The Relationship among Farmers' Embeddedness in Value Networks and their Innovation

A Ugandan coffee value chain perspective

Twan van der Slikke
Dr. D. Dentoni
Prof.dr. J.H. Trienekens

WAGENINGEN
UNIVERSITY & RESEARCH

World Agroforestry Centre

Author:	Twan van der Slikke
Student number:	940920767020
Study Programme:	Management, Economics & Consumer Studies
Specialization:	Management
Supervisor:	Dr. Domenico Dentoni
Co-supervisor:	Prof.dr. Jacques Trienekens
Faculty:	Social Sciences
Chair group:	Management Studies Group
Organisation of supervisors:	Wageningen University & Research

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"Be strong and courageous. Do not be afraid or terrified because of them, for the Lord your God goes with you; he will never leave you nor forsake you."
Deuteronomy 31:6.

Abstract

The purpose of this study is to investigate the relationship among farmers' embeddedness in value networks and their innovation. Many developing countries in Sub-Saharan Africa have problems setting up efficient and effective food systems. Smallholder farmers deal with uncertain markets, lack of farmer organizations, and lack of infrastructure. Farmers are heterogeneously embedded into value networks, which results to heterogeneous access to initial resources. Via semi-structured interviews data has been collected in the coffee value network in Manafwa, Uganda. By scoring the farmers on the features reciprocity, resource diversification, and channel diversification more information can be obtained on the embeddedness of a farmer. Defining the farmers in different clusters according to their characteristics and embeddedness leads to different value network maps of the heterogeneous embedded farmers. The variables location, gender, age, and farm size do have influence on the embeddedness of a farmer in the value network. Linking the way how farmers are embedded in the value network with the innovation constraints they face leads to new insights on how to organize the coffee system more efficient and effective.

Keywords

Value Chains, Value Networks, Embeddedness, Innovation, Value Network Analysis, Smallholder Farmers, Sub-Saharan Africa

Executive summary

Many developing countries have problems setting up efficient and effective food systems. In Sub-Saharan Africa smallholder farmers are responsible for most agricultural production. Farmers deal with issues like uncertain markets, corruption, lack of farmer organizations and lack of infrastructure (Hounkonnou et al., 2012). The smallholder farmers often lack access to appropriate skills, technologies, information and markets (Brenton, 2012; World Bank, 2013). Farmers can face heterogeneous constraints in their enabling environment. Differences in access to agricultural products, postharvest technologies, information and markets may lead to different performance. Because the lack of efficient and effective food systems the majority of farmers remain poor and marginalized.

This research aims to create more understanding in the heterogeneity of farmers' embeddedness in value chains and networks and their ability to innovate. The farmers and their environments form complex systems which are characterized by a large number of actors, diverse resources exchanges and relationships. More information about the value networks wherein farmers are embedded is needed. A value network is any set of roles and interactions in which people or organizations engage in both tangible and intangible exchanges to achieve economic or social good (Allee, 2008). More understanding about the wider network that creates value through both tangible and intangible resources may lead to insights on the (different) way farmers are embedded in the value network. More understanding on the farmers' embeddedness in the value network and the wide network of actors that influence embeddedness will be useful in creating more insights in how to overcome market imperfections and increase productivity and farm incomes. In this research there will be searched for patterns in the embeddedness of farmers and the constraints they face in introducing new products, new methods of production, new sources of supply, the exploitation of new markets or new ways to organize business.

A case study has been performed among smallholder farmers´ and their value network. Value network analysis was used in this research. Value network analysis has the key feature of mapping the existing relationships among actors in a system associated with the key resources that these actors exchange or share with each other (Allee, 2008). It includes all aspects of the network with all actors whose presence in the network can influence value creation of an actor. In value network analysis also the actors which are separated from the value chain are included. 27 smallholder farmers in Manafwa who produce Arabica coffee participated in the research. The 27 smallholder farmers showed good variation in the selected variables location, gender, age and farm size. In semi-structured interviews more information was retrieved regarding the farmers' resources exchanges, supply-side constraints and demand-side constraints. Further, nine other key informants of the coffee value network have been interviewed. These key informants were an input supplier, middlemen, government workers, processors/exporters and an area cooperative enterprise. These stakeholders have a good understanding of the market situation from their position in the value network (Ferris et al., 2006). The information retrieved from other stakeholders was also beneficial in identifying the opportunities for improved coordination and resource flows in the overall system. More insights were gained in what the farmers gain from the relationships with the other stakeholders, or what the farmers could potentially gain if a potential relationship would be in place (Zott and Amit, 2010; Dentoni and Peterson, 2011).

The interviews with farmers and other stakeholders involved in the coffee value network in Manafwa have led to the necessary information to conduct an embeddedness analysis. In the embeddedness analysis a specific indication was given to every farmer in the form of low, medium or high regarding the three features reciprocity, resource diversification and channel diversification. Reciprocity involves the extent to which an actor shares resources bi-directionally with another actor. The resource diversification of an actor describes the heterogeneity of resources provided or received from other actors. Channel diversification includes the wideness of relationships through which the resources of an actor are shared (Allee, 2000; 2008). The farmers scored the lowest on the feature reciprocity (mean=1.33, SD=0.734). In general the interviewed farmers take more resources than they give. They do not share resources bi-directional. The farmers score best on the feature resource diversification (mean=2.15, SD=0.602). This means that the farmers receive four or five different kinds of resources on average. On the feature channel diversification the farmers score a mean of 1.96 (SD=0.649). This means that, on average, the farmers exchange resources with four to five actors.

After the embeddedness analysis a cluster analysis has been performed. A total of ten inputs were used to determine the different clusters among the farmers. With the ten inputs 'reciprocity', 'resource diversification', 'channel diversification' 'gender of household head', 'age', 'sub-county', 'amount of land used for coffee production', 'use of pesticides', 'use of artificial fertilizers' and 'buyer' three different clusters of farmers have been defined:

1) Young male farmers located in Mukoto (highland). They have a small farm size and make little use of agricultural inputs. The farmers show low resource diversification and they sell their produce to middlemen.
2) Female farmers with a high age located in Namabya (midland). They have an average farm size and make little to no use of agricultural inputs. The farmers show high reciprocity and they sell their produce to middlemen and Area Cooperative Enterprises.
3) Middle aged male farmers located in Bukhofu (lowland). They have a big farm size and make extensive use of agricultural products. The farmers show low reciprocity and high resource diversification. They sell their produce to Area Cooperative Enterprises and processors/exporters.

In the third step of the research value network analysis was applied mapping the interrelationships among the different actors involved in an around the network of the three different clusters of farmers which have been defined. There are differences in resource exchanges and differences in accessibility to certain actors for the different clusters of farmers. Three value network maps provide an overview of all the resource exchanges of the farmers from the different cluster. The maps also provide more in-depth information, including the four different features of actors in the system, namely reciprocity, agility, resource diversification and channel diversification (Allee 2000; 2008). The agility of an actor gives information about the degree of separation from one actor to another.

In the final analysis of the research the innovation constraints the different clusters of farmers face were analysed. The most important constraints farmers face are 'lack of extension services', 'lack of capital', 'low coffee prices', 'price fluctuations' and 'hard access to inputs' (written in descending order of importance). In the supply-side inputs constraints category the farmers from cluster 3 perceive the constraint of lack of capital less often than the farmers from cluster 1 and 2. Looking at

the results of the supply-side services constraints there can be seen that there is a lack of extension workers in the whole region of Manafwa. Farmers from cluster 1, 2 and 3 face this constraint. Regarding the demand-side constraints the farmers from cluster 1 and 2 perceive the constraints of low coffee prices more often than the farmers from cluster 3.

The farmers from cluster 1 are the most marginalized farmers in the value network. They exchange a limited set of resources with a limited group of actors. Because of the fact that most of these farmers are coming from the highland Mukoto, it is hard for them to access certain actors and resources (i.e. input suppliers, processors/exporters). The farmers from cluster 1 sell their produce to middlemen. They miss out on resources like advice, information and training which they could receive from other buyers like area cooperative enterprises and processors/exporters. Creating platforms which are better accessible for the farmers from cluster 1 will stimulate their development. The government and NGOs can intervene in providing funds to set up a platform in these hard conditions. The government can also intervene in putting more regulations on the middlemen who the farmers from cluster 1 are selling their produce to.

The farmers from cluster 2 have no access to input suppliers. However, they have strong ties with area cooperative enterprises. Given their low agility with the farmers area cooperative enterprises could extend their services and bulk commodities like artificial fertilizers and pesticides. This will make the agricultural inputs more accessible for the farmers from cluster 2.

The farmers from cluster 3 show the highest embeddedness of all farmers in the value network. Many farmers from cluster 3 are located in the lowland Bukhofu. ACEs and processors/exporters are more active in this sub-county. This leads to a better price for the produce of these farmers and to a better accessibility to resources as information, advice and training. The farmers from cluster 3 have better access to the market and input suppliers from Mbale. The farmers from cluster 3 show low reciprocity. They could share more resources with other farmers who are less embedded into the network. Sharing their knowledge and information can stimulate the local development. Platforms are necessary to stimulate these resource exchanges.

The outcomes of this research confirm a possible positive relation in the variables farm size and adoption to innovations. The results also confirm that a constraining access to markets has a negative impact on farmers' embeddedness in the value network. Farmer groups like producer organizations and area cooperative enterprises take an important role in the value network. The presence of these actors is of big importance in a sub-county, and can contribute to the access to different resources. NGOs, government and national development agencies show low agility regarding the farmers. In order for these actors to stimulate development and make an impact they should increase their cooperation with farmer groups. Through the value network analysis performed, innovation support agents can understand where intangible and tangible resources and their associated value lay in the network. The government can contribute to tackle the lack of capital and lack of extension service by providing microfinance and facilitate the training of more public extension workers. Furthermore they can intervene in the coffee market by setting price regulations. This could tackle the low coffee prices and price fluctuations constraints. To tackle these constraints there needs to be cooperation between different actors in the chain to be able to orchestrate change and innovation.

List of abbreviations

ACE	Area cooperative enterprise
AIC	Akaike's Information Criterion
BCU	Bugisu Cooperative Union
GCS	Growers cooperative society
ITC	International Trade Centre
MSIP	Multi-stakeholder innovation platform
NA	Network analyses
NGO	Non-governmental organization
PO	Producer organization
PPE	Personal protective equipment
SACE	Semi-area cooperative enterprises
SACCO	Saving and Credit Cooperative Society
SCA	Supply chain analyses
SSA	Sub-Saharan Africa
UGX	Currency code Uganda shilling
USd	American dollar
USh	Uganda shilling
VCA	Value chain analysis
VIP4FS	The Value Chains Innovation Platforms for Food Security
VSLA	Village savings and loan association
VNA	Value network analysis

List of figures

List of tables

Contents

1. Introduction

Many developing countries have problems setting up efficient and effective food systems. The poor performance of agriculture has often been due to underinvestment in physical, institutional, and human capital (Diao *et al.,* 2007). In Sub-Saharan Africa (SSA) smallholder farmers (further referred as farmers) are responsible for most agricultural production. Farmers deal with issues like insecurity of land tenure, uncertain markets, corruption, lack of farmer organizations and lack of infrastructure (Hounkonnou *et al.,* 2012). Last decades both land and labor productivity hardly increased (Inter-Academy Council, 2004, p. 158; Pretty *et al.,* 2011) and the amount of food per person has not increased at all over the last 50 years. The increase in production is mainly achieved through expansion of agricultural land rather than through intensification (Alene & Coulibaly, 2009). This has led to land scarcity in many parts of SSA.

Because the lack of efficient and effective food systems the majority of farmers remain poor and marginalized. Agricultural intensification and development is widely seen as a pre-condition for sustainable pro-poor growth in Africa (Haggblade, Hazzel, Dorosh, 2007; Christiaensen, Demery, Kuhl, 2010; Ligon & Sadoulet, 2007; WDR, 2007). Technically it would be relatively easy to double or triple the farmers' yields through sustainable intensification (Godfray *et al.,* 2010). Because of economic growth in the East and Southern African region the food value chains are already changing. Changes in urbanization, income and demographics provide opportunities for the agriculture and agribusiness. The world Bank estimates that the value of urban food markets in SSA will increase fourfold over the next two decades, exceeding US $400 billion by 2030 (World Bank, 2013). The development of agriculture can benefit the local farmers and the rural poor. Despite all the opportunities, it is difficult for farmers to benefit from this growing demand. They often lack access to appropriate skills, technologies, information and markets (Brenton, 2012; World Bank, 2013). Institutional change at higher levels than the field and farm is required. Farmers have insufficient power to change rules, procedures, norms, and laws. These unchangeable parameters at the farm level can become manipulable variables at higher system levels (Fresco and Kroonenberg, 1992).

The adoption of innovations is an important component of many agricultural development strategies, which could lead to solutions for developing countries. The innovation literature recognizes different types of innovations including product, process, organizational, business model, and marketing innovations (Batterink et al., 2006). A general definition which will be used in this research is the one of Schumpeter (1934) who defined innovation as "the creation of new combinations". These innovations can be new products, new methods of production, new sources of supply, the exploitation of new markets, or new ways to organize business (Schumpeter, 1934; Batterink et al., 2006). Innovation activities are all scientific, technological, organizational, financial and commercial steps which lead to the implementation of innovations (van Lohuizen, 2016). However, due to traditional approaches to innovation in agriculture, many farmers fail to benefit. The slow rates of innovation of African farmers explain the stagnating agricultural yields. Governments need to invest in sciences that increase yields and in infrastructure to get the resulting technologies to the farmers who need them (Inter-Academy Council, 2004). Important is that the technologies are not only effective, but also appropriate to the context and desired by farmers given their circumstances and needs.

To increase adoption of innovation in SSA, 'coalitions of stakeholders' can be created to identify and address local agricultural development problems. These stakeholders form a multi-stakeholder innovation platform (MSIP): 'Multi stakeholder innovation platforms are a complex innovation network established to help farmers address multi-dimensional problems, by allowing for interaction among stakeholders at various levels of an agricultural value chain' (Pérez Perdomo *et al.,* 2016). In short MSIPs are decentralized local innovations systems, most often applied in developing countries. They are established to help farmers address multi-dimensional problems, by allowing for interaction among stakeholders at various levels of an agricultural value chain (Perdomo *et al.,* 2016). MSIPs bring together stakeholders from a group of villages or district. In theory representatives from different stakeholders will be chosen via a participatory process. These representatives can be farmers, researchers, traders, NGOs, governments and extension workers etc.. Different roles can help to organize collective action of stakeholders at different levels of the innovation network. All parties in MSIPs regularly meet at the platforms and articulate their views and negotiate joint strategies for action. In light of diversity in challenges across localities, one would expect different MSIPs to prioritize different problems and to formulate different strategies for action (Pamuk *et al.,* 2014). MSIPs should function as a springboard for participatory and bottom up processes. Furthermore they engage the broader communities within they are operational by raising awareness and the spreading of information via the assigned MSIP members (FARA, 2008). MSIPs can catalyze energies and synergies that would otherwise remain untapped. However, it will only attract any actors if they see a benefit in participating.

To be able to build more inclusive MSIPs and stimulate innovation among farmers, more information about the value networks wherein farmers are embedded is needed. A value network is any set of roles and interactions in which people or organizations engage in both tangible and intangible exchanges to achieve economic or social good (Allee, 2008). These set of interactions can be the linking or sharing of information, resources, activities and capabilities by organizations with other actors in the system to exchange or pool valuable resources (Grudinschi *et al.,* 2015). In a value network approach organisations focus not only on the company or the industry, but also on the value-creating system itself, within which different economic actors (supplier, partners, allies, and customers) work together to co-produce value (Peppard & Rylander, 2006). Instead of individual firms and farmers competing against each other, more importance is given in forming networks of interconnected organisations. The improvements of farmers are contingent on the environment within which innovation occurs. The farmers and their environments form complex systems which are characterized by a large number of actors, diverse resources exchanges and relationships. Farmers can face heterogeneous constraints in their enabling environment. Differences in access to agricultural products, postharvest technologies, information and markets may lead to different performance. There is a gap in the literature describing the relationship between the embeddedness of farmers and the constraints they face towards innovation.

Value network analysis (VNA) can be a useful tool describing the embeddedness of farmers in the value network. VNA has the key feature of mapping the existing relationships among actors in a system associated with the key resources that these actors exchange or share with each other (Allee, 2008). VNA helps understanding how tangible and intangible assets like inputs, knowledge or relationships can create value. VNA also takes into account informal exchanges and assesses the wider network in the system. Informal exchanges are actually key in creating trust and opening

pathways for innovation and new ideas (Allee, 2006). More understanding about the wider network that creates value through both tangible and intangible resources may lead to insights on the (different) way farmers are embedded in the value network. Classic concepts like value chain analysis (VCA) ignore these important intangible exchanges. Furthermore, VNA reveals useful features of the actors in the value network including their reciprocity, agility and channel- and resource diversification (Allee, 2000; 2008). Reciprocity involves the extent to which an actor shares resources bi-directionally with another actor. The agility of an actor gives information about the degree of separation from one actor to another. The resource diversification of an actor describes the heterogeneity of resources provided or received from other actors. Channel diversification includes the wideness of relationships through which the resources of an actor are shared. These features of actors in a value network may explain the challenges and opportunities that farmers face in coordinating resources effectively. Understanding these features of farmers in the value network helps to assess the wider actor network in the complete system that may influence farmer embeddedness.

More understanding on the farmers' embeddedness in the value network and the wide network of actors that influence embeddedness will be useful in creating more insights in how to overcome market imperfections and increase productivity and farm incomes. More information can be retrieved on the best ways to create, extend, and leverage value and in which way. The outcomes of the VNA may have an influence on farmer innovation. There will be searched for patterns in the embeddedness of farmers and the constraints they face in introducing new products, new methods of production, new sources of supply, the exploitation of new markets or new ways to organize business.

1.1 Problem description

Coffee is a crop commonly grown in Uganda and all around Sub-Saharan Africa. Coffee is the main cash crop of Uganda, and is important for the income of approximately 500,000 farmers who produce coffee. These farmers are heterogeneously embedded into networks, which results into a heterogeneous access to initial resources like information, funding or advice. This results in different abilities for the farmers to seize opportunities deriving from different actors in the value network. Opportunities to develop partnerships that build resource complementarities and may represent entry points for innovation should be identified.

1.2 Research objective

The research project aims to create more understanding in the heterogeneity of farmers' embeddedness in value chains and networks and their ability to innovate by making use of VNA. There is a dearth of studies on which roles are important for managing temporal challenges in agricultural networks in developing countries (Pérez Perdomo *et al.,* 2016). To inform the development and implementation of innovation-support interventions, diagnostic and mapping tools (Rich *et al.* 2009; Alvarez *et al*., 2010; Amankwah *et al.* 2012; Ilukor *et al.* 2015; Schut *et al.* 2015) are critical to define the areas in agricultural systems where changes are needed (e.g. at the production system level, the organizational level, the market level) and which key actors are involved, or should be involved, to induce and help produce those changes. Value network analysis will be a useful mapping tool to investigate this. More information about the flow of tangible and intangible products will create a clear overview of the value creation process. This could obtain insights on implications on how to involve farmers with a marginalized embeddedness into processes which enhance their access to initial resources and may lead towards innovation. The research topic in this project will specifically lead to new insights on how and where to facilitate innovation in the coffee sector of the Manafwa district in Uganda. Furthermore by doing this research more insights will be gained in how, the relatively new VNA tool, allows mapping value chains and networks. Although the literature on value networks and value network analysis has reached an increasingly interest (Allee, 2002, 2006, 2008; Lock Lee, 2007; Meggitt and Allee, 2006; Optimice Pty. Ltd., 2008; Anger, 2008; Plambeck and Denend, 2008) there is not a specific method for describing in detail how to map a value network. Allee (2011) has described the basics of value network mapping but provides no details about how to identify the added value that every actor brings to a network or how to identify the participants' assets (e.g., the value flows within the network). Therefore, more research is needed in this area. In this research VNA will help to understand the complex network as a whole, in order to understand how and why value is created by farmers. Placed in the context of the research VNA offers a way to model, analyse, evaluate and improve the capability of farmers to convert both tangible and intangible assets into other forms of negotiable value.

1.3 Research Questions

Main research question

"How does the heterogeneity of smallholder farmers' embeddedness in value chains and networks influence their ability to innovate?"

Sub research questions

(1) What is the value network smallholder farmers are embedded in?
(2) What are smallholders farmers' relationships with actors in their network?
(3) Is there heterogeneity between farmers' embeddedness in the value network?
(4) How does farmer embeddedness in the value network relate to constraints towards innovation?

1.4 Research Framework

A research framework defines a set of different research activities. Moreover, it defines what kind of research activities can be used to produce specific outputs (Oulon Yliopisto, 2007). The research framework gives a schematic representation of the research objective and includes the approximate steps that need to be taken in order to realize the research objective (figure 1). In the research approach first a study on literature and secondary data is conducted. The information retrieved from the literature study and the secondary data is used to give more background information on the studied subject and used concepts. Specifically there was searched for literature concerning VNA, the farmers' characteristics, the value network farmers are embedded in and the innovation of farmers. The empirical background provides more insights about the case being studied. Altogether, a clear answer can be provided for the sub research questions one and two, concerning the value network farmers are embedded in, and the relationships with the actors in their network. The embeddedness analysis shows the heterogeneity in farmers' embeddedness in the value network. In this analysis a closer look to the features reciprocity, resource diversification, and channel diversification was taken. In the next step of the data analysis value network maps were made from the results of the VNA. These maps show how different clusters of farmers in the coffee value network in Manafwa interrelate with other actors and exchange resources. The characteristics and embeddedness of the farmers in the value network will be linked to the different kind of constrains the farmers face towards innovation. Finally, after answering the sub-research questions, in the conclusion the general research question is discussed. The objective of the research is to investigate how the heterogeneity of farmers' embeddedness in value chains and networks influences their ability to innovate. More specifically the constraints the farmers face towards innovation will be discussed.

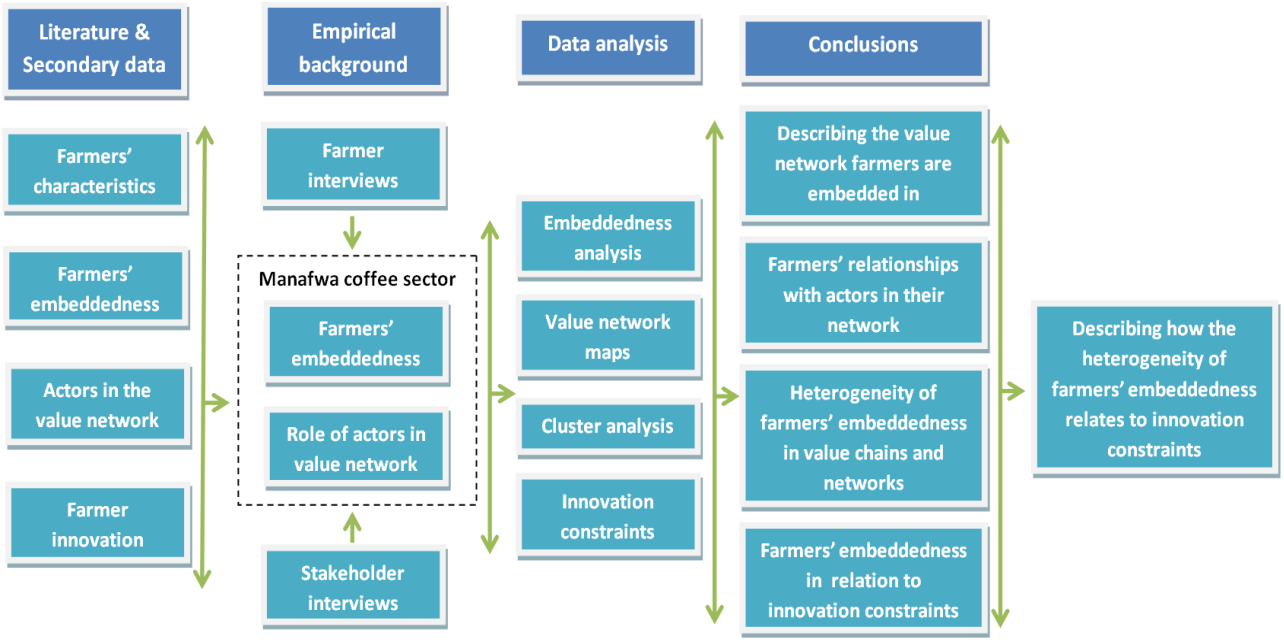

Figure 1. Research framework

2. Theoretical underpinning

In this chapter the theoretical concepts which are used in this research are introduced and further discussed. First the value chains and netchains concept are shortly introduced. This are widely known concepts which have proven their use in research. Subsequently VNA will be introduced, and there will be discussed what the difference and added value of a VNA will be in this research compared with the classic concepts. Furthermore a literature study is conducted to gather information on farmers' characteristics, farmers' embeddedness and innovation in farmer networks.

2.1 Value chain

The value chain concept has been used for the last 30 years to understand and analyse industries (porter, 1980; Porter 1985). It has proven to be a very useful mechanism for portraying the chained linkage of activities that exist in the physical world within traditional industries. It also framed our thinking about value and value creation. However, in times where products and services become dematerialised and the value chain itself no longer has a physical dimension, the value chain concept becomes an inappropriate device to analyse all sources of value (Normann and Ramirez, 1994; Parolini, 1999; Tapscott et al., 2000; Hakansson and Snehota, 1989; Campbell and Wilson, 1996). The value chain is designed around the activities which are required to produce the end product. Every company occupies a position in the chain. Upstream suppliers provide inputs before passing them downstream to the next actor in the chain. However, in a networked economy the key of value creation lies in understanding how value is created in relationships among different actors (Blankenburg Holm *et al.,* 1999; Anderson, 1995). The relationships among the actors are part of a larger whole. Therefore it is necessary to extend any analysis away from viewing value creation from the perspective of an organisation as an actor in the value chain, and look at the set of interdependent relationships in a network (figure 2).

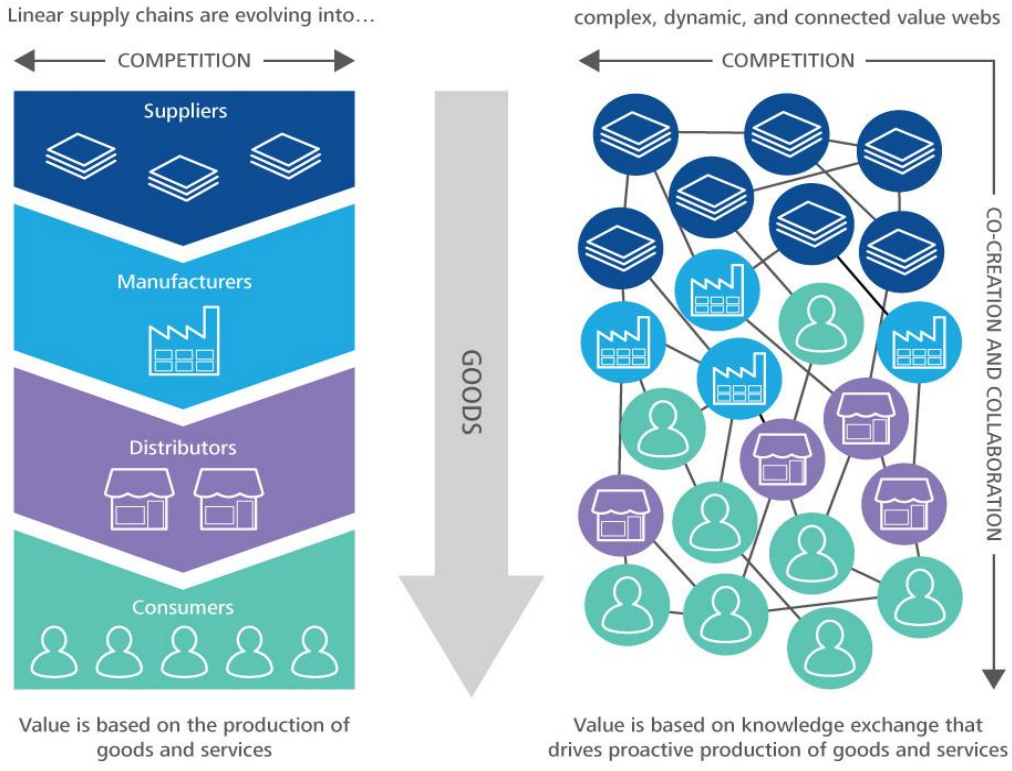

Figure 2. From value chains to value networks. (Kelly & Marchese 2015).

2.2 Netchain

The netchain concept uses a combination of two widely known management concepts, supply chain analyses (SCA) and network analyses (NA). Supply chains are defined as a set of sequential vertically, organized transactions representing successive stages of value creation (Lazzarini *et al.,* 2001). SCA is used to provide understanding in vertical interdependencies, resource allocation and the information flow between firms engaged in sequential stages of production (Christopher, 1998; Simchi-Levi *et al.,* 2000). NA provides tools to map the structure of inter-organizational relationships (Granovetter, 1973; Burt, 1992; Nohria, 1992; Wasserman & Faust, 1994). NA is rather focused on horizontal relationships between firms (Powell, 1990). A netchain analysis is a combination of both SCA and NA. A netchain is a set of networks, comprised of horizontal ties between firms within a particular industry or group, which are sequentially arranged based on vertical ties between firms in different layers (figure 3) (Lazzarini *et al.,* 2001). It is becoming increasingly important to evaluate not only how suppliers transact with a given buyer, but also how they interact between themselves to promote, for example, knowledge exchange (Stuart *et al.,* 1998; Dyer and Nobeoka, 2000). With netchains complex inter-organizational relations can be studied, both vertical and horizontal. If there is only a focus on vertical or horizontal type of interdependence, crucial elements involving other types of interdependence which may be responsible for a substantial part of the rent creation in the system, are likely to be missed (Lazzari *et al.,* 2001). In figure 3 there are three type of interdependencies between actors displayed. These three types of interdependencies are shown in figure 4. Pooled interdependence occurs when each individual in a group makes a discrete, well-defined contribution to a given task. This is the simplest type of interdependence. Sequential interdependence is when the activities of a firm precede those of another. It is a series of structured tasks. Reciprocal interdependences are the most complex. This type of interdependence involves simultaneous, ongoing relationships between parties in which each agent's input is dependent on the others' output and vice-versa (Thompson, 1967).

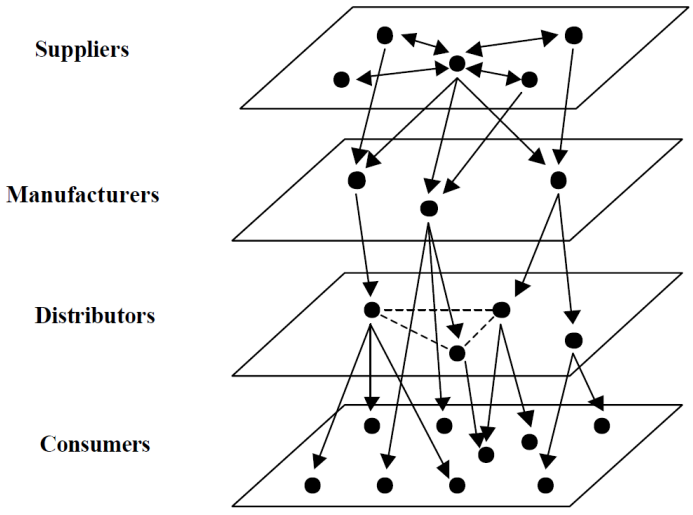

Figure 3. Example of a generic netchain. (Lazzarini et al., 2001)

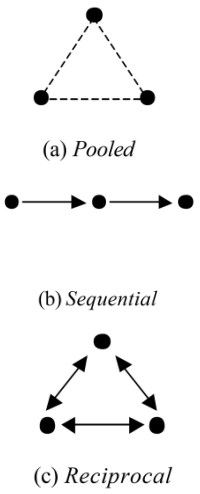

Figure 4. Types of interdependence. (Lazzarini et al., 2001)

2.3 Value Network Analysis

A value network is any set of roles and interactions in which actors engage in both tangible and intangible exchanges to achieve economic or social good (Allee, 2008). Networks consist of different specific roles and value interactions, all oriented towards the achievement of a particular outcome. The active agents in these networks are actors, who have particular roles in the network in which they convert both tangible and intangible assets into negotiable offerings and fulfill different functions. When one type of value or good has been created or realized from another type of value, a value conversion has been executed. Value conversion is the act of converting or transforming financial to non-financial value, or transforming an intangible input or asset into a financial value or asset (figure 5) (Allee, 2008). Intangibles go to market through conversion to monetary value or through conversion to a negotiable form of value that can be used more informally as a type of barter (Allee, 2003). Most estimates place intangible value at 50 to 70 percent of company value (Wild, 2009). However, according to top executives management, in the classic concepts not enough attention is given to the intangible exchanges and value (Gordon-Miller, 2004). Participants in value networks, either individually or collectively, utilize their tangible and intangible asset base by assuming or creating roles that convert those assets into more negotiable forms of value that can be delivered to other roles through the execution of a transaction.

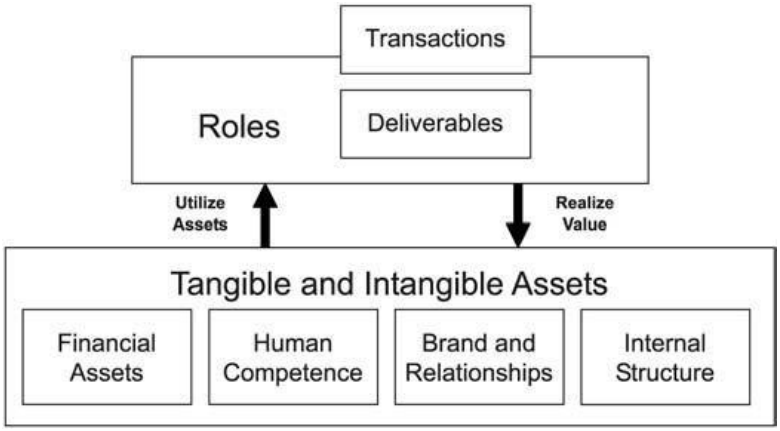

Figure 5. Value conversion strategy model. (Alee, 2008)

The need of understanding the fundamentals about particular value networks has yielded the proposition of value network analysis (Allee, 2011). VNA is a tool for qualitatively analyzing value networks. It is useful in analyzing tangible and intangible assets and identifying inefficient value flows, role interdependencies and response-delivery relationships of the value networks (Zwickl, Reichl & Ghezzi, 2001). VNA offers a way to model, analyse, evaluate, and improve the capability of a business to convert both tangible and intangible assets into other forms of negotiable value, and to realize greater value for itself (Allee, 2008). This offers researchers, managers, supervisors, analysts and front-line workers a more organic and accurate way to describe organizational and firm-level performance in complex environments. VNA can provide a better understanding in the value creating roles and relationships in a value network. It offers a dynamic view of how both financial and non-financial assets can be converted in negotiable forms of value, which has a positive impact on the relationships among the value network participants. It is essential to understand the functioning of a network as a whole, in order to understand how and why value is created. The number of academic articles and case studies referencing VNA is multiplying rapidly. The ability of VNA to better describe effective networks has been clearly demonstrated at many organizations addressing a wide range of business issues.

Although classic concepts provide powerful insights into patterns of relationships and communication flows, they fall short in describing the overall performance of an organization. Netchain analysis is useful to gain more understanding on actor's relationships and how institutions influence actors' relationships in value chains (Rick *et al.,* 2009) or show how to structurally map actors' relationships along the netchain in terms of number and type of interdependence (Lazzarini *et al.,* 2001). But a netchain analysis does not provide an empirical map that relates, at once, the existing interrelations among all actors, including the resources shared or exchanged among each other. The empirical link between network patterns and value creation or realization for the firm or the generation of economic and social good has not been well demonstrated (Allee, 2009). VNA has three key differences compared to the classic concept being used (table 1).

Table 1. Key differences between classic concept and Value Network Analysis.

Classic concepts	Value Network Analysis
The complete value chain is analyzed. Taken into account all actors providing activities which are required to produce the end product.	The complete value network is analyzed. Also taken into account the actors beyond the scope of the product chain.
One link represented between actors.	Multiple links represented between actors.
Tells about the type of interdependence between two actors.	Tells about the type of interdependence between two actors and gives information about the exchanged resources.

First, in netchain analysis there is only one link represented between actors. This makes the analysis of multiple variables and unique characteristics, describing different types of social or economic exchange, difficult. The second, and probably most important added value of VNA is that, relative to classic concepts, the complete value network is analyzed. VNA takes into account actors such as NGOs, government, research institutes, etc., which are beyond the scope of the product chain, but are important for innovation in agricultural systems (Levy 2008; Mair and Marti 2009; Kulve 2010; Klerkx et al., 2010). VNA includes all aspects of the network with all actors whose presence in the network can influence value creation of an actor. In VNA also the actors which are separated from the value chain are included. Actors like funding organizations and education institutes play important roles in the value creation within a value network. The links and influence of these actors, one degree separated from the value chain, are missing in the classic concepts. VNA takes into account the relationships among actors within and outside the traditional agricultural value chains. Figure 6 displays this key point of difference of VNA relative to VCA or netchain analysis. VNA makes it possible to also gain insights in the critical roles these actors, with one degree of separation from the value chain, play in creating financial, social and environmental value in the value networks (Allee, 2008).

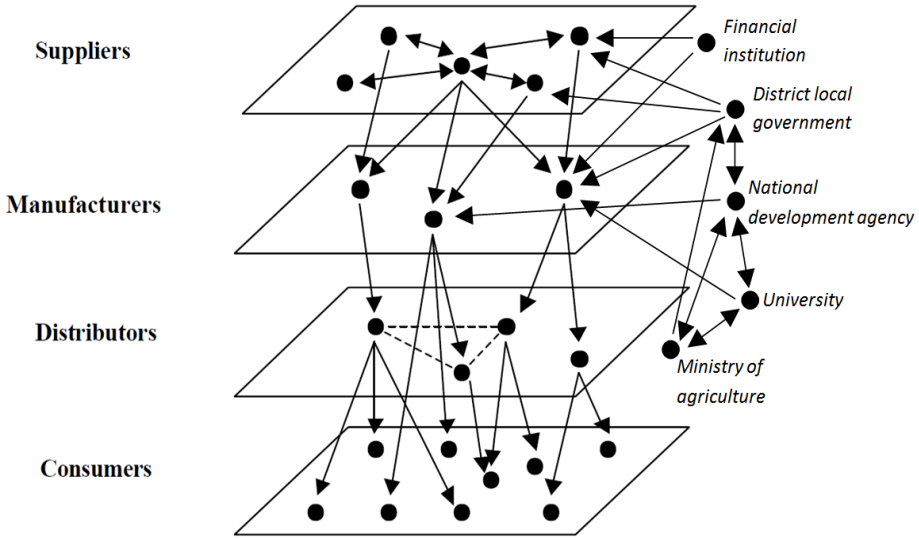

Figure 6. Key point of difference of VNA relative to netchain analysis. (Lazzarini et al., 2001)

And thirdly, different from classic concepts VNA has the key feature of mapping the existing relationships among actors in a system associated with the key resources that these actors exchange or share with each other. Where a netchain analysis will only tell the type of interdependence between two actors a VNA will also give information about the exchanged resource(s) (figure 7). The classic concepts only describe a reciprocal relationship between two actors in the value chain. A VNA will describe a reciprocal relationship as actor A providing information to actor B, and actor B exchanging a financial loan to actor A. Knowing more about the type of exchanged resources gives more insights in the value network as a whole, and the type of interdependencies between the actors.

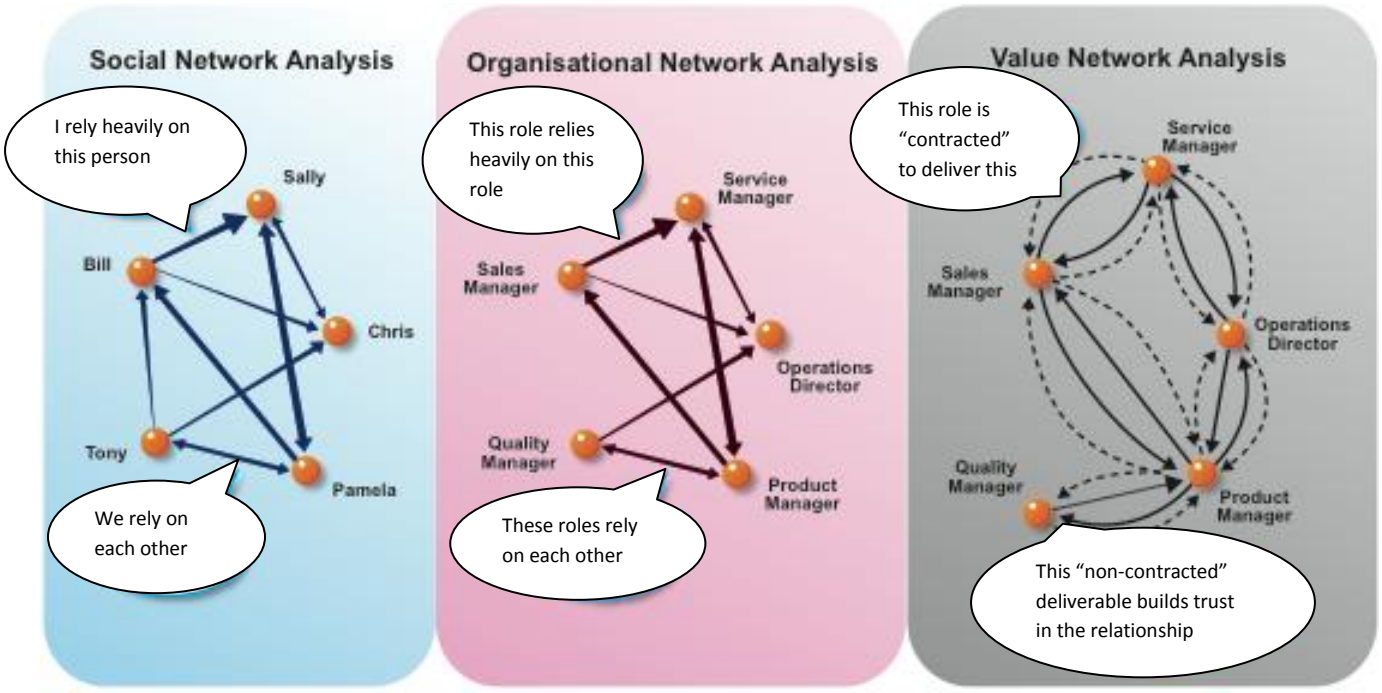

Figure 7. Added value of VNA compared with classic tools.(Besana, 2012).

VNA reveals useful features of the actors in the value network including their reciprocity, agility and channel- and resource diversification. Reciprocity involves the extent to which an actor shares resources bi-directionally with another actor. The agility of an actor gives information about the degree of separation from one actor to another. The resource diversification of an actor describes the heterogeneity of resources provided or received from other actors. Channel diversification includes the wideness of relationships through which the resources of an actor are shared (Allee, 2000; 2008). These four features are useful in describing the embeddedness of actors in the value network. Insights in the differences between investigated actors on the scores of features like reciprocity or channel diversification can tell more about the differences in how and to which extend these actors are embedded in the system. Furthermore, mapping the variation in resources from diverse actors contributes in disentangling the interdependent problems constraining innovation in complex agricultural systems. Knowing the resource distributions and mechanism of value creation facilitates more understanding in the value distribution and the specific role of the actors in the value network. Mapping the resource flows among the actors provides more precise information on how the actors in the value network influence each other. It leads to a better understanding of the underlying power structures of the actors in the system, and why actors in the system are more or less in favor of change (Smink *et al.,* 2013). This leads to a clear view of the innovation constraints of the marginalized actors in the value network and provides insights on implications how to enhance inclusion of these actors (Thompson and Scoones, 2009; Foran *et al.,* 2014). VNA tackles the broad question of how value is created among multiple actors. It does not only assume that value lies mainly within the chain (i.e. value chain and netchain analysis), but takes into account the relationships and value creation among actors within and outside the chain (Peppard and Rylander, 2006). Relationships are viewed as part of a larger interconnected whole. Including the four features and the innovation system makes VNA useful to analyze and inform stakeholders on their pathway to innovation.

2.4 Farmers' characteristics

The improvements of farmers are contingent on different characteristics of the farmers and the environment in which farmers are embedded. Some farmers are better able to introduce anything new successfully into the economic and social process. Farmers face different risks and constraints (figure 8). In this chapter a closer look will be taken at the different characteristics of farmers namely location, gender, age and farm.

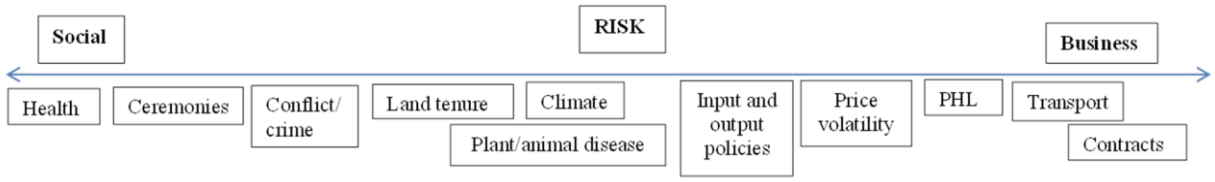

Figure 8. Risks faced by smallholder farmers. (IFAD, 2010).

2.4.1 Location

An important constraint which preserves the rural poverty is the extreme degree of geographical isolation of SSA farmers. 34% of the rural population in SSA live more than five hours from a market town of 5,000 people or more (table 2). This is striking considering the great number of people living in SSA compared with the Middle East & North Africa, South Asia, Central Asia, East Asia & Pacific and Latin America & Caribbean. The density of the road network in SSA is substantially lower than in

other developing regions. Only one-third of the people in SSA live within two kilometers of an all-season road. In other developing regions approximately two-third of the people live within an all-season road (Dorosh *et al.,* 2009).

Table 2. People living more than five hours to a market town of 5,000 people or more. (Sebastian, 2007).

Region	Percentage	Number (millions)
South Asia	5%	45
East Sia & Pacific	17%	188
Latin America & Caribbean	20%	26
Middle East & North Africa	31%	23
Central Asia	32%	32
Sub-Saharan Africa	34%	131

The constraining access to markets has a negative impact on the agricultural productivity of the farmers. If a farmer cannot profitably market their surplus, then there is no incentive to produce more than their farm can store or consume. Thus, there will be no or little motivation to adopt productivity enhancing technologies and/or to apply external inputs such as fertilizers and pesticides, which are costly and may not be available for the farmer at all. A farmer will be producing at a lower rate of their theoretical agronomic potential when located further away from a major city (Teravaninthorn & Raballand, 2008). The transportation costs to receive inputs and evacuate products are one of the biggest significant impacts of the distance to markets the farmers in SSA face. Figure 9 shows the price formation of fertilizer in different countries in Africa and Asia. The price of fertilizer is, on average, 80% more expensive in Mali than in Thailand. Landlocked countries like Mali and Uganda typically must absorb US$ 50-100 per ton in additional transport costs to have goods delivered from the nearest port to their own border (Bumb, 2009). Because of small market size and fragmentation it is also more difficult to achieve economies of scale, which are needed for more efficient production or import (World Bank, N.D.).

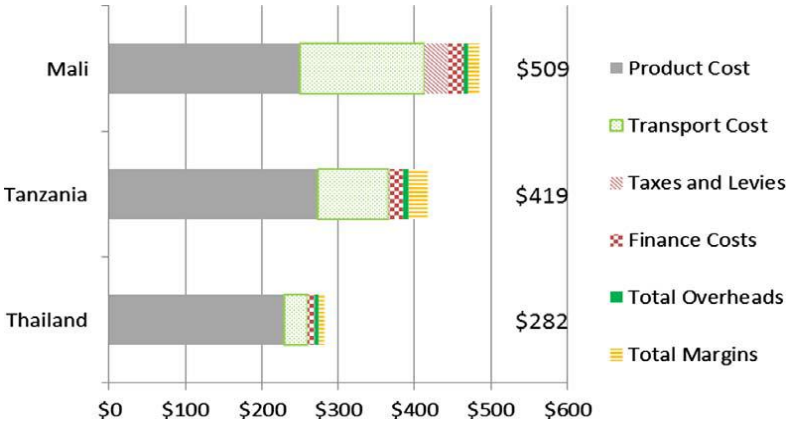

Figure 9. Fertilizer price formation per metric ton in Thailand, Tanzania and Mali in 2006. (Bumb, 2009).

2.4.2 Gender

In SSA women face greater barriers than men in accessing agricultural markets to sell their produce at reasonable prices and to access capital to raise their productivity and farm incomes (Jiggins, 1989; World Bank, 2011; Peterman, Quisumbing & Behrman, 2014). Women are particularly vulnerable to

exploitative trading practices and have weak bargaining positions with predominantly male networks in the value network (Balaku, Mayoux and Remmer, 2009; Jones, Smith and Wills, 2012). These constraints limit the agricultural productivity of women in SSA (Goldstein & Udry, 2008; Peterman *et al.,* 2011). Participation in collective action through cooperatives has been promoted as a promising strategy for female farmers to overcome market imperfections and increase the productivity in their farm incomes (Birchall. 2003; Pandolfelli, Meinzen-Dick & Dohrn, 2008; Markelova *et al.,* 2009; Quisumbing and Pandolfelli, 2010; Datta & Gailey, 2012; Majurin, 2012). However, one important aspect of farmers' membership in cooperatives can be land ownership (Meier zu Selhausen, 2016). Because land traditionally belongs to men, women are often not eligible to join cooperatives in cases where land ownerships is a condition for joining. Also in the cases where women own land, tenure insecurity lowers women's agricultural productivity in the medium run (Goldstein & Udry, 2008). Governments and donors realize that one of the critical factors in revitalizing agriculture in SSA, and elsewhere in Africa, is to raise the productivity of women farmers (Saito, Mekonnen & Spurling, 1994). The African rural household is already changing and traditional farming systems are breaking down. The gender-specific nature of African farming is disappearing as women are growing crops (such as coffee), take on tasks traditionally performed by men, and make decisions on the daily management of the farm and household. Female-headed households are becoming increasingly common in SSA (Saito, Mekonnen & Spurling, 1994).

2.4.3 Age

The age of a farmer can play a role in a farmers' production and a farmers' ability to develop. Farm operations are often heavy, and require much strength. The labour productivity of a farmer, necessary for farm-based technologies, decreases with age (Tauer, 1995). Younger farmers are more productive than their older counterparts. Younger farmers are also technically more progressive compared with older farmers. The younger farmers show greater willingness to adopt to new practices (Ike *et al.,* 2006). However, a farmers' years of experience positively correlates with his/her age. Older and more experienced farmers may be knowledgeable on various practices.

2.4.4 Farm size

The total land area per farmer (average farm size) are ultimately dictated by a region's farm population. Total land area available for agriculture changes relatively little from year to year, and in developing countries most rural people are farming. Changes in average farm size are ultimately driven by changes in the total population of a specific region. For most crops, cost-effective farm sizes are that of a household enterprise that balances the cost of supervising employed workers against any sources of scale economies such as mechanization (Masters *et al.,* 2013). Small farms are often characterized by a more intensive land utilization due to a higher cropping intensity, and/or to the cultivation of a higher proportion of operated land (Cornia, 1985). It is regularly hypothesized that farmers with a bigger farm size are more willing to invest in new technologies. However, given the observance of positive (Smit and Smithers, 1992; Fuglie, 1999), negative (Shortle and Miranowski, 1986; Clay et al., 1998) and insignificant correlations (Nowak, 1987; Agbamu, 1995), the overall impact of farm size on adoption is clearly inconclusive.

2.5 Farmers' embeddedness

Individuals and organizations do not typically possess al the requisite resources and capabilities to innovate. Therefore actors are integrated into value networks with other actors who can contribute resources and expertise they lack (Ryocroft & Kash, 1999; Christensen & Raynor, 2003). The

development of farmers is influenced by their network embeddedness. The network embeddedness describes the network of actors a person or organization is involved in (Methorst, Roep and Verstegen, 2016). The network embeddedness can be re-conceptualized as the value network relations. Important is in which value network farmers are a part of or linked to, or which networks or spheres of influence affect their farm development. Each farmer has a location with its own local supply of resources of a social, cultural, human and natural character (Casini *et al.*, 2012). One of the main hurdles for farmers in developing countries is their inability to integrate into navigable networks comprised of public extension workers, researchers, traders and public policies on science, education, investment, technology and agriculture. Therefore they lack access to markets, financing and technical and commercial information. Often farmers do not have adequate social and human resources to integrate into these navigable networks. Also in many cases the farmers do not operate in an institutional environment where such networks easily form.

2.6 Innovation in smallholder farmers networks

The growth and development of the agriculture in Sub-Saharan Africa is influenced by complex interactions among public, private and civil society actors. The market and policy regimes are rapidly changing, which affects the technical opportunities, knowledge flows and innovation processes (Spielman *et al.,* 2009). Given the complexity of agricultural systems, multiple actors need coordination to effectively support innovations either at farm level or along the related food supply chains (Thompson and Scoones 2009; Klerkx et al. 2010; Dentoni et al. 2011; Foran et al., 2014; Pamuk et al., 2014). The basis for any type of development is the ability of individuals, organizations, and societies to improve on what they are currently doing. The actors need to be able to improve their individual and collective capabilities. A successful innovation process is determined by the extent to which value networks gather sufficient variation in capabilities and resources from diverse agents. Innovation can have an important socioeconomic impact only when it is part of a sustained processes involving many actors with different capabilities and resources (Spielman *et al.,* 2009). For new or complex innovations actors have to interact often to resolve unexpected problems and to discuss the technical and market uncertainties derived from the innovation (Ryocroft & Kash, 1999; Christensen & Raynor, 2003). The ability to perform these new or complex innovations depends on a networks' effectiveness. Network effectiveness depends on the collective capacity to facilitate exchanges of information and resources (Spielman *et al.,* 2009).

2.7 Theoretical Framework

This research investigates the relationship among farmers' embeddedness in value networks and their innovation. In the research VNA is used to provide more understanding about the way farmers are embedded in the value network. After conducting the literature research it is found that characteristics like location, gender, age, and farm size are widely known indicators which may influence the embeddedness of a farmer. Also the roles of the other actors in the value network and the role interdependencies in the network may influence the embeddedness of a farmer. The relationship between farmers' characteristics and value networks on farmers' embeddedness will be investigated. The embeddedness of a farmer will be described using the four features reciprocity, agility, resource diversification, and channel diversification (Allee, 2000; 2008).

In the next step the relationship of farmers' embeddedness and farmers' ability to innovate will be investigated. Specifically there will be looked into the constraints the farmers face towards innovation. These constraints are further defined into: Access to inputs, access to services, and access to markets. The constraints will be put in the context of the environment in which the innovation occurs, namely the coffee value network in Manafwa. Figure 10 provides an overview of the described framework.

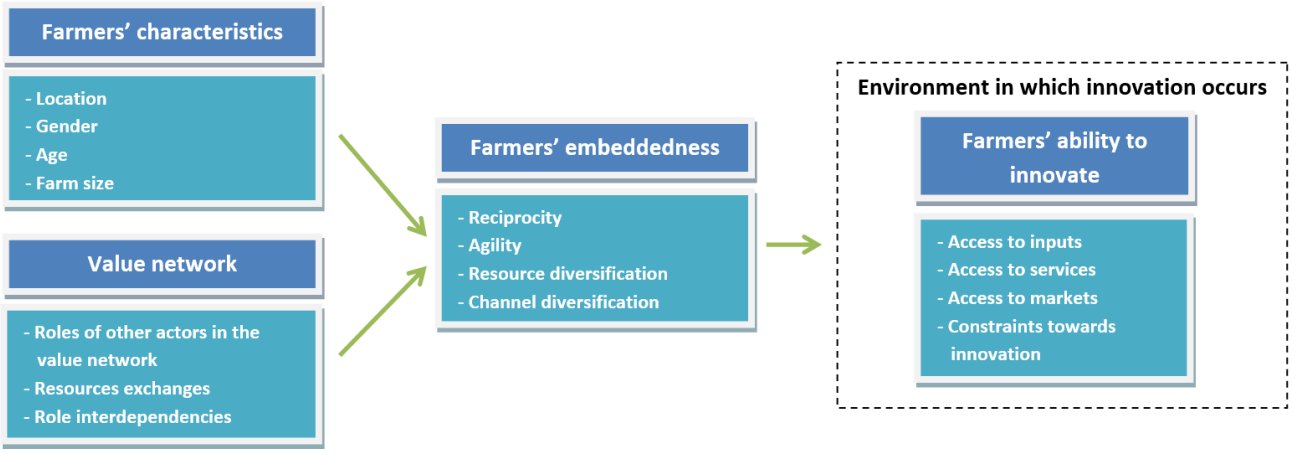

Figure 10. Theoretical framework.

3. Methods of data collection and analysis

3.1 Research strategy

The research strategy considers decisions regarding the method by which the research will be carried out and analysed (Verschuren & Doorewaard, 2010). The design of this research study is based upon a case study approach. A case study examines phenomena in their natural setting, without any control over behavioural events, and with a focus on contemporary events. In general case studies are the preferred strategy in answering "how" or "why" questions. The case study has been a common research strategy in social work (Gilgun, 1994) and business (Ghauri & Gronhaug, 2002). The case study is an appropriate research strategy when the researcher has little or no control of events (Yin, 2003). These reasons make the case study approach the best research strategy for this research. This case study will be explanatory and will provide an answer to the "how" questions of the research. A holistic multiple-case design will be used. In the data-collection there is searched for patterns and explanations for the developments. With the patterns and relationships found a theory can be build. The theories are formulated towards the end of the research, as a result of the interviews (Goddard and Melville, 2004). The benefit of the inductive approach in this case study is that the researcher is free to alter the direction of the study after the research process commenced.

This research aims to gain a deeper understanding in the impact of the heterogeneity of farmers' embeddedness in value chains and networks. Therefore, the research will predominantly employ qualitative data by using data collection methods. The methods of secondary data collection, semi-structured interviews and desk studies will be used. Table 3 describes the research methods, used for every research question, further in context.

Table 3. Methodological framework

Research question	Source category	Research method
GRQ: How does the heterogeneity of smallholder farmers' embeddedness in value chains and networks influence their ability to innovate?	Literature Documents Farmers & stakeholders	Literature study Secondary data Semi-structured interviews
SRQ 1: What is the value network smallholder farmers are embedded in?	Documents Stakeholders	Secondary data Semi-structured interviews
SRQ 2: What are smallholders farmers' relationships with actors in their network?	Documents Farmers	Secondary data Semi-structured interviews
SRQ 3: Is their heterogeneity between farmers' embeddedness in the value network?	Literature Farmers	Literature study Semi-structured interviews
SRQ 4: How does farmer embeddedness in the value network relate to constraints towards innovation?	Literature Farmers & stakeholders	Literature study Semi-structured interview

Before further explaining the empirical data collection methods, first more information about the case background and sample selection will be given.

3.2 Case background

More information on the VIP4FS project, the Ugandan coffee market and the study area, the Manafwa district, will be given.

3.2.1 Background VIP4FS project

The Value Chains Innovation Platforms for Food Security (VIP4FS) is a research and development project that seeks to use a participatory action research process involving different stakeholders to improve income and food security in the project sites. VIP4FS is a four year project funded by the Australian Government through the Australian Centre for International Agricultural Research (ACIAR). The project strives for delivering new and diversified enterprise options (particularly for women), enhanced market chains for smallholder agriculture and increased productivity, quality and market access for agriculture and agroforestry products. Because of limited resources and the desire to create an impact, there is decided to work with three commodities in the VIP4FS project. The selection criteria for the commodities are described in appendix 1. Based on the selection criteria the following commodities were selected (in descending order of importance as reflected in the criteria); coffee, dairy (milk) and bee-keeping (honey). Because of time limitations this research will focus on one commodity, namely coffee.

3.2.2 Background Ugandan coffee market

Uganda is one of Africa's major coffee exporters. In 2015 Uganda exported a total of 3.60 million 60 kilo bags. Of which 2.78 million bags Robusta and 0.81 million bags Arabica (UCDA, 2016). The type of coffee subject to this research is Arabica coffee, which is grown in multiple sub-counties in the Manafwa district. The total exported value of coffee in Uganda 2015 was $402,634,000 (International Trade Centre (ITC), 2016). The coffee market is dependent on smallholder farmers. There are around 500,000 smallholder farmers who produce coffee (Chiputwa, Spielmand and Qaim, 2015). Uganda has the 21th highest exported value of coffee in the world and the second highest in Africa. In Africa only Ethiopia has a higher exported value of coffee (ITC, 2016). Uganda accounts for 18.5% of the exported value of coffee in Africa in 2015. Most of the Ugandan coffee goes to Italy, North and South Sudan, Germany, and Belgium. The last five years the exported value of coffee decreased with 13.7%. However, coffee is still the most important commodity for Uganda. In 2015 coffee accounted for 17.8% of their total exported value (figure 11). In that year the total amount of exported Arabica coffee increased with 9.46% compared with 2014 (UCDA, 2016).

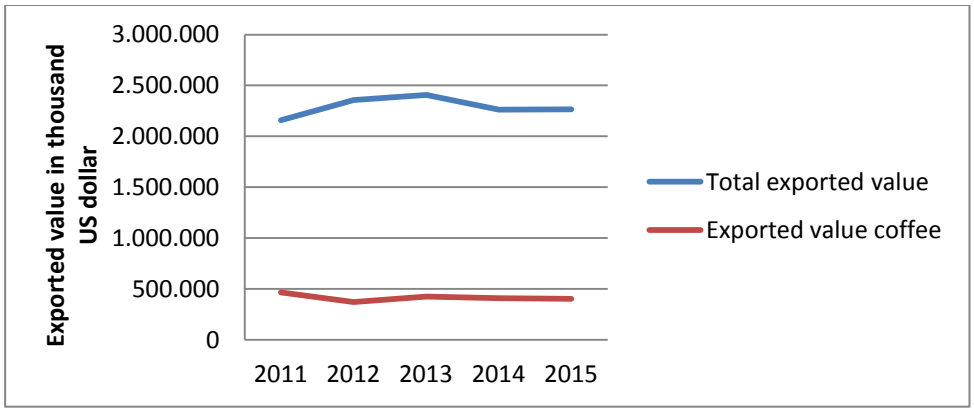

Figure 11 . Exported value Uganda.

The US dollar is the reference currency of the coffee transactions between Uganda and the domestic market. There is a strong positive relationship between the national currency of Uganda and the New York futures market of coffee (International Coffee Council, 2015). This indicates that the exchange rates in relation to the US dollar (US$) and the price of coffee develop in the same direction (table 4). A strong US dollar in relation to the Ugandan shilling (UGX) coincides with an increase in the price of coffee. This relationship is important regarding the price fluctuations of the coffee parchment. Many farmers need to deal with this inconvenience. The price fluctuations in coffee lead to an insecure and unstable income for the farmers.

Table 4: Results of the regression tests of the relationship of the exchange rates of national currencies in relation to the US dollar (January 2002 - December 2014). (International Coffee Council, 2015).

	UGX/US$	UGX/US$
	New York futures	**London futures**
Multiple R	0.64	0.55
R Square	0.42	0.30
a	0.10	0.04
b	-74.70	-16.40

3.2.3 Background Manafwa district

Uganda is divided into regions, sub regions, districts, sub-counties, parishes and cities/villages (in descending order from high to low). The selected case for this research study is the coffee sector in the Manafwa district. Manafwa is located in the Eastern region of Uganda, which is marked orange in figure 12. Every region in Uganda is divided into sub-regions. Manafwa is one of the five districts that make up the greater Bugisu sub-region. The district Manafwa is further divided into thirty sub-counties. In these sub-counties parishes are located which are further divided into towns and villages. The context in which the farmers from these villages live and operate has influence on their embeddedness and innovation. In the VNA this context is also taken into account. In this paragraph more context will be provided on the population statistics, legislative and organizational structure, geographical context and land use, agricultural economy and the supply and demand of food resources, group formation and the infrastructure and the accessibility of markets regarding the Manafwa district.

Population statistics

The Manafwa district has a population of 353,825 people (UNPHC, 2014). The population is distributed among 72,903 households with an average of 4.8 persons per household (UBOS, 2014). 85.5% of the people live in rural areas. In Manafwa there is a population density of 586 persons per square kilometre, which is considered to be much in Uganda. The Bugisu sub-region is home mainly to the Gisu people. People in Manafwa speak English, Luganda and Lugisu. Although most farmers are only fluent in Lugisu.

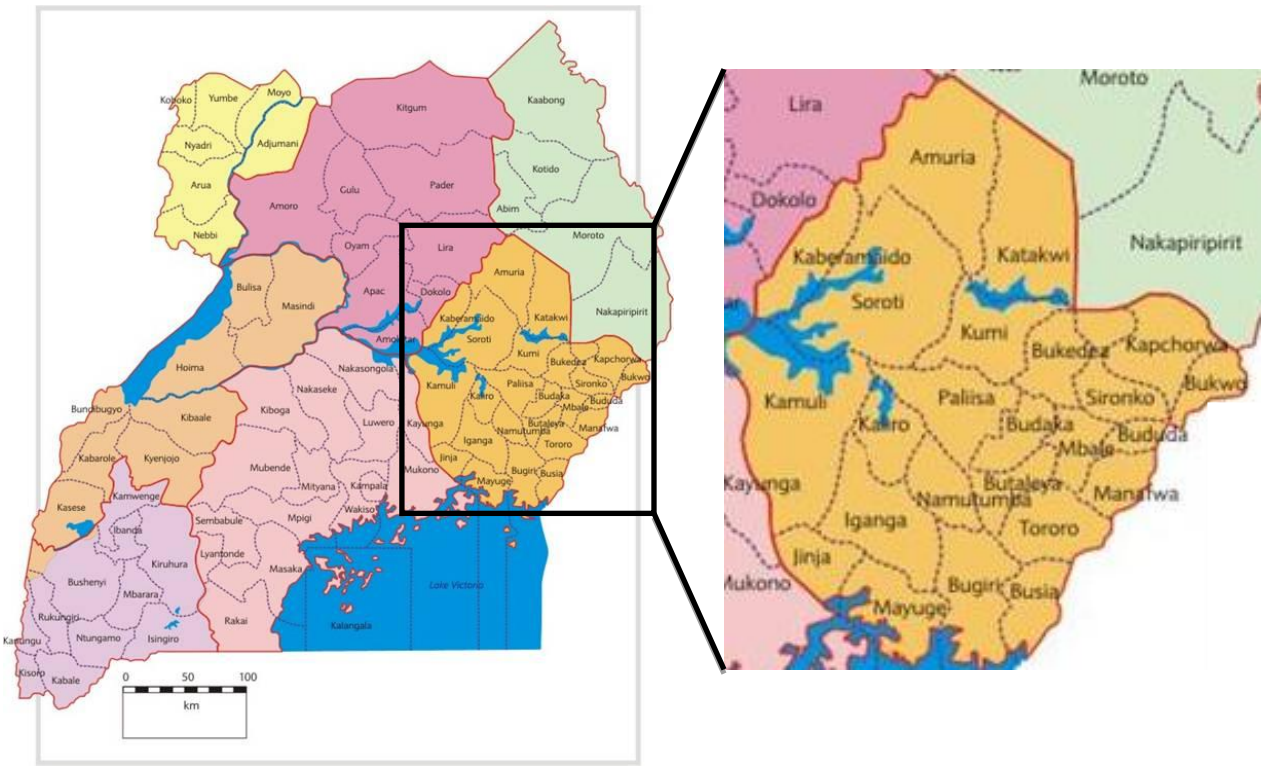

Figure 12. Uganda map (Turkmenistan, 2009).

Legislative and organizational structure

The legislative framework in Uganda has a pyramidal structure of Local Councils (LC) at district (LC5), county (LC4), sub-county (LC3), parish (LC2) and village (LC1) levels (Francis & James, 2003). The most critical levels for action are LC1, LC3 and LC5 (Oduol *et al.,* 2016). Villages are the lowest political administrative unit, consisting of approximately 50 to 70 households (Kavuma, 2009).

The administrative structure at the local government levels covers a political and a technical arm. The political arm is led by an elected chairman and is composed of elected councillors. The technical arm, composed of civil servants, is led by the chief administrative officer (CAO), who is appointed by the president's office. It is the task of the political arm to raise awareness, monitor and promote effective implementation of government programs at all levels. The council has various standing committees that help in various functions of management. These committees include the District Service Commission, District Land Board and the Public Accounts Committee. The civil servants are organized in departments, based on type of technical service provided. These departments reflect the different ministries and include production, education, work, health and security. Through these departments services are provided to the communities.

Geographic context and land use

Coffee is the main cash crop in Manafwa, particularly in the highlands (Oduol *et al.,* 2016). The income generated from coffee enterprises is likely to be higher compared to that from other enterprises (Oduol *et al.,* 2016). Also more differentiation is possible with coffee, compared with other crops. Nearly every sub-county and every household in Manafwa participates in the coffee value network. It is estimated that about 80% of the households in Manafwa are likely to benefit from improvements in the coffee chain (Oduol *et al.,* 2016).

The landscape of Manafwa is generally categorised in three different landscapes; the lowland, midland and highland. Each landscape has different characteristics.

Agricultural economy

Agricultural activities in Manafwa are coordinated by the district production office. This office is divided into four departments, (I) Crop production, (II) Livestock and Entomology, (III) Natural Resources: Environment, Land and Physical Planning and (IV) Commerce and Trade (Oduol *et al.,* 2016). The most important income generating activities for the communities are crop production, livestock and petty trade (in descending order). Crops commonly grown in Manafwa are perennial crops like coffee, bananas and other fruits, but also annual crops like maize, potatoes, beans and groundnuts. The same crops are grown in all three different landscapes, but their popularity, performance and importance varies across the lowlands, midlands and highlands because of the differences in the environmental factors and soil fertility status (Oduol *et al.,* 2016).

Group organization

There can be made a distinction in three levels of group organization in Manafwa; producer organizations (PO), semi-area cooperative enterprises (SACEs) which are also locally named as growers cooperative societies (GCSs) and the area cooperative enterprises (ACE) (figure 13). The most simple form of group organization is a producer organization. The majority of groups in Manafwa belong to this category. A producer organization consist of a small number of individuals who often come from the same village. Together they aim to improve their production and to market some of their commodities. In Manafwa there are 142 producer organizations involved in the coffee market (Kasaato, 2017). Second are the SACEs. These groups consist of more members than a producer organization and have members from more than one village. The amount of people in a SACE often goes beyond 100. SACEs often are more organized and can have offices. They bulk and store commodities from their members. In Manafwa there are 29 SACEs involved in the coffee market (Kasaato, 2017). The difference of the first two and the ACE is that not individuals, but other groups are the members of an ACE. ACEs are active in multiple sub-counties in the district and they bulk and market the commodities they collect from producer organizations and semi-area cooperative enterprises. In Manafwa there are four ACEs involved in the coffee market (Kasaato, 2017). For the sake of convenience SACEs will be further categorized as POs because they are only mentioned a few times in the research. This means that only a distinction between POs and ACEs will be made in this research.

Figure 13. Group organization in Manafwa.

Infrastructure and accessibility of markets

The Manafwa district only contains unpaved roads. Especially during a rainy period it can be hard to travel around. Most smallholder farmers do not own any transportation vehicles. Therefore many farmers prefer to sell at farm gate. The benefit of this is that the traders who visit the farm take responsibility for the transportation cost. Other places where farmers sell their produce are the weekly markets around the main roads or nearby trading centres or towns. Some of the people who have access to transport take their produce to neighbouring districts like Mbale. The market in Mbale is better developed but the farmers have to travel a long distance on the poor road network and hilly terrain (table 5). The farmers sell their produce individually.

Table 5. Accessibility from Sub-Counties to Mbale.

	Distance to Mbale	Travel time to Mbale by car
Bukhofu	39km	1.00 hour
Namabya	40km	1.30 hours
Mukoto	48km	2.30 hours

Not only the market, but the form in which farmers sell their coffee produce makes a big difference. In figure 24 the different stages along the coffee value chain are visualized. Most of the farmers in this research sold their coffee produce in the form of parchment, which is comparable to Fair Average Quality (F.A.Q) in the figure. Five farmers sold red coffee cherries. As shown in the figure the price increases steeply along the product chain. Every processing step the farmers are able to perform will result in more profits.

Figure 14. The coffee value chain (Nucafe, 2017).

3.3 Data collection

As shown in table 3, in this research use has been made of literature, documents, farmers and other stakeholders to investigate the research questions. Farmers and other stakeholders are the prime source of information, acting in the role of informants. In this section the empirical data collection methods to collect data from literature, documents and people will be further explained.

3.3.1 Literature & Secondary data

For the literature study mainly the resource engines Scopus, Google Scholar and the online library of Wageningen University & Research were used. Articles from the Journal on chain and network science were very useful for this research. For the secondary data research documents from the World Bank were widely used. For a better understanding of the coffee value chain in Manafwa the scoping study of Oduol *et al.,* (2016) was very useful. This study gives insights into potential value chains and institutional arrangements in Manafwa.

3.3.2 Interviews

During the research a research team of ICRAF Uganda helped under the name of the VIP4FS project. The team was composed of researchers, translators and drivers. The people in the VIP4FS team coordinated the contact with the interviewees and contributed during the data collection. Three

interviewers conducted a total of 38 interviews, which all took place in December 2016. Interviews were performed both in the native language and in English. The duration of one single interview ranged between 30 and 60 minutes approximately. The reason for the big range in the duration time of the interviews is the language gap. The interviews held in English tended to take more time. In the research different stakeholders in the value network have been interviewed to be able to gather information from multiple perspectives in the value network. For the data collection twenty-seven farmers, five middle man, one area cooperative enterprise, two processors/exporters, one input supplier and two local government employees were interviewed (appendix 2). Interviews with farmers and other stakeholders involved in the coffee value network in Manafwa have led to the necessary information to create the value network maps and understand the different value network configurations in which the farmers are embedded. By interviewing other stakeholders in the value network as well it was possible to interpreted how actors coordinate with each other. The information retrieved from other stakeholders was also beneficial in identifying the opportunities for improved coordination and resource flows in the overall system. More insights were gained in what the farmers gain from the relationships with the other stakeholders, or what the farmers could potentially gain if a potential relationship would be in place (Zott and Amit, 2010; Dentoni and Peterson, 2011). The other stakeholders interviewed are perceived as key informants of the coffee value network. Key informants are people who have a good understanding of the market situation from their position in the market value chains (Ferris et al., 2006). An overview of the key informants and their contribution is given in table 6.

Table 6. Overview of the other stakeholders in the value network interviewed and their key information.

Name	Role of interviewee in the value network	Key information provided by interviewee
Kaatoh Masawa Alex	Input supplier at Ramah agro inputs	Provides information on how farmers, farmer groups, government and NGOs access inputs. Gives information about the application of inputs and the benefits for the farmers. Is able to tell more about the constraints farmers face in the inputs market.
Mukulumi Dari **Kemdu George** **Naibkiire Phoebe** **Nasambi Micheal** **Mayuku Jabasihan**	Middlemen	Provide information on the role of middlemen in the value network. Give more insights in the distribution of the coffee and the transportation limitations. Are able to give examples of the constraints farmers face. Reflect on the role of processors/exporters in the value network.
Nabisi Benara	Project manager at Mt. Elgon Arabic Coffee Farmers Society	Provides information on the role of ACEs in the value network. Is able to give examples of ACEs initiatives to stimulate farmers development. Provides information on the distribution of coffee.
Wabulo **Ssenfuka Joseph**	Operations manager at BCU Field officer at Kyagalanyi	Provide information on the relationship and resource exchanges of the processors/exporters and farmers. Are able to give examples of processors/exporters initiatives to stimulate farmers' development. Provide information on distribution, quality and price of coffee. Reflect on the role of middlemen in the value network.
John Basco	Agricultural officer of the district local government of Manafwa	Provides information on the role and involvement of the public sector in providing advice, funding, information, regulation, infrastructure and training to the farmers.

Kisenge Robert	Sub-county president in Namabya	Provides information on the coordination between farmers and other stakeholders in Namabya. Is able to give examples of constraints which the farmers in Namabya face.

For the number of replications, the important consideration is related to the researchers' sense of the complexity of the realm of external validity (Yin, 2002). Because of the complexity of the system, and the suspect of much impact from external conditions, there is chosen for a bigger number of interviewees. Due to the exploratory mode of the research, it was not possible to determine the most appropriate theoretical base to use to guide project selection before the data collection process. Therefore, the decision was made to select farmers that differed on a range of measures: geographical location, gender of the head of the household, age and the size of farm. To be able to achieve more certain and generalizable results at least eight smallholder farmers were interviewed in each selected sub-county. By selecting a bigger number of farmers it was more likely to grasp more heterogeneous embedded farmers. By selecting the interviewees there was made sure that there was a wide representation of differences in the range of measures. Capturing a heterogeneity of farmers' characteristics is necessary to understand the relation between farmers' embeddedness and their ability to innovate.

Semi-structured, open-ended type of interviews were conducted. Semi-structured interviewing is best used when there is only one chance to interview someone, and when a researcher will need to go out into the field to collect data (Bernard, 1988). This type of interviewing will enable interviewees to expand on what they consider to be important and to frame those issues in their terms (Meredith *et al.,* 1989). The researcher can raise further questions if during the interview the experiences and responses from the interviewee opens new possibilities. The interviews were conducted individually, face-to-face, in an natural environment. If necessary, the help of a translator was used during the interview. The interview was recorded if the interviewee gave his/her approval and if a recording device was available. Anonymization of the data was discussed with the respondents. There is promised that the information that will be made public out of the interviews will not be able to be traced back to the respondent or his/her company.

Interview guides

During the research use has been made of two interview guides. One interview guide is designed for the farmers (appendix 4) and the other interview guide is designed for the other actors in the coffee value network (appendix 5). Both interview guides consist of four parts, namely: General information, Supply side constrains, Demand side constraints and Innovation. Because many parts of both interview guides are similar, first the four parts for the farmer interview guide will be further explained. Thereafter the differences of the interview guide for the other actors with the interview guide of farmers will be discussed. The interview guide of the other actors is smaller. This gave the interviewer more room to expand on the information what was considered to be important for each type of actor.

GENERAL INFORMATION - The first questions of the interview give some more background information of the interviewee. It are easy to answer questions concerning gender, age, household, farm size and crop production. These questions help the interviewee to get comfortable and gain confidence in answering the questions.

SUPPLY-SIDE CONSTRAINTS - The questions in the supply-side constraints consist of questions concerning inputs and services used for the production of coffee. First the interviewee is asked to list all the inputs and services he/she uses and to name the actor, quantity and frequency concerning the provided inputs and services. It gives more context of the network in which the interviewee is embedded. This gives an overview of all the exchanged resources of the farmer. After listing the provided inputs and services the farmers are asked to list the problems they face in ensuring sufficient inputs and services and who the perceived actor(s) is/(are) who is/(are) contributing to this problem. After they listed all the problems they face, they are asked to rank the mentioned problems regarding their importance. More detailed in-depth questions follow about the two major problems which they face in ensuring sufficient inputs and services for production. These follow up questions provide more information about what type of influence the perceived actor has on the problem in the farmers' opinion. Further, the interviewee is also asked who he/she thinks is also influenced or affected by the described problems.

DEMAND-SIDE CONSTRAINS - The setup of the questions in the demand-side constraints is similar to the questions asked before in the supply-side constraints part. Only in this part the interviewee is asked about the actors involved in selling the produce, and the problems they face in this process. More information on the resources going from the farmers is retrieved.

INNOVATION - In this part the interviewees are asked if, and how they applied new practices in their farm. This will lead to more insights in the possible innovations farmers apply to their farm. Also questions regarding the competitive position of the farmer related to other farmers are asked. The following definition of competitive advantage will be used for the purpose of this question: 'most forms of competitive advantage mean either that a firm can produce some service or product that its customers value (more) than those produced by competitors or that it can produce its service or product at a lower cost than its competitors' (Saloner, Shepard and Podolny, 2001). The definition of Saloner *et al.* (2001) is suitable in this situation because it can potentially ensure the maintaining of a farmers' leading position. It gives more insights in the question why some farmers perform better than other farmers. This can lead to more insights in what marginalized farmers can do to be able to facilitate more innovation in their farm.

The general information asked for the other actors is less comprehensive. Other actors are interviewed to get a more comprehensive view of the position of farmers in the coffee value network. Comparable with the farmer interview protocol, the first questions provide more details about the interviewee. It are easy to answer questions. In this protocol more details about the job and, if applicable, the company of the interviewee are asked. In the supply side constraints and demand side constraints almost the same questions are asked as in the farmer interview protocol. The difference is that in the other actors interview protocol the questions 12, 16 and 20 of the farmer interview protocol are left out. In question 12 and 16 the farmers are asked to list the inputs and services they use, and in question 20 they are asked to list the buyers of their coffee products. These questions are not applicable for other actors involved in the coffee value network. In the last part, innovation, the same questions are asked as in the farmer interview protocol. The other actors are asked how farmers they did business with applied new practices in the last five years. And also what they, as an actor involved in the value network of the coffee farmers (i.e. a trader, processor/exporter or input supplier), believe can be a farmer's biggest competitive advantage and disadvantage.

The interview guides consists of a clear set of instructions and structure for the interviewer. The first interviews also served as an orientation and were important to get a clear picture of the situation and people in the Manafwa district. After the first two interviews minor changes have been applied to the interview guides. Some interviews took place on site, which made it possible to gather supplementary data by observation. This can prove value in two ways. First, it offers the possibility of corroboration of interview data through methodological triangulation. Second, it proves data on context.

3.3.3 Sample selection

Different sampling methods have been used for different stakeholders. One by one the specific sample selection methods which have been used will be discussed. Table 7 provides an overview of all interviewees.

Cluster sampling and quota sampling

For the selection of the farmers cluster sampling and quota sampling were used. First the population was divided into three groups based on geographic region. The three clusters were lowland (Bukhofu), midland (Namabya) and highland (Mukoto). The coordinator of the VIP4FS team would contact a local person with a high rank and network located in the selected villages representing the lowland, midland and highland. In order to create no expectations from the farmers beforehand, the village contact persons would inform all the farmers only one day before the field research. On the day of the field research all the farmers who would be available and willing to participate in the research would come to one point in the village to be interviewed. This point was often located in a convenient and known place (i.e. the market square or the office of the producer organization). When selecting the farmers in each village the coordinator of the VIP4FS team requested to the village contact persons that there should be at least two females among the interviewees who are the head of the household. The purpose of this was to obtain a sample that is representative for the conditions in Uganda and to do research on the impact of the gender on the heterogeneity of embeddedness of farmers in the value network. In 2011 29.5% of the households in Uganda had a female head (World Bank, 2015). In the data collection two female headed households were selected in Bukhofu, three in Namabya and three in Mukoto. This means that the percentage of female headed households in the complete research sample 29.6% is.

Convenience sampling

For the selection of the middlemen, area cooperative enterprise and one employee of the local government, convenience sampling has been used. Many middlemen in the Manafwa district gather in the village called Bukhaweka. The location Bukhaweka was selected because it was easily accessible and the probabilities of a high amount of middlemen available to interview was high. Furthermore an office of the ACE Mt. Elgon Arabica Coffee Farmers Cooperative Society is located in Bukhaweka. Because of time and money constrictions only middlemen and an ACE from this place have been interviewed. It was possible to interview five middlemen. The middlemen indicated that approximately 40 middlemen are active in the same market. All five middlemen traded in coffee. Some of the middlemen also traded in other commodities like beans and maize. They were selling the coffee to different actors like Great Lakes, BCU, Kyagalanyi and Bubikala organic coffee cooperative society. The interview at Mt. Elgon was held with the project manager of the ACE. He was a high placed employee in the cooperative with executive power to influence the direction and

strategy of the cooperative. During the field work in the midland Namabya the sub county president (LC3 chairman) was present at the same location. It was possible to make use of this opportunity and interview him. The sub-county president is in the highest executive position of the sub-county and has a good understanding of the situation and the activities concerning the farmers in Namabya.

Judgmental sampling

For the selection of government, input suppliers and processors/exporters judgemental sampling has been used. Via the coordinator of the VIP4FS team contact was made with the agricultural officer of the district local government of Manafwa. With his expertise and network contact was made with an input supplier and two processors/exporters located in Mbale. The agricultural officer has been active in the community for many years, and was therefore able to give a fair judgement of who to select for a representative sample and accurate data. Being the first person interviewed, the agricultural officer was very useful in providing important information on the actors involved in the coffee value network in Manafwa and the role interdependencies. The interviewees representing the processors/exporters were an operations manager working for BCU and a field officer working for Kyagalanyi. Especially the operations manager at BCU had many years of experience in the company. Both interviewees consisted of a broad understanding of the activities in the coffee value network and their companies' impact on the development of farmers. The input supplier who was interviewed was one of the many input suppliers active in the market. Therefore this one interview may not be a representative sample, and there is a chance of incomplete information.

Table 7. Overview of interviewees

# of interview	Name (function and organization)	Location	Date of interview
Smallholder farmers			
1	Mutuma Valantino	Bukhofu	01-12-2016
2	Naigaga Mary	Bukhofu	01-12-2016
3	Honialya Patrick	Bukhofu	01-12-2016
4	Matuka Scola	Bukhofu	01-12-2016
5	Dinah Nambuya	Bukhofu	01-12-2016
6	Peter Wasubire	Bukhofu	01-12-2016
7	Robert Wamutinti	Bukhofu	01-12-2016
8	Wamalwa Joseph	Bukhofu	01-12-2016
9	Nabifo Allen	Bukhofu	01-12-2016
10	Nambwali Constant	Bukhofu	01-12-2016
11	Bukas Ford	Mukoto	02-12-2016
12	Sambula Beatrice	Mukoto	02-12-2016
13	Klakyaula Ekisofeli	Mukoto	02-12-2016
14	Klamono Patrick	Mukoto	02-12-2016
15	Nasitacia Wangutusi	Mukoto	02-12-2016
16	Masika Anthony	Mukoto	02-12-2016
17	Jane Timbiti	Mukoto	02-12-2016
18	Dison Masolo	Mukoto	02-12-2016
19	Kaloasi Joshua	Mukoto	02-12-2016
20	Benina Nabyrure	Namabya	03-12-2016
21	Grace Nabuso	Namabya	03-12-2016
22	Ernest Klasike	Namabya	03-12-2016

23	Bilah Nafula	Namabya	03-12-2016
24	Bilu Sifuma	Namabya	03-12-2016
25	Bufambo Joseph	Namabya	03-12-2016
26	Maiki Patrick	Namabya	03-12-2016
27	Kwomu Stephen	Namabya	03-12-2016
Input dealer			
28	Kaatoh Masawa Alex (Input dealer at Ramah agro inputs)	Mbale	06-12-2016
Middlemen			
29	Mukulumi Dari	Bukhaweka	05-12-2016
30	Kemdu George	Bukhaweka	05-12-2016
31	Niabkiire Phoebe	Bukhaweka	05-12-2016
32	Nasambi Micheal	Bukhaweka	05-12-2016
33	Mayuku Jabasihan	Bukhaweka	05-12-2016
ACE			
34	Nabisi Benara (Project manager at Mt. Elgon Arabic Coffee Farmers Society)	Bukhaweka	05-12-2016
Traders/processors/exporters			
35	Wabulo (operations manager at BCU)	Mbale	06-12-2016
36	Ssenfuka Joseph (field officer at Kyagalanyi)	Mbale	06-12-2016
Government			
37	John Basco (agricultural officer of the DLG of Manafwa)	Manafwa	01-12-2016
38	Kisenge Robert (sub-county president of Namabya)	Namabya	03-12-2016

3.4 Data analysis

In the data analysis there was searched for patterns in the data, and for ideas that helped to explain the existence of these patterns. It was important to stay very self-critical during the data analysis. The collected data was written down on paper immediately during the interview. Due to the big amount of interviews (38) and the lack of recording devices to record all interviewees there is chosen not to transcribe the interviews. It is also very doubtful if the advantage of analyzing transcribed data would outweigh the effort of transcribing all the interviews. The data sheets with the information of the conducted interviews were kept safely by the researcher, who had access to the data at all times during the research. Next to the data sheets some of the interviews (15) were recorded. The recordings of the interviews made it possible to get access to selective passages of the interviews and to listen again to the exact answers given by (15 of) the interviewees. Next to the data sheets and the recordings a summary of the data was made in Microsoft Excel. The Excel file gave a clear overview of the collected data and made much of the most important information given by the interviewees easily accessible during the data analysis. Furthermore, some of the information in the Excel file could later be directly copied into SPSS for further analysis.

The data analysis consists of four steps. In the first step the farmers are given a quantitative score for three of the four features, namely reciprocity, resource diversification and channel diversification. This score is given according to a rubric based on the collected data. This step is important to get a clear overview of the difference in the embeddedness of the farmers. The second step is the cluster analysis. In the cluster analysis a distinction is made between three different clusters of farmers. These three clusters will be further described in the results. Thereafter, in the third step, the exchanged resources in the coffee value network from the three clusters of farmers are displayed in

value network maps. In these maps the differences between the way how the different clusters of farmers are embedded will be visual. A corresponding table gives more information on the features of the other actors in the value network. Finally, in step four, a closer look will be taken to the innovation constraints farmers from the different clusters face.

3.4.1 Embeddedness analysis

The collected data consist of information of the existing relationships and resources exchanges farmers have with other actors in the value network. As explained before, this data is originally qualitative data. The type of relationships and resources exchanged have been represented in words. An example of these possible relationships described is: *"I receive quarterly information from the government extension service providers"* or *"the government has failed to provide extension service workers in our community".* In order to analyse the data further and get more understanding out of the impact of all the resource exchanges farmers are involved in, quantifying the data was helpful. Therefore the qualitative described resource exchanges with the actors in the value network map were transformed into quantitative scores. Quantitative scores allow us to get a quick and clear overview of the situation described. Of the four features the value network map reveals there was chosen to only quantify three of them, namely reciprocity, resource diversification and channel diversification. Agility was not quantified because it is hard to give one general score of agility to a farmer. Agility describes the separation of one actor to another. Farmers are embedded in a network with many different actors. It is not possible to measure the agility of farmers with all actors in the network. Furthermore farmers receive the same resources from different actors in the network. Measuring the agility of farmers with banks will not result to any conclusions about a farmers' ability to access credit. This is because farmers can also receive credit from other farmers, producer organizations or village savings and loan associations (VSLAs).

For every farmer a specific indication in the form of low, medium or high was given on the three features mentioned (table 9). The scores of each of the three features reflect the key dimensions of embeddedness of the famer in the value network. In the distinction between low, medium and high reciprocity there was looked if the farmers share resources bi-directionally with other factors in the value network. For the feature resource diversification there was looked closer to the exchanged resources of a farmer, namely: 'information', 'advice', 'training', 'funding' and 'commodities in exchange for money' (table 8). For the resources 'commodities in exchange for money' and 'funding' different types of commodities and funding like loans, seedlings or pesticides each counted as one exchanged resource. In table 8 also the two resources hierarchy/rules and infrastructure are shown. However, these two resources were not used in the embeddedness analysis. They are included later in the analysis in the value network maps (Paragraph 4.3). The reason that these two resources are not included in the embeddedness analysis is that each farmer already receives hierarchy/rules and infrastructure from the government, and in most cases a farmer group. Despite that this exchange of hierarchy/rules and infrastructure can be from a different quality, it will make no difference in the final outcome of this quantitative analysis. That is a shortcoming of this quantitative analysis. The channel diversification was measured looking at how many different actors farmers are exchanging resources with. Again, there is not looked into the quantity of the exchanged resources.

Table 8. Definition of exchanged resources

	Resource	Definition*
A	**Advice**	An opinion that someone offers the other about what he/she should do or how he/she should act in a particular situation
C	**Commodities in exchange for money**	The act of giving commodities to someone and the other giving you money in return
F	**Funding**	Money or commodities given by government, group or organization
H	**Hierarchy/rules**	Accepted principle or instructions that state the way things should be done, and tells what you are allowed or are not allowed to do
K	**Infrastructure**	Basis systems and services such as transport and power supplies that people and organizations use in order to work effectively
I	**Information**	Facts about farming/pricing/business/health
T	**Training**	The process of learning the skills you need to do a particular job or activity

*Based on the definition of the Cambridge dictionary.

Table 9. Definition of different level of features defining smallholder farmer embeddedness

	Reciprocity	Resource diversification	Channel diversification
1 Low	These farmers do not share any resources bi-directionally with other actors in the value network.	These farmers receive three or less different kind of resources. Most often these resources are: Seedlings, information and artificial fertilizers. These farmers provide only one resource, namely commodities.	These farmers exchange resources with three different actors at most.
2 Medium	These farmers are more experienced farmers. They give information and advice to others.	These farmers receive four or five different kind of resources. Most often these resources are: Seedlings, information, artificial fertilizers, pesticides and training. These farmers provide one or two resource(s), namely commodities and/or information, advice, or pulping services.	These farmers exchange resources with four to five different actors.
3 High	These farmers own a pulping machine. Other farmers or producer organizations use this pulping machine in exchange for money.	These farmers receive more than five different kind of resources. Most often these resources are: Seedlings, information, artificial fertilizers, pesticides, training, advice and loans. These farmers provide at least two resources, namely commodities and information, advice, or pulping services.	These farmers exchange resources with at least six different actors

3.4.2 Cluster analysis

In the second step of the analysis a cluster analysis was performed using SPSS. A cluster analysis is a statistical technique that sorts observations into similar sets or groups (Ketchen and Shook, 1996). A total of ten inputs were used to determine the different groups among the farmers. Table 10 gives an overview of the ten inputs used and their description. Within this sample of inputs are the three features defined in the embeddedness analysis, reciprocity, resource diversification and channel diversification. The other seven inputs are: 'gender of household head', 'age', 'sub-county', 'amount of land used for coffee production', 'use of pesticides', 'use of artificial fertilizers', and 'buyer'.

Table 10. Variables used for cluster analysis.

Variable	Description
Gender head of household	The gender of the head of the household
Age	The age of the head of the household
Sub-county	The sub-county where the farm is located
Total land coffee	The total size land the farmer is using for the production of coffee (measured in acres)
Buyer	The main buyer who the farmers is selling his/her produce to.
Use of artificial fertilizers	The use of artificial fertilizers like NPK triple 17, CAN or DAP on the coffee farm.
Use of pesticides	The use of pesticides like Sumuthionum, Thionex or Spirinex on the coffee farm.
Reciprocity	The extent to which the farmer shares resources bi-directionally with other actors
Resource diversification	The heterogeneity of resources the farmer provides or receives from other actors
Channel diversification	The wideness of relationships through which the resources of the farmer are shared

For the cluster analysis use has been made of Two-Step cluster procedure. The reason for this was the use of both nominal variables (i.e. 'gender of household head', 'sub-county' and 'buyer') and continues variables (i.e. 'age' and 'amount of land used for coffee production'). If a mixture of nominal and continuous variables is used then the Two-Step cluster procedure must be used (Norušis, 2012; Field, 2013). To determine the optimal number of clusters in the first analysis the clustering criterion is set on Akaike's Information Criterion (AIC) combined with an unspecified number of clusters, with a maximum of fifteen clusters. This analysis lead to figure 15. To be able to find the optimal number of clusters there was searched for a minimum value for AIC. The ideal number of clusters was found to be two or three clusters. This lead to a second and third cluster analysis, using a specified fixed number of clusters as outcome of the analysis. The second and third run with a number of two clusters and three clusters lead to identical fits of the quality of the defined clusters. Both two and three clusters showed a score of 0.3 on the Silhouette measure of cohesion and seperation. There is chosen to use the specified number of three clusters for further analysis because the three clusters defined showed good variation between the clusters and good similarities within the clusters. Three clusters seemed to better grasp the differences between the different groups of farmers interviewed.

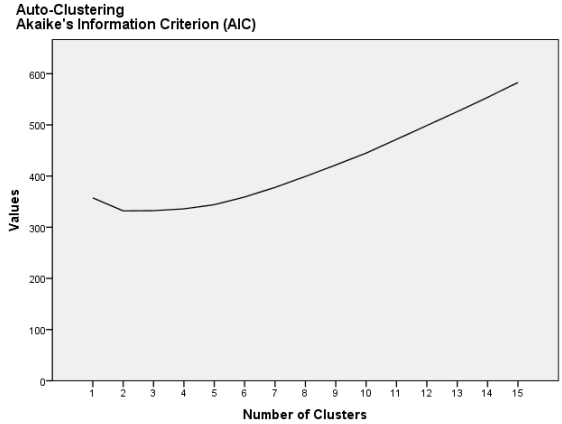

Figure 15. Akaike's Information Criterion – Lowest point indicating the optimal number of clusters.

3.4.3 Value network maps

VNA was applied mapping the interrelationships among the different actors involved in and around the Manafwa coffee network. Based on the value network maps, it was possible to interpret how actors currently coordinate with each other in pooling or accessing resources to support innovation and to identify opportunities for improving coordination and create value in the overall system. Information on exchanged resources among actors is qualitative (e.g., the maps illustrate that two actors exchange money and information, but not how much money or information). Yet, the mapped key resources are strategic (Das and Teng 2000), that is, interviewees consider them as the underlying valuable resources achieved from the relationship.

First one concept value network map of the whole value network was made after secondary data research of the scoping study of Oduol *et al.,* (2016). Key information from the document was organized in order to summarize which actor has which role in the value network. The purpose of the first concept value network map was to address what is being done in the value network and who the key players are. After the first concept value network map was finalized, it was presented to the contact person in Manafwa. Additions were made according to the received feedback. During the empirical data collection of the research the researcher asked interview respondents (both farmers and other stakeholders) to present their interpretation of the value network map. Especially the information retrieved from interviews with other stakeholders was valuable in this stage of the research. Based on their interpretations more additions on the map have been made. Finally, when all the data was collected, on the basis of data analysis the value network maps were completed. The value network maps reveal useful features of actors in the coffee value network. The maps also provide more in-depth information, including the four different features of actors in the system ;1. Reciprocity, 2. Agility, 3. Resource diversification, 4. Channel diversification (Allee 2000; 2008). Table 14 summarizes the results of the value network maps and provides more information on the other actors in the network regarding the four features.

3.4.4 Innovation constraints

The final part of the analysis is the innovation constraints analysis. In the interviews the farmers were asked to mention the constraints they face in ensuring sufficient inputs for production, ensuring sufficient services for production and in selling their coffee produce. The farmers could mention as many problems as they would like to. After listing the constraints the farmers were asked to rank the constraints, and more detailed questions about the two most important constraints in each of the three categories were asked. After coding all the mentioned constraints more general constraints were formulated. Mentioned constraints like "*I do not have enough credit*", "*my income is too low*", or "*it is hard for me to get a loan*" were coded as the constraint 'Lack of capital'. The coding has been done for all three categories. After coding the mentioned constraints there were seven constraints left for the supply-side inputs category, seven for the supply-side services category, and eight for the demand-side category. Table 11 gives the codes of the constraints and also gives examples of the more specific constraints the farmers mentioned in the interviews.

Table 11. Examples of constraints in the three categories.

Inputs constraints	Examples	Services constraints	Examples	Demand constraints	Examples
Lack of capital	- Not enough credit - Hard access to credit - Poor incomes	**Lack of capital**	- No sources for loans - Hard access to credit	**Low coffee prices**	- Poor market price - Trader underpays the farmer
High prices for inputs	- Price of fertilizer is too high - Price of pesticides is too high	**Lack of extension services**	- No extension workers - Not enough extension workers	**Price fluctuations**	- No stable prices
Malicious traders	- Thieves - Traders use fake weighing scales - Fake inputs	**High price of information/ advice**	- Not enough money to buy information - Not enough credit for extension services	**Malicious traders**	- Fake weighing scales
Not enough/or bad provision of funded goods	- Wrong timing of provided seedlings - Not enough seedlings provided - Government should provide more inputs	**Wrong time in provision of services**	- Wrong training given at wrong time	**Hard access to transportation**	- Expensive transport - Big distance to transport
Hard access to inputs	- Input suppliers are located far away - Lack of pulping machines - Expensive to hire pulping machine	**Poor weather conditions**	- Climate change - Dry season	**Lack of processing equipment/skills**	- Lack of processing equipment - Lack of pulping machine - Lack of skills to pulp
Lack of knowledge/skills on inputs	- Not enough information to apply pesticides.	**Lack of processing equipment**	- No pulping machines.	**Delay in payments**	- Takes too long to receive money for sold produce
Poor land and climate	- Climate changes - Many pest and diseases on the land - Poor land for farming	**Other**		**Low quality of coffee**	- Coffee did not meet the quality requirements demanded by the buyer
				Other	

After coding the constraints there was counted how often each constraint was mentioned by the farmers from the different clusters. When a farmer mentioned two constraints with the same code in one category, this code was counted only once. For example: In the supply-side inputs category a farmer mentions that the price of fertilizers is too high and the farmer also mentions that the price of pesticides is too high. These two constraints are both coded as “high prices for inputs”. In this case the farmer will be given only one time the code “high prices for inputs”. So every single code cannot occur more times in a single cluster than the amount of farmers in that cluster. In this analysis there is searched for possible patterns in the representation of specific constraints among the different clusters of farmers. The 27 interviewed farmers mentioned a total of 193 constraints. 77 constraints in the supply-side inputs category, 55 in the supply-side services category and 61 in the demand-side category. After ranking the constraints only the two most important constraints a farmer mentioned in each category were taken for further analysis. This lead to 54 constraints in the supply-side inputs category, 47 in the supply-side services category and 47 in the demand-side category. The reason why the supply-side services category and demand-side category only have 47 (and not 27x2=54) problems is because some of the farmers only mentioned one constraint in these categories.

3.5 Methods validity and reliability

In this research a holistic multiple-case design is used. By using multiple cases there is tried to increase the external validity of the research. Especially in the production of a commodity like coffee this is important. This because the production environment of coffee can change enormously. By taking cases from locations with different landscape characteristics there is tried to increase the generalizability of the outcomes. Stratifying by landscape provides equal chances of interaction with each landscape. More insights from each of the different landscapes will provide a better and less biased picture of the situation of the coffee sector in Manafwa in general. However, the sample size of the research is relatively small which makes the generalizability to other populations, situations and cultures still limited.

Because of time and money constraints multiple researchers have performed the role of interviewer. This was necessary to be able to collect the data within the limited time frame, and to keep costs of the spend per diem for each extra field day within the total budget available for the research. This case study involves multiple cases with three different locations which made the extra interviewers needed. In total three researchers conducted the semi-structured interviews among the smallholder farmers and the middlemen. One researcher conducted the semi-structured interviews among the other actors (government, input supplier, processors/exporters) who have been interviewed. Because the extra two researchers did not participate in the initial question-defining and research design phase of the study, a brief preparation was conducted before the actual data collection. The extra researchers were explained why the study is being done and what evidence was being sought. Furthermore the three researchers discussed the questions in the interview protocol and made necessary alterations concerning the local conditions in the field. Because of the brief training it can be that the desired level of understanding the interview protocol and its purpose has not been achieved. It can also be possible that the extra interviewers stuck too closely to the prescribed set of questions and did not utilize on the chances for further questions, which could lead to deeper understandings of the case.

The majority of the farmers could neither speak nor understand English. This made the information gathering process more challenging and affected the internal validity. Farmers were interviewed both in the English language as in their mother tongue, depending on the interviewer. Because of time constraints the group of participating farmers would be distributed among the research team in a group of farmers who were able to conduct the interview in English and those who were not. Because a part of the selected farmers were interviewed in their second language the chance of miscommunication is higher. Miscommunication can lead to missing information, invalid data and false conclusions. Therefore the language barrier may influence the internal validity of the research.

Due to the changing nature of the environment a researcher investigates in a case study it is difficult to receive the same results in a follow-up research. In this sense the reliability is limited because one cannot repeat the same experiments due to changes in situation and time. In this research the reliability is improved by developing an interview protocol that ensures that the data gathering was conducted in the same way and could be repeated. Respondents are faced with identical questions, in the same order.

4. Results

In this chapter the results of the research will be presented. The results are divided into paragraphs adequate to each step of the analysis. One by one the results of the different steps of the data-analysis will be discussed. Table 12 shows the descriptive statistics of the 27 interviewed smallholder farmers.

Table 12. General information of the interviewed smallholder farmers.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	27	20	78	52,19	16,474
Size_of_household	27	2	19	7,26	3,504
Amount_of_hired_labour	27	0	10	2,74	2,536
Total_land	27	,50	18,00	4,2222	4,15640
Total_land_crop_production	27	,50	17,00	3,6481	4,10339
Total_land_coffee	27	,25	5,00	1,5648	1,26831
Coffee_yield	27	65	1500	311,11	297,109
Coffee_yield_acre	27	65	400	232,28	109,918
Selling_price*	25	3000	6700	5426,00	871,675
Valid N (listwise)	25				

**For the selling price only the price of sold coffee parchment is taken.*

To define how the farmers are embedded in the network, information is needed about the three features reciprocity, resource diversification and channel diversification. Therefore, in the first paragraph the results of the embeddedness analysis will be given. Subsequently the outcomes of the cluster analysis will be presented. Different clusters of farmers are classified based on the ten selected indicators. A complete overview of the different type of farmers and their resources exchanges with different actors in the value network will be shown in the third paragraph, on the value network maps in figures 20, 21 and 22. The farmers will be the central point of discussion. A closer look will be taken at the differences between the way how the three clusters of farmers are embedded in the value network. In this paragraph also more details about the interrelationships of the clusters of farmers with the different actors in the value network will be discussed. The information from the interviews with the other actors in the value network will also be presented in this paragraph. More information on the four features reciprocity, agility, resource diversification, and channel diversification of the other actors will be given. Finally, in paragraph four, a closer look will be taken into the relation between the embeddedness of the different type of farmers and the type constraints these clusters of farmers face towards innovation.

4.1 Features describing farmers' embeddedness

For the embeddedness analysis every farmer received an indication of 1.low, 2.medium or 3.high according to description given in table 9 on the features reciprocity, resource diversification and channel diversification. Table 13 gives the descriptive statistics of the analysis.

Table 13. Descriptive statistics of the embeddedness analysis.

Descriptive Statistics

	N	Mean	Std. Deviation
Reciprocity	27	1,33	,734
Resource_diversification	27	2,15	,602
Channel_diversification	27	1,96	,649
Valid N (listwise)	27		

The farmers scored the lowest on the feature reciprocity (mean=1.33, SD=0.734). In general the interviewed farmers take more resources than they give. They do not share resources bi-directional. It is hard for the farmers to share resources as inputs, information or credit with other actors because the farmers have limited access to these resources. The coffee seedlings, fertilizers or pesticides they are able to receive are in most cases used for their own coffee production. Most farmers also reported that they own no processing equipment like pulping machines and have little information or knowledge to share with other farmers. On average the farmers score best on the feature resource diversification (mean=2.15, SD=0.602). This means that the farmers receive four or five different kinds of resources on average. Looking more closely there is found that these resources most often are coffee seedlings, artificial fertilizers, pesticides, information and training. The farmers also provide one or two resources to other actors. These resources are most likely commodities, or also information, advice and pulping services. On the feature channel diversification the farmers score a mean of 1.96 (SD=0.649). This means that, on average, the farmers exchange resources with four to five actors.

4.2 Farmer clusters

The cluster analysis defined three different clusters of farmers, further referred as cluster one, two and three. The silhouette measure shows a cluster quality of 0.3 (Appendix 3), which is in the category fair. The silhouette measure describes how separated clusters are from each other and how much cohesion there is within the clusters. Cluster one is the smallest group, which comprises 5 farmers (18.5% of the total sample size). Cluster two and three comprise respectively 10 (37.0%) and 12 (44.4%) farmers. The ratio of the size of the largest cluster compared to the smallest cluster is 2.40 (Appendix 3), which is a good ratio.

Figure 16 shows an overview of the three clusters and the specifications of each cluster on the ten variables. 'Use of pesticides', 'Sub-county', 'Use of fertilizers' and 'Resource diversification' were the variables with the highest input predictor importance. This means that these variables were more important in defining the different type of clusters. In cluster three all 12 farmers use pesticides, where in cluster one and two only respectively 20 and 10 percent of the farmers in the cluster make use of pesticides. The farmers of cluster three also make more use of artificial fertilizers. The good results on these two variables for the farmers from cluster 3 further results into a high score on the variable 'Resource diversification'. On this variable the farmers from cluster three (2.50) score way higher than the farmers from cluster one (1.80) and two (1.90). The three clusters also show good variation in sub-county. Each of the clusters contains a majority of farmers from one of the three selected sub-counties. Cluster one and cluster three show a dominance of the male headed households. Cluster two contains a slight majority (60%) of female headed households. There is a difference in average age between the clusters. The farmers from cluster two are the oldest (61.60 years old), the farmers from cluster three are relatively middle aged (49.50) and the farmers from cluster one are the youngest (39.80). The farmers from cluster one are selling their coffee produce only to middlemen (figure 17). The farmers from cluster two and cluster three are selling mostly to ACEs. However in figure 18 is shown that farmers from cluster two also often sell produce to middlemen. The farmers from cluster three are selling less to middlemen and more to processors/exporters (figure 19). The farmers from cluster two score higher on the variable reciprocity (1.70) than the farmers from cluster one (1.00) and three (1.17). This means that the farmers from cluster two share more resources bi-directionally with other actors. There happened to be three female headed households in cluster two who own a pulping machine. This fact contributed to the high score regarding reciprocity for cluster two. The farmers from cluster two (1.60 acre) and three (1.85 acre) do have a bigger size of land in use for the production of coffee compared with cluster one (0.80 acre). On the feature channel diversification, which is the least important variable defining the three different clusters, the three clusters shows rather similar scores.

Clusters

Input (Predictor) Importance

1,0 0,8 0,6 0,4 0,2 0,0

Cluster	1	2	3
Label			
Description	Young male farmers located in Mukoto with a small farm size, showing low resource diversification and selling produce to middlemen.	Female headed households with a high age and high reciprocity, selling most often to Area Cooperative Enterprises.	Middle aged male farmers with a big farm, using many inputs, showing high resource diversification. Selling to Area Cooperative Enterprises and Processors/Exporters
Size	18,5% (5)	37,0% (10)	44,4% (12)
Inputs	Use_of_pesticides no (80,0%)	Use_of_pesticides no (90,0%)	Use_of_pesticides yes (100,0%)
	Subcounty Mukoto (80,0%)	Subcounty Namabya (70,0%)	Subcounty Bukhofu (66,7%)
	Use_of_artificial_ fertillizers no (60,0%)	Use_of_artificial_ fertillizers no (100,0%)	Use_of_artificial_ fertillizers yes (66,7%)
	Resource_ diversification 1,80	Resource_ diversification 1,90	Resource_ diversification 2,50
	Gender_head_of_ household Male headed (100,0%)	Gender_head_of_ household Female headed (60,0%)	Gender_head_of_ household Male headed (83,3%)
	Age 39,80	Age 61,60	Age 49,50
	Buyer Middleman (100,0%)	Buyer Area Cooperative Enterprise (40,0%)	Buyer Area Cooperative Enterprise (58,3%)
	Reciprocity 1,00	Reciprocity 1,70	Reciprocity 1,17
	Total_land_coffee 0,80	Total_land_coffee 1,60	Total_land_coffee 1,85
	Channel_ diversification 2,00	Channel_ diversification 2,00	Channel_ diversification 1,92

Figure 16. Three different clusters of farmers and the ten inputs.

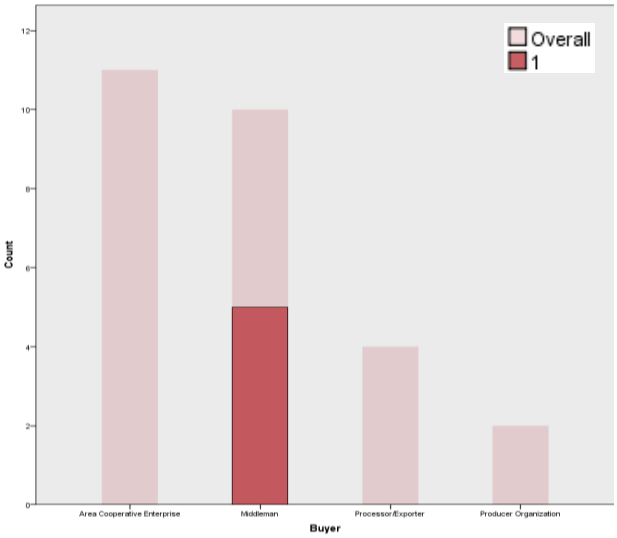

Figure 17. Buyers produce from farmers of cluster 1 compared to buyers of all the farmers.

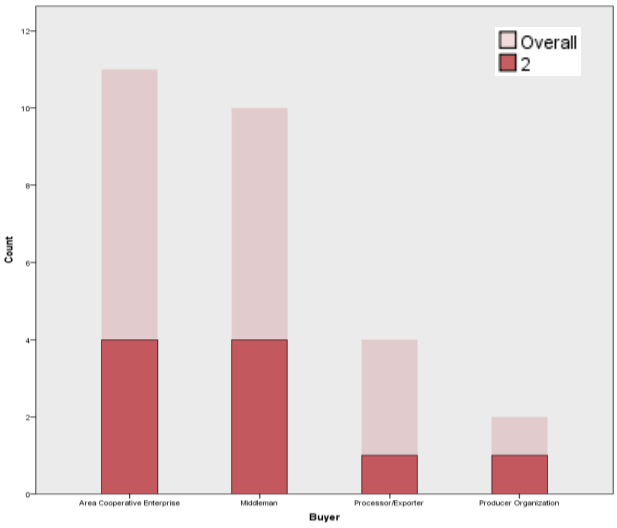

Figure 18. Buyers produce from farmers of cluster 2 compared to buyers of all the farmers.

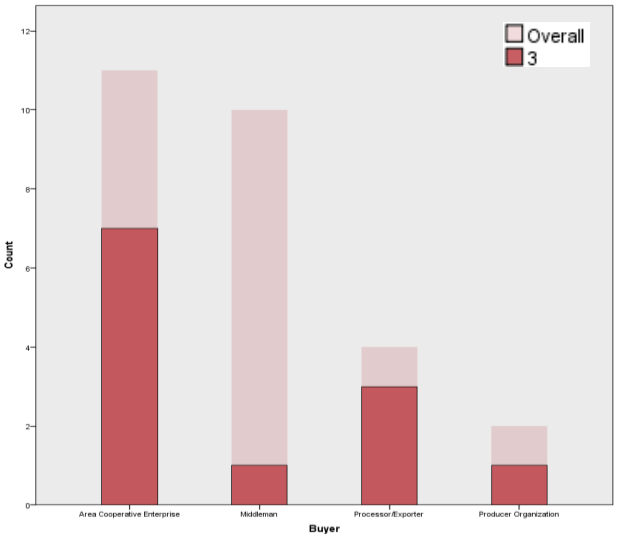

Figure 19. Buyers produce from farmers of cluster 3 compared to buyers of all the farmers.

4.3 Value Network Analysis

Based on the three different clusters of farmers a value network analysis has been conducted. There are differences in resource exchanges and differences in accessibility to certain actors for different farmers. An overview of all three clusters and their resource exchanges is provided in the value network maps shown in figure 20, 21 and 22. With the data collected from the interviews more detail about the heterogeneity of the different classes will be given. The value network maps also provide information on the resource exchanges and relationships among the government, NGOs, development organizations and other actors in the network. Table 14 gives an overview of the scores of the other actors on the four features reciprocity, agility, resource diversification and channel diversification. Furthermore, each actor will be shortly discussed one by one. More information about their role in the value network will be given. Thereafter more information will be given on the farmers' embeddedness in the supply-side of the value network and the farmers' embeddedness in the demand-side of the value network.

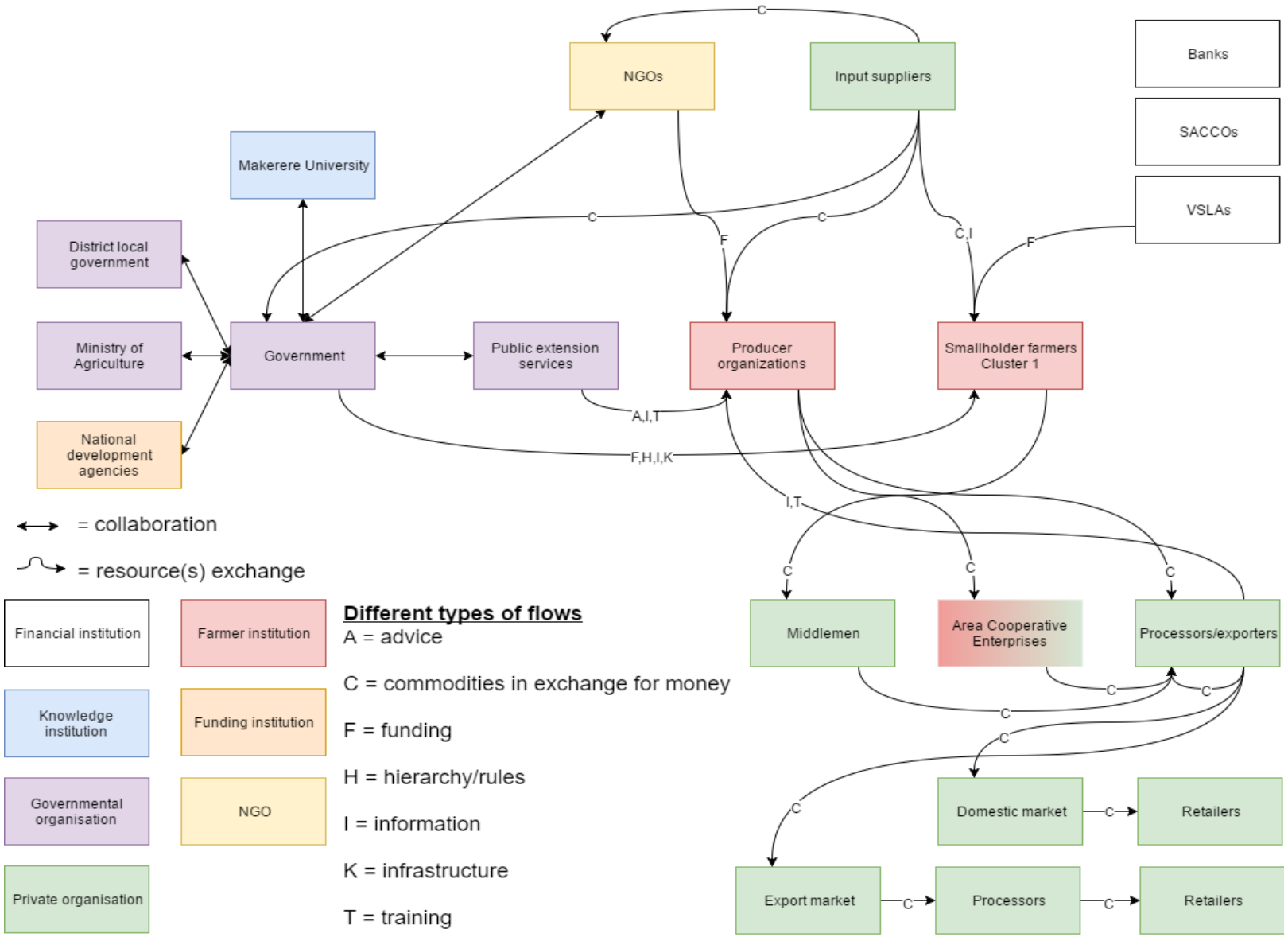

Figure 20. Value network map farmers cluster 1.

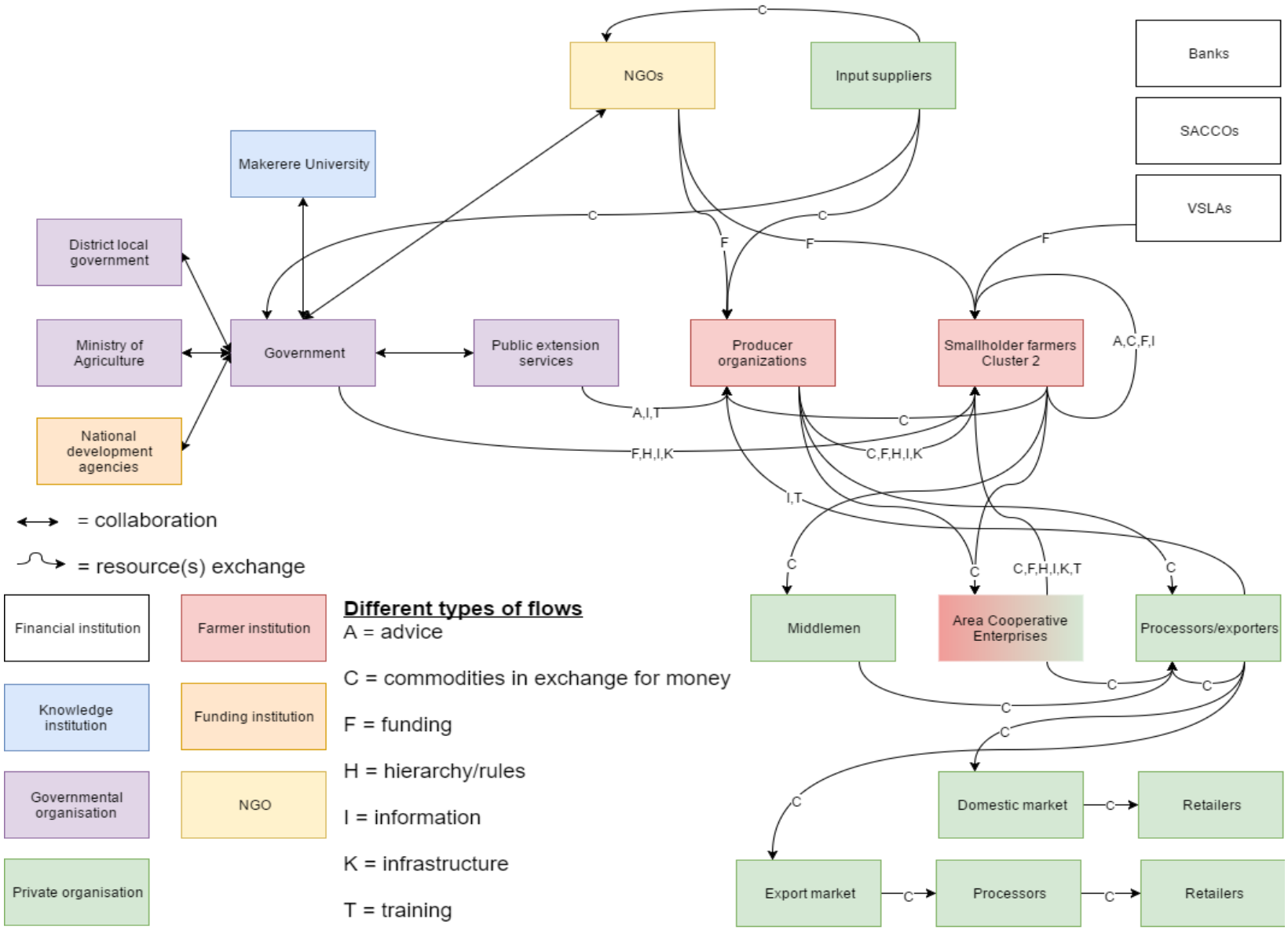

Figure 21. Value network map farmers cluster 2.

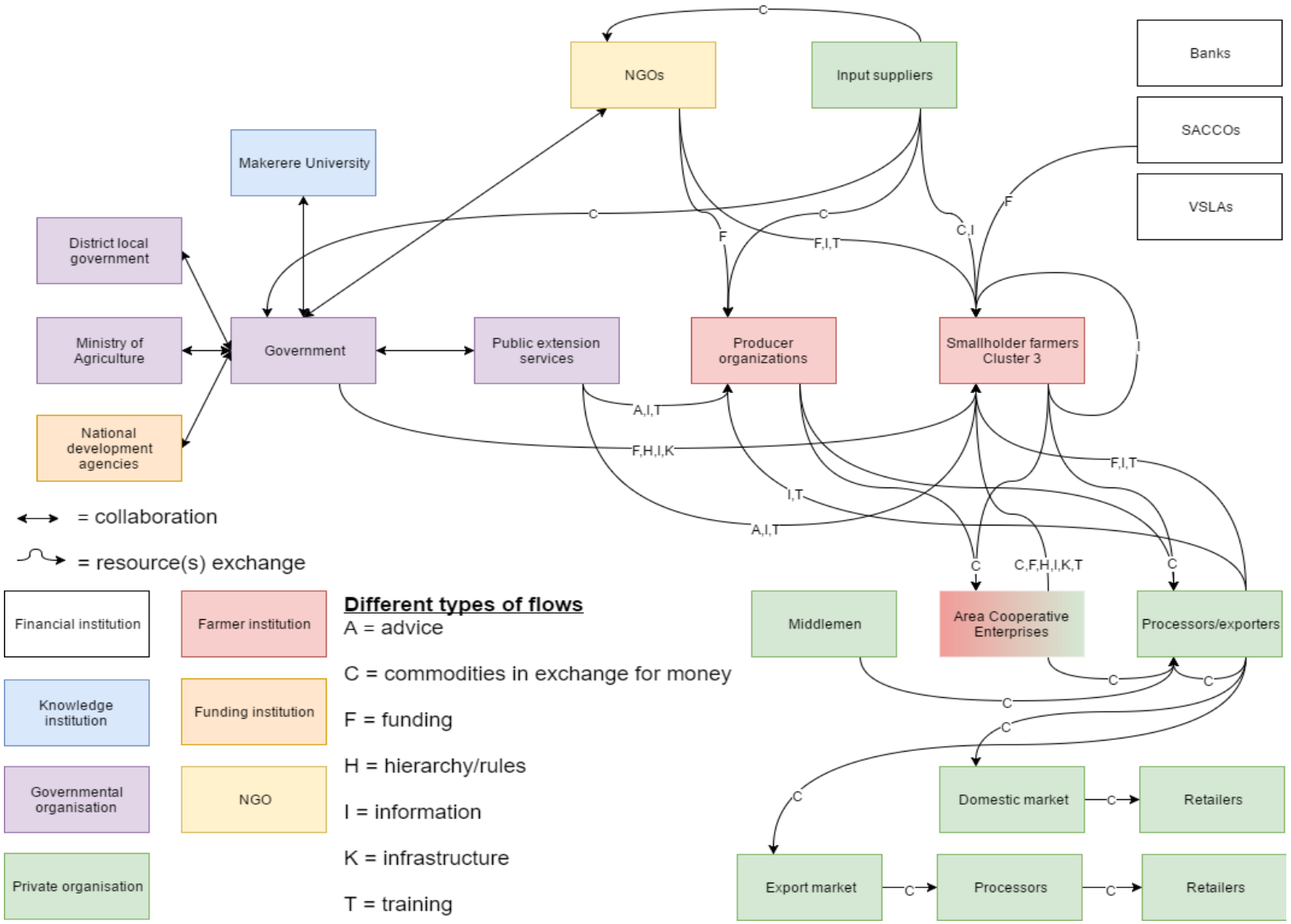

Figure 22. Value network map farmers cluster 3.

Table 14. Other actors scores on the four features.

Actor	Reciprocity	Agility	Resource diversification	Channel diversification
Smallholder farmers Cluster 1	**Low:** Farmers from cluster 1 receive more resources than what they give to others (C).	**Low:** Farmers from cluster 1 are separated from many actors in the value network.	**Medium:** Farmers from cluster 1 exchange resource like information, fertilizers and commodities.	**Medium:** Farmers from cluster 1 exchange resources with 4 to 5 different actors.
Smallholder farmers Cluster 2	**High:** Farmers from cluster 2 share resources A, C, F, I bi-directionally.	**Medium:** It is hard to access financial institutions, input suppliers and processors/exporters for farmers from cluster 2.	**Medium:** Farmers from cluster 2 exchange resource like information, advice, loans and commodities.	**Medium:** Farmers from cluster 2 exchange resources with 4 to 5 different actors.
Smallholder farmers Cluster 3	**Low:** Farmers from cluster 3 receive more resources than what they give to others (C, I).	**High:** There is a low degree of separation from the farmers from cluster 3 to other actors in the value network.	**High:** Farmers from cluster 3 exchange resources like advice, information, fertilizers, pesticides, loans and commodities.	**Medium:** Farmers from cluster 3 exchange resources with 4 to 5 different actors.
Input suppliers	**Medium:** Input suppliers give only limited information when selling inputs to farmers. But they exchange commodities with different actors in the value network.	**High:** Input suppliers provide inputs and information directly to farmers, NGOs and government.	**Medium:** Input suppliers provide multiple resources like pesticides, fertilizers and information within and outside the coffee value network.	**Low:** Input suppliers provide most of their resources to farmers and farmer groups.
Producer organizations	**Medium:** Producer organizations give a bit more resources (A, C, F, H, I, K) than what they get from other actors like NGOs and government.	**High:** Producer organizations receive and provide resources as commodities and information directly from traders to farmers with minimal degrees of separation. They also exchange resources with NGOs, input suppliers and public extension workers.	**Variable :** Different producer organizations receive and provide little or many resources in a lower or higher extent.	**High:** Producer organizations receive and provide resources through multiple channels. They exchange resources with farmers, ACEs, governmental bodies, or processors/exporters.
Area Cooperative Enterprises	**Low:** Area Cooperative Enterprises give more resources (A, C, F, H, I, K, T) than what they get from other actors like farmers and POs.	**High:** ACEs share many resources with farmers in close distance. They also exchange resources with POs and processors/exporters.	**Variable:** Different area cooperative enterprises receive and provide little or many resources in a lower or higher extent.	**High:** Area cooperative Enterprises receive resources from farmers and producer organizations and share them with processors/exporters.
Processors/ exporters	**High:** Processors/exporters buy commodities from farmers, middlemen, POs and ACEs. They give resources (F, I, T) to the farmers.	**High:** Processors/exporters show high agility with farmers. They also have a low degree of separation with middlemen, ACEs and are the gate to the domestic and international coffee market.	**Low:** Processors/exporters mainly provide money in exchange for commodities to farmers. A small amount of farmers also receives advice, information and training.	**High:** Processors/exporters exchange resources with farmers, middlemen, POs, ACEs, and other processors/exporters.
Middlemen	**Low:** Middlemen share limited	**High:** Middlemen have direct contact	**Low:** Middlemen deal in limited	**Low:** Middlemen often sell the

	resources with farmers and other actors in the network.	with the farmers. They visit the farmers at their farm. They have close ties to processors/exporters to who they sell produce.	amount of resources. companies.	produce they buy from farmers to the same companies.
Government	**Medium:** The (local) government exchanges limited information and advice to other actors in the value network. The government does provide infrastructure and hierarchy/rules.	**Low:** The government shows low agility in providing information. They gives information to farmers via a weekly radio programme. **High:** The government shows high agility in providing hierarchy/rules to the input dealers and other actors in the value network.	**High:** The government provides diverse resources like funding, advice, information, infrastructure and hierarchy/rules.	**High:** The government provides resources to multiple actors in the network. For example knowledge institutions, funding institutions, farmers, local governments, NGOs or input suppliers.
National development agencies	**Low:** National development agencies provide more information, advice and funding than what they receive from other actors.	**Low:** The national development agencies most often reach the farmers via producer organizations.	**High:** National development agencies provide a wide range of resources to farmers and farmer groups. This can be coffee seedlings, fertilizers, pesticides, or loans.	**High:** National development agencies exchange resources with (local) government, input suppliers, farmers and farmer groups.
NGOs	**High:** NGOs provide resources like funding and advice from donors to farmers. They receive and share resources.	**Low:** To exchange information and commodities with farmers NGOs use POs to mediate in the resource exchange.	**High:** NGOs provide extension work and funding. They share resources like information and training and give commodities to the farmers.	**High:** NGOs receive commodities and help from different actors and share it in the value network in collaboration with input suppliers, farmer groups and the government.
Research institutes	**Low:** Research institutes provide funding and advice to farmers. They also provide information to the government.	**Low:** Research institutes only have close ties to the government. The degree of separation to farmers and private companies is bigger.	**Medium:** Research institutes mainly exchange resources like information, advice and training.	**High:** Research institutes share resources with different actors like NGOs, private organizations and governmental bodies.
Banks	**Low:** Banks give funding to other actors in exchange for profit.	**Low:** Banks ask high interest and are located in Mbale, which is hard to reach for the farmers in Manafwa.	**Low:** Banks mainly provide loans.	**High:** Banks provide loans to many actors inside and outside the coffee value network.
SACCOs	**Low:** SACCOs give more resources than what they get from other actors.	**Medium:** In order to exchange resources you have to be a member. SACCOs are accessible for a small group of farmers.	**Low:** SACCOs mainly provide loans.	**Low:** SACCOs provide loans to members of the association.
VSLAs	**Low:** VSLAs give more resources than what they get from other actors.	**Medium:** In order to exchange resources you have to be a member. VSLAs are accessible for a bigger group of farmers.	**Low:** VSLAs mainly provide loans.	**Low:** VSLAs provide loans to their members in the village.

Farmers (general)

Farmers show a high dependency on information, advice, funding and commodities from other actors in the network. The provision of these resources come in different amounts and frequencies from different actors. Some farmers share and exchange resources among themselves as well. The villages have weekly markets where the farmers gather and trade commodities and exchange information and advice. The farmers sharing these resources are often the older, more experienced, farmers. Also some farmers mentioned that they receive a small loan from other farmers. A small selection of the famers owns a manual pulping machine (figure 23). Other farmers hire these pulping machines to be able to pulp their coffee beans and receive a better price for their produce.

Figure 23. Manual pulping machine (Erinamukuta, 2014).

Farmer groups

Most of the farmers in Manafwa are a member of a farmer group. Producer organizations and area cooperative enterprises provide many resources to the farmers. The type of resources and frequency in which they are exchanged varies for each farmer group and farmer. Some farmer groups only provide coffee bulking services, others also provide information, training, inputs, loans or pulping services. The frequency of the exchanged resources also varies a lot. One group can give a training every three months, but others may provide trainings only once or twice a year. Let us take Mt. Elgon Arabic Coffee Farmers Co-operative Society (further referred as Mt. Elgon ACE) as example (figure 24). This farmer group has twelve different training topics for each year. Mt. Elgon ACE provides the trainings in the different villages where they do business. In every location they select a lead farmer. For selecting the lead farmers Mt. Elgon ACE looks for people who have gone to school, who have a good interpersonal character and who have a good reputation in the local society. The lead farmers can take the role of providing advice and information to the farmers. From February to May Mt. Elgon ACE provides off season trainings to the farmers on how they should apply fertilizers and pesticides. In September they give post-harvest trainings.

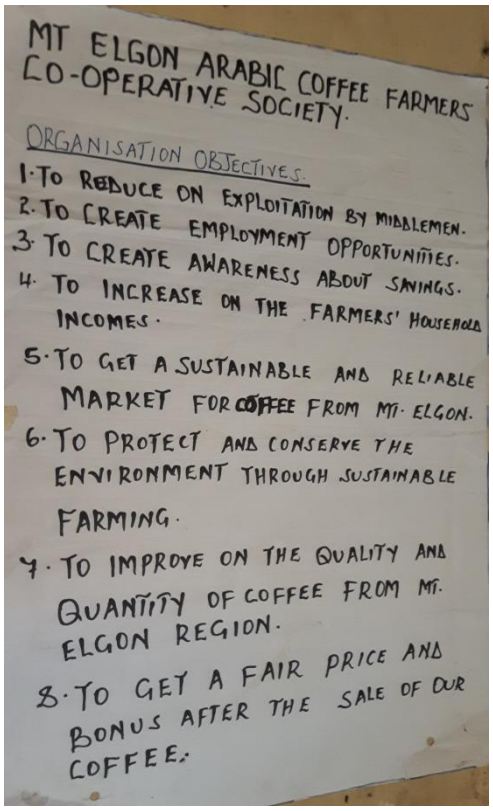

Figure 24. Organisation objectives of Mt. Elgon Arabic Coffee Farmers Co-operative Society.

Figure 25. Locations of Kyagalanyi's sustainable coffee schemes. (Kyagalany, 2017).

Input suppliers

The basic tools every farmer needs to be able to produce coffee are a piece of land, garden tools (hoes, panga's, slashers), coffee seedlings and labor. Farmers buy the garden tools from input suppliers. The garden tools can be used for a long time. Input suppliers also sell seedlings, artificial fertilizers, pesticides and fungicides (very limited). The input suppliers give advice in the shop on how to apply the fertilizers and pesticides they sell. Besides the farmers, input suppliers also sell products to the government and NGOs. The input suppliers are located in Mbale town, which is hard to reach for most farmers in Manafwa. Other problems for the farmers are limited credit and fake inputs in the market. The fake inputs are often sold for a lower price which makes it more interesting and feasible for the farmers to buy.

Middlemen

Many farmers sell (a part of) their produce to middlemen. Middlemen visit the farm gates of the farmers and buy the produce directly from them. Because of the lack of transportation options it is very convenient for the farmers to sell to their produce to middlemen. The middlemen give price and market information to the farmers, but there is much danger that malicious middlemen cheat the farmers. Despite this fact, the need for money is high for many farmers, which forces them to sell their produce to middlemen.

Processors/exporters

Another frequent buyer of the produce of farmers is the processor/exporter. The resource exchange with the processors/exporters is more diverse and leads to more benefits for the farmers. Besides the exchange of commodities they can also receive information, training and/or funding. Let us take

Kyagalanyi as example. Kyagalanyi has sustainability initiatives in different parts of Uganda, including the Manafwa district (figure 25). They have a field team consisting of agronomist, nursery operators and sustainability managers, which is dedicated on increasing the coffee yields and coffee quality of the farmers. They give intensive agronomy training programmes to selected producer organizations. Furthermore they provide inputs, personal protective equipment (PPE) sets, seedlings, information and advice to the selected farmers.

Government

The government plays a role in the regulation and funding of the farmers. Furthermore they also provide advice in the form of extension work and they distribute useful information for the farmers via the radio. The coordination between the government bodies does not seem optimal. An example for this is the complaints of many farmers that the provided seedlings by the government arrived in a wrong time, which made the seedlings useless. Farmers would also like to see more/better regulations of the government in the coffee market. The government puts strict regulation on chemicals. This makes the prices of agricultural inputs high. The government could stimulate the businesses of farmers by implementing price regulations for agricultural products and the selling price of coffee, subsidies for inputs or more intensive controls on fake inputs and malicious traders.

Funding institutions

There are multiple national development agencies or programmes active in the Manafwa district. For example the Uganda Coffee Development Authority (UCDA) gives advice on post-harvest handling to farmers, the National Agricultural Advisory Services (NAADS) provides information and trainings to farmers, and the National Forestry Resources Research Institute (NaFORRI) distributes information among the farmers. The origin and structure of the organizations can vary. The NAADS, for example, is a semi-autonomous public agency within the Ministry of Agriculture Animal and Fisheries (MAAIF). It is founded in 2001 to specifically address constraints of lack of access to agricultural information, knowledge and improved technology among rural poor farmers in Uganda.

Knowledge institutions and NGOs

Makerere University and NGOs, such as GAP, exchange resources most often with POs. Makerere University plays a role as a knowledge provider. They provide information and training to some farmers. NGOs provide funding like seedlings to the farmer groups. They can buy inputs from input suppliers which they distribute among the farmer groups. NGOs have much power in their relationship with the input dealers because of the big order they place.

Financial institutions

There are multiple financial institutions involved in the coffee value network. Besides the, often very small loans, provided by friends, farmers can access credit via banks, Saving and Credit Cooperative Societies (SACCOs) and Village Savings and Loan Associations (VSLAs). The capital bases increases as one moves from the individual lenders to the VSLA to the SACCO to the banks (Oduol *et al.,* 2016). The banks are located in Mbale town, which is hard to reach for the farmers. Besides that, reportedly unfriendly conditions for borrowing money are reported among farmers (Oduol *et al.,* 2016). Therefore most farmers move to VSLAs and SACCOs. In most cases VSLAs and SACCOs only provide loans with registered members of the group. There are also farmer groups who provide loans to farmers. These loans provided by SACCOs are mostly micro credits which lending rates can be 3% per

month (Oduol *et al.,* 2016). The amount of credit is limited and the procedure can take much time. Therefore it can be hard for many farmers to get access to these loans. The interest the financial institutions ask is also a problem for the farmers.

4.3.1 Farmers' embeddedness in the supply-side of the value network

For the farmers in cluster 2 and cluster 3 the farmer groups play a more important role in the value network of the farmers. Farmers receive advice, information, loans and trainings from the ACEs Bukusu Jetena Area Cooperative Eterprise and Bukalala Coffee Cooperative Society and POs like Bukhofu Christian Woman association or Bukhofu Unitid Farmers Association (both member of Bukusu jetena Area Cooperative Enterprise). Many farmers from cluster 2 and 3 also sell coffee produce to these actors. In cluster 1 there are little resources exchanges with farmer groups. The farmers from this cluster have to find alternative sources to get access to the resources these farmer groups share. They are more dependent on information and extension work from other farmers, the (local) government and national development organizations. Farmers found alternatives to get access to resources. They receive credit from friends, family or can get a loan from a village savings and loan association. The farmers from cluster 2 and cluster 3 do exchange resources with processors/exporters. Among the farmers in cluster 1 exchanges with processors/exporters are not mentioned one single time. As could be seen in figure 15, 100% of the farmers from cluster 1 sell their produce to middlemen. The resource exchange with middlemen as a buyer is often very limited. And even when resources like information or advice are exchanged this may be unreliable. The farmers from cluster 1 also miss out on the extension services most processors/exporters provide. This makes the farmers from cluster 1 more dependent on the extension services of the government and NGOs, which are rather limited.

The farmers from cluster 3 make the most use of pesticides and artificial fertilizers. 100% of the farmers in this cluster make use of pesticides and 66.7% of them make use of artificial fertilizers. This is clearly more than the inputs usage of the farmers from cluster 1 and 2 regarding pesticides (20% and 10%) and artificial fertilizers (40% and 0%). The variables location, gender, age and farm size have been taken apart for further analysis to get more insights in the role they play in the inputs usage of farmers. In this analysis also the usage of organic fertilizer is taken into account. Farmers produce their own organic fertilizer. This resource is not exchanged.
In table 15 the inputs usage among farmers from different sub-counties is shown. The table shows the high percentage of inputs usage in Bukhofu. This explains the high usage of inputs in cluster 3, knowing that 66.7% of the farmers from cluster 3 come from Bukhofu. In Namabya the farmers use the least amount of artificial fertilizers and pesticides. The farmers in Mukoto score rather low on the use of artificial fertilizers but, in contrary, score very decent in the use of pesticides.

Table 15. Inputs usage among farmers from different sub-counties.

Sub-county	Nr. of Farmers	Use of organic fertilizer	Use of artificial fertilizers	Use of pesticides	% Use of organic fertilizer	% Use of artificial fertilizers	% Use of pesticides
Bukhofu	10	8	7	8	80%	70%	80%
Namabya	8	8	1	1	100%	12.5%	12.5%
Mukoto	9	9	2	5	100%	22.2%	55.6%

Looking at the variable gender there can be seen that the farmers with a male headed household do make more use of artificial fertilizers and pesticides (table 16). For the inputs artificial fertilizers and pesticides the male headed households score slight less than double the score of the farmers with a female headed household. The farmers with a female headed household score higher regarding the use of organic fertilizers.

Table 16. Inputs usage among farmers with different gender.

Gender	Nr. of Farmers	Use of organic fertilizer	Use of artificial fertilizers	Use of pesticides	% Use of organic fertilizer	% Use of artificial fertilizers	% Use of pesticides
Male	19	17	8	11	89.5%	42.1%	64.7%
Female	8	8	2	3	100%	25%	37.5%

Among the interview respondents the younger farmers, with an age below 36 years did make the most use of agricultural inputs. They showed the highest usage rate for pesticides (table 17). The middle aged farmers scored lower regarding the usage of pesticides, but showed slightly more usage of artificial fertilizers. The farmers belonging to the category of older than 68 years scored lowest regarding the usage of artificial fertilizers and pesticides.

Table 17. Inputs usage among farmers with different age.

Age	Nr. of Farmers	Use of organic fertilizer	Use of artificial fertilizers	Use of pesticides	% Use of organic fertilizer	% Use of artificial fertilizers	% Use of pesticides
< 36	5	5	2	4	100%	40%	80%
36 – 67	16	14	7	8	87.5%	43.8%	50%
> 68	6	6	1	2	100%	16.7%	33.3%

When taking a closer look at the inputs usage of a farmer regarding his/her total size of land under the production of coffee there can be seen that the usage of agricultural inputs increases with the amount of acres (table 18). The farmers belonging to the category of 2.5 acres of land under the production of coffee or more did use way more artificial fertilizers and pesticides. However, the use of organic fertilizer was lower compared to the farmers with a smaller size of land under the production of coffee.

Table 18. Inputs usage among farmers with different farm size.

Farm size	Nr. of Farmers	Use of organic fertilizer	Use of artificial fertilizers	Use of pesticides	% Use of organic fertilizer	% Use of artificial fertilizers	% Use of pesticides
<0.5 acre	7	7	2	3	100%	28.6%	42.9%
0.5 – 2.5 acre	15	15	5	7	100%	33.3%	46.7%
>2.5 acre	5	3	3	4	60%	60%	80%

The farmers from cluster 3 used coffee seedlings which are provided by the government or government programmes. These seedlings are provided for free to the farmers. The farmers from cluster 1 and cluster 2 also bought seedlings from the input suppliers (table 19). Some farmers did not give any information on their provision of coffee seedlings. The reason why farmers buy

seedlings from input suppliers is that the provision of seedlings from the government is unreliable. The provided seedlings can also be given on a wrong time. The possibility for some farmers to buy seedlings from the input suppliers makes them less dependent on the government.

Table 19. Where the farmers get their seedlings from.

Sub-county	Government	Government and Input supplier	Other
Bukhofu	6	0	0
Namabya	3	4	0
Mukoto	3	4	1

4.3.2 Farmers' embeddedness in the demand-side of the value network

The 27 interviewed farmers sold their produce to a total of 37 buyers (table 20). The farmers who sold red coffee cherries to middlemen received the lowest price (mean= 1480, SD=455). Given reasons why these farmers sold red coffee cherries were lack of processing skills, lack of processing equipment (*i.e. there are only few pulping machines available*), high price of processing and pressing financial needs (*i.e. I need to pay the tuition fee for my children's' education*). Three of the five farmers who sold coffee cherries have less than 0.5 acre of land used for coffee production. The coffee cherries selling farmers have an average of 0.8 acre used for the production of coffee. This is half the acres of the average 1.6 acre for all 27 farmers. The ACEs were mentioned most often as the buyer of the farmers produce, namely thirteen times. They are followed by processors/exporters who are mentioned nine times, then by the middlemen, 8 times, and lastly producer organizations, who were mentioned two times as the buyer of the farmers' produce. On average the processors/exporters paid the highest price for one kilo of coffee parchment of the farmers (mean=6056 USh, SD=559 USh) (table 20) (figure 26).

Table 20. Buyers of the farmers' coffee produce.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Middleman_berries	5	1000	2200	1480,00	454,973
Middleman	8	5000	6700	5462,50	673,875
Producer_organizations	2	5000	6500	5750,00	1060,660
ACEs	13	3000	6200	5146,15	814,059
Processors_Exporters	9	5000	6700	6055,56	559,265
Valid N (listwise)	2				

Also within the mentioned groups there were big differences in the price paid. The processor/exporter Bugisu Cooperative Union (BCU) was mentioned four times as the buyer of a farmers' produce. The prices paid for one kilo of parchment were 5500USh, 6000USh, 6500USh and 6700USh. Middlemen most often paid 5000 USh for a kilo of coffee parchment but there were also some who paid 6000 USh. One time a middleman even paid 6700 USh for the parchment of a farmer. Given reasons for the differences in the paid price are; price fluctuations, the many different middlemen active on the market and the use of 'second payment' by many POs, ACEs and processors/exporters. Second payment is a bonus a farmer receives when the quality of their sold coffee is from a high grade. This incentive will stimulate the farmers to aim for high level quality coffee. However, due to limited financial resources not all the cooperatives are able to pay (enough) for the extra quality a farmer delivers. In a situation with no or limited second payment the

incentives of a farmer to invest in extra inputs and time to produce high quality coffee will be low. Because of the wide spread of middlemen active in the market there will be many possible buyers for a farmer to sell their produce to. If one buyer does not buy the coffee produce another person or company will buy it, despite the low quality.

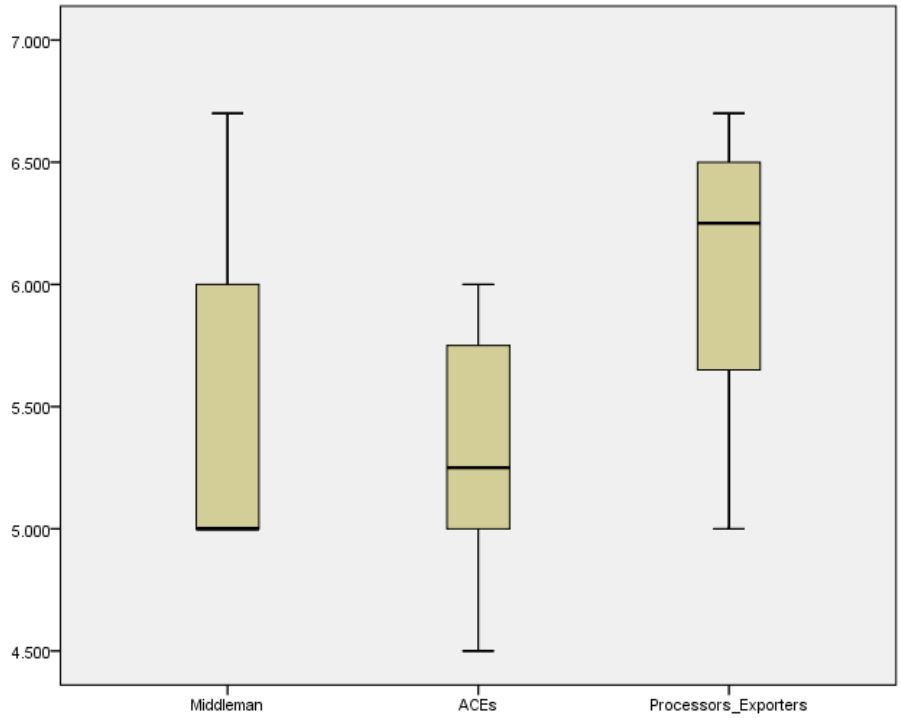

Figure 26. Selling prices to middlemen, ACEs and processors/exporters.

The farmers from cluster 1 and cluster 2 are more likely to sell (a part of) their produce to middlemen. When you compare the situation of the farmers from these two clusters with the farmers from cluster 3 there are two main reasons for this phenomenon. For the farmers of cluster 1 Bukusu Jetena Area Cooperative Enterprise plays an important role. 80% of the interviewed farmers in Bukhofu sold (a part of) their produce to this ACE (table 21). Bukusu Jetena Area Cooperative Enterprise was not mentioned one single time by a farmer in Namabya or Mukoto. Because the lack of an active ACE or PO in the sub-county farmers are more dependent on the middlemen who visit their farm. This brings us to the second problem, the landscape characteristics. Namabya (midland) and Mukoto (highland) have more extreme landscape conditions. Because of the high altitude and height differences it is hard for the farmers to transport their produce to a cooperative or market, and it is harder for the cooperatives and other traders to reach the farmers. A middleman visiting them at the farm gate is therefore a very convenient solution for many farmers. Farmers who sell their produce to an ACE have to bring their produce to the ACE at location. In the landscapes of Namabya and Mukoto this could be more of a problem for the farmers. There are ACEs like Mt. Elgon Arabica Coffee Farmers Society who meet the transportation costs of the farmers once the coffee is brought at the bulking store. However, in this situation farmers still need to have access to some initial credit and transportation to be able to bring it to the ACE.

Table 21. Buyers of the produce of farmers from different sub-counties sell.

Sub-county	Nr. of Farmers	PO	ACE	Middle men	Processor /Exporter	% PO*	% ACE*	% Middle man*	% Processor /Exporter*
Bukhofu	10	1	8	2	4	10%	80%	20%	40%
Namabya	8	1	1	5	3	12.5%	12.5%	62.5%	50%
Mukoto	9	0	4	6	0	0%	44.4%	66.7%	0%

**The total percentage of each sub-county can be more than 100% because farmers may sell to more than one actor.*

Looking further than the variable location there is no relationship found in the gender of the head of the household of a farm and the actor to whom the produce is sold. Male and female headed households sell to the same actors in a comparable number (table 22). For the variable age is found that the farmers of the age categories < 36 and 36 – 67 years old more often sold their produce to processors/exporters. None of the six farmers in the category of 68 years and older sold produce to processors/exporters (table 23). The category 36 – 67 years old showed the lowest percentage of sold produce to middlemen. In the variable farms size there can be seen that farmers with less land under the production of coffee more often sold their produce to a middleman (table 24). None of the farmers belonging to the category <0.5 acre sold any produce to a processor/exporter.

Table 22. Buyers of the produce of farmers with different gender.

Gender	Nr. of Farmers	PO	ACE	Middle men	Processor /Exporter	% PO*	% ACE*	% Middle man*	% Processor /Exporter*
Male	19	1	9	9	5	5.3%	47.4%	47.4%	26.3%
Female	8	1	4	4	2	12.5%	50%	50%	25%

**The total percentage of each gender can be more than 100% because farmers may sell to more than one actor.*

Table 23. Buyers of the produce of farmers with different age.

Age	Nr. of Farmers	PO	ACE	Middle men	Processor /Exporter	% PO*	% ACE*	% Middle man*	% Processor /Exporter*
<36	5	0	2	3	1	0%	40%	60%	20%
36 – 67	16	2	7	6	6	12.5%	56.3%	37.5%	37.5%
>68	6	0	4	4	0	0%	66.7%	66.7%	0%

**The total percentage of each age category can be more than 100% because farmers may sell to more than one actor.*

Table 24. Buyers of the produce of farmers with different farm size.

Farm size	Nr. of Farmers	PO	ACE	Middle men	Processor /Exporter	% PO*	% ACE*	% Middle man*	% Processor /Exporter*
< 0.5 acre	7	0	4	5	0	0%	57.1%	71.4%	0%
0.5 – 2.5 acre	15	1	7	7	6	6.7%	46.7%	46.7%	40%
> 2.5 acre	5	1	2	1	1	20%	40%	20%	20%

**The total percentage of each farm size category can be more than 100% because farmers may sell to more than one actor.*

4.4 Innovation constraints

Table 25 gives an overview of the different constraints the farmers mentioned in each of the three categories, and how many times each constraint was mentioned.

Table 25. Amounts of times each innovation constraint of the three categories is mentioned by the farmers.

Supply constraints – inputs		Supply constrains – services		Demand constraints	
Lack of capital	19	Lack of extension services	21	Low coffee prices	16
Hard access to inputs	10	Lack of capital	14	Price fluctuations	12
Not enough/or bad provision of funded goods	8	High price of information/advice	4	Lack of processing equipment/skills	5
Lack of knowledge/skills on how to use inputs	6	Poor weather conditions	2	Hard access to transportation	4
High price for inputs	4	Wrong time in provision of services	1	Delay in payment	4
Poor land and climate	4	Lack of processing equipment	1	Malicious traders	3
Malicious traders	3	Other	4	Low quality of coffee	2
				Other	1

4.4.1 Innovation constraints in the supply-side of inputs

The most mentioned constraint in this category is the lack of capital (table 25). There are multiple reasons for this constraint; 1) it is hard/not possible for many farmers to receive a loan. Even when a farmer has access to a loan it may be too little and the interest rates are very high, 2) the incomes of the famers are low, 3) Many farmers have big households (mean=7.26, SD=3.5) including younger children. To be able to give their children a good future they want them to go to private schools. The tuition fee of these schools is very high and puts a lot of financial pressure on the farmers. The lack of capital also makes it hard for farmers to buy sufficient inputs for their farm such as fertilizers and pesticides. According to the farmers the government and farmer groups play an important role in the problem of the lack of capital. The farmers think these actors should make it easier for the farmers to get access to loans. The farmers from cluster 1 and cluster 2 mentioned the constraint of lack of capital more often than the farmers from cluster 3 (table 26).

Table 26. Supply side inputs constraints faced in each cluster of farmers.

Constraint	Cluster 1	(%)*	Cluster 2	(%)*	Cluster 3	(%)*
Lack of capital	4	80%	8	80%	7	58.3%
Hard access to inputs	2	40%	2	20%	6	50%
Not enough/or bad provision of funded goods	1	20%	5	50%	2	16.7%
Lack of knowledge/skills on how to use inputs	2	40%	2	20%	2	16.7%
High price for inputs	0	0%	2	20%	2	16.7%
Poor land and climate	1	20%	1	10%	2	16.7%
Malicious traders	0	0%	0	0%	3	25%

**The total percentage of each cluster can be more than 100% because each farmer was able to list two constraints.*

In total ten farmers mentioned that it is hard for them to get access to inputs. At the local community of the farmers there is no input supplier available who sells fertilizers and pesticides. The pulping machines available are also limited and can be old. To process their coffee cherries some farmers have to pay a high price to make use of the pulping machines. The input dealers who sell inputs like seedlings, fertilizers and pesticides are located in Mbale town, which is far away for the farmers in the Manafwa district (table 5). Besides the input suppliers, actors like POs, ACEs and processors/exporters also provide agricultural inputs to farmers. The farmers believe that input dealers and farmer groups could cooperate more and provide inputs closer at location. The farmer groups have storage facilities and would be able to bulk the inputs. The government could also play a role in providing a better infrastructure from Manafwa to Mbale town. Farmer groups and the government are also the actors who the farmers mention to provide more pulping machines for them to use.

According to the farmers there is a lack of given inputs. Especially the farmers from cluster 2 perceive this as an important constraint. 50% of the farmers in this cluster believe that there is not enough, or bad provision of funded goods. In the farmers opinion the government should provide some fertilizers and pesticides to them. The farmers also complained that when the government provides inputs like coffee seedlings, the provision was often poorly timed. The seeds were given too early, which made them too dry when they needed to get planted, or too late, after the planting season. Some farmers also complained about the quality of the provided coffee seedlings.

Another constraint often mentioned by farmers in all three cluster is the lack of knowledge or skills on how to apply inputs. Farmers do not know how to apply the fertilizers and pesticides in the right way. Input suppliers can give information on the products but farmers may be passive in asking for this information. The farmers believe that the government should provide more extension work and information regarding the use of inputs. Remarkable point is that the farmers with a high level of channel diversification did not mention the constraint 'lack of knowledge/skills on how to use inputs' one single time.

Other problems mentioned are too high prices for inputs, a poor land and climate and malicious traders. The prices of the inputs sold at the input suppliers are high. Given reason for the high price is the high taxes the government puts on the inputs. Input suppliers can switch too cheaper fertilizers from other companies to keep the price lower. However, the risk of the inputs being fake or ineffective is higher for these cheaper products. There are also malicious input suppliers on the market. Only the farmers from cluster 3 mentioned this constraint (25%). These traders mix their own fertilizers or pesticides with cheap chemicals. The farmers who have been cheated on are more reluctant to buy fertilizers and pesticides again. There are already forms of regulation on the market, provided by the government, in which they register the certified input suppliers and check incoming inputs. But more regulation from the government would be a good initiative. They could intervene more with harder quality standards and controls on the provided inputs. A good alternative for the problems regarding the agricultural inputs is the own production of organic fertilizer. Farmers who own animals use the manure of the animals as a fertilizer for their coffee farm.

4.4.2 Innovation constraints in the supply-side of services

In the services category it is evident that a lack of extension services and lack of capital are the most important problems. The farmers from all three clusters perceive these constraints to be very important (table 27). There is a shortcoming of extension workers, both from the government and private organisations. Let us take Mt. Elgon ACE as example for the private sector. This ACE only has

one extension worker employed. The extension worker is supported by the lead farmers, but the lead farmers also have to be trained first. In total there are 34 lead farmers. The ACE is in need for more extension workers. In the sub-county Mukoto the farmers mentioned that there are no extension workers from any organization or government at all. Because of the lack of extension services most of the farmers remain uneducated and have limited knowledge on the production of coffee. The farmers who are able to receive some advice and training get it only once or twice a year in general. The reason why a lack of capital is mentioned many times is because the provided extension services like trainings and workshops are often located far away. Farmers will have to pay much for transportation and accommodation to attend these workshops. It is also possible that a tuition fee is asked for the extension services of some private organizations. The extension services of Mt. Elgon ACE are available for every farmer and they do not ask any payment for it. Mt. Elgon ACE hopes that the farmers decide to join their organization after attending some extension work. The farmers who want to become a member of Mt. Elgon ACE have to pay a membership fee to entry. The farmers believe that it is the task of the government to provide more training to the farmers. NGOs can also play an important role in this problem. More extension workers should be recruited to provide information, advice and trainings at local communities.
Other problems which are mentioned in the innovation constraints in the supply-side of services are wrong time in provision of services, poor weather conditions and lack of processing equipment. However, the count of these constraints is rather low in all three clusters.

Table 27. Supply side services constraints faced in each cluster of farmers.

Constraint	Cluster 1	(%)*	Cluster 2	(%)*	Cluster 3	(%)*
Lack of extension services	3	75%	7	70%	9	75%
Lack of capital	1	25%	5	50%	7	58.3%
High price of information/advice	1	25%	1	20%	2	16.7%
Poor weather conditions	1	25%	0	0%	1	8.3%
Wrong time in provision of services	0	0%	0	0%	1	8.3%
Lack of processing equipment	0	0%	0	0%	1	8.3%
Other	1	25%	2	20%	0	0%

**The total percentage of each cluster can be more than 100% because each farmer was able to list two constraints.*

4.4.3 Innovation constraints in the demand-side

The two most important problems for the farmers when it comes to selling the coffee produce are the low coffee prices and the price fluctuations (table 25). Farmers complain that they receive too low prices for their coffee products. Especially the farmers from cluster 1 and cluster 2 perceive this constraint to be important (table 28). The farmers from these clusters are selling more often to middlemen, POs and ACEs (paragraph 4.3.2). Therefore it is more likely that they receive lower prices for their coffee produce. The farmers from cluster 3, who sell more often to processors/exporters, perceive the constraint of low coffee prices to be less important in comparison with the farmers from cluster 1 and cluster 2. The prices of coffee are unpredictable and fluctuate all the time. The low coffee prices and price fluctuations discourage farmers to go into the coffee business. Farmers are uncertain if they will receive a fair price for their produce. They need to earn enough to compensate the costs they made, and to keep some profit. Farmers have little market and price information and

have financial obligations (i.e. school tuition fees for children). The farmers are vulnerable and have a bad negotiation position against the traders because they sell their produce individually. The middlemen and processors/exporters are mentioned as the cause of the low coffee prices problem. They are accused of abusing the unorganized farmers. Farmers also believe the government could intervene with minimum prices for the coffee produce. Also price regulations from the government would help to reduce the price fluctuations and ensure a more stable income for the coffee farmers.

Table 28. Demand side constraints faced in each cluster of farmers.

Constraint	Cluster 1	(%)*	Cluster 2	(%)*	Cluster 3	(%)*
Low coffee prices	4	80%	7	70%	5	41.7%
Price fluctuations	0	0%	5	50%	7	58.3%
Lack of processing equipment/skills	1	20%	1	10%	1	8.3%
Hard to access transportation	0	0%	1	10%	3	25%
Delay in payment	1	20%	1	10%	2	16.7%
Malicious traders	1	20%	0	0%	2	16.7%
Low quality of coffee	0	0%	1	10%	1	8.3%
Other	0	0%	0	0%	1	8.3%

**The total percentage of each cluster can be more than 100% because each farmer was able to list two constraints.*

Hard access to transportation is also a problem for farmers. Most farmers do not have their own transportation vehicles like a car, boda boda (motorcycle) or bicycle. To hire private transportation is very expensive. The farmers who are able to transport their coffee can get a better price in markets located more distant, like the market in Mbale town. Given the hard access to transportation farmers are more likely to sell their produce to middlemen, who visit the farmers at their farm gate. This could be the reason that the farmers from cluster 1 did not mention the 'hard to access transportation' constraint. Because they do not transport their produce to sell it. But selling to middlemen may lead to another constraint, namely the one of malicious traders. There are middlemen who are not trustworthy and provide very low prices to the farmers who have lack of information, or are in a high need of money. Some farmer reported middlemen to make use of false weighing scales. Farmers believe that the government could help in these constraints by providing a better infrastructure in Manafwa and giving punishment to malicious middlemen or certificates to the trustworthy traders. Other mentioned constraints by the farmers are lack of processing equipment and skills, delays in payment and low quality of coffee.

5. Discussion

This research study explored the heterogeneity of smallholder farmer's embeddedness in value networks and their ability to innovate. In this chapter the interpretation, limitations and suggestions for further research will be given. In the interpretation part the provided literature will be linked to the findings of the research. The outcomes will be discussed and interpreted. Thereafter the reliability and internal and external validity of the conclusions of the research will be discussed. Finally, based on the interpretation and limitations of this study, suggestion for further research will be given.

5.1 Interpretation

The research conducted can provide general indications on the use of value network analysis in describing farmers' embeddedness in value networks. It provides more insights in the use of VNA, and how it allows mapping value networks. The outcomes of the study provide more information on the specific role of the farmers in the coffee value network and the different value interactions the farmers have with other actors in the network. It shows how the farmers are heterogeneously embedded in the value network. Different flows of tangible and intangible assets lead to a different ability to perform value conversion. The embeddedness analysis and value networks maps describing the embeddedness of different clusters of farmers in the value network contributes to the current theory describing the situation farmers in SSA are involved in. The embeddedness analysis resulted into more insights in the three features reciprocity, resource diversification and channel diversification of the farmers in the value network. These features are useful tools describing the embeddedness of an actor in a network. They explain challenges and opportunities that farmers face in effectively coordinating resources with other actors. The quantitative score on these three features gives a clear indication of the qualitative information belonging to the way how the farmers are exchanging resources in the network. These features also prove to be useful providing more descriptive information next to the value network maps. The three value network maps, each map representing one of the three different clusters of farmers which can be defined in the analysed value network, display the resources that actors exchange. This important part of the VNA shows the differences in the exchange of key resources between the different clusters of farmers and other actors in the value network. Providing multiple maps, belonging to different clusters of farmers, produces a deeper layer of analysis. Instead of one value chain or value network representing a general situation, the different value network maps show striking differences and points of entry for further development, collaboration and innovation, applicable for farmers which are differently embedded in the value network. Mapping the differences in the exchange of key resources as funding, information and training explains how the interrelatedness among the actors in the network results in dispersed power structures. The VNA provides a clear overview of the multiple actors (a selection of) the farmers are exchanging resources with and the role these actors have in the constraints and opportunities towards innovation. VNA reveals how also the actors which are beyond the scope of the product chain create or destroy value in terms of their reciprocity in sharing key resources with farmers, their agility in sharing resources with farmers and other stakeholders, their resource diversification and channel diversification. Analyzing the constraints the farmers face towards innovation also proved to be an important step contributing to the VNA. First, listing and ranking the problems farmers face in the categories supply-side inputs, supply-side services and demand-side provided a general overview of all the constraints existing in the value network. By counting the time these constraints were mentioned it was possible to see which innovation

constraints the farmers deemed to be the most important. Secondly, by linking the different farmer clusters to the mentioned innovation constraints, more insights could be gained in the nature of the innovation constraints the famers from a specific cluster face. This provides further insights in the link between the way how farmers are embedded in the value network and the constraints they face towards innovation.

The farmers from cluster 1 are the most marginalized farmers in the value network. As can be explained from their low reciprocity, low resource diversification and medium channel diversification they exchange a limited set of resources with a limited group of actors. There are multiple factors contributing to the bad embeddedness of the farmers from cluster 1. The farmers show little usage of agricultural inputs as artificial fertilizers and pesticides. Farmers in this cluster can have resources exchanges with input suppliers but, because of the fact that most of these farmers are coming from the highland Mukoto, it is hard for them to access the inputs market. Because of the hard access to markets and the lack of transportation these farmers need to sell their produce to middlemen. Compared to other buyers middlemen exchange little resources with the farmers. The farmers miss out on resources like advice, information and training which they could receive from other buyers like POs, ACEs and processors/exporters. Creating platforms which are better accessible for the farmers from cluster 1 will stimulate their development. The access to an PO, ACE or MSIP will lead to a better accessibility of the resources information, advice and training. It may also lead to a higher selling price of the produce of the farmers. The government and NGOs can intervene in providing funds to set up a platform in these hard conditions. The government can also intervene in putting more regulations on the middlemen who the farmers from cluster 1 are selling their produce to.
The farmers from cluster 2 are hardly using agricultural inputs. They do not use artificial fertilizers and almost none of them makes use of pesticides. The farmers from this cluster showed the highest age. They also showed the highest score regarding the feature reciprocity. This is in line with the positive correlation between age and a farmers' years of experience. The older farmers from cluster 2 provide advice and information to other farmers. Farmers from cluster 2 are selling mostly to ACEs and middlemen. The ACE is an important actor which can help the farmers from cluster 2 overcoming their constraints. Given their low agility with the farmers ACEs can provide more information and training to the farmers. Furthermore they could extend their services and bulk commodities like artificial fertilizers and pesticides. This will make the agricultural inputs more accessible for the farmers from cluster 2. The ACEs could take this role, which is normally occupied by input suppliers, upon themselves.
The farmers from cluster 3 show the highest embeddedness of all farmers in the value network. They show a high score on the feature resource diversification, which can also explain the widely use of agricultural inputs in this cluster. Many farmers from cluster 3 are located in the lowland Bukhofu. ACEs and processors/exporters are more active in this sub-county. This leads to a better price for the produce of these farmers and to a better accessibility to resources as information, advice and training. The farmers from cluster 3 have better access to the market and input suppliers from Mbale. Furthermore they have a big farm size. The outcomes of this research confirm a possible positive relation in the variables farm size and adoption to innovations. The farmers from cluster 3 are better embedded into the value network compared with the farmers from cluster 1 and 2. They show higher resource diversification and use of agricultural inputs. The farmers from cluster 3 show low reciprocity. They could share more resources with other farmers who are less embedded into the network. Sharing their knowledge and information can stimulate the local development.

The situation and the development of the smallholder farmers in SSA is a complex phenomenon. The value network analysis provides a clear overview and model to be able to analyse, evaluate and improve the resources exchanges of the farmers in the network and to offer solutions to realize greater value for the farmers from different clusters. The value network maps show how the farmers are unequally adapted to their environment. Therefore better embedded farmers will be more able to have access to certain inputs, services and markets. These farmers are more likely to introduce new practices in their farm, which may lead to innovation and better performances. Furthermore the value network maps also provides a clear overview on how the farmers are dependent on the other actors in the value network.

There can be seen that farmer groups like producer organizations and area cooperative enterprises take an important role in the value network. The presence of these actors is of big importance in a sub-county, and can contribute to the access to different resources. NGOs, government and national development agencies show low agility regarding the farmers. In order for these actors to stimulate development and make an impact they should increase their cooperation with POs and ACEs. A promising option in this process is building multi stakeholder innovation platforms, consisting of these actors, to increase the agility with farmers. There will be less separation which may lead to an increased accessibility to key resources. By understanding this interconnectedness and linking actors through VNA, innovation support agents can understand where intangible and tangible resources and their associated value lay in the network. Together with the information of the actors providing the resources and the differently embedded farmers who need the resources to be able to adopt innovation, opportunities and risk for value creation can be detected by connecting different actors to the network to share resources and to explore new relations and resources flows to overcome the existing constraints in the value network. Ultimately a successful innovation process is determined by the extent to which the whole value network gathers sufficient variation in capabilities and resources from different actors.

5.2 Limitations

For a more comprehensive view of the value network ideally experts from the Makerere University, NGOs, producer organizations and national development agencies would also have been interviewed. However due to limitations of time and financial resources this was not possible.
This study is unable to encompass the entire set of relationships in the value network. Because of the complexity of a full VNA, there are determined boundaries in this research. Mapping a complete set of interrelationships would be impossible to represent in any system (Allee, 2000). To narrow the field of investigation this study focuses exclusively on the heterogeneity of farmers' embeddedness that may influence innovation in the Manafwa coffee value network. Putting boundaries also results to limitations of this research. The use of VNA in this research will only capture information about the coffee value network, but in reality it is possible that farmers and other stakeholders participate in multiple value chains, which may influence each other. Furthermore, this application of VNA does not represent relationships within each organization investigated (i.e. ACE, processor/exporter, government) in the research. Also the relationships of stakeholders with agents outside the coffee value network are not taken into account within this research.

5.3 Suggestions for further research

This study was focused on the value network smallholder farmers are involved in. The VNA conducted is not able to map all the set of interrelationships among the actors. Further research could provide more insights in the resources exchange among only the farmers. This research showed that farmers receive and provide a wide set of resources to and from other farmers. A value network analysis specified on the relationships within the community of smallholder farmers could provide more insights on the networks and density of the networks of the smallholder farmers within the local community. It can show differences and comparisons between innovators and non-innovators in a community.

Another suggestion for further research will be the performance of a qualitative comparative analysis (QCA). QCA bridges qualitative and quantitative analysis. The analysis makes it possible to assess causation that is very complex, involving different combinations of causal conditions capable of generating the same outcome. Causation in the features reciprocity, resource diversification and channel diversification could be further investigated. With conventional methods it is hard to tackle causal complexity. QCA will be a good tool to assess a complex system like discussed in this research. It works well with data containing many verbal formulations. Furthermore it can be applied to research designs involving small and intermediate size. In this range of research size there are often too many cases for researchers to keep all the knowledge “in their heads”, but too few cases for most conventional statistical techniques. For further research on this case will be suggested to perform a three-value fuzzy set analysis. The rubric of the three features made and used in the quantitative part of this research can be used in this type of analysis.

Quantitative research could be performed on farmers’ variables like age, education level, farm size, coffee yield, reciprocity, resource diversification and channel diversification. A regression analysis could lead to more insight on possible correlations among these variables. This will lead to new insights in how farmers could overcome challenges according their reciprocity, resource diversification and channel diversification in the value network.

6. Conclusion

Smallholder farmers in the coffee value network in Manafwa show a high dependency on the resources advice, funding, information and agricultural inputs. The provision of these resources come in different amounts and frequencies from different actors like input suppliers, producer organizations, (local) government and traders. The power in the value network is unequally distributed, in the disadvantage of the farmers. The farmers are heterogeneously embedded in the value network. Variables like access to agricultural inputs, location, age, and resource diversification are important to define how a farmer is embedded in the coffee value network in Manafwa. The location, gender, age and farm size seemed to have effect on the usage of agricultural inputs of the farmers. Farmers from the lowland Bukhofu are making more usage of artificial fertilizers and pesticides compared with other sub-counties. For the farmers in the midland Namabya and highland Mukoto it is harder to have access to actors providing these inputs. The usage of artificial fertilizers and pesticides is also higher among the male headed households compared with the female headed households. The older farmers are making less intensively use of agricultural inputs. This was also the case for the farmers with a only few acres of land under the production of coffee. Farmers with more acres showed higher usage of artificial fertilizers and pesticides. Given the agility of the input suppliers they could play a more important role in the exchange of agricultural inputs, along with provision of information and training on how to apply the inputs.

Area Cooperative Enterprises are most often the buyer of the coffee produce of the farmers in Manafwa. Middlemen and processors/exporters are also widely active in the value network as a buyer. Producer organizations rarely buy produce of the farmers in Manafwa. Processors/exporters pay the highest price for one kilo of coffee parchment. The variables location, age and farm size seemed to have effect on the fact to whom the farmers sell their coffee produce. No differences between male headed households and female headed households could be detected. Farmers from the midland and highland are more likely to sell their produce to middlemen. The farmers from the highland Mukoto do not sell their coffee produce to processors/exporters at all. Middle aged farmers are more likely to sell their coffee produce to an ACE or processor/exporter. Young and old farmers sell more often middlemen. Old farmers do not sell their coffee produce to processors/exporters. The farmers with less than 0.5 acre of land under the production of coffee do neither sell their produce to processors/exporters. They sell mostly to middlemen. Farmers with more acres under the production of coffee are more likely to sell their produce to a processor/exporter. Farmers selling to processors/exporters also made more usage of agricultural inputs and showed higher resource diversification.

All the farmers in the coffee value network in Manafwa perceive a lack of extension services. The farmers believe it is the task of the government and NGOs to provide more extension services. The farmers who are less embedded in the value network face more often the constraint of a lack of capital. This can be due to their poor income, the hard access to actors providing loans or the high interest rates of loans. For these farmers low coffee prices are also a more restricting constraint. Furthermore, the price of inputs, information and services is often too high for the farmers who are less embedded in the value network. The high embedded farmers encounter the constraint of a lack of capital less often. They do experience more often constraints with malicious practices. All farmers are experiencing constraints because of the price fluctuations. It is also hard for all the farmers to get access to agricultural inputs. Farmer groups like POs and ACEs show high agility with the farmers, and

both groups have access to multiple channels. Given their agility and channel diversification they can utilize the current resources flow to be able to provide resources like agricultural inputs, information, loans and training more intensively and in better quality. Also the government can contribute to tackle the lack of capital and lack of extension service by providing microfinance and facilitate the training of more public extension workers. Furthermore they can intervene in the coffee market by setting price regulations. This could tackle the low coffee prices and price fluctuations constraints. To tackle these constraints there needs to be cooperation between different actors in the chain to be able to orchestrate change and innovation.

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Appendix 1. Criteria for commodity selection VIP4FS project

1. Impact – the enterprise should have the potential to create a big or high impact in the community. In this context, impact was looked at in three dimensions.
    i) Number or proportion of people in the community that would be positively affected (the easiest to report),
    ii) Size of the effect or difference created - an enterprise that would result into a high or big impact in the livelihoods of the targeted communities would be given high priority (difficult to measure and report but vital to try) and
    iii) Type of people among the communities that would be affected most by the enterprise. Although focus is on the small holder farmers, emphasis will be on women and the young people.
2. There should be prospects for tractable interventions and comparisons that could yield useful results from planned comparisons. This is a necessary condition, since this is the route through which the project makes progress.
3. Demand from development partners. Existence of demand of the enterprise and its products from development partners strengthens the worthiness of a given enterprise and intervention. The project is about increasing income.
4. Potential private sector partners – availability of a pool of interested or potential private sector partners increases the confidence of working with a given enterprise given the presence of partners that will easily create more business opportunities around it. The private sector is very important as a partner especially in co-investments geared towards improving the marketing system in the value chain of a product.
5. Co-benefits – the more the opportunities of co-benefits to the small holder livelihood beyond increased incomeaccruing from working with the selected enterprise the more it is given priority. Co-benefits are important is motivating and sustaining participation of the actors/farmers in an intervention
6. Competence within the team to appropriately handle enterprise and possible tractable the enterprises and interventions the higher the chances of reducing costs and increasing level of success
7. They should have potential to impact women and young people
8. Clear institutional access necessary to effect change.
9. Supportive policy context within which interventions can be developed.
10. Sustainability of the interventions (strategies and value chains)

Appendix 2. Table of interviewees

# of interview	Name (function and organization)	Location	Date of interview
Smallholder farmers			
1	Mutuma Valantino	Bukhofu	01-12-2016
2	Naigaga Mary	Bukhofu	01-12-2016
3	Honialya Patrick	Bukhofu	01-12-2016
4	Matuka Scola	Bukhofu	01-12-2016
5	Dinah Nambuya	Bukhofu	01-12-2016
6	Peter Wasubire	Bukhofu	01-12-2016
7	Robert Wamutinti	Bukhofu	01-12-2016
8	Wamalwa Joseph	Bukhofu	01-12-2016
9	Nabifo Allen	Bukhofu	01-12-2016
10	Nambwali Constant	Bukhofu	01-12-2016
11	Bukas Ford	Mukoto	02-12-2016
12	Sambula Beatrice	Mukoto	02-12-2016
13	Klakyaula Ekisofeli	Mukoto	02-12-2016
14	Klamono Patrick	Mukoto	02-12-2016
15	Nasitacia Wangutusi	Mukoto	02-12-2016
16	Masika Anthony	Mukoto	02-12-2016
17	Jane Timbiti	Mukoto	02-12-2016
18	Dison Masolo	Mukoto	02-12-2016
19	Kaloasi Joshua	Mukoto	02-12-2016
20	Benina Nabyrure	Namabya	03-12-2016
21	Grace Nabuso	Namabya	03-12-2016
22	Ernest Klasike	Namabya	03-12-2016
23	Bilah Nafula	Namabya	03-12-2016
24	Bilu Sifuma	Namabya	03-12-2016
25	Bufambo Joseph	Namabya	03-12-2016
26	Maiki Patrick	Namabya	03-12-2016
27	Kwomu Stephen	Namabya	03-12-2016
Input dealer			
28	Kaatoh Masawa Alex (Ramah agro inputs)	Mbale	06-12-2016
Middlemen			
29	Mukulumi Dari	Bukhaweka	05-12-2016
30	Kemdu George	Bukhaweka	05-12-2016
31	Niabkiire Phoebe	Bukhaweka	05-12-2016
32	Nasambi Micheal	Bukhaweka	05-12-2016
33	Mayuku Jabasihan	Bukhaweka	05-12-2016
ACE			
34	Nabisi Benara (Project manager at Mt. Elgon Arabic Coffee Farmers Society)	Bukhaweka	05-12-2016
Traders/processors/exporters			
35	Wabulo (operations manager at BCU)	Mbale	06-12-2016
36	Ssenfuka Joseph (field officer at Kyagalanyi)	Mbale	06-12-2016
Government			
37	John Basco (agricultural officer of the DLG of Manafwa)	Manafwa	01-12-2016
38	Kisenge Robert (sub-county president in Namabya)	Namabya	03-12-2016

Appendix 3. SPSS outcomes

Model Summary

Algorithm	TwoStep
Inputs	10
Clusters	3

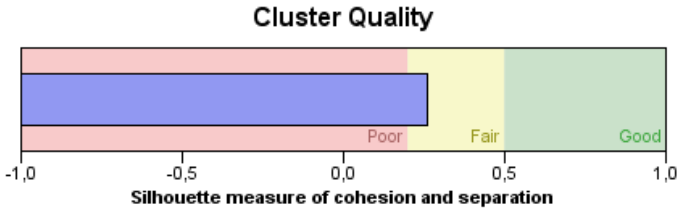

Figure 27. Model summary and cluster quality of the cluster analysis.

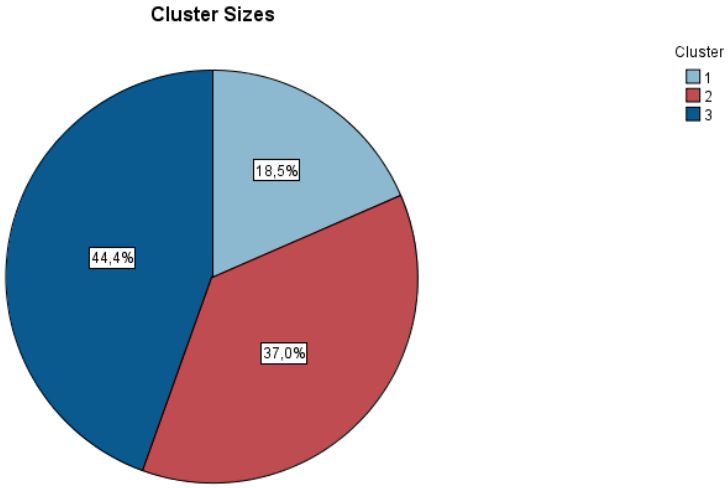

Figure 28. Cluster sizes.

Size of Smallest Cluster	5 (18,5%)
Size of Largest Cluster	12 (44,4%)
Ratio of Sizes: Largest Cluster to Smallest Cluster	2,40

Figure 29. Ratio of cluster sizes.

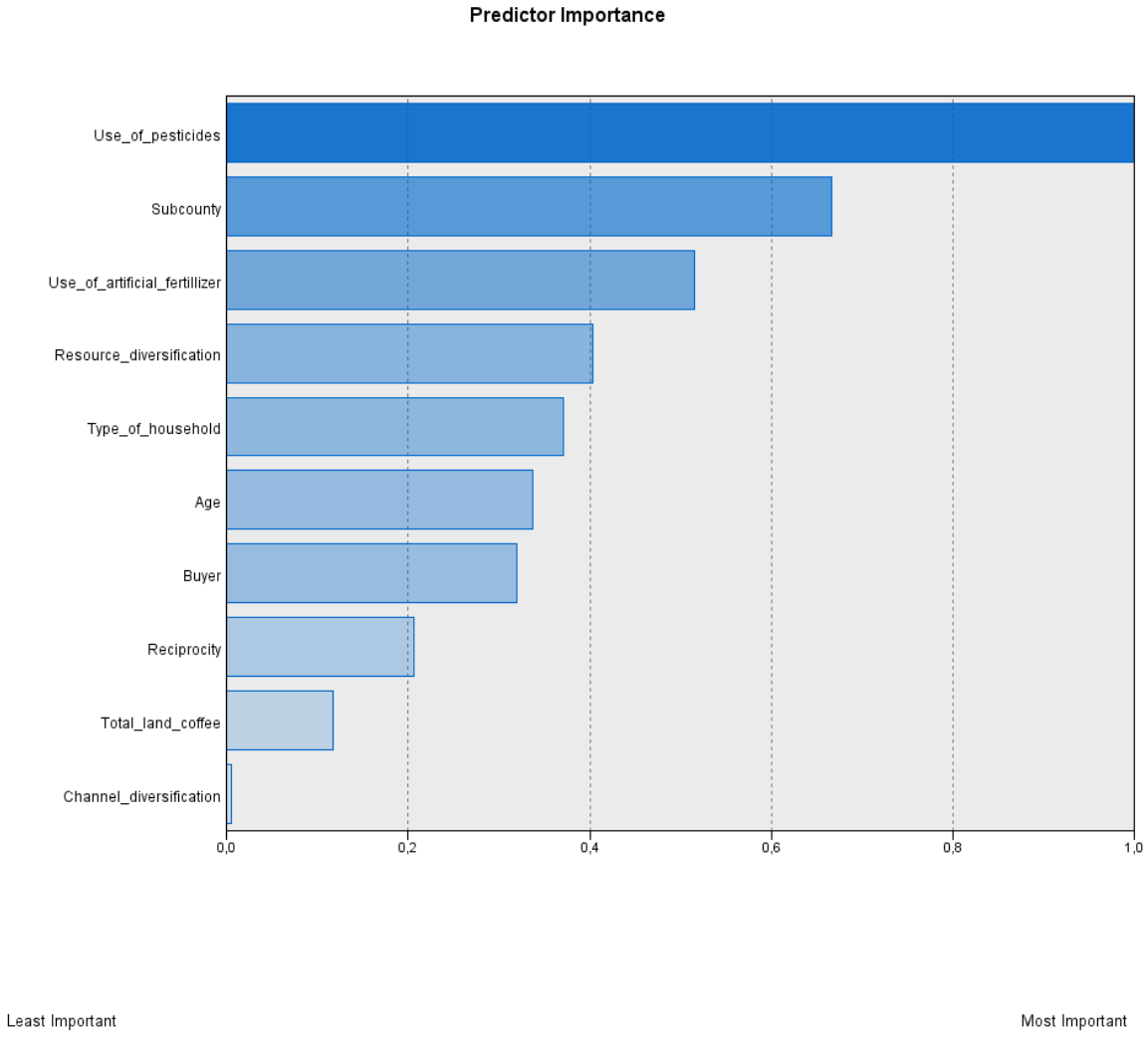

Figure 30. Predictor importance of inputs used for the cluster analysis.

Appendix 4. Interview protocol smallholder farmers

GENERAL INFORMATION

1. Background information about the respondent

Name of respondent	Is respondent the household head (tick) **Yes** ☐ **No** ☐	Type of Household (please tick what applies) **Male headed** **Female headed**	Age of respondent (years)	Size of household (No. of members in household)	Village	Sub-county	Phone number of respondent

2. Which groups or associations or farmer organizations are you a member of? (please list them)

Information about the farm

3. What is your total farm/land size (acres)?
4. What size of your land/farm do you allocate to crop production (acres)?
5. What size of crop land do you allocate too coffee production (in acres)?
6. (a) What crops or plants do you intercrop with coffee on your land (please list them)

(b) What proportion (approximate percentage) in the intercrop is occupied by coffee on your farm/land?

7. What is your average coffee yield per season?

8. In what form do you sell your coffee?

9. What is your average selling price of coffee (per Kg)?

10. Who or which members in your household participate in the coffee enterprise

Household Member (include their number where applicable)	Role(s) played by the member(s) in the coffee enterprise

11. On average, how many people do you hire for their labor in your coffee enterprise per season?

SUPPLY-SIDE CONSTRAINTS

12. Which INPUTS do you use for the PRODUCTION of coffee? (interested in ALL the inputs the respondent uses for the production of coffee)

Which inputs do you use for the production of coffee? (Please list them all, this can be funding, fertilizer, pesticides, seedlings, manure etc.)	Who are the actors who provide the mentioned inputs for coffee production? (Please list the specific actor with the right input. Actors can be farmers, input suppliers, local government, NGOs, etc.)	In which quantity do the actors who provide the mentioned inputs for coffee production deliver the input?	In which frequency do the actors who provide the mentioned inputs for coffee production deliver the input?

13. What are the major problems that you face in ensuring sufficient INPUTS for PRODUCTION of coffee (interested in major problems and actors/players that influence the problem)

The problem(s) faced	Ranking of the problems	Perceived actor(s) or player(s) contributing to the problem(s) – (please list them)

14. For the two most important problems ranked above, please describe the type of influence of the actors on the problem (some alternatives may include things like funding, regulation, information, advice, among others)

15. Apart from you as a coffee farmer, who else do you think is influenced or affected by what the actors (mentioned above) do? (Check if these come out other farmers, input suppliers, local government, NGOs, etc.)

16. Which SERVICES do you use for the PRODUCTION of coffee? (interested in ALL the services the respondent uses for the production of coffee)

Which services do you use for the production of coffee? (Please list them all, this can be funding, information, advice, etc.)	Who are the actors who provide the mentioned services for coffee production? (Please list the specific actor with the right service. Actors can be farmers, input suppliers, local government, NGOs, etc.)	In what quantity do the actors who provide the mentioned services for coffee production deliver the services? (Only mention if possible, for example funding can be quantified but information not)	In what frequency do the actors who provide the mentioned services for coffee production deliver the services?

17. What are the major problems that you face in ensuring sufficient SERVICES for PRODUCTION of coffee (interested in major problems and actors/players that influence the problem)

The problem(s) faced	Ranking of the problems	Perceived actor(s) or player(s) contributing to the problem(s) – (please list them)

18. For the two most important problems ranked above, please describe the type of influence of the actors on the problem (some alternatives may include things like funding, regulation, information, advice, among others)

19. Apart from you as a coffee farmer, who else do you think is influenced or affected by what the actors (mentioned above) do? (Check if these come out other farmers, input suppliers, local government, NGOs, etc.)

DEMAND-SIDE CONSTRAINTS

20. Who are the buyers of your coffee products (interested in ALL the actors who buy the coffee products of the respondent)

Who are the actors who buy the coffee products? (Please list them all. Actors can be local trader(s), distant trader(s), cooperatives (e.g. BCU, Gumutindo), etc.)	In what quantity did the actor(s) buy the coffee products in the last season?	For what price (per Kg) did you sell your coffee products to this actor in the last season?	In what frequency did the actors buy the coffee products in the last season?

21. What are the major problems that you face in selling your coffee products (interested in major problems and actors/players that influence the problem)

The problem(s) faced	Ranking of the problems	Perceived actor(s) or player(s) contributing to the problem(s) – (please list them)

22. For the two most important problems ranked above, please describe the type of influence of the actors on the problem (some alternatives may include things like funding, regulation, information, advice, among others)

23. Apart from you as a coffee farmer, who else do you think is influenced or affected by what the actors (mentioned above) do? (Check if these come out other farmers, input suppliers, local government, NGOs, etc.)

INNOVATION

Important to take notes of the crops and machinery at the farm

24. How did you apply new practices/methods/ideas in your farm in the last five years? *(e.g. intercropping, indigenous tree vegetation, fertilizer, pesticides, improved seeds, manure, machinery)*

25a. What is your biggest competitive advantage compared with other farmers in the coffee business in your sub-county? *(e.g. cost control, quality, lead times, delivery, inventory/records, employee training)*

25b. What is your biggest disadvantage compared with other farmers in the coffee business in your sub-county? *(e.g. cost control, quality, lead times, delivery, inventory/records, employee training)*

Appendix 5. Interview protocol other stakeholders

GENERAL INFORMATION

1. Background information about the respondent

Name of respondent	Gender of the respondent **Male** ☐ **Female** ☐	Age of respondent (years)	Function of the respondent	How many people are conducting a similar business in town	Phone number of respondent

2. Do you work for a institute?
   Yes

   No

   If yes, what is the name of the institute you are working for……..

3. What is the name of the place/market where you or the institute you work for is operating in coffee?

4. Which groups or associations or organizations are you a member of? (please list them)

If applicable:

5. What type of trader/processor are you or the business/firm you work for? (e.g. wholesaler, exporter retailer)

6. In which commodities do you or the business/firm you work for trade/process? (please list them all)

SUPPLY-SIDE CONSTRAINTS

7. What are the major problems that farmers face in ensuring sufficient INPUTS for PRODUCTION of coffee (interested in major problems and actors/players that influence the problem)

The problem(s) faced	Ranking of the problems	Perceived actor(s) or player(s) contributing to the problem(s) – (please list them)

8. For the two most important problems ranked above, please describe the type of influence of the actors on the problem (some alternatives may include things like funding, regulation, information, advice, among others)

9. Apart from the farmers, who else do you think is influenced or affected by what the actors (mentioned above) do? (Check if these come out other farmers, input suppliers, local government, NGOs, etc.)

10. What are the major problems that farmers face in ensuring sufficient SERVICES for PRODUCTION of coffee (interested in major problems and actors/players that influence the problem)

The problem(s) faced	Ranking of the problems	Perceived actor(s) or player(s) contributing to the problem(s) – (please list them)

11. For the two most important problems ranked above, please describe the type of influence of the actors on the problem (some alternatives may include things like funding, regulation, information, advice, among others)

12. Apart from the farmers, who else do you think is influenced or affected by what the actors (mentioned above) do? (Check if these come out other farmers, input suppliers, local government, NGOs, etc.)

DEMAND-SIDE CONSTRAINTS

13. What are the major problems that farmers face in selling coffee products (interested in major problems and actors/players that influence the problem)

The problem(s) faced	Ranking of the problems	Perceived actor(s) or player(s) contributing to the problem(s) – (please list them)

14. For the two most important problems ranked above, please describe the type of influence of the actors on the problem (some alternatives may include things like funding, regulation, information, advice, among others)

15. Apart from the farmers, who else do you think is influenced or affected by what the actors (mentioned above) do? (Check if these come out other farmers, input suppliers, local government, NGOs, etc.)

INNOVATION

16. How did farmers you do business with apply new practices/methods/ideas in the last five years? *(e.g. intercropping, indigenous tree vegetation, fertilizer, pesticides, improved seeds, manure, machinery)*

17a. What can be a farmers' biggest competitive advantage compared with other smallholders in the coffee business in your area of business? *(e.g. cost control, quality, lead times, delivery, inventory, employee training)*

17b. What can be a farmers' biggest disadvantage compared with other smallholders in the coffee business in your area of business? *(e.g. cost control, quality, lead times, delivery, inventory, employee training)*