the other business partner, e.g. the farmer, receives the massage that he received the money. The middleman than calls the customer service of Safaricom claiming that he transferred money to the wrong account. He then eventually gets his money back and the farmer might never get his money. Therefore trust is an essential part of transactions via m-pesa to ensure that these problems do not occur. A farmer from the area of Timau relates to that: He does not rely on middlemen because they are not trustworthy and come up with excuses not to pay. Some of them are related to m-pesa. For example the middleman claims that he has no network. Another farmer from the area of Limuru only uses m-pesa for transactions with middlemen if she sees them doing the transaction. Otherwise she is afraid of cheating. In the context of the conceptual framework this indicates the importance of extended trust for the use of m-pesa.

The possibility to reverse the money after it has been send enables fraud and misuse. As mentioned before several farmers mentioned their hesitation to use m-pesa because of this problem. They only transfer money to people they know and trust. Missing trust for that matter is apparently the main obstacle for the use of m-pesa. From the three trust relations mentioned in the conceptual framework the farmers mentioned the missing extended trust most frequently. The inter-personal trust is also relevant for the use of m-pesa because several farmers mentioned that they use m-pesa to send money to distant relatives. Also the institutional trust was mentioned. The farmers stated that they use m-pesa to pay school fees or bills.

However the previously mentioned back-transfer if the money is send to the wrong account is viewed differently by the interviewed farmers. Some see it as a good thing but some criticize that it is an unreliable service and the back-transfer is not guaranteed. Others of course complain about the possibility of misuse.

Another disadvantage of m-pesa is that it requires mobile phone network. Some farmers from the area of Naro Meru complain about the lack of it in some areas.

Just one farmer (p. 77, from the area of Limuru) mentioned that he does not use m-pesa because he is not conversant with this technology. Nevertheless this indicates the neediness of certain skills to operate mobile phones which are essential to use m-pesa.

Dannenberg & Lakes (2013, p. 71) suspect that a reason for the non-use of ICTs is the expensiveness. That aspect was not mentioned by any of the interviewed farmers. As mentioned before, the reasons against the use of m-pesa and therefore ICTs are mainly trust issues.

The following table sums up all the advantages and disadvantages of the three payment systems mentioned in this research. It also gives an overview on the different areas where the systems are used.

Table 3: Comparison of the three payment systems used in the horticultural value chain

	cash	m-pesa	Bank account
Mainly used for the payment of…	• FFV • farming supplies • workers • things in the private life (buying food on the market)	• FFV • farming supplies • workers • things in the private life (paying bills, sending money over long distances)	• FFV
Used in the FFV value chain mostly by…	middlemen	middlemen	exporters
Advantages	+ easy for small amounts on the market + no charges and costs + no limitations, can be used by everyone	+ save (cashless) + convenient (time saving, flexible, instantly, simple, easy) + less distance to m-pesa agent then to bank + distances can be bridged + discrete, confidential + fast and reliable 24/7 + possible to link m-pesa and bank account	+ save + no cheating + no trust required + transfer over distances possible
Disadvantages	- big amounts are unsave - sometimes difficult to get enough cash	- transaction costs depending on amount - possibility of fraud and cheating	- constant transaction costs - account is

		- wrong transfers possible - trust is required - limitation of 140.000 Ksh per day - Transfer of small and very huge amounts to unregistered users not possible (Table 1) - Agents not always have enough money - Dependent on network - Technical skills required	required - time consuming to get to the next bank

(Source: Own Figure)

5. Conclusion

Our first research question "Which payment system is most common in the horticultural value chain and for the farming business in the Mt. Kenya Region?" has to be answered differently for the different types of the value chain. There is evidence that m-pesa is the most common form of payment in the local value chain. For the international value chain it seems to be common to pay via bank account. Nevertheless there are exceptions from these findings.

The question concerning the inclusion or exclusion into the value chain cannot be answered easily. Although many farmers stated that m-pesa is meaningless for their transactions with the exporters and that the main form of payment is via bank account, there are some farmers who are being paid via m-pesa. Those farmers added that they use m-pesa on their free will. They are not "forced" by the exporters and therefore would not be excluded from the international value chain if they would not use m-pesa. It almost seems as if the exporters conform in that matter to the farmers. All in all the research indicates that the use or not use of m-pesa does not severely affect the integration in the international value chain.

Although m-pesa is not common in the export orientated value chain it seems to play an important role in the local chain and the farmer's private life. Many farmers stated that they get paid via m-pesa by the middlemen. Some farmers even said that they would prefer cash instead. Unlike in the international value chain the farmers are dependent on the middleman's will. Therefore the not-use of m-pesa can lead to exclusion from the local value chain if the farmer is not registered with m-pesa.

The more power the different actors have the better they can determine the form of payment. The exporters and middlemen on the one hand decide how they want to pay the farmers for they produce. Only a few of the interviewed farmers could choose their own preferred form of payment. On the other hand the farmers decide how they want to pay their workers.

Although most of the farmers consider the use of m-pesa a positive thing because it is easier to use than a bank account, they sometimes mentioned pretty high distances to the next m-pesa agent. That is to say by western standards. The distances to the next agent varied from 10 minutes by feet to 30 minutes.

There are other negative aspects too. A big issue seems to be the missing trust. According to our research the use of m-pesa is only possible if the two business partner trust each other.

For the matter of m-pesa and ICT for Development we conclude that it is a form of ICT that contributes to the development of the Kenyan horticultural sector by being convenient and relatively secure. It is wide-spread and generally improves the business of the farmer of the FFV value chain. The opportunity to link the m-pesa service with a bank account opens new possibilities because in the export-orientated value chain the payment via bank account is most commonly used.

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Appendix 1: BECKER, SCHETTLER-KÖHLER, SCHUBERT, STIEBNER

The following questions were always asked during an interview. Our questionnaire started with some general questions about the person and general questions about the agricultural crops. Afterwards we focused on the mobile money transfer. Here we differentiated between farmers who use and don't use mobile money transfer.

- How old are you?
- Are you married?
- Do you have children?
- What is your educational level?

- What crops do you grow?
- Which crops do you grow for the local market?
- Which crops do you grow for the export market?
- Whom do you sell your crops to?

Do you use mobile money transfer?

If yes,

- Which money transfer do you use?
- For what do you use mobile money transfer?
- How do you pay products like fertilizer or seeds
- Do you have workers?
- If yes, how do you pay your workers?
- Why did you choose this type of payment for your workers?
- How do you get paid?
- How did you get paid before there was m-pesa?
- Why did you changed your payment into mobile money transfer?
- Do you use MMT for the export market? (Why not, Why do you use it)
- Do you use MMT for the local market?
- Do you think MMT is good for your business? And why?
- Can you say something positive and negative about MMT?

If no,

- Why don't you use MMT?
- Which other form of money transfer do you use?
- Why do you use this form of money transfer?
- How do your pay products like seeds, fertilizer?
- How do you get paid?

Questions which were added

- How far away is the next m-pesa agent? How do you get there?
- Since when do you use m-pesa?

Q. No: ..... Date: ..... GPS Data: .....
District/Subregion: .....

Research theme: Food Access of Horticultural Farmers in the Mount Kenya Region

Introduction:

This questionnaire is part of an international scientific study of Karatina University and targets horticultural farmers. Its aim is to analyse the influence of different factors (especially income) on household's food access and food security. Based on the results of the study, recommendations will be made on how to improve the conditions of farmers in future.

You have been selected as one of the participants in this study to assist in providing information. You are requested to feel free to answer all of the questions asked or decline in any instance you may not wish to.

Your name will not be quoted in the findings of this study, unless you wish so. Furthermore, the information you provide will be used strictly for academic reasons and your confidence will be upheld.

This study does not involve any payment and hence you are requested for assistance on voluntary basis. Your contribution will be highly appreciated. In case you have any reservations, please feel free to express them. Otherwise you are very welcome to answer the questions that hereby follow.

1. Household characteristics

1.1 Sex O male O female

1.2 Age .....

1.3 Marital status O single O married O widowed O divorced

1.4 Do you have children? O yes O no

1.5 (If yes) How many children do you have? .....

1.6 How many people, including yourself, live in your household right now? .....

1.7 What is your educational level?

O University O College O Secondary school O Primary school O None

O Other (specify) .....

1.8 What educational level is your wife/husband?

O University O College O Secondary school O Primary school O None

O Other (specify) .....

1.9 Do you own land? O yes O no, specify .....

1.10 Who owns the land title? .....

1.11 What crops do you grow? .....

.....

1.12 What crops do you grow for the export? .....

.....

1.13 What crops do you grow for the local market? .....

.....

2. Income levels and generation

2.1 What is the average monthly income of this household? (in total) ..... Ksh

2.2 What are the sources of this household income?

.....

.....

2.3 How much does your wife/husband contribute towards this income?

Specify the percentage per month ..... %

2.4 Who between you and your wife/husband decides how the income is used?

O The man/husband O the woman/the wife O both

O others (specify) .....

2.5 Do you obtain loans? O yes O no

2.6 (If yes) Who between you and your wife/husband decides how the loan is used?

O The man/husband O the woman/the wife O both

O others (specify) .....

2.7 (If applicable) How much money do you spend on the education of your children?

Specify the amount by year ..... Ksh

2.8 How much money do you spend on farming business (including inputs and (casual) labour)?

Specify the amount per month ..... Ksh

3. Farming resources

3.1 How much land do you own/rent? ..... acres

3.2 **(If export farmer)** How much of the land is used for export production? ..... acres

3.3 **(If local market farmer)** How much do you sell at the local market?

..... % of the total harvest

3.4 How much is used for your own food production? ..... % of the total harvest

3.5 Did your farm-size change in the past five years? O no O increase O decrease

3.6 Did you add a new crop in the past two years? O no

O yes, which one? .....

3.7 (If yes) why? .....

3.8 Do you keep livestock? O yes O no

3.9 Do you irrigate the farm? O yes O no

(If yes) Specify which type of irrigation .....

3.10 Do you sell the produce to a broker/middleman/marketing agent? O yes

O no, specify .....

4. Social Embeddedness

4.1 Are you a member in a local group? O yes O no

(If yes) Specify which types of groups (e.g. export group, water project, self-help group, cooperative, etc.) .....

.....

5. Buying habits

5.1 How often do you buy food?

O every day O once a week O once a month O other, specify .....

5.2 Who is responsible to buy food?

O The man/husband O the woman/the wife O both

O others (specify) .....

5.3 Where do you buy your food from?

Specify sources .....

Specify distance in each case .....

5.4 What is the main mode of transport to reach the sources named in 5.3?

.....

5.5 Do you own means of transport? O yes O no

(If yes) Specify the type of transport .....

5.6 What influences your decision to buy specific types of food (e.g. taste, price or diet habits)?

.....

5.7 Where (or from whom) do you get information about food products and nutrition?

.....

6. Food consumption and food security

6.1 How often do you eat grains? (e.g. maize, rice, wheat etc.)

O every day O once a week O once a month O other, specify .....

6.2 How often do you eat vegetables?

O every day O once a week O once a month O other, specify .....

6.3 How often do you eat fruits?

O every day O once a week O once a month O other, specify .....

6.4 How often do you eat meat?

O every day O once a week O once a month O other, specify .....

6.5 How often do you eat dairy products?

O every day O once a week O once a month O other, specify .....

6.6 How often do you eat fish?

O every day O once a week O once a month O other, specify .....

6.7 What types of food you eat are from your own farm? (Please, specify)

.....

.....

6.8 How many meals do adults in your household eat on average per day?

Specify ..... (number of meals)

6.9 (If applicable) How many meals do children in your household eat on average per day?

Specify ..... (number of meals)

6.10 (If applicable) Do your children eat in school? O yes O no

6.11 Are there any times in a year when you have not enough food?

O yes O no (if no, **end of questionnaire**)

(If yes) Specify which months .....

.....

Specify the reasons why .....

6.12 In times when you didn't have enough food, did you get help from your friends, relatives or your local group?

O yes O no

6.13 (If yes) Do they give you money to buy food? O yes O no

6.14 (If yes) Do they give you food? O yes O no

6.15 In times when you didn't have enough food, did you eat smaller portions?

O yes O no

6.16 In times when you didn't have enough food, did you skip meals in a day?

O yes O no

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